

**AUG
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ADM - Flexible Steel Pipe for Drilling and Service Applications





DESCRIPTION OF A ABANMARINE FLEXIBLE LINE

Abanmarine Flexible Line

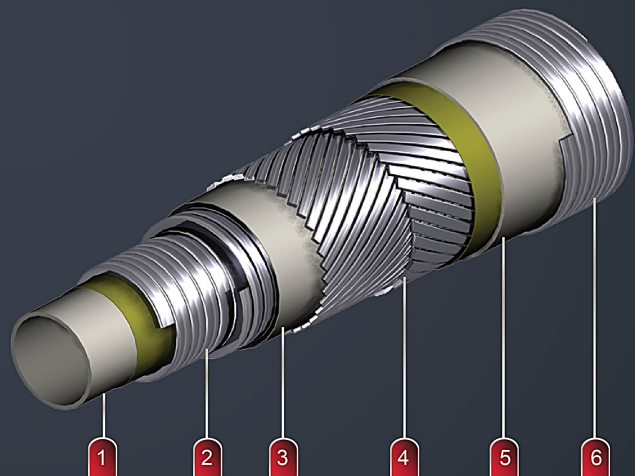
Flexible lines are manufactured in long continuous sections (up to several kilometres) and are cut to fit each client's requirements. End fittings with the most common types of end connectors are kept in stock thus minimising delivery times. End connectors not kept in stock will be machined or obtained according to the client's specifications. Delivery time depends mainly on the type of end connectors required and our client's particular specifications.

“Abanmarine products are designed for oil field services, both on and offshore, where heavy duty is required in combination with flexibility and reliability”

The pipe structure

Abanmarine pipes are composed of successive layers of steel and thermoplastic to produce unique structures that have the strength and durability of steel pipes combined with the flexibility of reinforced rubber hoses. Each layer works independently from the others, as no vulcanisation is used during manufacturing. This results in the structural stability of the pipe.

- 1 The thermoplastic inner tube makes the pipe leak-tight.
- 2 The interlocked zeta and flat steel spiral pressure carcass resist internal pressure and external crushing loads.
- 3 The intermediate thermoplastic sheath is an anti-friction layer.
- 4 The double crosswound steel armours resist axial loads, protect the pipe from torsional strain resulting from handling and working conditions.
- 5 The thermoplastic outer jacket protects the armours from external corrosion.
- 6 The Stainless Steel Outer Wrap (SSOW), protects the pipe from mechanical impact, abrasion, weathering and accidental mishandling.



Advantages

- ☐ Flexible, therefore easy to hook up
- ☐ No intermediate couplings or swivels that might leak
- ☐ Remarkable strength and crush resistance
- ☐ Heavy-duty capability, exceptional abrasion and fatigue resistance
- ☐ No maintenance
- ☐ Absorbs vibrations
- ☐ Corrosion free
- ☐ Minimum head loss and turbulence due to the smooth surface of the inner thermoplastic tube and no sharp bends
- ☐ Does not "belly out" (i.e. the diameter does not expand due to the internal pressure) or shorten due to pressure

Temperature limits

- Standard Rilsan® lines : -20°C to +100°C (-4°F to 212°F)
- High temperature Coflon® lines : -20°C to +130°C (-4°F to 266°F)

