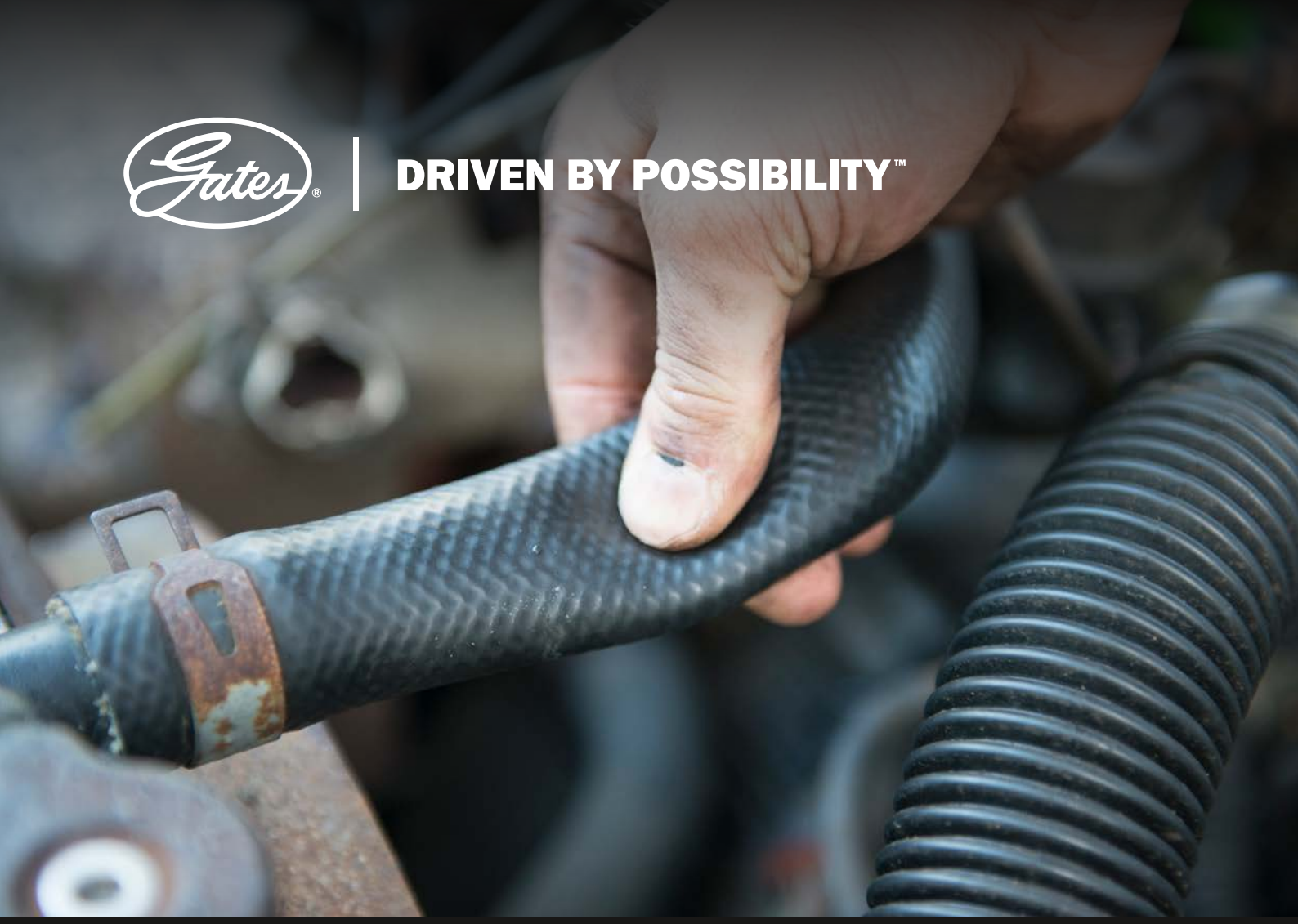

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TYPICAL COOLANT HOSE FAILURES AND HOW TO DEAL WITH THEM

QUICK GUIDE

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TYPICAL COOLANT HOSE FAILURES AND HOW TO DEAL WITH THEM

When engines used to be less complicated, your workshop had to carry only a few sizes and types of coolant hoses. But with today's smaller engine compartments, coolant hoses come in all shapes and sizes to fit tight engine spaces. In addition, the cooling systems themselves have grown increasingly complex in recent years, as more and more vehicles became turbocharged or were equipped with battery packs that needed cooling.

