

The Importance of Mechanical Diagnostics in the Collision Repair

Process: Part One By Larry Montanez III, CDA and Jeff Lange, PE



© iStockphoto.com/CompuArt

Frontal collisions often result in damage to mechanical components. Often, such damage goes unidentified until the final stages of the collision repair. Finding a significant mechanical malfunction at the latter stages of the repair process can be trouble for all the parties involved, including the repairer who overlooked basic diagnostic tests that may have avoided a situation where a partially repaired vehicle now becomes a total loss or requires a delayed delivery due to the necessary diagnostics and mechanical repairs. This two-part article will outline some of the tests you can perform to reduce the possibility of such issues before the repair has reached the point of no return.

It is our recommendation that all mechanical issues should be addressed before repairing any collision damage. Although you may not have to complete the mechanical repairs, take the time to access the mechanical systems. Make a concerted effort to identify mechanical damage before you get deep into the collision repairs. Many times in the repair facility, a collision-damaged vehicle will have some mechanical components damaged, and the facility waits until the repairs are almost complete before attacking the mechanical damage. In some cases, the vehicle totals out due to the mechanical damage, and this is where a major issue begins for the repair facility and the insurance company. The insurance company now has a

collision-damaged vehicle that is repaired, but not running and must sell it at an auction. The problem is that most of the buyers at the auctions do not want a vehicle that has been repaired but has mechanical damage, so the insurance company must sell the vehicle at a lower price. Adding to that loss is the cost of the repairs that the insurance company paid out to the repair facility. Now, as a shop owner, you might be saying, “So what? The insurance company has plenty of money.” But this is where you would be wrong with that kind of attitude. The insurance company’s loss is calculated and applied to the rates they charge the consumers. The insurer might even blame the repair facility for the loss, which is bad business and leads to bad relations. You might not think this is your fault, but it is. You are the repair professional, and you should have diagnosed the damages properly. Let’s look at some of the mechanical damages you will encounter and the testing required to determine the damage.

Physical Inspection

To start, take a good look at the mechanical components involved in the collision. Is the radiator broken? Are the hoses kinked? Fans obstructed? This should prompt you to question the driver about the collision and how long the vehicle may have been run after the impact. Loss of coolant from a broken radiator or re-

striction of flow by a kinked hose often leads to engine overheating and head gasket failure. A cooling system pressure test and/or a compression test will offer great insight into the integrity of the cooling system within the engine.

If you identify broken housings, consider the damage within; transmission and differential housings often prompt replacement of the housing without considering the effects of the collision on the internal components. Interaction with the engine’s harmonic pulley should send up a red flag to check deeper within the engine before proceeding.

Engine Compression Testing

A compression test will help establish the integrity of the engine. An engine is essentially a self-powered air pump, so it needs good compression to run efficiently and cleanly and start easily. As a rule, most engines should have 125 to 160 pounds (check with the OEM repair manual or ALLDATA for the exact readings). Cranking compression should have no more than a 10-percent difference between any of the cylinders. Low compression in one cylinder usually indicates a bad exhaust valve, which could be a pre-existing condition. Low compression in two adjacent cylinders typically means you have a bad head gasket, which could be from overheating due to loss of coolant during the collision or, even

worse, during movement around the shop without the radiator installed. Low compression in all cylinders would tell you the rings and cylinders are worn and the engine needs to be overhauled, which could be a pre-existing condition.

How Do You Check Compression?

Compression can be checked two ways: Manually with a compression gauge or electronically with an engine analyzer that measures cranking compression. Information on performing a compression test is available in the OEM repair manual or ALLDATA. With electronic testing, a computer analyzer estimates compression in each of the engine's cylinders by measuring slight variations in engine cranking speed. The results correlate well with actual gauge readings, and can be completed in a matter of minutes without having to remove any spark plugs. What's more, the analyzer prints out the results of the compression test making it easy to see and compare the actual numbers. To check compression manually with a gauge, all the spark plugs must be removed. The ignition coil must then be disabled, or the high-

tension lead grounded. If the engine has a distributor-less ignition, the ignition coils must be disabled to prevent them from firing. The throttle must also be held open and fuel pump disabled. After a compression gauge is screwed in a spark plug hole, the engine is cranked for a few seconds using a remote starter switch or a helper. The maximum compression reading is noted, and then the process is repeated for each of the remaining cylinders. The individual cylinder readings are then compared to see if the results are within specifications (always refer to the OEM manual or ALLDATA for the exact compression figures for the engine because they will vary from vehicle maker and model to vehicle maker and model).