Physical characteristics vs. rubber hose characteristics

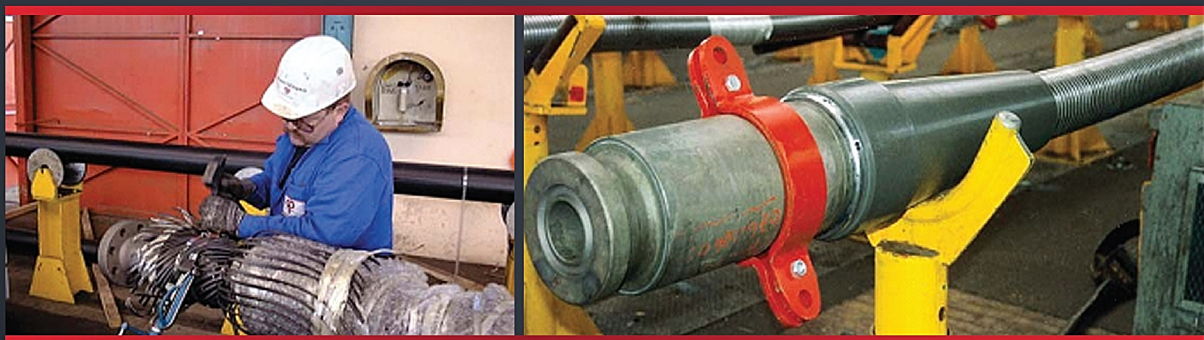
- For a given ID and working pressure, a ADM flexible line with its Stainless Steel Outer Wrap (SSOW) has a smaller OD than rubber hose without SSOW.
- Smaller Minimum Bending Radii (MBR) than most rubber hoses
- a ADM flexible line, with its SSOW, has a lower weight/foot than most rubber hoses without SSOW.

Bend stiffener

The bend stiffener is an additional component installed on the flexible pipe, during the end fitting mounting process (above). Its purpose is to increase the local bending stiffness in the region of the end fitting to attain a smoother stress transition from the end fitting to the flexible pipe structure.

The bend stiffener is an optional item. It will allow the flexible pipe to better resist overbending.

Resistance to overbend damage at the end fitting/flexible line interface is increased by a significant factor when using these components. Manufactured in polyurethane, it is intrinsically resistant to corrosion.



End fittings

ADM flexible steel pipes are supplied complete with any common oilfield type of connector. The most widely used connectors, such as hubs, API flanges, hammer unions, etc are available from stock. Other connectors can be machined as required. All parts which are subject to corrosion undergo a special Nikaflex® treatment which gives them an excellent resistance to corrosion.

I.D.	Maximum Working Pressure	Test Pressure	Weight in Air Empty		O.D.	Minimum Bending Radius for Storage		Recommended Radius		Temperature range*		TYPICAL APPLICATIONS						
												Rotary & Vibrator Line / Mud Line	Choke & Kill Booster and Cement Line	Hydraulic Line	Acidizing Line	Test Lines		
in	psi	psi	lbs / ft	kg/m	in	feet	meters	feet	meters									
1	5,000	10,000	6.0	9.0	2.4	2.0	0.6	3.0	0.9									
2	5,000	10,000	21.0	31.2	4.5	2.3	0.7	3.4	1.0									
3	5,000	10,000	33.4	49.8	5.7	2.9	0.9	4.4	1.3									
3.5	5,000	10,000	22.9	34.0	5.4	2.7	0.8	4.1	1.3									
3.5	5,000	10,000	28.3	42.2	5.8	3.0	0.9	4.4	1.4									
4	5,000	10,000	58.3	86.8	7.5	3.8	1.2	5.7	1.7									
4	5,000	10,000	60.5	90.0	7.5	3.9	1.2	5.8	1.8									
2	10,000	15,000	21.0	31.2	4.5	2.3	0.7	3.4	1.0									
3	10,000	15,000	33.4	49.8	5.7	2.9	0.9	4.4	1.3									
3	10,000	15,000	52.3	77.7	6.5	3.3	1.0	5.0	1.5									
4	10,000	15,000	58.3	86.8	7.5	3.8	1.2	5.7	1.7									
4	10,000	15,000	60.5	90.0	7.5	3.9	1.2	5.8	1.8									
2.5	15,000	22,500	34.5	51.2	5.4	2.8	0.9	4.2	1.3									
2.5	15,000	22,500	42.0	62.4	5.8	3.0	0.9	4.4	1.4									
3	15,000	22,500	43.0	64.0	6.0	3.1	1.0	4.7	1.4									
3	15,000	22,500	52.3	77.7	6.5	3.3	1.0	5.0	1.5									

*This chart is not exhaustive, but indicates the range of ADM pipes available.