Coolant hoses today are much more than formed rubber. Many vehicle manufacturers utilise modular hoses, which feature integrated components such as branched connectors, quick connectors, valves, flow restrictors, sensor ports, and other plastic components. And with these newer modular coolant hoses come new reasons for replacement as well. While leakage is still quite easy to spot, there are more ways in which modular hoses can fail that you need to be aware of as a mechanic, such as internal valves getting stuck open or closed. In this document, we explain all about diagnosing and handling these different modes of failure.

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1. INTRODUCTION

1.1 EXPANDED USE OF MODULAR COOLANT HOSES

Through the years, basic rubber hose design has remained more or less the same. Coolant hoses are still made up of three layers: the tube, reinforcement and hose cover. The tube conveys the coolant, and the reinforcement prevents the tube from rupturing under pressure. The outer cover protects the entire rubber portion of the hose assembly from harsh external environments and contaminants. These three components are bonded together by special adhesives.

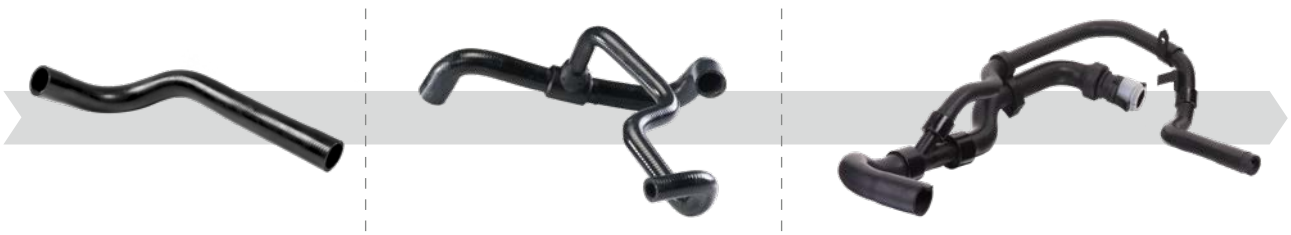
Despite the lack of recent changes in rubber design, coolant hoses have become more complex over time. Contrary to traditional, moulded coolant hoses, which carry coolant from the radiator to the engine and back, modular coolant hoses branch off to carry coolant to a variety of under-bonnet equipment. In addition to the traditional upper, lower, by-pass and heater hoses, many vehicles are also equipped with small coolant hoses that carry coolant to the fuel injection throttle body, turbocharger, oil cooler and other components. Moreover, modular coolant hoses are typically outfitted with connectors and sensors as well.

1.2 EVOLUTION IN CLAMPS AND CONNECTORS

Traditional, moulded coolant hoses require you to regularly check each clamp and connector and replace any that are defective, as well as replacing the clamps and connectors each time you install a new coolant hose. It's important to have the correct style and size of hose clamps at hand when installing new hoses, because hose clamps come in different types, each designed to meet different hose specifications.

Modular coolant hoses, by contrast, come as complete assemblies with clamps and quick connectors already mounted on them. These quick-connect couplings make it hard to reuse the hose, even if the latter is still in perfect condition, because they tend to get damaged when you pull them off. This means that, every time you need to replace a component that touches the hose, you will likely need a new hose assembly to go with it.