How Do I Know if it is the Rings or the Valves?

If compression is low in one or more cylinders, you can isolate the problem to the valves or rings by squirting a little 30-weight motor oil into the cylinder through the spark plug hole and repeating the compression test. The oil temporarily seals the rings. If the compression readings are

higher the second time around, it means the rings and/or cylinder is worn. No change in the compression readings would tell you the cylinder has a bad valve. Valve related malfunctions might be diagnosed with vacuum gauge if the engine can be run.

Internal Coolant Leaks

These are the worst kind of coolant leaks for two reasons. One is that they are impossible to see because they are hidden inside the engine. The other is that internal coolant leaks can be very expensive to repair. The most common internal coolant leaks are:

Bad head gasket: Internal coolant leaks are most often due to a bad head gasket. The head gasket may leak coolant into a cylinder, or into the crankcase. Coolant leaks into the crankcase contaminate the oil and can damage the bearings. A head gasket leaking coolant into a cylinder can foul the spark plug, and create a lot of white smoke in the exhaust. If you suspect a head gasket leak, have the cooling system pressure tested. If it fails to hold pressure, and no coolant is

HEADLINERS

EMPIRE AUTO PARTS ENSURES AFTERMARKET QUALITY

For 15 years, Empire Auto Parts has put their name and reputation on the line by promising only the highest-quality aftermarket crash parts the industry has to offer. And for 15 years, they have exceeded expectations and defied misconceptions.

Boasting three warehouse distribution centers (Maryland, Massachusetts and New Jersey) and 10 shuttle locations in 12 northeastern states, Empire Auto Parts delivers parts twice a day to most

of their locations. The company specializes in aftermarket crash parts, plus cooling parts, wheels, reconditioned/discounted OEM parts and light truck accessories.

The company's roots were planted by Steve Bollander, a mainstay of the AASP/NJ community who first entered the auto business world with Auto Bumpers Incorporated in 1970. Eleven years later, he founded Champion Bumpers, which merged with POY Auto

Parts Supply to form Empire in 1995. Steve's son Randy, who has worked at the family business since 1990 and currently serves as sales and marketing manager, credits Empire's long-lasting success to maintaining a strong focus on offering products that last.

"Aftermarket parts have come a long way as far as quality," he says. "We're members and supporters of CAPA, and CAPA certification has really pushed the industry. Our mission really is

found to be leaking, there is an internal leak. A “block tester” can also be used to diagnose a leaky head gasket. This device draws air from the cooling system into a chamber that contains a special blue colored leak detection liquid. Combustion gases will react with the liquid and cause it to change color from blue to green if the head gasket is leaking. Another tool to use is a leak detection dye, which can be added to the coolant itself to make a slow leak easier to find. Some of these dyes glow bright green or yellow when exposed to ultraviolet light. Head gasket failures are often the result of engine overheating, which may have occurred because of the collision damage that caused a coolant leak elsewhere in the cooling system or an electric cooling fan not operation properly or damaged. When the engine overheats, thermal expansion can crush and damage portions of the head gasket. The damaged areas may then start to leak combustion pressure and/or coolant.

