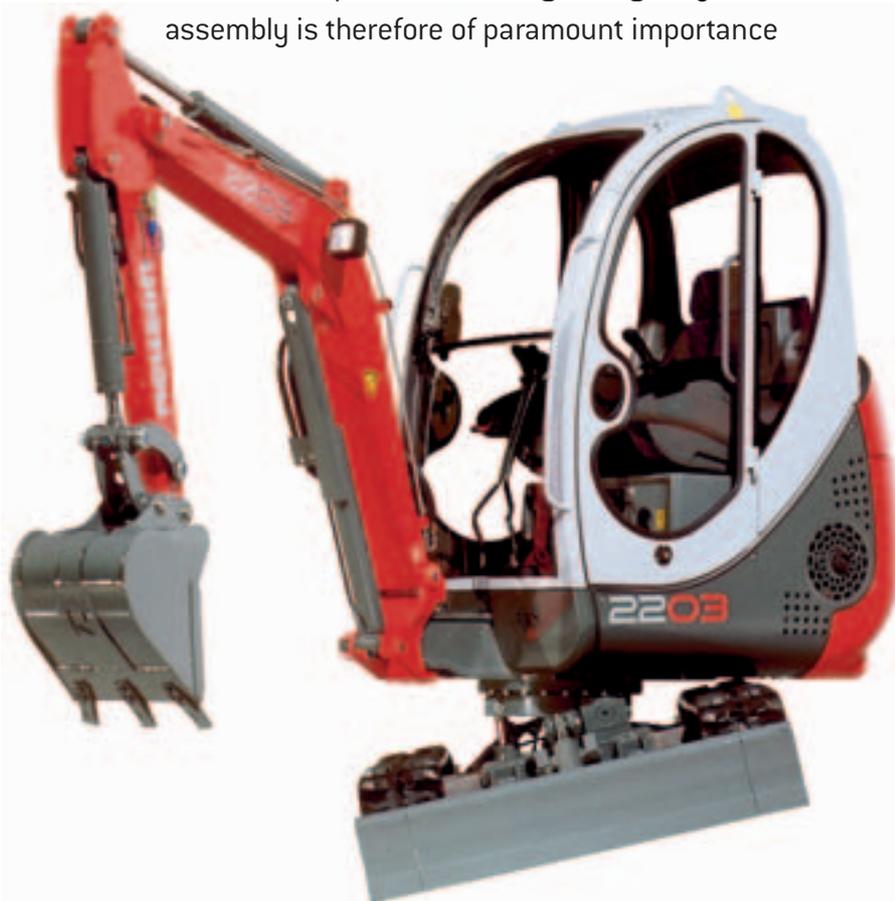


THE WEAKEST LINK?

The quality of your machinery is only as good as its weakest component. Choosing the right hydraulic hose assembly is therefore of paramount importance



how to evaluate the true cost/benefit value equation of a hydraulic hose assembly.

Know your hose assemblies

The first step in understanding how hydraulic hose assemblies can impact upon total system performance is knowing that such an assembly is not a single component but is actually comprised of three elements (a length of hose and two couplings) which are assembled or crimped together.

This means that the hose assembly's performance is affected by several factors: the hose, the couplings and the crimping machinery. Furthermore, the quality of the hose assembly is also affected by the quality of execution of the crimping operation. Finally, the overall reliability of the hose assembly (a critical determinant performance versus warranty expectations) depends on how integrated the components (hose and couplings) and the assembly equipment (die profile) are at the design level.

Quality components – hoses

Using the right hose for the job is the first step to long service life. A hydraulic hose consists of three parts: the tube, the hose reinforcement, and the hose cover.

The purpose of the tube is to allow the fluid to pass through with as little resistance as possible. Multiple complex compounds of chemicals are used to produce various tough, smooth, extrudable, synthetic rubber tubes.

The reinforcement is the hose's muscle. It provides the necessary strength to resist internal pressure (or external pressure in the case of suction/vacuum). The three basic types of reinforcement are braided, spiralled and helical and are shown on page 150.

Braided reinforcement can be high-tensile steel wire or textile and can have single or multiple layers. Spiralled reinforcement on hydraulic hose is typically wire and has four or six layers (plies). Spiral-reinforced hose can typically handle higher pressure and more severe applications with longer impulse service life. Helical coil reinforcement keeps the hose from collapsing during suction (vacuum).

The cover protects the reinforcement and tube from environmental conditions such as weather, ozone, abrasion, temperature, and chemicals, etc. For the

The cost of machine component failure is frequently high and, when totalled, can by far exceed the mere cost of the component in question. Downtime, repair and warranty costs can very quickly add up to turn a seemingly 'clever' low-price component-sourcing decision into a very expensive mistake.

Furthermore, the potential long-term damage to a manufacturer's reputation – which comes as a consequence of a string of component failure incidents – can be catastrophic.