COOLANT HOSE EVOLUTION



common 30 years ago | common 20 years ago | common today

1.3 EXPECTED HOSE LIFE: RULE OF THUMB

Hose materials have improved substantially over the years. Thanks to these improvements, hoses last longer today than before. Yet, their harsh working environment will inevitably affect them and, over time, even the best hoses will wear. As it is difficult to tell from a simple visual inspection if a coolant hose has internal damage, and statistics show that failures increase dramatically after the sixth year of service, as preventative maintenance Gates recommends that coolant hoses be replaced at least every six years or every 150,000 kilometres (93,000 miles).

While the six-year replacement interval is a basic rule of thumb, it is not exact. Vehicles operating under severe conditions or vehicles that are not driven often may require more frequent replacements. Therefore, it is imperative to periodically inspect hoses whenever a vehicle comes in for service – even hoses less than six years old – for damage from the major hose enemies: leakage, electrochemical degradation, heat, ozone, abrasion, oil contamination, damage to sensors, and damage to directional valves and flow restrictors. If the hose exhibits any of the tell-tale signs of wear, it should be replaced immediately.

Gates has coolant hoses in its range that are electrochemical resistant (ECR), delivering longer-lasting service for your customers and building a reputation of reliability for your shop! So if you choose a Gates ECR hose as a replacement you are using the highest quality product on the market. This will enhance your reputation with your customers.

2. GENERAL GUIDELINES FOR HOSE INSPECTION

THERE ARE THREE GENERAL GUIDELINES TO KEEP IN MIND WHENEVER YOU PERFORM A HOSE INSPECTION.

1. ALWAYS CHECK FOR KINKING

When inspecting a coolant hose for damage, make sure that it is not kinked, and is not touching hot or moving engine parts or sharp edges. A kink can reduce the flow of coolant and cause the engine to overheat. A sharp surface may eventually cut or abrade through the hose, resulting in a loss of coolant.

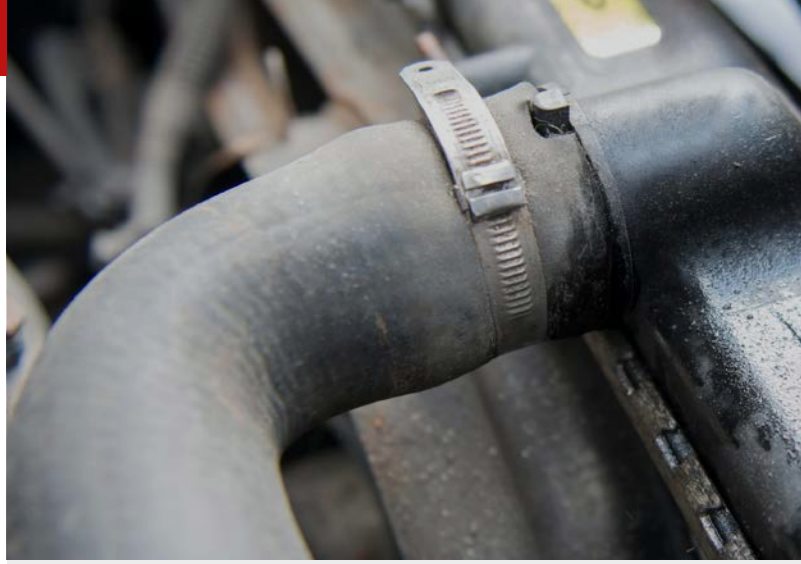
2. CHECK THE HOSE TEMPERATURE TO FIND OUT IF THE SYSTEM IS FUNCTIONING PROPERLY

Use an infrared thermometer to read the hose temperature. If the heater is on, both the ingoing and outgoing heater hoses should be close to the same temperature. If not, it might be time for a repair. If the upper radiator hose already gets hot before the engine has properly warmed up, it means the thermostat is not closing properly or even is constantly open. If it does not get hot at all, it means the thermostat is blocked. In both cases, the thermostat should be replaced immediately.

3. PAY SPECIAL ATTENTION TO THE CONNECTORS

Visually inspect all connectors on a modular hose assembly, looking for breaks or cracks in any plastic components.

