



Product Information

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A little water can't hurt anything... or can it?

Water. It covers three-quarters of the earth's surface. It makes up 90% of the human body. You yourself need more than 4 pints of it every day... and without it, you wouldn't live.

But in your automatic transmission — that's another story! Because water — the "fluid of life" — is **deadly** to automatic transmissions... **including** the friction plates.

How can water get into my transmission?

Water can find its way into an automatic transmission in several ways. The one you're probably most familiar with is through the transmission cooler in the radiator. You don't have to be in the business long to become acquainted with the "strawberry milkshake" in the radiator. But what can be even worse is when a tiny amount — sometimes less than a thimble full — finds its way into the transmission.

All too often, customers forget to flush the cooling system and replace the antifreeze. The term "permanent antifreeze" confuses a lot of car owners — **permanent** in this case, means **year round**, not **never needs replacing**.

Three, four, five years... acids build up in the coolant — 'til the transmission heat exchanger welds begin to corrode. It doesn't have to be a big hole... in fact, most of the time the hole is so small that ATF won't even get into the radiator.

But the antifreeze solution has a



Not all water damage is this obvious... you may not even realize that water found its way into your transmission. And even a few drops can be deadly to your automatic transmission.

greater surface tension than ATF, and as the radiator builds up pressure, it forces the antifreeze solution through the pinholes or cracks into the cooler. Once there, it mixes with the ATF, and creates that milky, pink-colored sludge you're familiar with. By the time the fluid reaches this point, chances are pretty good the transmission's about shot.

And neglect's not the only reason for the transmission heat exchanger to fail. Any time you have a liquid in contact with different metals, a chemical reaction takes place, known as **electrolysis**. Electrons carry atomic metal from one type of metal to another in a process very similar to metal plating. This can occur at brazed joints in a heat exchanger. And the heat in an

automobile radiator makes it even worse — accelerating the failure.

As countless electrons flow away from the brazed joints, the joints weaken and pit. More and more pits develop, and the continual heating and cooling of the radiator stresses the weakened joints, causing microscopic cracks between the coolant tank and the transmission heat exchanger.

New fluid can actually cause water damage!

Just because you didn't see any sign of water damage during a rebuild doesn't mean you're off the hook...

You just rebuilt the transmission and flushed the cooler. Now the cooler's clear, and the pump's

pushing fresh ATF — under pressure — through the cooler. Fresh ATF that's loaded with active **dispersants** and **detergents**.

As these active ingredients flow through the cooler, they come in contact with those hairline cracks or pinholes. So even though the unit didn't come in with a water problem, that water problem won't be long in coming, as fresh ATF washes away the varnish and sludge that blocked the crack.

And no matter how good a job you do rebuilding the unit, if you don't fix the water problem, your rebuild won't last.

But a bad heat exchanger's just one way for water to get in and destroy your transmission.

There are others.

One good pass through a deep puddle can soak the unit's insides. Or how about the car stalling in a flash rainstorm — at the low spot in the road? And don't forget when the kids decide to play "service station" with the garden hose!

Clutch plates are hygroscopic...

... which is a big word that means they attract or absorb moisture. What's interesting is that clutch plates would rather absorb water than ATF — water will actually **displace** ATF in the friction plates.

So it doesn't take a lot of water to cause a lot of headaches. A few drops here, a few drops there, and with each drop, more and more ATF gets pushed out of the friction plates... and replaced by water.

And slowly but surely, the bond between the friction surface and the steel core plate is attacked and begins to weaken. Chunks of clutch material — even whole rings of clutch facing — begin separating from the steel backing.

