



HEAVY EQUIPMENT SAFETY TRAINING COURSE LOOK, LISTEN, SMELL – CLUES THAT SOMETHING IS WRONG

Importance of Pre-Operational Inspections

Sometimes, looking, listening and smelling can prevent an accident or severe damage to equipment. Here are some tips on what to look for, how to listen and what certain smells may mean to an operator.

Has park brake been applied or checked and keys removed?

Check fluid levels and filters:

1. Engine crankcase

- a. Looking for external leaks
- b. Check dip stick. If the oil on dip stick is extremely black it is probably due for a change.
- c. Smell dip stick fluid. If smells of diesel fuel or gasoline it may have a leak allowing fuel to enter crankcase, or problems with the carburetor, or injection system.
- d. If dipstick shows way over full it may indicate fuel, or coolant leak getting into crankcase.
- e. Unidentified coloring of engine oil could have many implications if crankcase fluid does not look like “normal” oil shut down immediately and have it checked out.

2. Radiator and coolant.

- a. If there is a sweet smell coming from the engine area it may indicate that there is radiator coolant leaking on to a hot engine.
- b. If you have a machine that has a pull fan and works in a dusty or weedy area be sure to check the front side of the radiator at least daily to make sure that there is no buildup of debris in the front side of the radiator this may involve removing the front radiator shield or grill cover to allow access to the radiator. This same procedure applies to all machines but time intervals vary with operating conditions and type of machine.
- c. If your machine has a push fan you follow many of the same procedures, but you need to access the backside of the radiator. If your machine has a fan that allows you to push in on the blades and change direction of airflow, be sure that you have all the blades turned the same direction. Prior to the start



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of the operating season it is a good idea to spray the hub bolts and adjustable fans with penetrating oil and allow them some time to loosen up stuck or rusty bolts and blades. Air-cooled engines are just as susceptible to becoming plugged up by debris and should be attended to in much the same manner as water-cooled systems are.

3. Hydraulic Systems

Some manufacturers will use the hydraulic reservoir as a heat sink thus creating a system with a huge capacity to reduce the heat generated by the system and keep operating temperatures at reasonable level.

Whereas some systems are designed to keep the flow of oil traveling as smoothly as possible thus generating much less heat as the machine is operated, some machines are also engineered to use long runs of seamless tubing to act as a cooling medium in as much as the steel tubing has much better flow characteristics than neoprene/rubber hose thus generating much less operating temperature.

Finding the fluid level checkpoint and the filter on hydraulic systems is not always easy. Some equipment will have the dipstick located below the operator area, while using the differential case as a reservoir, which supplies fluid for the hydraulic system, the transmission and the differential.

Occasionally you can find a reservoir mounted up front ahead of radiator where is used for ballast to help put additional weight on the front axle, this does however create a problem when there is spillage of hydraulic fluid which then migrates to the radiator and attracts dust and debris.

If an operator identifies a frothy appearance to the hydraulic oil that quite often will indicate that there is some air entrainment occurring in the system the frothy condition usually means that there are tiny air bubbles being generated within the hydraulic system, because the air bubbles are compressible it greatly reduces the efficiency of the fluid and the hydraulic pump.



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Good hydraulic system health is similar to good cardio vascular health in a human being. If the hydraulic flow gets sluggish and erratic the entire machine suffers, as is the case within the human hydraulic system.

4. Transmission and Torque converter:

- a. In as much as transmission and torque converters are a nearly closed system, there is very little that can be done to change the behavior of the system, but it is very critical that the transmission fluid level be kept up and the system kept clean, an influx of water or dirt into the system makes quick work of the clutch packs and valve bodies within.
- b. Some machines use a sight glass mounted on the machine to check fluid levels, transmissions and hydraulic systems are two prime examples of possible sight glass utilization. It does require a glass for each systems and it is incumbent on the operator to know which is which. With this system and all others it is up to the operator to read and understand the operators manual. As the technology improves the machines it is important that the operator also improves.

5. Windshield Washer Bottle (if equipped)

- a. The windshield washer bottle is only a small part of the overall system needed to keep all the windows clean and damage free.
- b. Operating with dirty or busted and cracked windows is much like operating with very poor vision. In the Fall of the year when we have frost developing on the windows and we are experiencing sunrise at right around starting time and if we have dirty windows inside and out it is an accident waiting to happen and quite often does. Operators need to exhibit professionalism and keeping the cab windows clean and in good repair is an indicator of professionalism.
- c. Either carry a bottle of commercial window cleaner and good quality wiping cloths with you or have your shop make up large quantities of window cleaning material utilizing water, ammonia and white vinegar. There are recipes available in any of the how to clean it books.

6. Pre-cleaner



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There are a few different kinds of pre cleaners. John Deere for instance has a visual check through a plastic dish that can be removed by spinning off a wing nut removing the cover and inverting the plastic dish and dumping out the dirt. Some manufacturers utilize a small rubber cone that you tweak periodically and it allows the dirt to fall out. It is important for the operator to know how the air intake system works. Read the Operators manual and check at least daily.