3. HOSE FAILURE PATTERNS



IN WHAT FOLLOWS, WE'LL LIST THE TELL-TALE SIGNS INDICATING THAT A HOSE NEEDS TO BE REPLACED.

Keep in mind that the engine should be cool before you start any repair work!

3.1 LEAKAGE

APPEARANCE:

From moisture, drips or coolant bleed marks on or around the hose clamps, connectors or on the hose itself, to coolant pouring out of the hose assembly.

CAUSES:

Leakage can be caused by insufficient clamp torque. Heat causes metal to expand. If a new hose is installed while the engine is still warm, the expanded diameter of the inlet or outlet tubes prevents the clamp from tightening as much as it needs to. Heat also causes the rubber hose to expand – about 20 times more than the metal. The clamp holds the hose on the tube, but the hose 'sets' in this expanded state. Then when the engine cools off, a gap appears between the 'set' ID (internal diameter) of the hose and the contracted OD (outer diameter) of the metal tube, and the coolant leaks.

Other than clamp failure, leakage can be caused by a deteriorated hose itself. Both modular coolant hoses and traditional, moulded coolant hoses are exposed to coolant and to the hot and cold cycles underneath the bonnet. Over time, this may cause the rubber to soften, the hose to expand and the walls of the hose to become thinner, leading to small pinhole leaks in the rubber walls.

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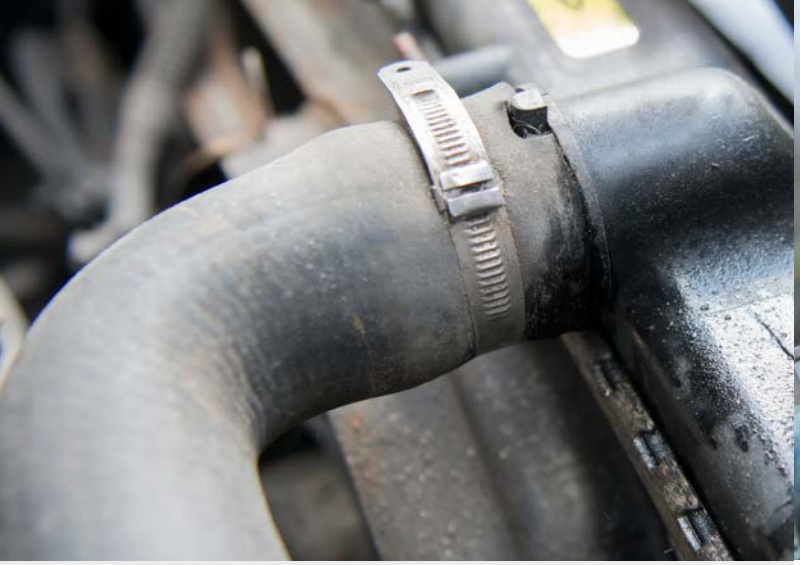
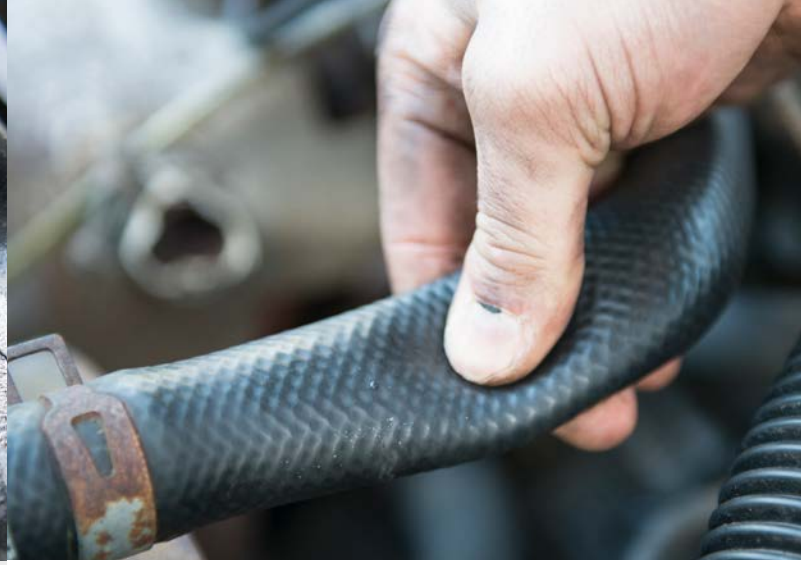