* These temperature are for permanent use. High temperatures can be acceptable for short periods. Please consult our representatives.

ADM test lines

The absence of rubber components and the extreme resistance of the ADM structure gives compatibility with crude oil and outstanding mechanical performance and durability. The lines are designed to resist abrasion and corrosion from all types of hydrocarbons, H₂S and CO₂, sand, etc. The concept of separate layers with independent functions ensures maximum stability during pressure surges

ADM rotary / vibrator lines

ADM line does not react like a rubber hose, it will not contract, elongate, "belly out" or kick as "classic" hoses do when submitted to pressure : the ADM rotary / vibrator line will resist oil-based muds with a high aromatic content, up to temperatures of 100°C (212°F) or 130°C (266°F) for high temperature lines.

Years of experience have shown that when properly installed, all ADM lines have an exceptionally long service life.



These requirements are in applications such as:

- ✓ Choke and kill lines
- ✓ Rotary and vibrator lines
- ✓ Test lines
- ✓ Hydraulic lines
- ✓ Acid and cement lines
- ✓ Nitrogen lines

ADM acidizing and fracturing lines

Used on stimulation boats and work-over rigs worldwide. They are built to handle acidizing liquids and fracturing solutions, at high pressures and flow-rates. The maximum continuous flowrate for all smooth bore, ie. thermoplastic inner sheathed lines, is 15 metres per second. Many lines, particularly those for acidizing / fracturing applications, have been subjected to flowrates well in excess of this figure for relatively short periods of time without any damage being sustained. This is entirely dependent on the abrasive properties of the flow medium, therefore maximum short term flowrates cannot be quantified for all flow conditions.



ADM choke and kill lines

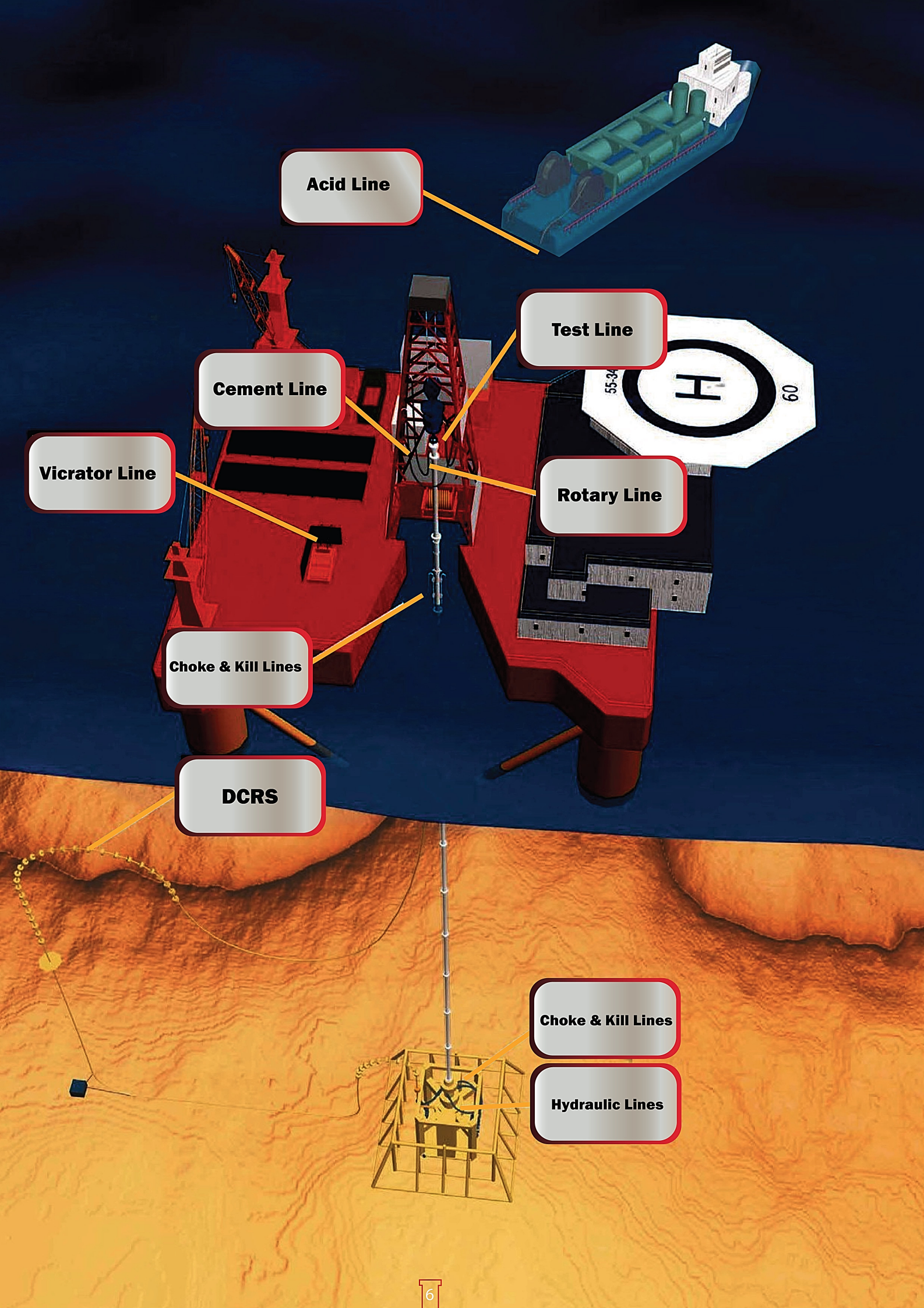
Choke and kill lines are an essential part of the well control equipment. ADM's drilling application flexibles are specifically designed to handle the high pressures and flowrates demanded by this application.

