

Industrial Heavy Equipment Technician Program
Northern Alberta Institute of Technology

EARTHMOVING SCRAPER
Caterpillar 637G

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EARTHMOVING SCRAPER

Caterpillar 637G

INTRODUCTION

During 1920s and 1940s, the heavy-equipment industry have been evolved significantly (Orlemann, 2000). Organizations spend a considerable amount of money for purchasing heavy equipments. Highly expensive equipments demand proper maintenance strategies; thus, proper maintenance plans are compulsory. Many maintenance systems are used in the heavy-equipment industry: breakdown, preventive, and predictive maintenance. Although a minority of small shops and companies apply breakdown maintenance strategies, tremendous organizations, such as Caterpillar goes with preventive and predictive maintenance plans. The importance of preventative and predictive maintenance strategies is illustrated by examining a basic maintenance strategy of earthmoving scraper - Caterpillar 637G.

Purpose

The objective of the report is to provide basic preventative and predictive maintenance approaches for the CAT 637G. The content is designed to assist technicians, equipment owners, and stakeholders in recognizing the significant of these proactive maintenance strategies; thus, they can benefit from these plans. Instead of repairing major failures, technicians can save time by predicting and replacing components; equipment owners can save money by reducing unscheduled downtime; and stakeholders can see this maintenance strategies as a precursor of potential investments. The report will cover fundamental parts of preventative and predictive maintenance schedules. It does not include all maintenance tasks required to keep the CAT 637G in shape.

EQUIPMENT DESCRIPTION

The CAT 637G is a typical earthmoving scraper, designed for quick loading, hauling, dumping, and spreading of loose material. It significantly boosts productivity by speeding up cycle times (Caterpillar, 2010). Following figure shows a CAT 637G in action.



Figure 1

Sources: (Dawson, August 5, 2015; Dawson, August 5, 2015; Heavyequipment.org, 2005)

The CAT 637G is a replacement for the CAT 630E. The CAT 637G retains many good features from its former brother. (Heavyequipment.org, 2005) The CAT 637G has an excellent self-loading capability in a wide range of material. It is designed to load material with an auger mechanism which allows material distributed throughout the bowl. (Caterpillar, 2010). As shown in the below figure, an earthmoving scraper has two parts: tractor and scraper.

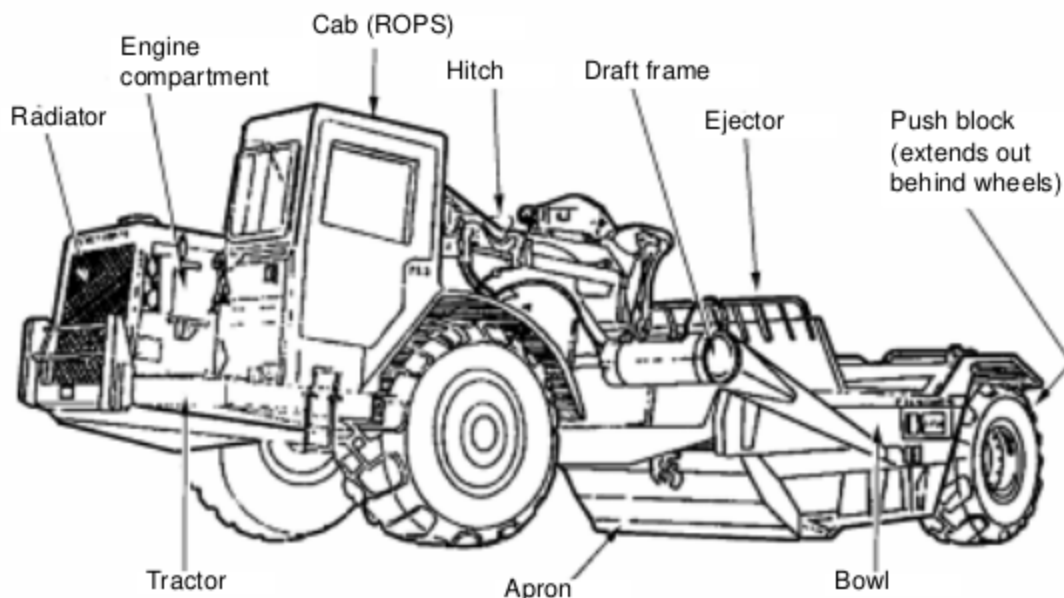


Figure 2

Sources: (Department of Army, 2000)

