

## How To Read A Damaged Piston

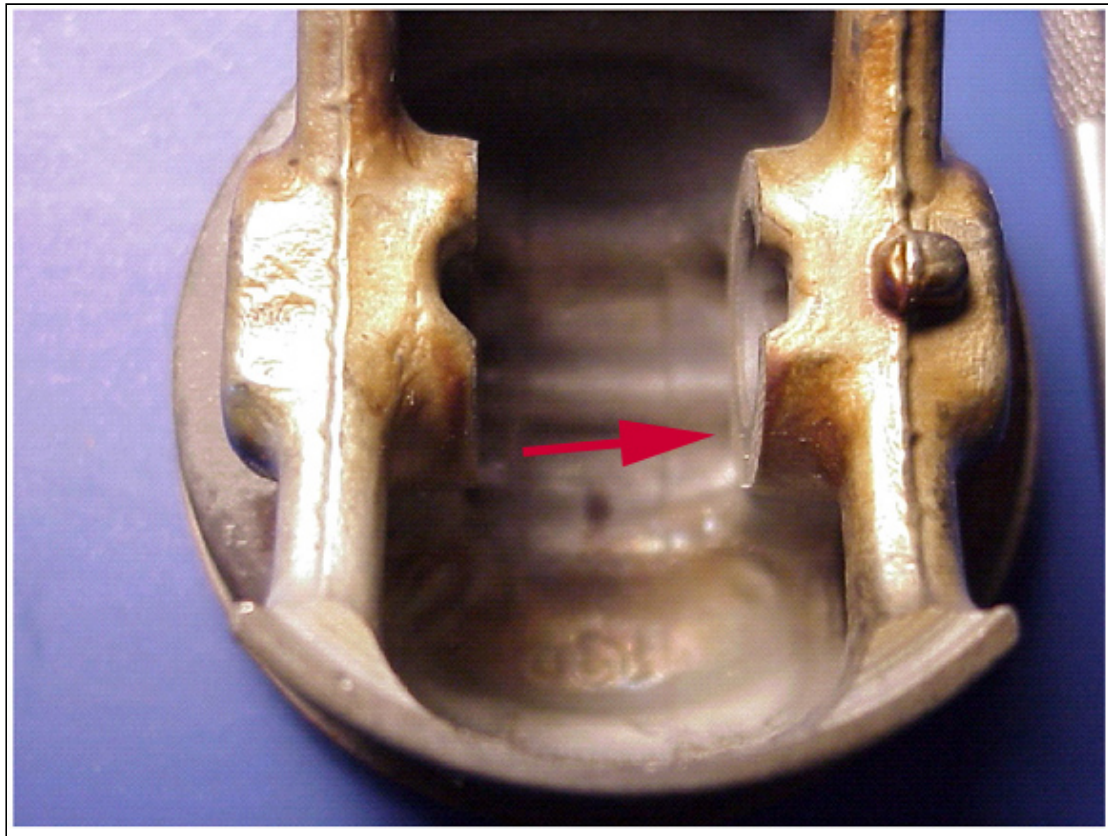
When a tree falls on a saw, there is rarely any doubt what happened, but when the engine fails, it is sometimes difficult for pro users to understand what has occurred and why. The following images of damaged pistons illustrate what can happen inside a saw's engine. While the piston is not the saw's only internal engine part, it is often the part that "pays the price" when a saw is not operated or maintained correctly. We hope this information helps explain what can occur and why, and more over, provide knowledge of how to avoid common causes of failure in the first place.

### Damage From Running Unmixed Fuel



The piston above has severe scouring on the exhaust skirt with the heaviest damage on the clutch side of the piston. All of this damage was caused from running straight fuel in a STIHL MS360. The lack of lubrication on the piston has caused it to seize to the cylinder wall. The damage you see was caused in the moments before the piston "stuck," which seized the engine.