3.1 LEAKAGE (CONTINUED)

Specific to modular coolant hoses, moreover, and not leading to small leaks but to coolant pouring out of the hose assembly, are cracks in the plastic T-shaped or Y-shaped connectors that are used to make the hoses branch off in different directions. By virtue of where they are on the vehicle (exposed to hot and cold cycles, and to engine vibration), the plastic is going to become brittle over time, the connectors are going to flex and eventually break or crack, causing the whole assembly to fail.

SOLUTION:

- **HOSE SUGGESTIONS:** Replace it with the recommended Gates hose. Gates uses the latest rubber technology for maximum resistance to the negative effects of compression, while our modular hoses come as complete assemblies with OE equivalent clamps and connectors for a guaranteed fit.
- **CLAMP TORQUE SUGGESTIONS:** To avoid cold water leaks, adjustable tension clamps must be retightened after a brief run-in period. Another solution is to use constant-tension clamps, which automatically adjust with the heating and cooling of the system.

3.2 ELECTROCHEMICAL DEGRADATION – INTERNAL DAMAGE

APPEARANCE:

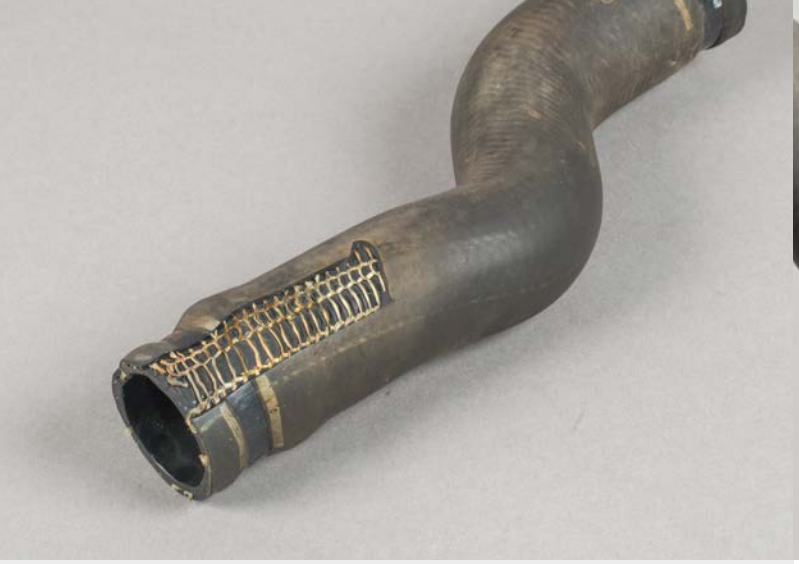
Electrochemical degradation (ECD) is the number one cause of failure on the rubber portion of coolant hoses. ECD weakens the hose from the inside and is therefore not obvious by visual inspection. Do the squeeze test: ECD initially attacks the hose 5 to 10 cm (2 to 4 inches) from the ends so first squeeze both end sections using your thumb and one or two fingers. Then squeeze the middle straight section of the hose, checking for a detectable difference between the ends and the middle. If the ends feel softer and mushier or if you feel gaps or channels inside the hose, the hose is most likely under attack by ECD.