Other advantages make the ADM solution very attractive to the end user:

- ☐ No welding
- ☐ No steel elbows to "wash out"
- ☐ Easy accommodation to height changes (installation of a new BOP spool), etc.

ADM engineering services are available to calculate correct length and configuration of line





Acid Line

Test Line

Cement Line

Vicrator Line

Rotary Line

Choke & Kill Lines

DCRS

Choke & Kill Lines

Hydraulic Lines

DCRS - Drillcuttings Well Re-Injection System (DCRS)



The solution to well debris problems

The question of what to do with contaminated drill cuttings from drilling with oil based mud has become an increasingly pressing issue in Norway, the UK, and anywhere around the world where environmental pressures require an alternative to partial treatment and dumping. Re-injection from semi-submersible rigs has not been possible, and with the vast majority of drilling done this way there has been no solution other than to transport well debris to shore as landfill. Until now.

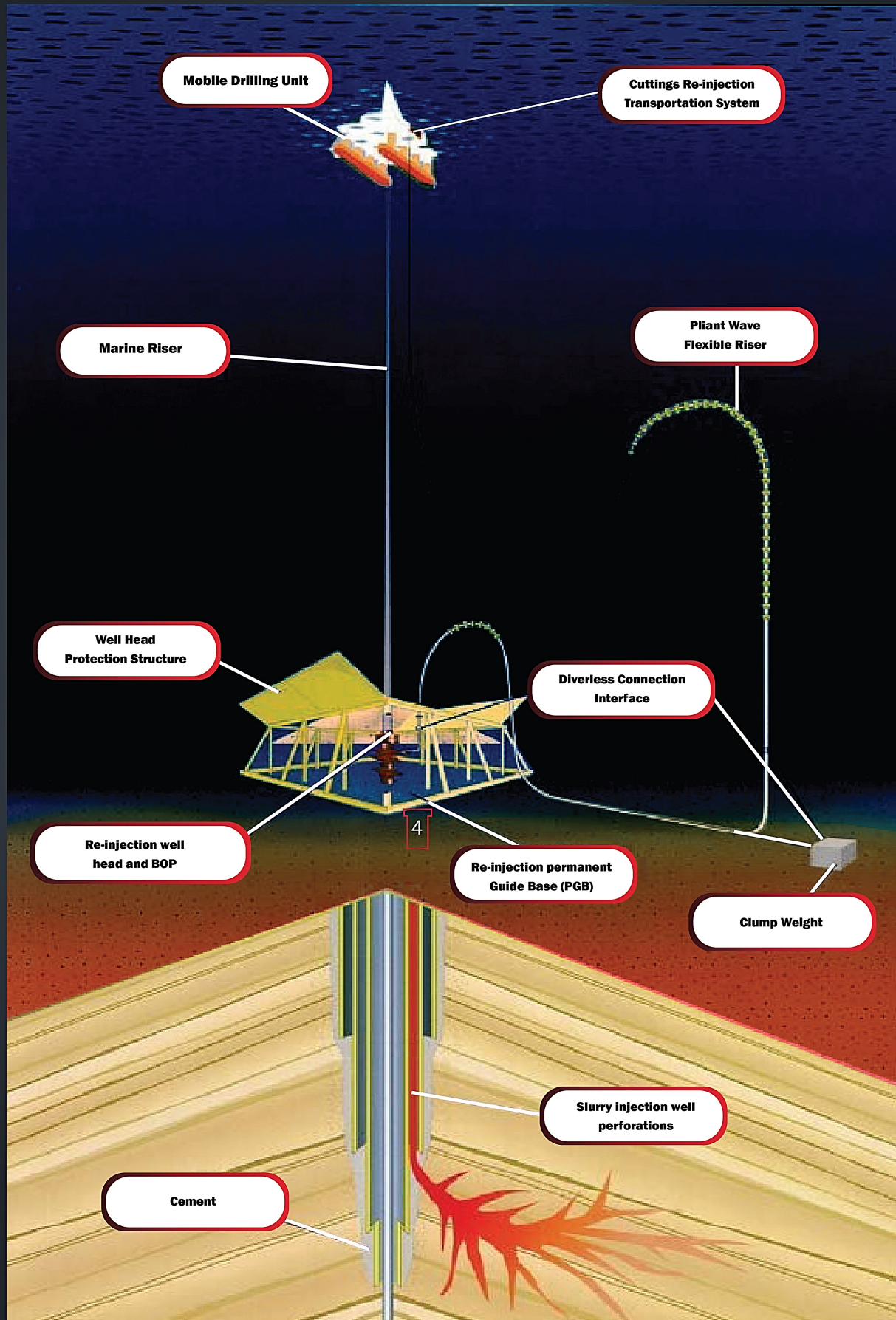
A new well re-injection system developed by the Technip Drilling and Refining Applications Division specifically for semi-submersible rigs, has used unbonded flexible pipe technology to solve the issue once and for all.

The system for grinding up cuttings is well established, with this part of the process being supplied by a cuttings slurrification unit. The drillcuttings are pulverised and mixed with seawater before being transported through a Pliant Wave[®] configured flexible riser system and re-injected at high pressure into the formation.

The hub of the system uses a Coflexip[®] flexible Riser in a Reverse Pliant Wave[™] configuration, which connects the mobile drilling unit to the wellhead re-injection interface connection. The subsea end of the riser is connected to the subsea template via an ROV-operable end fitting.

The riser system consists of a single length section of dynamic flexible pipe with buoyancy modules attached over a specified distance. The buoyancy modules orientate the riser into a "wave" configuration, the geometry of which is predetermined by design analysis. The riser is attached to the seabed and brought back on itself by a tether and clump weight arrangement, which controls the bending radius at the seabed touch-down position.

The flexible line is deployed from the drill rig using the chosen overboard system, (i.e. over the side by chute or by direct drop through the moon pool) and is terminated with a subsea diverless connection. The system can be installed totally independently from the rig and drilling operations.