7. Air filter

An air cleaner is one of the more important features on your machine, quite a few manufacturers utilize a small bottle on the air filter case that indicates green if the air intake system is functioning properly, and switches to red when the air filter flow becomes to restricted to allow for good efficient operation.

Check the air cleaner, the dust valve and the cab air filter often (at least daily).

8. Fuel System

A fuel filter is an important part of the system. Without a clean fuel supply, the engine may be easily damaged. Check the operator manual that came with the equipment to help locate the filter and sediment bowl on your equipment.



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General Visual Inspections:

1. Inspect bucket, cutting edges, tips, wear plates, adapters, protectors, and hardware for excessive wear or damage.

Your cutting edges, bucket teeth, etc. are known as the ground engaging parts of your machine so consequently they are also subject to extreme wear depending on the application, and usage. The ground engaging components should be checked daily and replaced as soon as needed.

For a machine with teeth on the bucket, if one tooth breaks off and all that is left is the adapter, it may be wise at that time to replace all of the teeth. The logic being that you will put a great deal of stress on that one new replacement, and perhaps bust it and the adapter off because of the disproportionate load that is placed on it. Usually if the adapter is torn off it breaks back into the bucket, which involves major repair to the base metal on the bucket.

Conversely if the tooth comes off and the adapter is left without a replacement tooth the adapter will wear rapidly and within a short period of time the adapter will not accommodate a tooth because of the wear and you won't be able to get a tooth to stay on the adapter. Sometimes you can extend the life of your bucket teeth by moving two of the inside teeth to the outside and taking the two outside teeth and moving them to the inside (the outside corners always wear faster than the middle). This logic also applies to a loader bucket if you have a segmented cutting edge or one that is reversible.

2. Inspect Loader or excavator control linkage for wear, damage, and loose or missing hardware. For graders and dozers, check the blade/ripper scarifier for wear or damage.

Evaluator will look for the operator to identify any excessive wear, cracked welds, distorted or wrinkled paint and loose or missing hardware that could present a problem during operation. Control linkage problems can be identified visually because of a misalignment or a missing link or connecting bar. It may also be identified by operating certain controls that exhibit a looseness or sloppy feeling



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when they are actuated. These issue need to be dealt with immediately in that they are a safety issue.

3. Inspect all hydraulic cylinders, rods, hoses, and fittings for damage and leaks

The operator should thoroughly check everything mentioned with confidence. The hydraulic cylinders, rods, hoses are the heart of the hydraulic system. They are all external and exposed to damage from a variety of sources. Cylinders can be damaged by contact with other obstacles. Rods can be scratched and nicked which will cause damage to seals and O-rings in turn causing external leakage and internal contamination of the hydraulic system.

4. Inspect under machine for damage, fluid leaks, trash build-up, and loose or missing hardware and fasteners

The operator should look under the equipment and identify any item that is or can become a safety hazard or prevent the operator from productively and safely operate the equipment. We're constantly exposed to material under the machine which can fly up when driven over and create damage to the underside of the machine. Trash buildup can affect operating controls and linkage and give appearances of being some completely unrelated related problem. Fluids can be trapped in belly pans and bottom engine covers and only become apparent when the machine is operated on a steep grade or the fluid becomes so excessive that it finally will flow out of the cover.

5. Inspect transmission/torque converter, covers, seals, and hoses for leaks

Looking for problems under a machine is advisable whenever the operator has been in very rough terrain and has exposed the machine to contact with brush, rocks, boulders, trees, etc. If the machine is a very high hour unit you may experience a seal that has failed and is losing lubricant this will usually indicate a deterioration of bearing fit and does not have to necessarily be caused by damage from an obstacle. Hoses are always vulnerable because their placement is on the exterior of the machine and can be hooked, stabbed torn or in some other way damaged in the normal workday activity.

6. Make sure guards and covers are firmly in place. Check for damage and loose or missing bolts



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The operator should physically check for damaged or loose items. It is a definite matter of safety if guards and covers are removed and then left off of a machine, guarding needs to be in place and secured throughout the life of a machine. Quite often a guard or cover protects vulnerable parts of a machine, they not only protect the machine from damage but protect those employees working around the machine. PTO shafts look very benign but even the smallest machines that are equipped with a PTO drive are potentially life threatening to the person that does not take the threat of injury or death seriously. If you remove it put it back in place.

7. Inspect Engine compartment for...

- Leaks – oil, fuel, coolant, and exhaust gas

- Belt - tension, cracks, and wear

- Fan - security, cracks, and broken or missing blades

Quite often, fluid leaks are easily identified simply by using a shop cloth and wiping off the liquid. You can identify the smell as being diesel fuel, gasoline, engine coolant, motor oil, gear oil, etc.

Exhaust gas can be identified by an exhaust smell in the cab of the machine. The leak will often leave traces of black smoke in the engine area, the closer that you get to the source of the smoke the darker the smoke will appear.