Industry trends, such as the extension of warranty coverage to longer periods by some off-highway machinery engine manufacturers, have exacerbated this risk by raising the bar for component reliability. In this environment, manufacturers whose components are sourced on a purely low-price strategy (and are usually already stretched to deliver normal performance levels) will

find themselves at risk of incurring substantial costs and being labelled as unreliable by end users.

Such situations are a frequently encountered risk in the area of hydraulic hose assemblies which, despite being critical determinants of hydraulic system performance, remain an often misunderstood and underestimated component for most manufacturers.

How to manage this risk?

There are two ways that manufacturers can manage such a risk. Firstly, make sure that design engineers understand the importance of hydraulic hose assemblies, their composition, and the factors that determine their performance. Secondly, ensure that those responsible for purchasing decisions are aware of the potential costs and risks associated with sourcing hydraulic hose assemblies on a purely low-price, 'commodity' basis, and

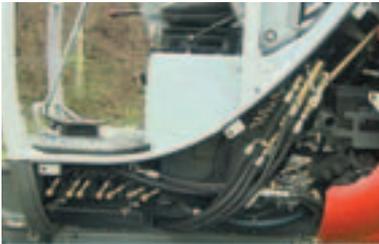
Neuson machines have Gates's hydraulic hose assemblies



toughest abrasion applications, Gates MegaTuff or XtraTuff products should be specified.

The Gates Global Megasys hose range is based on the constant pressure line approach of the SAE standards. It features four pressure lines – 21.0, 28.0, 35.0 and 42.0MPa. Each line comprises wire braid (MxK) and spiral wire (GxK) hoses where the 'xK' denotes the pressure in '000psi [see Table 1].

The idea behind the MegaSys hose range and the definition of the pressure lines has been developed in close co-operation with some major global OEMs. It allows design engineers to easily identify the most efficient hose construction based on the system pressure of the machine. The MegaSys pressure lines have been identified as the most common system pressures in the various hydraulic markets.



Neuson's mini excavator

Quality components – couplings

Hydraulic couplings can be sourced in either preassembled (one-piece) or two-piece configurations. One-piece couplings are made with the ferrule permanently attached to the stem, while two-piece couplings consist of a stem and separate ferrule. When using two-piece couplings, it is important to match the ferrule with its appropriate stem and hose.

There are also two types of ferrules – skive and no-skive. Skive ferrules require the hose cover to be removed and crimped directly onto the reinforcement wire, while no-skive ferrules compress or bite through the hose cover. Gates offers two ranges of no-skive couplings – the GlobalSpiral range for spiral-wire hose and MegaCrimp range for wire-braid hose. No-skive reduces the

assembly time and eliminates the dust given off when skiving, thereby reducing potential contamination. It also eliminates the risk of couplings blowing off improperly skived hoses.

Every Gates hydraulic hose and coupling combination is designed and built to demanding specifications for optimum interface compatibility, then verified by the most rigorous tests in the industry. When used as an integrated system, Gates Global hoses and couplings ensure compliance with the European machinery directive 98/37/CE and deliver performance levels above and beyond international standards.

Integration of elements and proper assembly

Quality components are only the first step in the fabrication of a high-performance hose assembly. These 'right' components must be designed to work together. Most manufacturers offer individual components that meet generally acceptable quality standards but this is no guarantee of performance as part of a hose assembly.

The manufacture of assemblies by mixing and matching couplings from one manufacturer with hoses from another can lead to premature assembly failure. In fact, European legislation (98/37CE & EN 982) specifies that "care must be taken to determine proper compatibility between the hose and fitting".

That is because hoses, couplings, assembly equipment and crimping tolerances vary from one manufacturer to another and are not interchangeable. Even in tightly controlled production, there can be substantial variations on the internal, over-the-wire and cover diameters of hydraulic hoses.

The combined effect of all of these variables can result in considerable variations of the crimp diameter, resulting in under- or overcrimped couplings which will eventually lead to premature failure of the assembly. As it is the hose manufacturer that controls these essential coupling retention parameters, it is very difficult for the coupling manufacturers to ensure full



compatibility of their products with hoses they do not produce (and vice versa).

As an integrated supplier, Gates Fluid Power Europe controls the important technology at the hose/coupling interface and has developed a Global integrated line of hoses and couplings that, when used together, exceed the requirements of the various international standards.

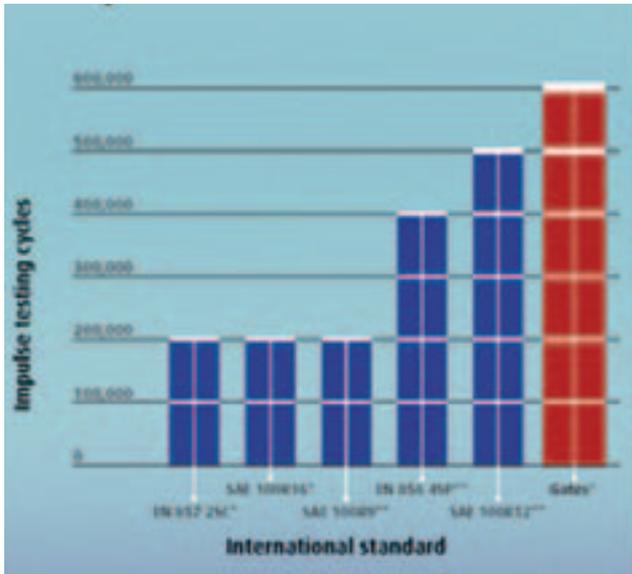
Gates spiral hoses and the GlobalSpiral coupling are developed together to withstand 1 million impulse cycles at oil temperatures of 120°C, while Gates wire-braid hoses and the MegaCrimp couplings are designed to withstand 600,000 impulse cycles at oil temperatures of 100°C.