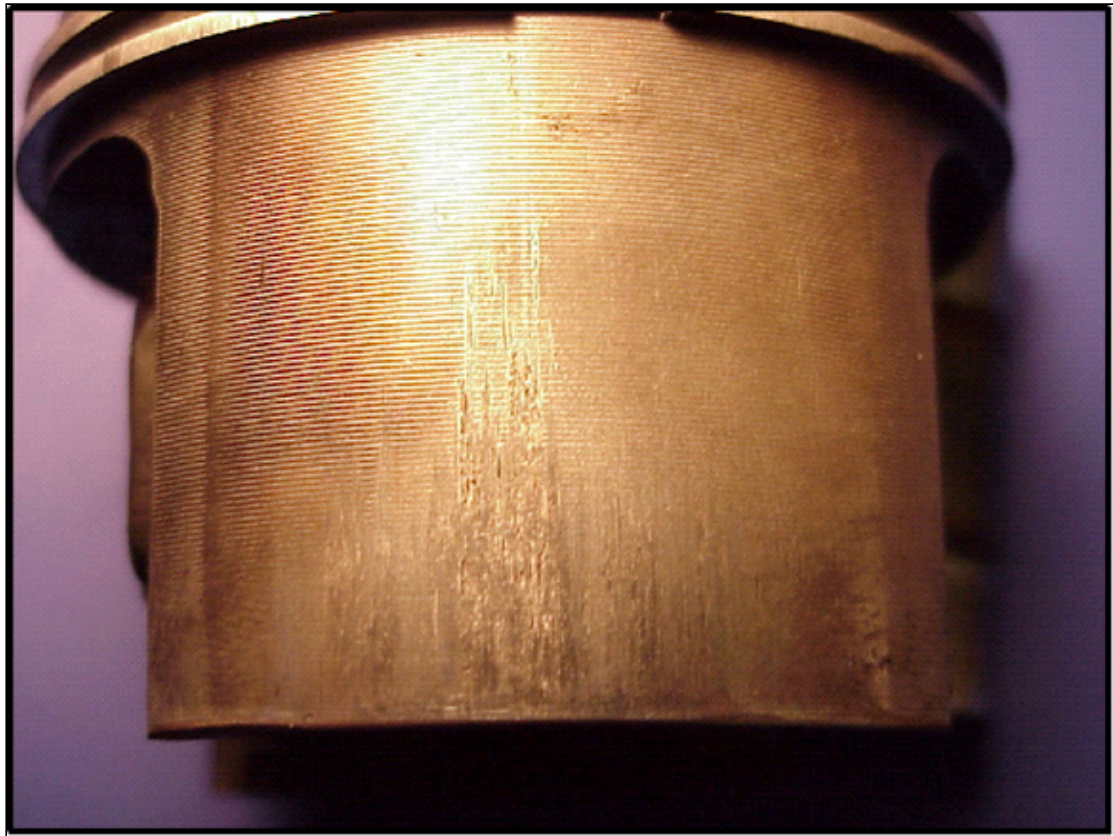
This kind of piston damage can also be found on a saw that was run with the carburetor set too lean or one that was run with an air leak. If you didn't know this saw had been run with no oil in the fuel, how would you know it wasn't a heat seizure? To fully understand the cause of this failure, it is important to look at the rest of the piston. The photo below is of the same piston. It shows additional damage that's usually only found on a saw engine that had been run with unmixed fuel.



On this piston, notice the scouring in the wrist pin area. (red arrow) You can also see it is dry under the piston, in the cir clip area, under the rings, and in the transfer ports -- no oily residue. A heat seizure will show similar damage on the piston skirt (photo one), but the conditions under the piston will look normal. On this piston, the scouring and other dry conditions provide the evidence to suggest this seizure was caused by no lubricant in the fuel.

If you tear down a saw and find this kind of damage, don't forget to replace the fuel in the saw's fuel tank before you test run it after the repair. It is also important to check the contents of the fuel container that was last used to fill it. Since the repair required the replacement of both the barrel and piston (read: expensive,) this is a repair you don't want to do twice or on more than one saw.

