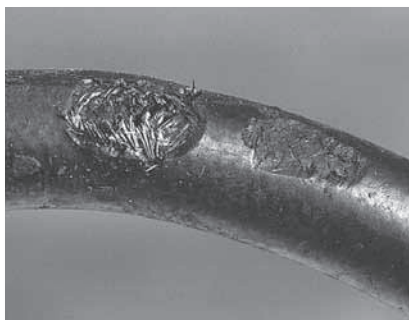


# TROUBLESHOOTING

## Hydraulics



### Abrasion

**Problem:** Part of the hose cover has been removed, exposing the hose reinforcement.

This may be caused by continuous rubbing against equipment components, other hose or objects in the operating environment. Cover erosion may also be caused by non-compatible fluids such as toxic chemicals, acids, detergents and non-compatible hydraulic fluids. Exposed hose reinforcement is susceptible to rust and accelerated damage leading to failure.

#### Solutions:

##### 1. Reroute hose.

Bundle hoses together that flex in the same direction. Clamps, bent tube couplings, nylon ties, spring guards and sleeving can be used to keep hoses away from abrasion sources and exposure to non-compatible fluids.

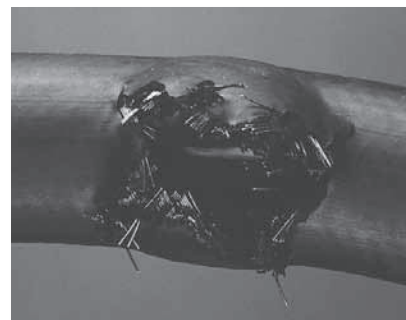
##### 2. Protect hose.

Nylon and urethane sleeving and spring guards can be used to protect the cover from abrasion. See page 62 for more information.

##### 3. Change to a hose with a cover that is compatible with any chemicals it may contact.



Gates offers abrasion-resistant hose covers with far greater abrasion resistance than any standard rubber hose in the industry. Gates MegaTuff® and XtraTuff® hoses were developed to solve your abrasion problems.



### Hose Burst at Body

**Problem:** The hose has burst at some length away from the hose ends.

This may be caused by excessive pressure surges, flexing, kinking, crushing or exceeding minimum bend radius.

- Pressure surges that exceed the hose's maximum operating pressure rating may result in reinforcement failure.
- Excessive flexing, kinking, and crushing causes reinforcement fatigue and eventual failure, i.e., flexing a metal paper clip back and forth until it breaks.
- 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.

#### Solution:

Review/inspect your operating pressure. It may be necessary to use a pressure transducer to measure the magnitude of any pressure surges. Select a hose that has the proper working pressure rating to handle the maximum pressure (including surges) of your application. If your application has frequent pressure

# TROUBLESHOOTING

## Hydraulics, cont.

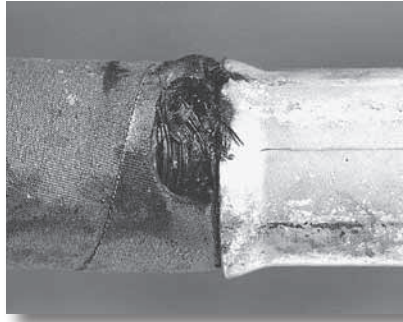
surges, you may want to consider a spiral wire-reinforced hose rather than a wire braid-reinforced hose

Reroute hose to eliminate excessive flexing and/or exceeding the minimum recommended bend radius for the hose in use. Use a hose that has a smaller bend radius.



Gates MegaSys® hose products are designed

to improve flexibility and perform at half the industry standard (SAE) minimum bend radius. This includes very high-pressure spiral-reinforced, wire-braid and low-pressure suction hose.



### Hose Burst at Coupling

**Problem:** Hose has burst at coupling end.

This may be caused by insufficient hose slack, excessive bending/flexing or an overcrimped hose end. When a hose is pressurized, it typically shortens in length putting excessive stress (tug) at the coupling. Excessive bending or flexing increases stress of the reinforcement. Overcrimping or use of the wrong ferrule will damage or crush the reinforcement, severely limiting its ability to withstand pressure.

#### Solution:

Increase hose length to accommodate contraction under pressure. Increase actual bend radius as the hose exits the coupling

Bend restrictors can also be used to reduce bending stress at the coupling. Replace hose assembly with properly crimped assembly.