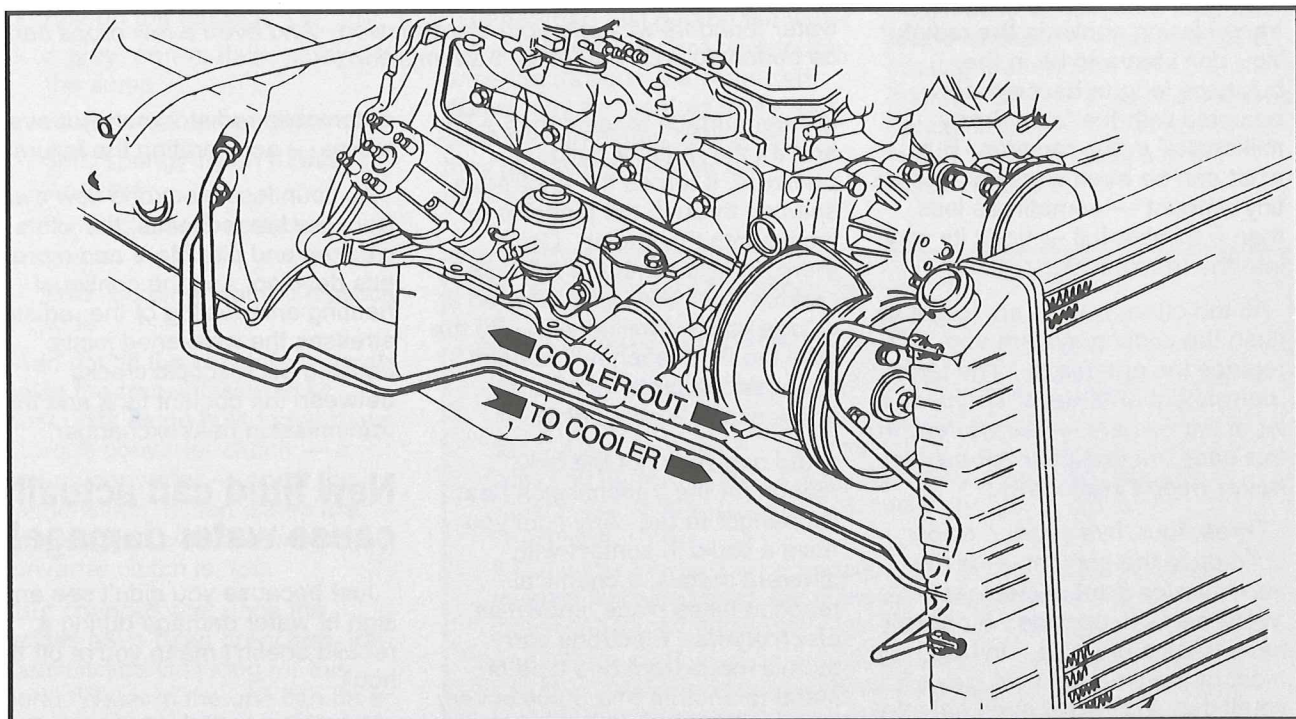
So it's important for you to be able to recognize the ghost of water damage — and exorcize it before it comes to haunt you!

Even the over-zealous car wash attendant with a steam cleaner can soak your transmission's insides.

Here's something that's shown up a couple of times on VWs and Mercedes — a bad hood seal, which allows water to find its way down to the transmission vent. The vents on these units sit in a valley, and when the valley fills with water, so can the transmission.

And while water can sometimes find its way into a transmission through the vent, a **clogged** vent can lead to water damage, too.

As the transmission heats up, any condensation that found its way into the unit boils off and turns to water vapor. That vapor is supposed to find its way out the vent, to keep the transmission from becoming contaminated. But if the vent gets clogged, the vapor can't dissipate — instead, it turns



When fluid leaves the transmission, it heads directly for the cooler. So by pulling the cooler-out line off of the cooler, contaminated oil never gets to mix with the new oil in the pan.

the transmission into a kind of pressure cooker — an apt analogy, considering it cooks the transmission!

So there are *plenty* of ways for water to find its way into the transmission.

No problem, right? Just drain it out, and replace the fluid, right?

Not necessarily! You've got to determine how the water got there in the first place, and take care of *that* problem — otherwise, as fast as you drain it out, it'll be right back in. If it was the kids playing "gas station," or you got caught in a flash flood, you might luck out... *if* you get the car towed to a shop and drain the fluid out *before you*

start the engine! Once you've started the engine, forget it — it's too late to save the transmission — you'll have to overhaul it to get all the water out.

How can you flush out the rest of the ATF?

After you drop the pan and drain out the ATF in the transmission, refill the unit — but don't start the engine yet! First, disconnect the **cooler-out** line from the transmission cooler — that's the line that takes oil *from* the transmission *to* the cooler. Slip a piece of hose over the end of the line, and run the other end of the hose into an empty bucket.

Now have someone start the engine, and place the transmission into Neutral. As the contaminated oil pumps out, you'll have to add clean oil to the transmission at the same time so the fluid level doesn't get too low. Keep flushing the unit, until the oil coming out of the cooler line is as fresh as the oil you're adding. Now you can shut off the engine, and re-connect the cooler line to the cooler. Don't forget to check your fluid level!

But if the water came from a bad radiator cooler, you've got to get *that* problem fixed — before you do anything to the transmission. You've got two choices for repairing a leaking cooler: (1), have the transmission oil cooler in the radiator replaced, or (2), by-pass the radiator cooler, and use an after-market transmission oil cooler.

Cooler-out lines on most popular units

Transmission	Cooler-out Line (on transmission)
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GM

125 (3T40)	Bottom
180	Bottom
200/200-4R	Top
325/325-4L	Bottom
350	Bottom
400 (4L80)	Bottom
440-T4 (4T60)	Bottom
700-R4 (4L60)	Bottom

Ford

A4LD	Bottom
AOD	Top
ATX	Bellhousing end
AXOD	Top
C3, C4, C5, C6	Front

Chrysler

904, 727	Front
FWD	Bottom

Foreign

Honda	Over bellhousing
Jatco (RWD)	Front
Mitsubishi	Inner
Renault	Top
RL3F01A	Top
RL4F02A	Front
Subaru	Top of differential
Toyota FWD	Top
Toyota RWD	Front

So much for the water... or is it?

Sure, you got all the water out of the transmission — but was it soon enough? Because if that water had time to soak in to the clutches, it's just a matter of time before the unit fails.