Cracked Head or Block: Internal coolant leaks can also occur if the cylinder head or engine block has a crack in a cooling jacket. A

combustion chamber leak in the cylinder head or block will leak coolant into the cylinder. This dilutes the oil on the cylinder walls and can damage the piston and rings. If the coolant contains silicates (conventional green antifreeze), it can also foul the oxygen sensor and/or catalytic converter. (This is why it is essential that the correct OEM antifreeze is always used.) If enough coolant leaks into the cylinder, as when the engine is sitting in the repair facility waiting for repairs to begin or during repairs, it may even hydro-lock the engine and prevent it from cranking when you try to start it. Internal leaks such as these can be diagnosed by pressure testing the cooling system or using a block checker. Coolant leaking into the crankcase will make the oil level on the dipstick appear to be higher than normal. The oil may also appear frothy, muddy or discolored because of the coolant contamination.

Coolant System Damage

Where coolant leaks occur after a collision:

WARNING: DO NOT open the radia-

tor cap while the engine is hot! Even if the cooling system is leaking, the coolant can be under considerable pressure, especially if it is low and coolant is boiling inside the engine. Shut the engine off and let it sit for about an hour. Place a rag over the upper hose and squeeze it; if it is hard the system is still pressurized, if it is soft then the system is cool enough to open the cap. Place a rag over the radiator cap and slowly turn the cap until it starts to release pressure. Wait until all the pressure has vented before turning the cap the rest of the way off.

Coolant leaks can occur anywhere in the cooling system. The collision repair facility has an advantage over a mechanical shop in that the system was most likely operating correctly during the collision, so you should first inspect the collision damage area for any stains, leaks, damage or kinked lines. Coolant leaks are generally easy to find because the coolant can be seen dripping, spraying, seeping or bubbling from the leaky component, especially a collision damaged system. Open the hood and visually inspect the

continued on page 46

to buy quality parts, because no one wants something that's defective or doesn't fit right."

"We've stood behind our products for a long time," he adds. "We've always said we're going to buy the best quality that's available on the market and sell it to our customers. In the meantime, our customers have always been the body shops – not any outside forces telling them where to go."

In February 2009, Empire Auto Parts launched an online parts ordering website (www.empireauto.us) that currently

accounts for 15 to 20 percent of the company's overall business.

"I think it's just easier for the shops to know that they can log in and see all the parts we have," says Randy of the new system. "We can update the parts and the pricing in real time."

Currently, Empire Auto Parts is offering 60 percent off all replacement aftermarket headlamps until the end of June. But that's only one of countless reasons to give this veteran parts supplier a try.

At a time when aftermarket parts are under scrutiny like never before, Empire

Auto Parts is working hard to continue its tradition of high-caliber parts at competitive prices.

As Randy says, "Our focus is quality and efficiency. If those two aren't met, you're definitely going down the wrong path as a businessperson."

For more information, please visit www.empireauto.biz.



SPRINGFIELD TOYOTA

6570 Amherst Ave.
Springfield, Va. 22150



Competitive Prices
Knowledgeable Staff
Delivery Service
Large Inventory



Parts Hours:

M-F: 8am - 5pm

703-269-1406 • Fax: 703-269-1456

O'Donnell Honda

8620 Baltimore Nat'l Pike
Ellicott City, MD 21043

Parts Direct:
410-461-5972

24 Hour Fax:
410-461-9654

www.odonnellhonda.com



Hours of Operation:
M-F: 8:00am-6:00pm
Sat: 8:00am-5:00pm

- **Complete Line of Glass & Sheet Metal**
- **Your Source for OEM Honda Parts**
- **Competitive Pricing**
- **Professional Wholesale Staff**
- **Free Delivery Always**



TECHNICAL FEATURE

continued from page 31

engine and cooling system for any sign of liquid leaking from the engine, radiator or hoses. Remember, the color of the coolant may be green, orange or yellow depending on the type of antifreeze used in the system by the OEM. Some of the most common components that would be damaged in a collision and where coolant may be leaking out of are the water pump, radiator, radiator hoses, heater core, intake manifold, ATF oil/fluid cooler or coolant overflow reservoir.

Look for Part Two of this article in next month's *Hammer & Dolly*.