### Leak at Thread End/Seat

**Problem:** Coupling leaks at thread or seat.

This may be caused by any of the following:

1. Missing or damaged O-ring.
2. Damaged threads or seat angle.
3. Thread misalignment.
4. Incompatible thread ends or seat angles.
5. Over or undertorquing.

#### Solutions:

Remove the connection and inspect.

1. Certain couplings require the use of an O-ring. If it is missing, replace it. If an O-ring is used, check for damage caused by installation or possible material breakdown from heat or fluid incompatibility. Alternative O-ring materials may be required. Replace if necessary.
2. Check the threads and/or seat angle for damage that may have occurred prior to or during installation. Any ding or burr may be a potential leak path. Replace if necessary.
3. If the coupling was misaligned during installation, threads may have been damaged. Replace and carefully reinstall.

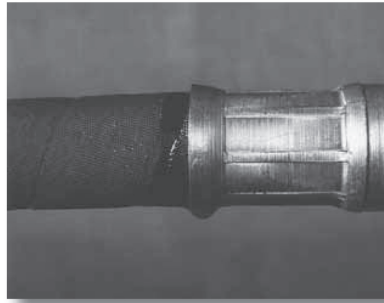
# TROUBLESHOOTING

## Hydraulics, cont.

4. It is possible to thread together some components that are not compatible. Use Gates thread I.D. kit to assist in identifying mating components. Some thread end configurations have better sealability than others.

5. Overtorquing of a threaded connection can stretch and damage threads and mating seat angles. Overtorquing can also damage the staking area of the nut. Overtorquing can cause cracking of either the nut or seat. Undertorquing does not allow

Use of a torque wrench can alleviate such problems.



### Weep at Hose Coupling Interface

**Problem:** Fluid is seeping or weeping from the end of the ferrule.

This may be caused by insufficient hose insertion during assembly and/or undercrimping/overcrimping. Also, excessive vibration, flexing and tugging may weaken the interface and reduce the assembly's ability to prevent fluid seepage.

#### Solution:

Whether it has been undercrimped or the stem has been improperly inserted, the hose assembly must be replaced with one that has been properly assembled.



### Coupling Blow-Off

**Problem:** The crimped coupling comes off the end of the hose.

This may be caused by any of the following:

1. Under or overcrimping.
2. Incorrect crimping dies.
3. Improper skive (if applicable).
4. Incorrect fitting/hose combination.
5. Ferrule not engaged into the stem locking collar (if using two-piece coupling).

Insufficient hose slack in routing will cause the hose to pull away from and release the coupling. Mixing various manufacturers' hose and couplings may also reduce coupling retention.

**Solution:** Examine and replace the hose assembly to ensure proper assembly procedures are followed.

Modify hose length and/or routing to accommodate potential hose length reduction under pressure

Never mix different manufacturers' hose, couplings or crimpers.



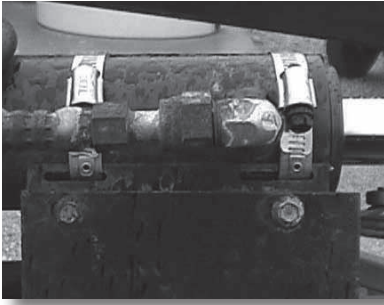
Gates revolutionary MegaCrimp® coupling has

been designed to provide "weep-free" performance as well as easy/simple insertion.



# TROUBLESHOOTING

## Hydraulics, cont.



### Coupling Corrosion

**Problem:** Coupling has been exposed to corrosive conditions that have begun to cause rust and deterioration. Chemicals, fertilizers, humidity or a marine environment could be the cause of the corrosion.

Many hydraulic fittings are manufactured from carbon steel and have zinc dichromate plating that provides minimal corrosion resistance. SAE J516 requires manufacturers to pass a 96-hour continuous salt spray test.

#### Solution:

Provide adequate protection for the coupling or minimize exposure to corrosive elements. Other coupling materials, such as stainless steel and brass are available and can provide better resistance to some corrosive elements.



Gates TuffCoat® plating provides over 400 hours of protection against corrosion. This is a 400 percent improvement over the 96-hour SAE standard.