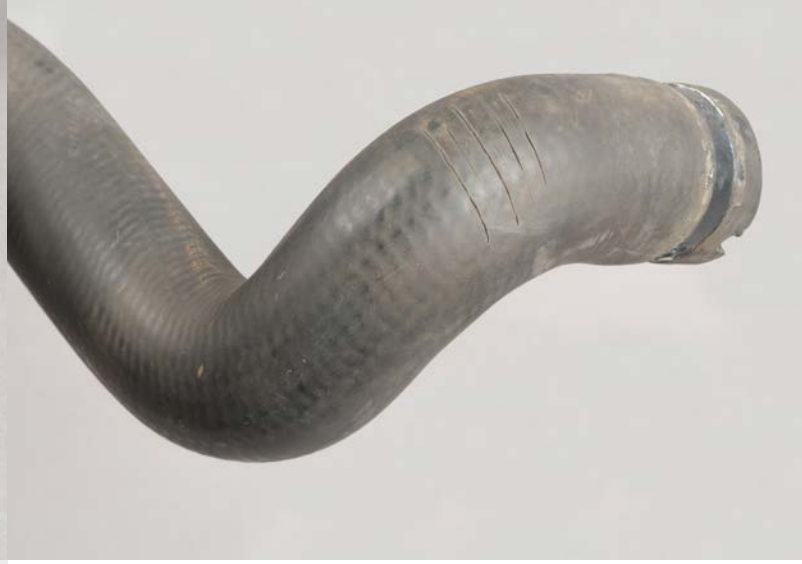
CAUSE:

ECD occurs when different kinds of metals in the cooling system generate an electrical charge, which is carried from one component to another by the coolant. In case of high concentration, this electrical charge will affect the hose tube, creating tiny internal cracks, which weaken the hose.

SOLUTION:

Replace the damaged hose immediately. The best way to avoid ECD failure is to install a hose that resists ECD. Gates electrochemical resistant hoses are your best protection against electrochemical degradation.





3.3 HEAT DAMAGE

APPEARANCE:

Heat damage can occur both internally and externally. Slight swelling is one sign of internal damage. If the interior yarn has been severely damaged by the heat, the hose will feel soft and may even bulge in places. External heat damage is easier to detect since heat-damaged hoses typically have a hardened, glossy cover that is covered with cracks.

CAUSE:

As engine compartments become smaller and more compact, temperatures under the bonnet increase. Ambient temperature from nearby hot engine parts, low coolant levels and/or temperature spikes also contribute to deterioration.

SOLUTION:

Replace it with the recommended Gates hose. Gates hoses are specially designed to resist deterioration from heat.

3.4 OZONE DAMAGE

APPEARANCE:

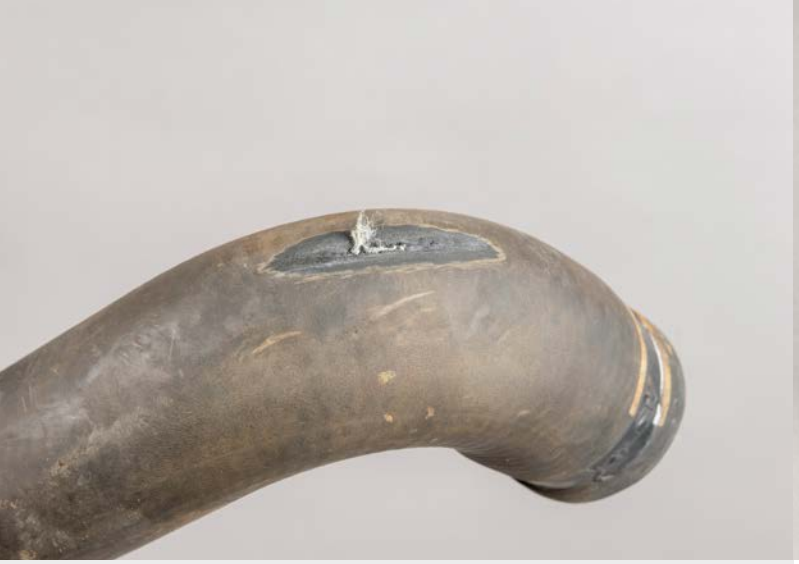
Tiny, parallel cracks in the hose cover, usually at hose bends.