Larry Montanez is a former I-CAR instructor and is co-owner of P&L Consultants with Peter Pratti Jr. P&L Consultants work with collision repair shops on estimating, production and proper repair procedures. P&L conducts repair workshops on MIG & resistance welding, measuring for estimating and advanced estimating skills. P&L also conducts investigations for insurers and repair shops for improper repairs. P&L can be reached by contacting Larry at (718) 891-4018 or larry-goju@aol.com.

Jeff Lange, PE is president of Lange Technical Services, Ltd. of Deer Park, N.Y. (www.LangeTech.net). Jeff is a licensed New York State professional engineer who specializes in investigating vehicle and component failures. Lange Technical Services, Ltd. is an investigative engineering firm performing forensic vehicle examinations and analysis for accident reconstruction, products liability and insurance issues. Jeff can be reached at 631-667-6128 or by e-mail at Jeff.Lange@LangeTech.net.

The Importance of Mechanical Diagnostics in the Collision Repair

Process: Part Two By Larry Montanez III, CDA and Jeff Lange, PE



© iStockphoto.com/centurion9

In Part Two of their extensive feature, Larry Montanez and Jeff Lange outline a variety of things to consider when determining if a vehicle has received mechanical damage in a collision.

Water Pump

A bad shaft seal will allow coolant to dribble out of the vent or weep hole just under the water pump pulley shaft. In a longitudinal motor (i.e. rear-wheel/four-wheel/all wheel drive), the radiator support and radiator could have been pushed rearward into the clutch fan or electric fan assembly from the force of the collision and damage the water pump or the water pump shaft. Look for stains, discoloration or liquid coolant on the outside of the water pump, engine or on the floor below the water pump.

Radiator

Radiators can develop leaks around upper or lower hose connections as a result of cracks from the collision and vibration of the engine. The seam where the core is mated to the end tanks is another place where leaks can develop, especially on aluminum radiators with plastic end tanks, during a collision event. The core itself is also vulnerable to damage from the grille, hood latch vertical brace or front fascia. Most cooling systems today are designed to operate at anywhere from eight to 18 psi (check with the OEM or ALLDATA for the exact operating pressure). If the radiator can't hold

pressure, your engine will overheat and lose coolant.

Hoses

Cracks, pinholes or splits in a radiator hose or heater hose will cause a coolant leak or sprayout. A hose leak will usually send a stream of hot coolant spraying out of the hose. A corroded hose connection or a loose or damaged hose clamp may also allow coolant to leak from the end of a hose. Sometimes, the leak may only occur once the hose gets hot and the pinhole or crack opens up, so it is essential to test run the motor once it has been inspected for damage.

Heater Core

The heater core is located inside the HVAC (Heating Ventilation Air Conditioning) unit/box between the dash panel/firewall and the instrument panel/dashboard. Due to its location, seeing a leak directly can be difficult (a borescope could be useful). But if the heater core is leaking or a hose connection to the heater core is leaking, coolant will be seeping out of the bottom of the HVAC unit and dripping on the floor inside the passenger compartment. Look for stains or wet spots on the bottom of the plastic HVAC case or on the passenger side floor, a pungent smell and a greasy film on the inside passenger side of the windshield.

Intake Manifold

The intake manifold, especially a

plastic one, is susceptible to damage from components installed in front of the engine, which could be forced rearward into the manifold. Also take note of the mileage on the vehicle, as many intake plastic manifolds and the plastic gaskets used on today's aluminum engines often fail at 50,000 to 80,000 miles.

Damaged ATF (Automatic Transmission Fluid) cooler

A collision can damage the internal automatic transmission fluid oil cooler that is inside the radiator tank. On most vehicles with automatic transmissions, ATF is routed through an oil cooler inside the radiator. If the tubing leaks, coolant can enter the transmission lines, contaminate the fluid and ruin the transmission. Red or brown drops of oil/fluid in the coolant would be a symptom of such a leak. Because the oil/fluid cooler is inside the radiator, the radiator must be replaced to eliminate the problem. The transmission fluid should also be changed, and this may take multiple flushes of a trip to the dealer for a full transfer. This is an important check due the risk of damage to the automatic transmission.