### Hose Cracks

**Problem:** Hose cover or tube has cracks and appears hardened.

This is typically caused by exposure to excessive heat and/or ozone. Excessive heat can be created by:

- Routing near a heat source such as an exhaust manifold.
- Using an undersized hose or reservoir.

An increase of 18°F above the maximum temperature may decrease hose life by half. Cracks can also be caused by flexing, especially at excessively low temperatures. Never exceed the temperature rating of the hose.

#### Solution:

Select a hose that meets the temperature and flow requirements of the application. Also, identify the heat source and consider re-routing it away from the source to minimize the heat's effects. Examine reservoir size (if necessary).



### Hose Twist

**Problem:** Hose assembly is twisted.

This is evident by a spiraling hose label and bends in two planes, as demonstrated in the photograph above. Twisting misaligns the reinforcement and reduces its ability to withstand pressure. Twisting a high-pressure hose seven degrees may reduce service life by as much as 90 percent.

#### Solution:

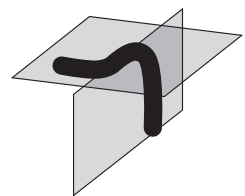
Replace and re-route the hose to ensure that bending occurs only in one plane (see below). The use of bent tube or block style couplings and adapters may improve routing. Also, when installing the assembly, hold the backup hex to prevent it from turning and applying a twist. If male and female couplings are used on the same hose assembly, install the male (non-swivel) end first.

Right



One-plane bend

Wrong

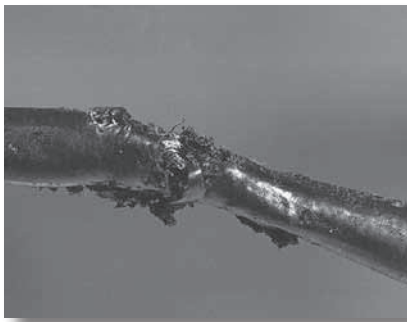


Two-plane bend

\* Twist can also cause the coupling to twist in service causing leaks or coupling blow-off.

# TROUBLESHOOTING

## Hydraulics, cont.



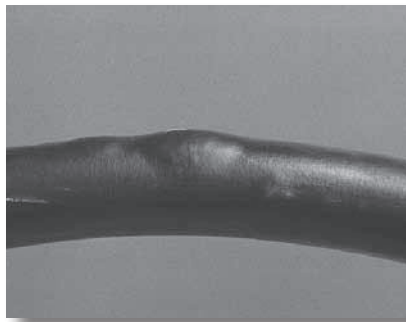
### Crushed Hose

**Problem:** Hose has been crushed.

Flattened area has been caused by external forces (movement). Reinforcement is weakened and could burst. Also, the tube has collapsed restricting fluid flow.

**Solution:**

Determine source of damage. Re-routing or guarding may be necessary. Replace hose.



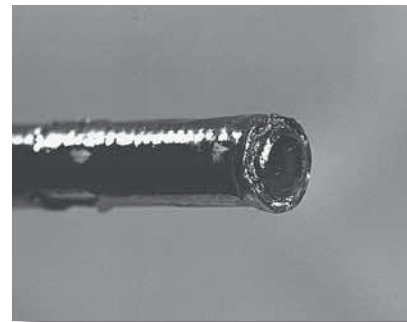
### Cover Blisters

**Problem:** Blisters have formed on the hose cover.

This can be caused by incompatible fluids that have permeated the hose tube and collected under the cover. Compressed gases can also permeate or effuse through the tube and become trapped under the cover. Trapped air in the hydraulic system can also cause blisters.

**Solution:**

Replace the hose with one that is compatible with the fluid being used. If it is compressed gas, the cover can also be perforated (pin-pricked) to allow the gas to pass through the cover. Textile hose covers also eliminate blistering. Bleed the system to eliminate any trapped air.



### Tube Swell

**Problem:** The equipment has become sluggish and unresponsive.

Cutting and evaluating the hose shows the hose tube is swollen and deteriorated and possibly washed out in sections. Fluid incompatibility is the likely cause. Many new fluids are now promoted as "environmentally friendly" but may not necessarily be compatible with the hose.

See chemical resistance tables in Gates hydraulic catalog 35093.

Excess fluid temperatures can also cause the tube to bulge near the end of the coupling.

**Solution:**

Replace the hose using a tube material recommended for that particular fluid.