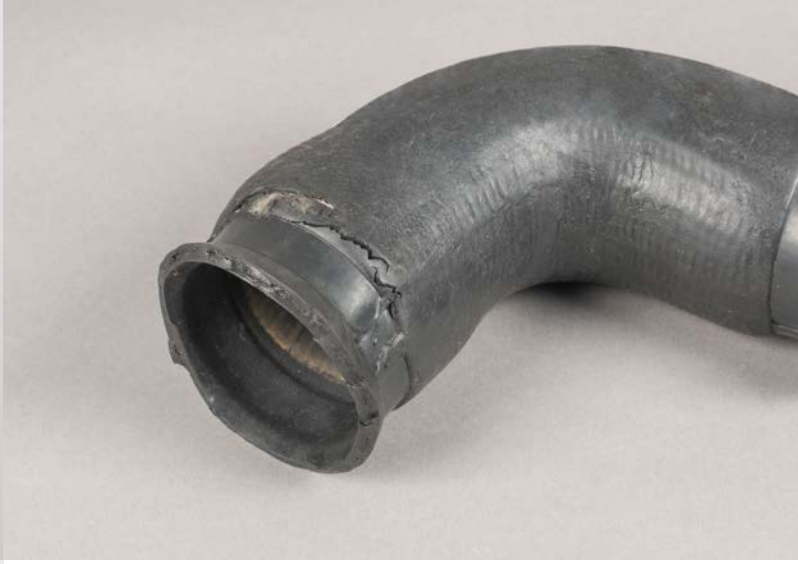
CAUSE:

Increased concentrations of ozone, caused by pollution, attack the bonds in certain rubber compounds. Tiny cracks appear, primarily where the hose experiences stress: curves, bends and at clamping surface areas. These cracks allow contaminants to enter and destroy the hose.

SOLUTION:

Replace it with the recommended Gates hose. Gates hoses are made of EPDM and are unaffected by ozone.





3.5 ABRASION DAMAGE

APPEARANCE:

Abrasion can be identified by rubbing marks on, or damage to, the hose cover.

CAUSE:

Abrasion damage is caused by the hose rubbing against other engine parts or against objects in the environment. A hose can, for example, be abraded by coming into contact with a part that was accidentally moved during maintenance or repair, or after hitting a speed bump. In other cases, abrasion occurs after the OE hose guiders have broken or after a hose is no longer properly seated in the guider.

SOLUTION:

Replace the hose. If the hose is resting on or will come into contact with a sharp surface, or is near a heat source, try one of the following:

- Reroute the hose away from the point of contact or replace/repair the hose guiders, if needed
- If that is not possible, slightly twist the hose on one or both spouts to reroute the hose away from the sharp surface
- As a last resort, wrap a protective sleeve around the new hose at the point of contact – Gates advises against using a slit piece of an old hose, as this will negatively affect the system's overall temperature.

3.6 OIL CONTAMINATION

APPEARANCE:

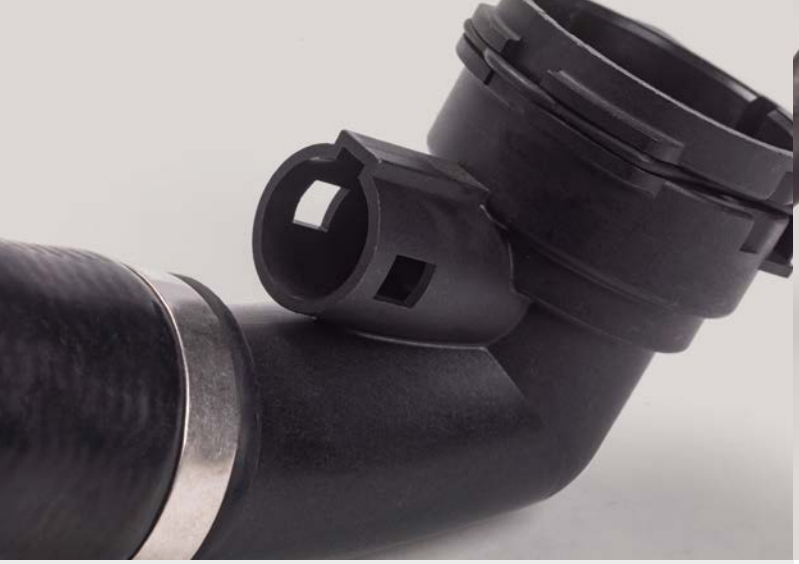
The hose feels soft or spongy to the touch. Bulges and swelling are readily apparent.

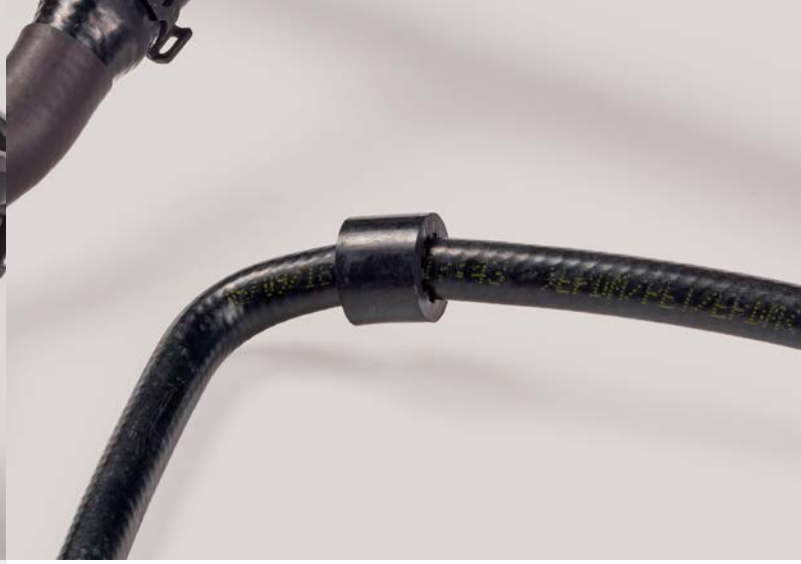
CAUSE:

Oil reacts chemically with the hose compounds and weakens the molecular bonds. This causes the hose to soften, swell and separate, layer by layer, leading to failure.

SOLUTION:

Replace the hose and eliminate any source of oil. If this is not possible, reroute the hose.





3.7 DAMAGE TO SENSORS AND OTHER ELECTRICAL COMPONENTS

APPEARANCE:

The plastic is broken or cracked around the sensor. Also look for signs of corrosion.

CAUSE:

If you disconnect the sensor from a modular hose assembly, for maintenance for instance, it will likely be damaged. Or sensors may be damaged by water leaks, too. In short: anything that can damage an electrical connection can happen to modular hoses as well.

SOLUTION:

If the sensor or sensor plug has been damaged, you should replace the entire hose assembly.

3.8 DAMAGE TO FLOW RESTRICTORS AND DIRECTIONAL VALVES

APPEARANCE:

Coolant is not getting to the radiator and to the engine, causing the engine to overheat. (Damage to the flow restrictors and directional valves is difficult to spot, because they are inside the hose, so you have to look elsewhere for signs of failure.)

CAUSE:

A lot of modular hoses have flow restrictors and directional valves inside of them to control the flow of the coolant. These can be stuck open or closed, so if the coolant is not getting to the radiator and to the engine, chances are something in the hose is locked.

SOLUTION:

Replace the entire hose assembly.

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SIGN UP FOR OUR TECHNICAL NEWSLETTER OR FEEL FREE TO VISIT OUR BLOG @ GATESTECHZONE.COM

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