

Hydraulic Maintenance & Safety



Gates Connected™

Tips to prevent downtime and save you money.

Presented by Gates Corporation

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Why Preventive Maintenance?



Hydraulic preventive maintenance and safety is

important for anyone who operates hydraulically powered equipment. Improperly maintained hydraulic assemblies can cause premature assembly failure and blowouts, resulting in equipment downtime, possible equipment damage, personal injury and even death.

At Gates we believe following proper preventive maintenance procedures is time well spent. Shown at the right are some of the numerous benefits provided by preventive maintenance.

Let's take a look at some preventive maintenance and safety procedures. They'll put you on the right track to safe and long-lasting hydraulic assemblies.

Benefits

- **Reduce downtime.**
- **Improve production.**
- **More efficient use of maintenance personnel.**
- **Better control of spare-parts inventory.**
- **Decrease safety hazards and accidents.**
- **Extend equipment service life.**
- **Reduce capital outlays for new equipment.**



Choosing the Right Components

Safe, long-lasting hydraulic assemblies begin by choosing the right components. The “right” components are couplings and hoses designed to work together. Most manufacturers offer safe, high-quality components. But mixing and matching couplings from one manufacturer with hoses from another manufacturer can lead to premature assembly failure.

That’s because hoses, couplings, assembly equipment and crimping tolerances vary from one manufacturer to another and are not interchangeable. When components from different manufacturers are mixed, coupling retention can be adversely affected. Mixing components can not only cause unnecessary downtime, it can result in personal injury as well. In addition, the thread or flange ends of couplings



must be properly matched to their mating components to create leak-proof connections.

Gates offers a complete line of couplings, hoses and related equipment, all designed to work together as a system. Gates components meet stringent test requirements and are engineered to provide the highest quality and longest service life. Your Gates distributor is specially trained to make sure you get the couplings and hoses that specifically meet your needs.

Choosing the Right Hose

C *hoosing the right hose is the first step to long and safe assembly service life.* But before we look into how to select the proper hose for the job, let's first take a look at the benefits of using rubber hose in fluid power applications. Unlike rigid tubing, rubber hose offers the following advantages:

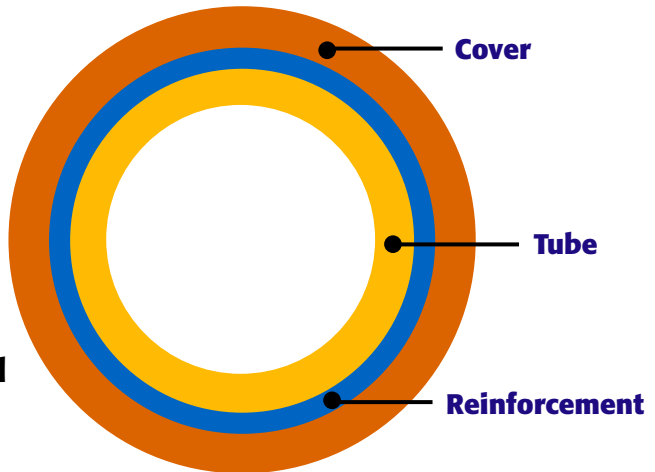
- **Less susceptible to vibration and movement.**
- **No brazing or specialized bending required.**
- **Easier to obtain in the aftermarket.**
- **Easier to route around obstacles.**
- **Sound absorption.**
- **Dampens pressure surges.**

Given its easy availability and routing advantages, many maintenance personnel actually prefer rubber hose to metal tubing. In

fact, it's not uncommon for maintenance technicians to replace tubing with a hose assembly.

Hose Construction

Hydraulic hoses have three parts: the cover, tube and reinforcement. The cover protects the tube and reinforcing material from environmental conditions such as the weather, ozone, abrasion,



heat, chemicals, etc. Choose a hose with a cover that can meet the demands of your system, especially in abrasive situations or if the hose will be exposed to chemicals or extreme temperatures.

The tube is the part of the hose that comes in contact with the hydraulic fluid. Reinforcement allows the hose to withstand internal pressures, or in the case of suction/vacuum hose, external pressures. Hoses generally have braided, spiraled or helical reinforcement. The type of reinforcement depends on the intended use of the hose.

When choosing a hose, it is crucial that the cover, tube and reinforcement are all compatible with the type of fluid used in the system. This is an important point to remember, because many hoses are not compatible with all of the common fluids on the market today, including petroleum-based, phosphate esters, water-based and diester fluids.

Other variables, such as elevated temperatures, fluid contamination and fluid concentration, will also affect compatibility. If in doubt, consult your hose distributor or the hose manufacturer.

The “**STAMPED**” Method

Studies conducted by fluid power parts manufacturers indicate that

the three most common causes of hydraulic hose failure are abuse, misapplication and improper plumbing. Equipment operators and technicians can reduce, if not eliminate, premature hydraulic hose failure by giving maximum consideration to hose assembly selection and installation.

Yet, with all of the different types of hoses on the market, choosing the right one can be difficult.