**CAUTION:** Some gases can displace breathable air and/or be flammable. Properly ventilate the routing area.



Gates EnviroFluid® hoses are compatible with biodegradable hydraulic fluids like polyolester, polyglycol and vegetable oil as well as standard petroleum-based fluids.

# TROUBLESHOOTING

## Hydraulics, cont.

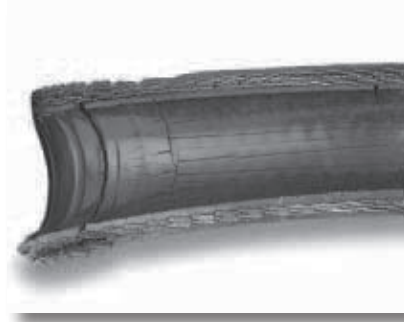


### JIC/SAE Seat Cracks

**Problem:** Fitting sealing cone seat is cracked.

**Solution:**

If crack is due to overtorquing, use torque wrench and follow recommended torque specifications. If crack is due to excessive vibration or shock loading, change hose routing to reduce side load on fitting.

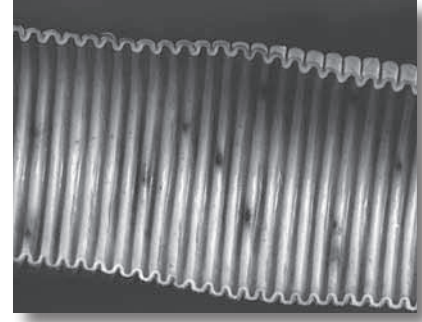


### Hose Tube Failure

**Problem:** Hose tube failure – tube material is cracked and brittle. High temperature caused by excessive fluid velocity.

**Solution:**

Compare pump output to the hose size using flow rate chart. Select a hose type with a higher temperature rating. If not possible, add cooling devices and increase reservoir size.



### Static Discharge On Teflon® Hose

**Problem:** Pinholes in Teflon® tube that allow fluid to escape through the cover.

Dissection of tube shows black “burn” areas and pinholes. This is caused by a release of an electrostatic charge through the tube to the wire cover. Some fluids have the potential for electrostatic buildup.

**Solution:**

Replace damaged hose with one that has a conductive tube (Gates C14 conductive tube). This allows any charge to be conducted to the end fittings rather than discharging through the tube wall.



# TROUBLESHOOTING

## Hydraulics, cont.



### Overcrimp

**Problem:** The ferrule appears to be overcrimped which could lead to leaking or premature failure.

**Solution:**

Refer to the crimp manuals or charts for proper die selection and crimp settings. Receive hands-on training for fabricating hydraulic assemblies. Use Gates calipers to measure the finished crimp diameter for accuracy. Crimp O.D. tolerance is +/- .010 (in.).



### Undercrimp

**Problem:** The ferrule appears to be undercrimped which can lead to coupling leaks or blow-offs.

**Solution:**

Refer to the crimp manuals or charts for proper die selection and crimp settings. Receive hands-on training for fabricating hydraulic assemblies. Use Gates calipers to measure the finished crimp diameter for accuracy. Crimp O.D. tolerance is +/- .010 (in.).



### Mushroom Flare Crimp

**Problem:** The crimp of the ferrule is not full length, leaving a mushroom flare at the top of the ferrule. This could lead to coupling blow-off or early failure.

**Solution:**

With the Gates crimping system, be sure that the ferrule or shell is fully engaged with the dies to ensure a full-length crimp. Refer to Gates crimp manuals and charts for proper crimping instructions. Receive proper training on crimping procedures with the Gates hose and coupling system.

# TROUBLESHOOTING

## Hydraulics, cont.



### Tail-Flare Crimp

**Problem:** The crimp of the ferrule is not full length, leaving a tail flare at the end of the ferrule.

**Solution:**

With the Gates crimping system, be sure that the ferrule or shell is fully engaged with the dies to ensure a full-length crimp. Refer to the Gates crimp manuals and charts for proper crimping instructions. Receive proper training on the crimping procedures with the Gates hose and coupling system.