Fire resistance

The flexible pipe structure itself has an excellent built-in resistance to fire. Upon request a further degree of fire resistance can be obtained by the addition of optimised end-fitting covers, in order to meet the client's requirements (on fixed Offshore installations for instance).

Warranty

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All Abanmarine products are guaranteed against faulty materials and/or workmanship.



ENGINEERED SOLUTION

ADM offers application engineering for its products

Examples : Configuration and lengths of flexibles for:

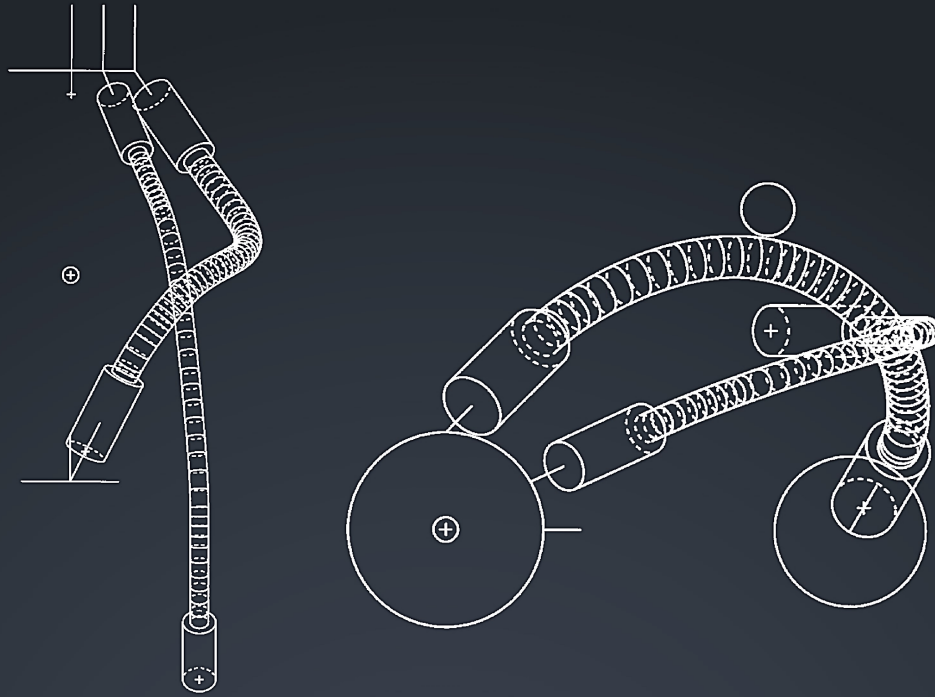
- ☐ Lower marine riser packages
- ☐ Moonpool lines
- ☐ Choke and kill lines on jack ups, land rigs, fixed platform rigs, etc
- ☐ Rotary "hoses" and vibrator "hoses"
- ☐ Skidding rigs
- ☐ Derrick mounted cement and circulation lines
- ☐ Installation between flow heads and choke manifolds
- ☐ Drag chains
- ☐ Special applications

Winches can be designed to take full advantage of the inherent qualities of ADM flexibles. A most important factor is that our flexibles do not deform (become oval) when reeled and can therefore be used at full working pressure on the winch.



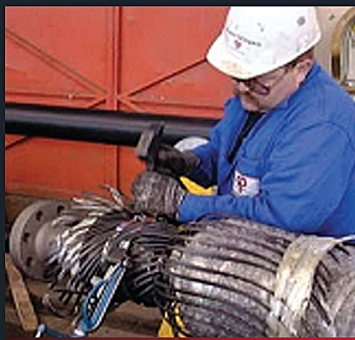
IMR (Inspection, Maintenance and Repair)

The Drilling & Refining Applications Division (DRAPS) has dedicated IMR facilities and authorised IMR agents throughout the world - France, UK, Brazil, the Middle East, Canada and Singapore. Details may be obtained by logging on to the DRAPS Division website www.technip.com/draps, or from your nearest sales office or authorised agent.



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