Coolant Surge Tank or Coolant Overflow Reservoir

Another cooling system component that needs attention is either the coolant surge tank or the coolant overflow reservoir. The surge tank is part of the cooling system and is under

pressure. The coolant overflow reservoir does more than catch the overflow from the radiator; it serves as a storage tank for excess coolant. When the system is hot, coolant will be forced out through the radiator pressure cap and into the reservoir. Then, as the system cools down, decreasing pressure will draw coolant back into the radiator. On many newer vehicles, the coolant reservoir is pressurized and is an integral part of the cooling system. The filler cap for the cooling system is located on the reservoir tank, and the tank is connected to the radiator and engine with hoses. The reservoir is transparent plastic and you can see the coolant level inside; the surge tank is generally black and you cannot see inside unless you open the pressurized cap. If the coolant reservoir or surge tank is cracked or leaking, the system may lose coolant every time the engine heats up. Eventually, this can cause the engine to overheat. Small punctures or cracks in the overflow reservoir can usually be repaired with silicone glue. There are no repairs allowed to the surge tank. When replacing the reservoir or surge tank, make sure that all the hoses are routed correctly between the radiator and the reservoir or surge tank, and that the hoses are free from kinks that could

block the flow of coolant back and forth.

Pressure Testing the Cooling System

There are several ways to find out whether or not your cooling system is holding pressure. One is to top off your cooling system, tighten the radiator cap and start the engine. When



the engine reaches normal operating temperature, turn on the air conditioner (this will increase the cooling load on the system) and/or take it for a short drive. Then, check the radiator, hoses and water pump for seepage or leaks. A special tool called a “pressure tester” can also be used to check your cooling system. The tool is nothing more than a little hand pump with a combination vacuum-pressure gauge and a fitting that is attached to the radiator filler neck (available from tool companies like Sears, Snap-On, Mac,

Matco, etc.). To check for leaks, attach the tool to the radiator and pressurize the radiator to the pressure rating on the radiator cap. For example, if you have a radiator cap that says 14 pounds, you pressurize the radiator to 14 pounds and wait to see if the system holds pressure for 10 to 15 minutes; it should if there are no leaks. If it does not hold pressure, the system is leaking somewhere and further testing is required. If you cannot see any visible leaks on the outside, it means the leak is inside (bad head gasket or cracked head or block).

Radiator Cap Checks

The radiator cap should also be pressure tested, especially if the system has been overheating or losing coolant with no obvious external leaks. A weak cap that cannot hold pressure will allow the system to boil over. If the cap cannot hold its rated pressure, replace it with the correct rated cap. Remember: The surge tank has a pressurized radiator cap on it and it also should be tested.

Roll Over and Hydrolock

Hydrolock (a shorthand notation for either “hydraulic lock” or “hydrostatic lock”) is an abnormal condition of an internal combustion engine

HEADLINERS

SCRS ANNOUNCES “REPAIRER DRIVEN EDUCATION” AT SEMA SHOW

The Society of Collision Repair Specialists (SCRS) has announced additional details regarding their upcoming educational opportunities being featured at the 2010 SEMA Show. The educational track, entitled “Repairer Driven Education (RDE),” will feature over 21 seminar offerings, many of which are being offered for the first time, and all of which specifically focus on issues and information that are relevant to collision repair

professionals operating in today’s marketplace.

The RDE track, being conducted between 8am and 3pm on Thursday, November 4 and Friday, November 5, will be launched with an inspiring opening seminar conducted by Charles Coonradt, author of *The Game of Work*, *Managing the Obvious* and *The Better People Leader*. The two-day RDE program will also be packed full of information from

speakers, including: Mike Anderson; Toby Chess; Erica Eversman J.D.; John Sweigart; Patrick McGuire Esq.; Steven Feltovich; Tim Ronak; Greg Horn and many more.