### Good Crimp MegaCrimp® Coupling



### Good Crimp GlobalSpiral® Coupling





# TROUBLESHOOTING

## Hydraulics, cont.

### Unresponsive Equipment

**Problem:** Equipment has become sluggish or unresponsive. There are a number of potential causes that should be reviewed:

If you encounter a problem that hasn't been covered in this manual or which still exists after your troubleshooting efforts have been exhausted, contact your Gates distributor or sales representative.

| Cause   | Solution  |
|---|---|
| <b>Air in the hydraulic system</b>                                | Check fluid level.<br>Purge (bleed) air out of system.<br>Check connections on suction line (pump intake).  |
| <b>Pressure drop</b>  | Review hose sizes and lengths to minimize pressure drop. Smaller hose diameters and longer lengths increase the pressure drop in a line.<br>Replace block style couplings and adapters with bent tube style to improve laminar flow and reduce pressure drop. |
| <b>Hose tube collapse or swell</b>                                | Check fluid compatibility with tube material.<br>Vacuum may have exceeded hose vacuum rating. Select a hose that meets the requirements.  |
| <b>Non-functioning hydraulic components (pumps, valves, etc.)</b> | Check each hydraulic component for full function, i.e., seal may have rolled in a cylinder causing it to bind and limit stroke.   |
| <b>Blockage in fluid flow</b>                                     | Check flow in each line and component for blockage. It may be necessary to remove and replace each component to determine where blockage exists. Eliminate source of contamination.<br>Check and replace filter if necessary.                                 |

# TROUBLESHOOTING

## Hydraulics, cont.

### H O S E S E L E C T I O N

#### Why Use Hose?

There are two common types of fluid connection — rigid tubing and hose assemblies.

**Rigid tubing** offers the following advantages:

- Better heat dissipation.
- Tighter bend radius.
- Lighter weight.
- Ability to handle pressures exceeding 6,000 psi.

**Hose assemblies**, however, have the following advantages:

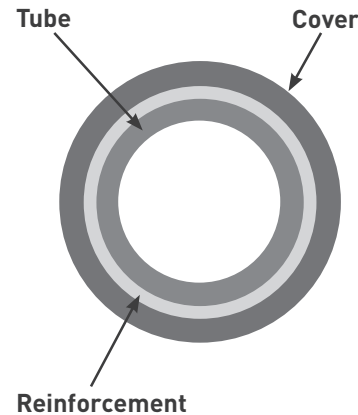
- Less susceptible to damage from vibration or movement.
- No brazing or specialized bending required.
- Easier to obtain in the aftermarket.
- Easier to route around obstacles.
- Sound absorption.
- Dampens pressure surges.

Today's hydraulic hose is much lighter and provides improved bend radius compared to earlier products. With the introduction of these hoses (such as Gates MegaSys® products), the weight advantage of bent tubing has been minimized, while the bend advantage has been reduced by half.

Given the availability and routing advantages of hose, maintenance personnel often prefer it over metal tubing. It is not uncommon to replace a hard-to-reach failed bent tube with a hose assembly.

#### Hose Construction

A hose is generally made up of three components:

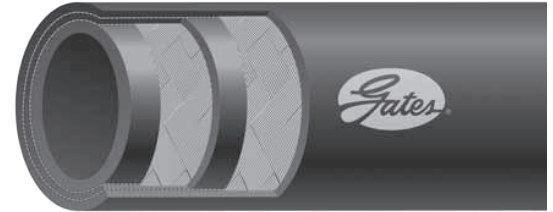


**1. Tube:** The tube's function is to contain the material conveyed. Refer to the chemical resistance charts and characteristics of hose stock types in Gates hydraulic catalog to identify material for a specific fluid.

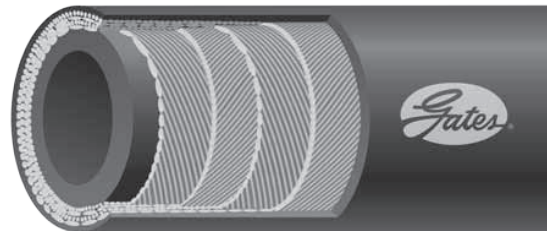
**2. Reinforcement:** The reinforcement is the hose's muscle. It provides the necessary strength to resist internal pressure (or external pressure in the case of suction/vacuum).

The three basic types of reinforcement are:

- Braided
- Spiraled
- Helical



**Braided** reinforcement can be wire or textile and can have single or multiple layers.



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



**Helical** coil reinforcement keeps the hose from collapsing during suction (vacuum) and tight bending.