Gates's new 8M5K wire-braid hose combines 35.0MPa working pressure with a 90mm bend radius. The 8M5K lowers costs by extending wire-braid hose

Gates no-skive MegaCrimp couplings with patented C-inserts ensure weep-free concentric crimping resulting in cleaner leak-free assemblies

Table 1: Gates MegaSys hose line

Hose I.D	Working pressure	1/4in	3/8in	1/2in	5/8in	3/4in	1in	1 1/4in	1 1/2in	2in
21.0MPa	3,000psi	M3K	M3K	M3K	M3K	M3K	M3K	G3K	G3K	G3K
28.0MPa	4,000psi	M4K	M4K	M4K	M4K	M4K	G4K	G4K		
35.0MPa	5,000psi	M5K	M5K	M5K	G5K	G5K	G5K	G5K	G5K	G5K
42.0MPa	6,000psi	M6K	G6K	G6K	G6K	G6K	G6K	G6K		



ABOVE: The 8M5K wire-braid hose combines 35.0MPa working-pressure tolerance with a 90mm bend radius

performance beyond previous limits. With its superior flexibility and compactness, 8M5K is ideal for a variety of applications, such as load-handling equipment and mounted boom cranes.

Gates also ensures the highest possible performing hose assemblies by retaining full control over crimping equipment and the assembly process. Its hose assemblies are made on high-performance, custom-designed crimping machines using proprietary die profiles and crimping data settings. Gates also controls the crimping process with extensive training programmes, such as Safe Hydraulics to disseminate best practices in the production of hydraulic hose assemblies.

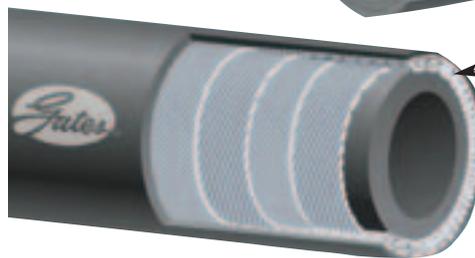
Understand the total acquisition cost of your hydraulic hose assemblies

The second step in managing the risk of sourcing inferior hydraulic hose assemblies is making sourcing decisions based on an understanding of the total acquisition cost of a hydraulic hose assembly.

Many manufacturers adopt a purchasing policy based on standardised definitions and descriptions in a misguided effort to facilitate comparison between manufacturers. This type of approach leaves little room for an in-depth understanding of product performance and tends to foster a 'commodity' mentality where price is erroneously seen as the only variable.

This approach also has the effect of limiting component quality to a level of

Braided – reinforcement can be made of wire or textile, and can have one or multiple layers



Spiralled – reinforcement on hydraulic hose is typically wire and has four or six layers (plies). Spiral-reinforced hose can typically handle more severe applications with longer impulse service life

Helical – coil reinforcement prevents the hose from collapsing during suction (vacuum)



The reinforcement is the hose's muscle and provides the necessary strength to resist internal pressure (or external pressure in the case of suction/vacuum)

minimal compliance with standard requirements. The fact that many standards have not been revised in a long time (decades in some cases) exacerbates the issue.

The net result of this commodity-sourcing approach in today's environment is inevitable – inferior hose assemblies are unwittingly sourced and then they deteriorate and fail prematurely (versus warranty and design expectations), generating huge costs to both manufacturer and end user.

Many well-known manufacturers have avoided this trap by changing to a purchasing approach based on total acquisition cost. The following two articles in this series will cover two such case studies of companies who are nowadays renowned for the quality of their machines and after-sales support but who have both faced serious warranty and service issues in the past as a result of their former hydraulic component sourcing practices.

Gates application engineers can evaluate the performance of your existing hydraulic hose assemblies and recommend the right product choice to

lower your warranty costs and increase your machine performance.

Don't let them be misunderstood

Hydraulic hose assemblies are critical determinants of hydraulic system performance but remain an often misunderstood and underestimated component for most OEMs. Compromising on the quality of these components can turn your hydraulic system into an Achilles' heel and a potential source of warranty costs and reliability issues.

An in-depth understanding of the determinants of hydraulic hose assembly performance coupled with an evolved buying strategy based on Total Acquisition Cost will not only improve machine reliability and performance but will transform your machine's hydraulic system from a potential weak spot to a featured selling point. **ivT**

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