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PAPER**

**Line-of-Sight Sleeving is the
Safest Alternative for Protecting
Operators and Personnel**

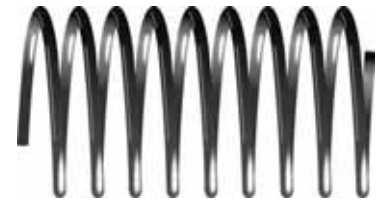
Protective covers for hydraulic hose assemblies are taking on a whole new meaning.

They are still being used to protect hoses on mobile construction and mining equipment. However, with the need for higher-pressure systems and more compact machine designs, design engineers are increasingly looking for ways to safely protect machine operators and personnel from catastrophic hydraulic hose failure.

First and foremost, the best way to protect a hose assembly, especially from abrasive wear, is to reroute it away from hose-to-hose and hose-to-metal conditions. A second option is to specify a hose made of special hybrid compounds. Some new hybrid cover materials have been tested to last up to 300 times longer than standard rubber covered hoses, like Gates MegaTuff[®] hose.

To further protect hydraulic hoses from external damage and wear, design engineers can use several different types of hose guards or sleeves:

Metal Spring Guard – This form of hose protection is often used when an exposed hose may encounter flexing, twisting, kinking, tensile or side loads, a tight-bend radius and/or vibrations. The metal spring guard needs to be fitted before the hose is assembled.



Plastic Spring Guard – This flat, plastic guard is also used on exposed hoses, but has the added advantage of being able to be fitted after the hose has been assembled and sometimes after it has been attached to the equipment.



Textile/Nylon Sleeving – This type of sleeving is often used on hoses inside the equipment or in places where abrasion may occur. The textile sleeving offers excellent wear resistance and can help reduce the amount of oil spillage.



While these sleeve covers may protect a hydraulic hose from abrasion and cuts, they typically offer little or no protection from hose bursts and pinhole leaks. Before determining the solution, engineers should make sure they understand the problem.



Excessive pressure surges, flexing, kinking crushing or exceeding the minimum bend radius may cause a burst away from the hose ends. Pressure surges that exceed the hose's maximum operating pressure rating may result in reinforcement failure. Excessive flexing, kinking and crushing can cause reinforcement fatigue and eventual failure. Bending the hose tighter than recommended will place excessive stress on the reinforcement, could open large gaps between strands of reinforcement and will severely reduce the hose's ability to withstand pressure.



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A pinhole leak in a hydraulic hose that is under pressure can release toxic fluid at more than 600 feet per second – close to the muzzle velocity of a gun. Although it is the hose's high-tensile wire-reinforcement structure that bears the brunt of the pressure, the inner tube itself has to bridge the gaps in the braid, formed when the hose is bent and stressed. If the compound is not strong enough (tensile at break not high enough) it will be blown through the gaps in the braid, which can cause a scissoring effect and cut a hole in the tube, resulting in a pinhole leak. The very fine jet of hydraulic fluid at high pressure will act like a hypodermic needle that may penetrate both protective clothing and skin.

To protect operators of hydraulic equipment from catastrophic hydraulic hose bursts or pinhole leaks, several hose manufacturers have developed their own versions of a safe “line-of-sight” nylon sleeving.

When choosing a sleeve product, design engineers need to understand that current standards and specifications relating to hydraulic hose protection are vague.

ISO 3457 and EN474-1 state, “Hydraulic hoses containing fluid with a pressure of more than 5MPa (50 bar) and/or having a temperature over 50°C, and which are located within 1.0 m of the operator, shall be guarded.”

Mining industry equipment must conform to Mine Safety and Health Administration (MSHA) standards and be certified. MSHA's Accident Prevention Program simply says, “Install abrasion protection such as spiral wrapping, sleeves and guards.”

ISO and European standards don't specify a test method for sleeving products.

While there are no current industry regulations, Gates Corporation has developed its Lifeguard™ (patent pending) sleeve following a rigorous testing program that could likely be used to establish future standards for end-user applications. The LifeGuard sleeve has been tested both in the lab and in the field to verify its performance and capabilities at typical fluid pressure and temperature levels.



Gates revolutionary LifeGuard sleeve is comprised of two nylon layers. During manufacture, the two sleeve layers are continuously woven at the same time, one inside the other, but they are not attached to one another.



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The inside sleeve layer is made of nylon fiber that elongates or stretches up to 20 percent. By stretching, it can absorb the energy of a burst or pinhole leak. The outer sleeve contains the fluid and redirects it to the clamped ends. The outer sleeve is resistant to abrasion, but is not specifically designed for abrasive environments. Worker safety within a three-foot line-of-sight of a burst or pinhole leak is the primary benefit.

The sleeve is secured at either end of the hose with special “channel” clamps. The clamps allow leaking fluid to escape, so the fluid won’t collect behind the sleeve and cause it to burst. Fluid leaking past the clamps lets the operator know that there’s a leak in the hose.

LifeGuard sleeving protects hoses from up to 5,000-psi pinhole leaks for up to five minutes and up to 10,000-psi bursts. The sleeving is compatible with a wide range of fluids, including environmentally friendly liquids and biodiesel fuel. LifeGuard 3000 protects up to 212° F, and LifeGuard 4000 and 5000 up to 250°F.

Gates LifeGuard line-of-sight sleeving is a safe, effective, economical alternative to other costly metal, plastic and nylon shielding.

For more information on LifeGuard line-of-sight sleeving and other Gates hydraulic products, visit www.gates.com/lifeguard.