See, with most clutches made these days, the facings are made of a type of paper bonded to a steel plate. "Bonded" — that's a fancy way of saying "glued". So you've got glued paper, and now it's soaked with water. It doesn't *have* to soften the adhesive... it'll get into the paper, and after a couple of clutch applications the heat that's generated during the engagement will turn the water to steam, and literally blow the facings right off the clutch plate!

Here's how water can attack the clutch plate:

Clutch facings absorb water like a sponge, and, given time, the water will penetrate the resins that hold the facings to the steel plate. But that's just part of the story...

Clutch plates aren't designed to

operate in a damp environment. As water soaks through the friction material, a little bit of that water finds its way to the steel clutch plate core.

No doubt you're familiar with how water affects steel — the corrosion begins almost immediately. And as the metal is oxidized, it expands... lifting away more friction material and exposing more and more bare steel, until it literally lifts the clutch facing right off the core plate.

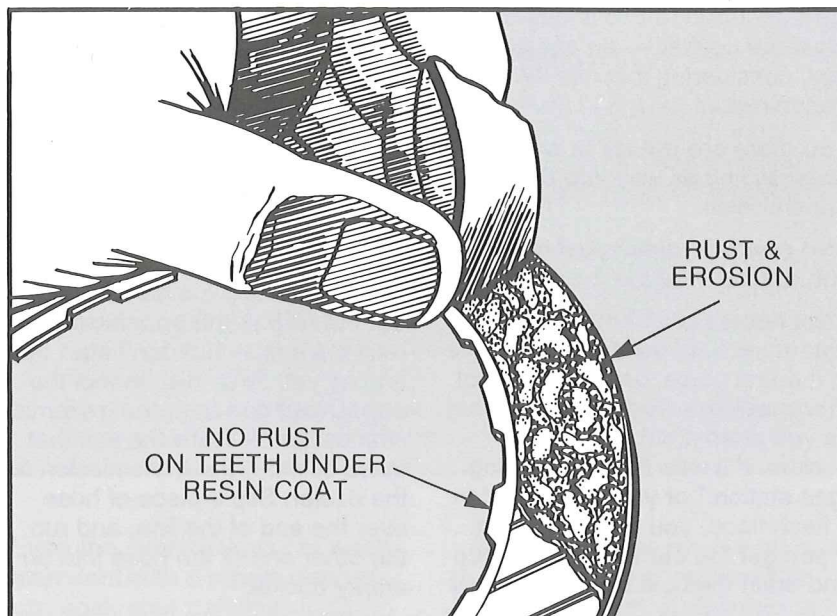
One look will tell you whether this was what happened to the unit you've got apart on the bench. Look at what's left of the clutch plate cores — they're rusty, the facings are gone... but look at the resin on the teeth? Scrape some of that resin away, and you'll see there's no rust on the teeth themselves — that proves the steel was clean and dry when the factory applied the resin.

Rusty, de-laminated clutch plates aren't the only way to identify a transmission that's been contaminated with water. Here are a few other clues you should watch for:

- rust on the dipstick
- a grey, non-metallic sludge in the sump
- rusty metal components
- soft, spongy nylon thrust washers
- "hour-glassed" speedometer gears
- fluid "burping" out the dipstick tube

And not all the clutch facings are inside the transmission itself... most units being built today have a torque converter clutch — a lock-up converter — and if the transmission friction plates are water-logged, you can bet the converter clutch is, too.

But chances are, once the insides have been drenched, the transmission isn't long for this world. Water in the unit can be a real good reason for a rebuild... Flaking or separated clutch



Here's how clutch plates look after being attacked by water. Small rust pits form under the clutch facings, lifting the facings off the steel core plate. But along the teeth, the steel's clean — no sign of rust forming.

plates... worn bushings and thrust washers, damaged bearings... and every nylon thrust washer has to be replaced! Water isn't just hard on clutches — it's a lousy lubricant, too!

Remember, just getting the water out of the unit may not be enough, once the frictions are saturated. Water may be the fluid of life, but once friction plates take a sip — they're headed for their own funerals!

The problems that water in the transmission creates aren't new... and at **Raybestos** we've been working on newer and better ways to improve the durability of every clutch plate we produce. Every **Raybestos** clutch plate is **phosphate etched** — which leaves a coating that **resists rust**... and the crinkle finish the phosphate leaves behind improves the bond between the steel plate and the friction material.

Warning - water can be hazardous to your health!

Water can be deadly when it finds its way into your transmission!

As you drive down the road, transmission temperatures quickly exceed **212 degrees F** — water's boiling point. And when water boils and turns to steam, it expands rapidly... when an ounce of liquid water turns to steam, it can easily displace 2 quarts of transmission fluid.

If that water happens to be trapped in the torque converter when it reaches its boiling point, the pressure it generates as it turns to steam can force transmission fluid out the vent or dipstick tube.

And ATF has a flash point of **375 degrees F**... an exhaust manifold can reach temperatures well above **1800 degrees F**! So when hot fluid belches all over an even hotter exhaust manifold — a nasty underhood fire can occur.