Gates suggests using the “STAMPED” method to be sure you get the right hose assembly for the job. “STAMPED” stands for Size, Temperature, Application, Material to be conveyed, Pressure, Ends or couplings, and Delivery. Here’s how it works:

Size – Choose a hose with an inside diameter that is adequate to minimize pressure loss and to avoid hose damage caused by the heat generated by excessive fluid turbulence.

Temperature – The hose must be able to withstand the system’s minimum and maximum fluid and ambient temperatures.

Application – Determine where or how the hose will be used. You’ll need to know the equipment type, working and surge pressures, fluid to be used, bend radius, electrical conductivity, etc.

Material to be Conveyed – The hose, including the hose tube and cover, along with the coupling and O-rings, must be compatible with the type of fluid to be used.

Pressure – Know the system pressure, including pressure spikes. The hose’s published working pressure must be equal to, or greater than, the normal system pressure and any pressure spikes it will encounter.

Ends or Couplings – Identify the type of threads the system uses and select a coupling that is compatible with that thread type.

Delivery – How many hose assemblies do you need and when do you need them? Your local Gates distributor will work with you to make sure you get the assemblies you need when you need them.

Periodic Inspections

Periodic hose assembly inspections can prevent unwanted and unexpected assembly failures. During normal operations, be aware of how the equipment sounds, feels, etc. Be sure to check out any noticeable abnormalities.

When and how often to inspect a hose assembly can vary by the type of equipment used. Refer to your equipment manual and always follow the manufacturer's inspection recommendations. If the recommendations are not available, use the following guidelines:

- **Inspect mobile equipment every 400 to 600 hours or every three months, whichever comes first.**
- **Inspect stationary equipment every three months.**

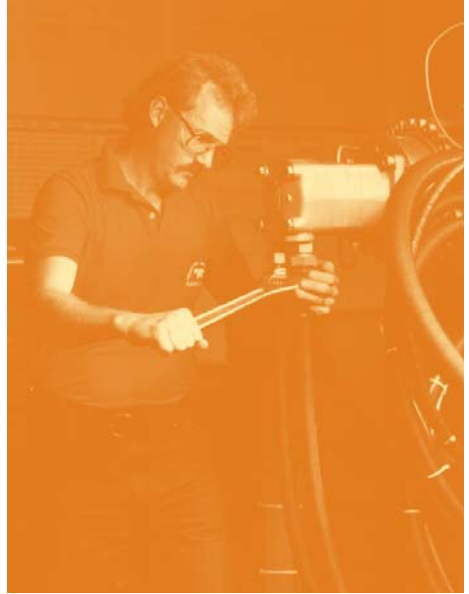
Other factors that influence inspections include:

- **Whether the equipment is critical to the operation.**
- **Operating pressures and temperatures.**
- **Difficult routing conditions.**
- **Environmental factors such as extreme temperatures, high or low humidity, abrasive conditions, exposure to sunlight, etc.**
- **The type of usage: rugged, abusive, shock, vibration, operating time, etc.**
- **Accessibility of equipment.**

Inspection Procedures

Here's a checklist that will help keep your equipment in good running order:

- 1 First, always turn off the equipment's power.**
- 2 Place the equipment and components in a safe and/or neutral position.**
- 3 Remove access panels and inspect hose and fittings for damage or leaks.**
- 4 Repair or replace assemblies as needed.**
- 5 Inspect other hydraulic components.**
- 6 Reinstall access panels.**
- 7 Turn power back on.**
- 8 Remain aware during operation for unusual noises, vibrations, etc.**

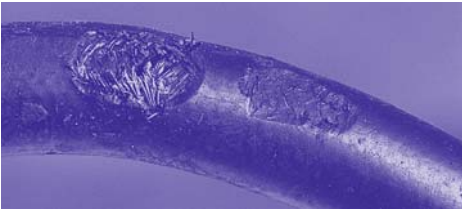


All of these points are covered in greater detail in the Gates "Safe Hydraulics" workshop. See your local Gates representative to schedule a workshop at your location.

Hose Troubleshooting

The goal of troubleshooting is to identify the cause, or causes, of a hose failure, and then to take the appropriate corrective action. Here's a list of some common causes of premature hose failure and some everyday solutions to correct the problems:

Hose Abrasion



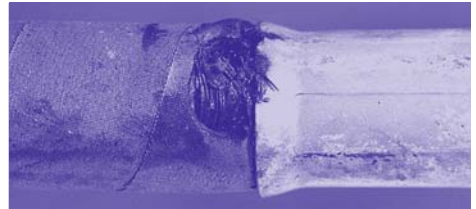
Solution – Reroute the hose to keep it away from abrasive sources or guard the hose with a protective sleeve.

Hose Burst Away from Hose Ends



Solution – Inspect system operating pressure and select a hose that meets or exceeds the system's maximum pressure. Try rerouting the hose to prevent excessive flexing and/or to keep the hose from exceeding its minimum bend radius.

