

DOWN TO THE WIRE

WHEN IT COMES TO HYDRAULIC FLOW, DEMANDS FOR BIGGER, FASTER AND BETTER ARE LARGELY ENABLED BY HIGH-PRESSURE SPIRAL WIRE REINFORCED ASSEMBLIES. ENSURING THESE PROVIDE MAXIMUM LIFETIME AND MINIMUM INSTALLATION EFFORT ALL HINGES ON STATE-OF-THE-ART ENGINEERING

▶ For most medium- and high-pressure hydraulic hose applications, steel wire braid and spiral wire reinforcement are frequently used. But given that one of the most important advantages that wire braid reinforced hoses have over spiral wire hoses is their flexibility, which enables easier mounting in confined spaces, the question naturally arises: 'Why do some off-highway OEMs still continue to use the more rigid, heavy and difficult-to-assemble spiral wire hoses?'

The reason is that spiral wire reinforced hoses better support high working pressures and will also withstand wire fatigue and flexing much better than steel wire that has been arranged in a braided fashion. Consequently, spiral reinforced hoses are normally recommended for use in high-impulse applications prone to frequent, very high pressure peaks – for example, hydrostatic transmissions. In addition, these hoses are often the only option for large-bore, high-pressure delivery lines near the hydraulic pump, due to the pressure requirements.

With MegaSpiral assemblies from Gates, however, many of the disadvantages that can result from spiral hose selection have been well taken care of, so the upsides of spiral wire hose application engineering, installation and performance are ready for the taking.

MegaSpiral hose construction features

To meet the tough working and burst pressure requirements, the wire pack of MegaSpiral spiral wire hoses typically consists of four or six layers of high-tensile steel wire reinforcement. The various, alternating layers of reinforcement wires are wound around the hose tube in a way that achieves the optimal resistance against the internal pressure created by the fluid conveyed and from the external tensile forces caused by tube bending.

By studying the effects of bending on the wire layers, and through the use of advanced spiral wire techniques, Gates has further improved its MegaSpiral constructions and capabilities, placing great importance on both longevity and



Gates MegaSys is an engineered hydraulic hose and coupling system that provides superior performance, versatility, simplicity and value – aiming for the best total cost of ownership solution

compactness to maximize communicated pressures. A combination of its decades of production experience, continuous testing, development and improvement – as well as the use of top-quality materials – have enabled a reduction of the minimum bend radius by up to 40% of the ISO standard requirements and an installation force up to 25% less than is usually required.

This greatly reduced bend radius and superior hose flexibility of the MegaSpiral products means off-highway designers and installers can benefit from easier routing, simplified installation and a reduction in the amount of hoses, leading to more compact machines and lower fuel consumption.

In line with the company's MegaSys program, MegaSpiral hoses follow the

constant pressure concept and feature a working pressure-specific color code for easy identification.

No-skive across the range

In terms of the construction of assemblies that involve skiving, it is generally accepted that this additional process step is a major contributor to fabrication errors. Many coupling designs for spiral wire hose-coupling combinations require the hose cover to be removed before crimping, while some ultra-high-pressure hoses such as SAE 100R15 hoses even need dual-skiving, i.e. removal of both cover and tube material.

Skiving is not only costly and time-consuming; it requires special equipment and skilled people, and being operator-

The energy extraction and exploration market faces a growing need for larger-diameter, more robust spiral wire assemblies and integrated solutions



ABOVE: The stem of a GlobalSpiral coupling is machined from a solid bar for greater strength and integrity

Large-bore spiral lines

As modern off-road hydraulic equipment and machinery become bigger, faster and more powerful, higher liquid flow under extreme pressure becomes crucial. They require hydraulic components that enable an increased fluid capacity – and large-diameter high-pressure spiral hose assemblies are an important part of the solution. However, these large-diameter applications can have some of the most demanding requirements in the industry, so it is essential that manufacturers design products with these stringent requirements in mind.

Gates therefore expanded its MegaSpiral spiral offering a few years ago with no-skive solutions up to 2in and 420 bar, consisting of 32EFG6K hoses in conjunction with one-piece GSM couplings. And with two new hose types – 40EFG5K (2.5in up to 350 bar MWP) and 48EFG4K (3in up to 280 bar MWP), Gates is further raising the bar and enabling OEM designers to further push the boundaries of machinery capabilities and its output. As none of the international standards for hydraulic hoses covers these new diameters so far, these hoses have been developed and tested according to SAE J2545 Test Procedures for Non-SAE Hydraulic Hoses. The new large-diameter spiral wire hose products are impulse tested at 133% of the working pressure at 121°C for more than one million impulse cycles – in other words, far above the SAE J2545 minimum performance requirements.

Hose construction: On the inside, all MegaSpiral hose types consist of an Envirofluid nitrile-based tube for use with biodegradable, as well as petroleum-based, hydraulic fluids. On the outside, the chloroprene-based tube offers superior ozone-resistance (there is no cover cracking after testing in accordance with ISO 7326 when viewed under 7x-magnification) and abrasion resistance (weight loss of <0.4g/2,000 cycles at 50N abrading force). It also has MSHA approval for optimal flame retardancy in mining and marine environments where accidents can be particularly devastating.

The pressure-related color lay line coding allows for easy identification, completely

	MWP (MPa)	DN10 (-6)	DN12,5 (-8)	DN16 (-10)	DN19 (-12)	DN25 (-16)	DN31,5 (-20)	DN38 (-24)	DN51 (-32)	DN63 (-40)	DN78 (-48)
EFG3K	21,0						GS	GSP	GSP		
EFG4K	28,0	GS	GS	GS	GS	GS	GS				GSM*
EFG5K	35,0	GS	GS	GS	GS	GS	GS	GSM	GSM	GSM*	
EFG6K	42,0	GS	GS	GS	GS	GS	GS	GSM	GSM		

TABLE 1: Gates MegaSys hose-coupling combinations
 GS = Global Spiral couplings, two-piece design, developed for four- and six-layer spiral wire hoses
 GSP = Global Spiral Plus couplings, two-piece design, for wire-braid and four-spiral wire hoses with ID of 1.5in or greater
 GSM = Global Spiral Maximum couplings, one-piece design, for high-pressure, six-spiral wire hoses with ID of 1.5in or over

dependent, three major skiving errors can be expected to be encountered:

- Skiving too deep can often damage the wire reinforcement;
- Skiving too shallow will leave excess rubber, altering correct crimp compression;
- Improper skive length – in either way – is critical. If too long, it will not form a reliable weather seal at the end of the coupling, which can then expose the hose wire to environmental conditions and cause hose wire rust. If too short, it will affect the coupling ferrule compression.

These issues can then lead to numerous failure modes, the worst being premature hose failure and poor coupling retention, which can result in catastrophic failures such as hose burst or coupling blow-off.

But there is more – the smoke and odor from rubber dust created by skiving requires health and safety precautions to guarantee a clean assembly and working environment. Last but not least, it can introduce contamination inside the hose, which can often lead to hydraulic system damage and downtime of the equipment.

MegaSpiral hose featuring GlobalSpiral couplings has been developed without the need for skiving, even for the highest pressures up to 420 bar and in six-spiral wire hydraulic lines (SAE 100R15). This complete ‘no-skive across the range’ hose-coupling program not only rules out the above skiving problems, it also consistently performs more than one million impulse cycles at leading bend radii.