### **Damage From Debris Getting Through the Air Filter**



The damage on this piston skirt is caused by debris getting through the air filtering system. Notice the horizontal machine marks have been scrubbed off all across the bottom indicating extreme wear on the lower part of the skirt. Not shown, but the other side of the piston looked perfect. This damage was only found only on the intake side of the piston. This is typical for damage caused by intake debris. The other side of the piston is not exposed to an intake port, so it isn't affected at early stages.

What damages the intake skirt is debris from a leaking filter wedging between the piston and cylinder wall causing scuffing on the piston skirt. Since the piston is made of softer material, the damage is more pronounced on the skirt than on the cylinder bore's hard surface. This wear on the piston increases the clearance, which allows the piston to "rock" in the cylinder's bore. As the skirt becomes thinner and weaker, rocking increases. Eventually the piston will break. When it does, the engine seizes.

On a pro saw, the piston skirt performs another important function. Not only does it guide the piston, the skirt serves as the engine's intake valve. As the piston travels up and down the cylinder, its base opens and closes the intake port as it passes. For the engine to run its best, it is important for this valve to function well .

### **Intake Skirt Damage**

Some intake skirt damage is not uncommon on a pro saw's piston after it has run hundreds of hours. No air filtering system is perfect, so you can expect to see the affects of debris damage even on saws whose filters have been well maintained. The important thing to learn is this damage can happen quickly when the filtering system is leaking debris.

Piston damage is not the only consequence of bad filtration. This debris can also collect in the bottom end of the engine. This leads to premature bearing and seal failure.

When a faulty air filter is replaced, this puts a temporary stop to further debris damage, but it does not reverse damage once it has occurred. This is why it is important to change air filters *before* they fail. Most pro saw manufacturers suggest changing the air filter after thirty days of use or before if a regular inspection reveals any leakage.

### **Damage From Bearing Failure**





These fine scratches and "peppering" on the exhaust skirt and lower intake skirt is caused by the failure of the lower rod bearing or main bearings. Small, but hard pieces of the bearings and retention cages are breaking loose, causing this piston damage. If you are lucky enough to catch a piston in this condition, stop running the saw until you find which bearing is giving up material. If you keep running the saw, eventually the bearing(s) will completely fail. This usually releases larger pieces of bearing material.

When this occurs, sometimes the crank shaft locks up. But if it keeps running, loose pieces in the bottom end will travel up through the transfer ports and into the engine. All the parts won't make the complete trip. Some won't pass through the upper transfer port and when the piston goes by, it will drive these parts into the cylinder wall, destroying both. To repair this damage, both the crankshaft assembly and the cylinder and piston must be replaced -- two very expensive components.

We typically see this kind of damage on saw engines that have been over-revved. For more information see our section on [Rod Bearing Failure](#).

## **Damage From Over-Speeding The Engine**



The piston above has been damaged by over-speeding. Look at the piston material between the ring-lands. You can see a big chunk of it is missing and some has been "squished" thinner, creating a super-wide ring-land. Look at the top ring (bottom of photo). You can see the edge is rounded-over, a sure sign the rings were catching in the exhaust port. When this occurs, this sets off a high frequency vibration, eventually breaking the ring-land.