The operator should be able to find the appropriate give in the belts by reading the operators manual and while he is checking for the flex tolerance, an operator should be looking at belt condition and cracks that can cause immediate belt breakage. If the v-side of the belt is very shiny it may indicate that it has been slipping and the tensions need to be increased or the belt replaced. As a rule of thumb, if you identify a problem with a belt to the point where it needs to be replaced then all the belts should be replaced or thoroughly examined.

Fan blades and fan hubs should also be checked for loose or broken Components. Fan blades are usually riveted to the hub, the blades should be checked individually for loose or missing rivets. Bolts that attach the fan hub to the water pump can also fall out and go unnoticed for quite some time.

8. Inspect rear axle and front axle for oil leaks. For Grader, also inspect the pivot points and the tandem housing.



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Rear and powered front axles can also leak lubricating fluid, the inside of the tire need to be looked at on a regular basis on both the front and rear axle. If leakage is noticed it should be serviced immediately. If a week passed and the leakage stops it probably means that the differential housing is dry of fluid and from there it is a short time before there is major internal damage to the differential assembly.

9. Check condition of steps, handholds, ROPS, retaining hardware and operator compartment for cleanliness.

Steps should be looked at every day because they are subject to a variety of damages. Look to see if there has been a strike against the step that caused broken metal, bent or missing attaching bolts or clips. The same precautions apply to hand rails and hand holds. Cleanliness is paramount for any machine this includes cleaning of windows as well. ROPS systems cannot be welded onto or drilled for any installation.

10. Inspect the windows of the cab and the mirrors for cleanliness and visibility. Also check for cracks and holes

11. Inspect lights for broken lamps, bulbs, lenses and loose or frayed wires. Checks for slow moving vehicle sign (if applicable)

Loose wires, broken lamps, bulbs that are burned out and busted lenses constitute a violation of state law.

12. Inspect seat belt and mounting hardware for wear and damage and proper latching.

It is an OSHA violation to alter, re-configure or in any way change a seat belt from its intended use or purpose. Belts can become worn or torn and must be replaced. If a latch is not functioning it also must be replaced. In the case of a rollover or serious collision it is imperative that you are wearing a seat belt.

13. Inspect tires for correct inflation, valve cores and stems for leaks and damage. Remove any rocks from treads.



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Good tire maintenance on all rubber tired vehicles is important, especially where you will experience inordinate amounts of loading of the sidewall and extreme loads from a full loader bucket of material on uneven ground.

Keep the pressures at recommended levels and keep them equal side to side. Do not use valve stems that extend outside of the rim. Keep valve caps on the stems. This will help limit the possibility of getting soil forced into the stem and having the tube develop a slow leak. Removing rocks from the tire treads will prohibit the tire from launching a rock and causing windshield damage to traffic while the machine is being driven.

14. Inspect radiator for leaks to hoses, cap, and connections. Remove debris from radiator and radiator guard area.

The operator should demonstrate understanding of the need for proper cooling system operation. Faulty hoses can create many problems in the cooling system, the internal lining of the hose can break down and restrict the flow of coolant to the engine. It is wise to grab the hoses and squeeze them and determine that there is an equal amount of resistance when pressure is applied to each hose.

Make sure your connections are tight fitting to reduce the risk of a hose blowing off when it is under pressure. Check the operator manual and identify the appropriate pressure requirement for the radiator cap. Clean debris and any collected grass or brush from the radiator or the radiator guard area to reduce the chance of over heating the system.

15. Where applicable, inspect tracks for tension and any excessive wear. Remove debris from the area.

The operator should demonstrate understanding of the need for proper track tension and the need for a inspection of the area for any debris that could cause problems.



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LUBE/GREASE:

Demonstrate correct lubrication for the following (where applicable):

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| 1. All Pivot Points..... | |
| 2. Front Axle Trunnion Bearing (if applicable)..... | |
| 3. Other lube points as shown in chart for specific machine..... | |
| 4. Tracks (if applicable)..... | |
| 5. For Dozer, equalizer beam center and outer pivot point..... | |
| 6. For Grader, Wheel Lean system bearings and king pin bearings ... | |

Loader pivot arm pins and bushings as well as grader bearings are subject to a large amount of heavy loading. PSI on the surface of the pin and bushing can amount to thousands of pounds per square inch. The correct grease needs to be chosen to provide adequate reduction in friction under these heavy load conditions. Ground engaging segments of the machine need to be greased frequently. The more wear that occurs in those areas, the more grease is required and more often.

The front axle spindles and the front axle yoke that attaches to the tractor are traditionally over looked because of their location on the machine and the difficulty reaching them easily. Pivot pins, bucket linkage, swing assemblies, wheel lean and king pin bearings all need regular attention, the criteria for all equipment is if it squeaks, moans or groans it probably needed grease a while ago.

OPERATIONAL:

After starting the engine:

- Check engine monitoring system, gauges, lights, horn, wipers, etc. for correct operation (allow sufficient warm up time).
- Look and listen for excessive noise and smoke at startup
- Check transmission, steering, brakes and hydraulic controls for proper operation
- Adjusts mirrors

If there are unique problems that arise, you may be able to find the solution in your operator manual, or contact the service department or dealership.