Hose Burst at Coupling

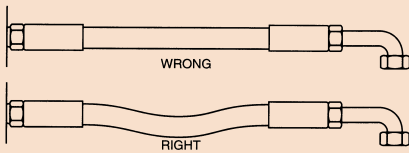


Solution – Increase the hose assembly's length to accommodate contraction under pressure; increase the hose bend radius or install bend restrictors; or replace the hose assembly with a properly crimped assembly.

Hose Routing

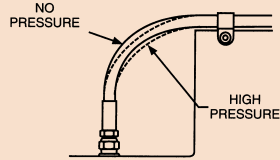
Many assemblies fail because of improper routing. To minimize damage caused by excessive flexing or whipping, restrain, protect or guide (using clamps) all replacement hoses. Protective armor, spring guards or sheaths made of abrasion-, temperature- or chemical-resistant material will help protect hose from cuts, abrasions, corrosives or hot components. Here are some hose routing tips that will prevent unnecessary assembly failures:

Length Change



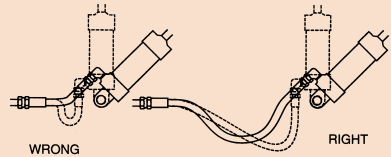
When hose installation is straight, allow enough slack in hose line to provide for length changes that will occur when pressure is applied.

Length Change



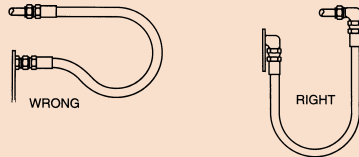
To allow for length changes when the hose is pressurized, do not clamp at bends so that curves will absorb changes. Do not clamp high and low pressure lines together.

Movement/Flexing



Adequate hose length is necessary to distribute movement on flexing applications and to avoid abrasion.

Tight Bend



When radius is below the required minimum, use an angle adapter to avoid sharp bends.

Hose Cleanliness

Contaminants in the system can decrease equipment life and cause expensive failures. Therefore, it's important to use clean components and assemblies. Cleaning methods vary based on shop capabilities, the cleanliness level required and the critical nature of the equipment.

Perhaps the easiest cleaning method is to blow shop air through the hose assembly after it is completed. However, this offers minimal cleaning and is the least effective method. A more sophisticated method is to use a combination of shop air, water and a small sponge soaked with isopropyl alcohol. Push the sponge through the hose with shop air until the hose meets cleanliness levels.

A fluid flushing apparatus provides the most effective cleaning method. With this technique, cleaning fluid is flushed at a high velocity through the hose until the hose meets cleanliness levels. Your Gates representative can provide you with more information on hose cleanliness and cleaning methods.



Assembly Installation

Be sure to follow these seven steps when installing a hydraulic assembly:

- 1 Clean the surrounding area where the connection will be made. Do not let dirt or contaminants get into the hydraulic opening.**



- 2 If adapters are used, install them now.**



- 3 Lay the hose assembly into the routing position to verify length and correct routing.**



- 4 Thread one end of the assembly onto the port or adapter. Install angled fitting first to ensure proper positioning.**



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5 Now, thread the other end of the assembly, taking care not to twist the hose. Use a wrench on the fitting's backup hex while tightening.



7 Run the hydraulic system under low pressure and inspect for leaks and potentially damaging contacts.

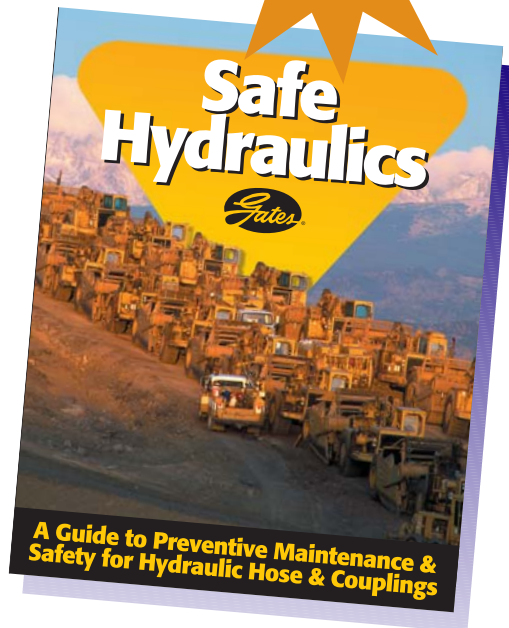


6 Properly torque both ends.



Safe Hydraulics

**FREE
Seminar**



There you have it—an overview of hydraulic safety and preventive maintenance. If you are looking for more information on this topic, Gates offers a special hydraulic preventive maintenance training program called “Safe Hydraulics.” The class provides you with everything you need to know to properly maintain your equipment for safe operation.

In addition to the training program, refer to the Gates Guide to Preventative Maintenance & Safety for Hydraulic Hose & Couplings for detailed information on the following topics:

- Fitting orientation
- Coupling identification
- Agency specifications
- Hydraulic fluids
- Hose storage life
- Proper installation torque values

- Crimper preventive maintenance
- Troubleshooting and hose assemblies

For more information, contact your local Gates hydraulic distributor, call Gates at **1-800-777-6363** or visit us online at **www.gates.com/safehydraulics**.



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