## **Damage From Detonation**

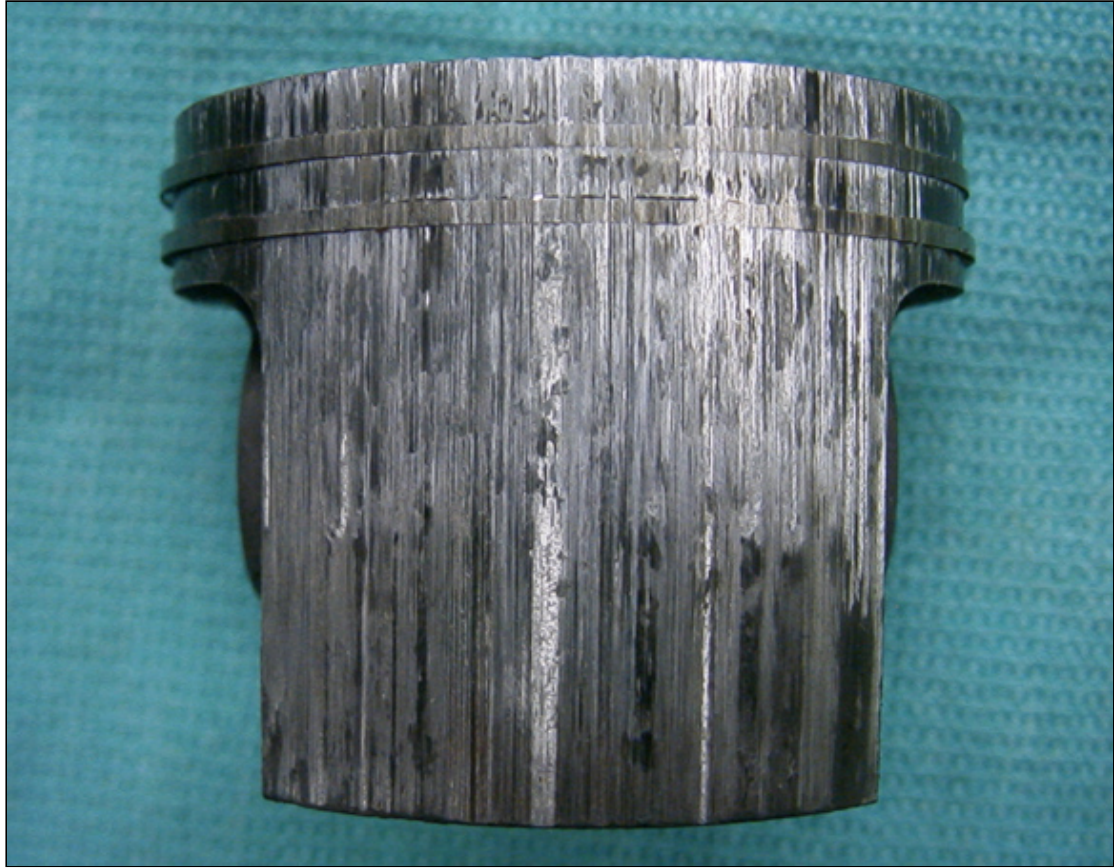


The piston above has been damaged by detonation. Notice the damage on the top and the edges of the piston. The heat caused by detonation made the piston so hot, the rings stuck and the piston seized in the cylinder. You can see the seizure marks on the side of the piston. This damage usually ruins both the cylinder and piston.

Detonation can be caused by a number of things. In this case, changing to higher octane supreme grade fuel was the answer. See our article on Fuel for more information.