The seminar topics will range from how to legally and practically address steering to getting ready for transitioning your business to a lean model. A complete list of seminars included can be found on the SCRS website, www.scrs.com, which

in which an incompressible liquid, commonly water or coolant, has been introduced into one or more cylinders, causing immobilization or damage. Hydrolock occurs in an internal combustion engine because the engine must compress a volume of fuel/air mixture in order to operate. But if any liquid is introduced into the combustion chamber at a volume greater than the volume of the combustion chamber at its minimum (top of the piston's stroke), the piston cannot complete its travel. Either the engine must stop rotating, or a mechanical failure will occur. Bent or broken connecting rods are often the result of hydrostatic lock. This can occur during a rollover collision event or from flood damage. If an engine hydrolocks while at speed, a mechanical failure may occur. Commonly damaged components include bent or broken connecting rods, a fractured head, a fractured block, crankcase damage, damaged rod bearings, damaged seals or any combination of these. Forces absorbed by other interconnected components may cause additional damage. Physical damage to metal parts will manifest in a "crashing" or "screeching" sound and usually requires replacement of the engine or a substantial rebuild of its major components. If an engine hy-

drolocks while idling or under low power conditions, the engine may stop suddenly with no immediate damage. In this case, unscrewing the spark plugs or injectors and spinning the engine to expel the liquid from the combustion chambers can purge the engine. Depending on how the liquid was introduced to the engine, it can possibly be restarted and dried out with normal combustion heat, or it may require more work, such as flushing out corrupted operating fluids and replacing damaged gaskets.

Driving the Vehicle with Components Disconnected

Many times, technicians will attempt to drive vehicles inside and around the repair facility with the radiator removed. They will usually loop transmission and oil lines, but there is no cooling for these components and the motor. This is usually not an issue if only driven for a minute or two. In many cases, the vehicle is run for five to 10 minutes, during which time overheating could occur and any of the issues mentioned earlier in this article could occur. Please take all precautions not to cause any further damage to the vehicle.

Hopefully, this article has brought to your attention the importance of

diagnosing mechanical damage, preventing further damage, the testing processes required and, of course, charging for what needs to be done, to restore the vehicle to pre-loss condition. Feel free to contact us at any time if you have any questions that we could help with.



Larry Montanez is a former I-CAR instructor and is co-owner of P&L Consultants with Peter Pratti Jr. P&L Consultants work with collision repair shops on estimating, production and proper repair procedures. P&L conducts repair workshops on MIG & resistance welding, measuring for estimating and advanced estimating skills. P&L also conducts investigations for insurers and repair shops for improper repairs. P&L can be reached by contacting Larry at (718) 891-4018 or larrygoju@aol.com.

Jeff Lange, PE is president of Lange Technical Services, Ltd. of Deer Park, N.Y. (www.LangeTech.net). Jeff is a licensed New York State professional engineer who specializes in investigating vehicle and component failures. Lange Technical Services, Ltd. is an investigative engineering firm performing forensic vehicle examinations and analysis for accident reconstruction, products liability and insurance issues. Jeff can be reached at 631-667-6128 or by e-mail at Jeff.Lange@LangeTech.net.

includes more specific details necessary to plan your time in Las Vegas.

"Any time the industry finds additional venues and opportunities where repairers can learn about ways to improve their businesses and capitalize on the energy derived from stepping out of your box to focus on the business, we win as an industry," shares SCRS Executive Director Aaron Schulenburg. "Not only are the attendees going to have access to some of the best educational opportunities, speakers and specialists

available to our industry, but additionally, the participants are going to be able to harness all the excitement that the SEMA Show has to offer."

"SCRS and its members represent an important audience at the SEMA Show," stated Peter MacGillivray, SEMA vice president of events and communications. "We're pleased to be working with them to develop programs and features that are relevant to the collision repair industry."

Exhibitor space sign-up for the show has already opened, and exhibitor applications received with deposits by May 7 will be included in the priority space selection process. Attendee online registration will open on April 5. Attendees will be able to register for both their SEMA Show entrance and SCRS RDE seminars through the show website, www.semashow.com.