## **Damage From Heat Seizure**

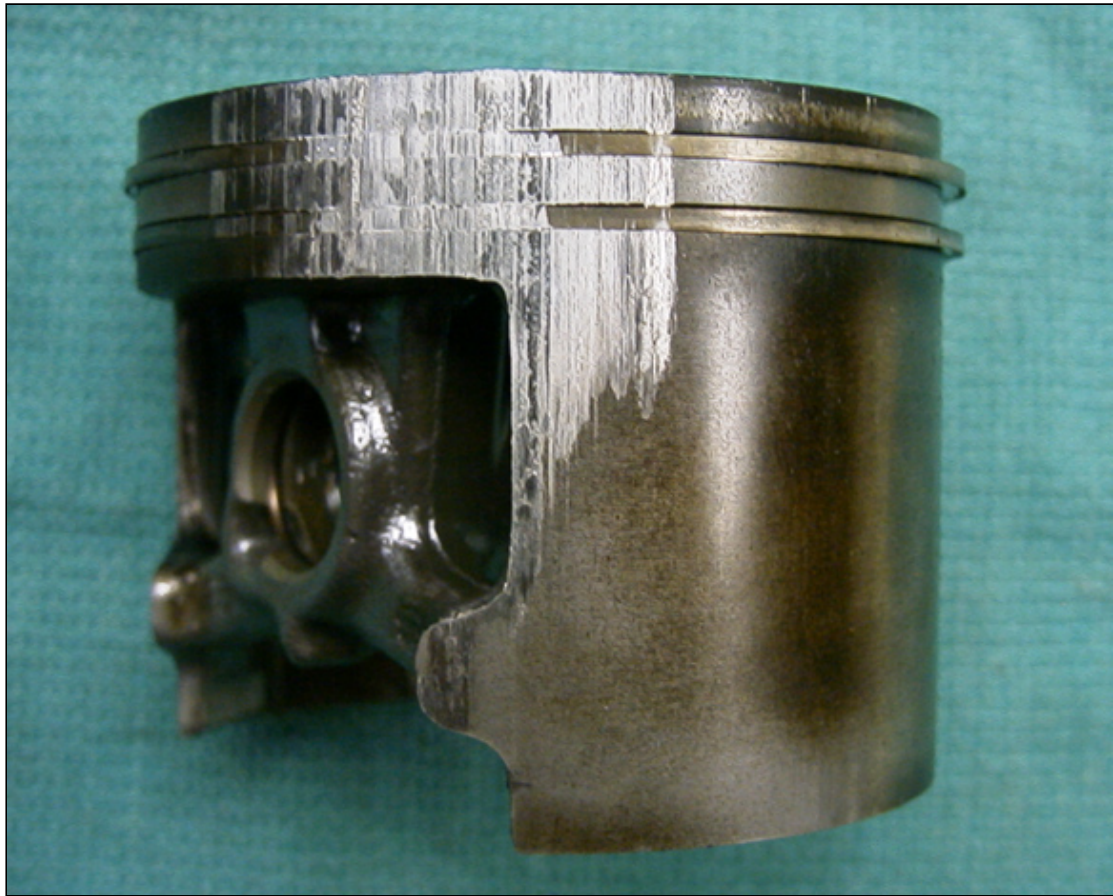




The piston above shows the most common severe piston damage we see - the exhaust side has damage caused from excess heat. This damage looks similar to piston damage caused by running straight gas shown in the first image, but with this piston, conditions under the piston looked normal.

This kind of damage can be caused by over-revving the saw, running the carburetor adjustment too lean, by ignoring an air leak in the saw's engine, or a combination of factors. The best way to avoid a such a seizure is to use good quality fuel and mix oil, avoid over-revving the engine, and always stop running a saw that shows signs of a potential air leak. This kind of damage can also be caused by a partially plugged fuel filter, which is another reason fuel filters should be replaced regularly.

## **Damage From Heat Seizure Due to Blocked Cooling**



The piston above also shows damage from excess heat. What makes this piston damage interesting is that this damage is on the side of the piston - near the transfer port, and not on the exhaust side where heat damage is found more frequently. In this case, the damage occurred on the back side of the cylinder, where less air passes over the cylinder's cooling fins.

On all saws, the cylinder causes a sort of circulation "shadow" reducing air volume to the cooling fins behind the bore. This is one reason it is important to keep the cylinder's cooling fins clean and free from debris. When wood chips build up around the cylinder, they can block air circulation that cools a saw's cylinder. Today's pro saw engines need all the cooling they can get, especially when a saw is making a big cut in a tree on a hot day.

## Our Advice

Hopefully these images help you understand more about your pro saw's engine, and in turn, help you avoid running conditions that can damage it. The manner in which a saw is operated and the maintenance it receives greatly affect its performance and working life. Now you know some things to look for and to avoid.

When operating a pro saw, don't over-rev it. Some pro saw users like the sound of a "screaming" saw, but it shortens its life and causes expensive repairs. Proper fuel mix also plays a role in both the performance and working life of a pro saw. High octane fuel and the use of properly formulated mix oil is extremely important. The way the fuel is blended and its age are also factors. Maintaining the air filter is also important. Inspect it, clean it, and replace it often. Postponing air filter and fuel filter replacement is not a good way to save money.

Got questions or comments? Call or stop in.

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