- Scraper uses the bowl to load and carry loose material. When the bowl is lower, the cutting edge enters the ground for loading the material. An auger in front of the bowl is responsible to lift material off of the cutting edge. Material is distributed evenly throughout

the bowl, resulting in consistent loads. Afterwards, the bowl is raised for carrying. Finally the bowl is lower again for dumping and spreading (Heavyequipment.org, 2005).

- Material is retained by an apron in front of the bowl. When the scraper loads the material, the apron moves up create a path for incoming material. The apron is closed upon hauling to prevent spillage. (Heavyequipment.org, 2005).
- Material is removed from the bowl by an ejector in the rear wall of the bowl. Upon spreading, the ejector moves forward, forcing material discharged (Heavyequipment.org, 2005).

HISTORY

Back in 1922, Robert Gilmour Letourneau and his brother-in-law Ray Peterson built the first earthmoving scraper in Stockton, California (Orlemann, 2000, p. 35). After the first scraper was built by Letourneau in 1922, the author created a second version of earthmoving scraper, nicknamed the Gondola. Later, the third edition Mountain Mover was created in 1923. The Self-Propelled scraper was the fourth built. Letourneau continuously dedicated his life to improve his creations (Orlemann, 2000).

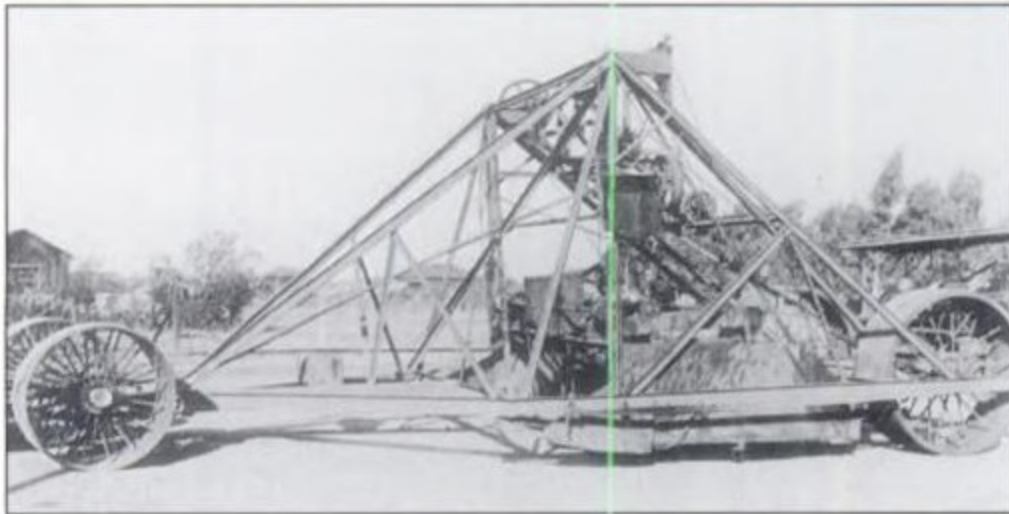


Figure 3

Source: (Haddock, 2015)

EQUIPMENT USE

Primary

Heavyequipment.org states that “A scraper is a compromise between a machine designed exclusively for either loading or hauling”. A scraper provides the ability of quick loading and hauling in a medium distance. It is better than a truck due to its fast load time, and it is better than a dozer because of its travel speed. (Heavyequipment.org, 2015). Due to its versatile functions, it is used in road construction and maintenance where we need the job done quickly and neatly.

Secondary

The CAT 637G can work as a substitution of front-end loaders, haul trucks and hydraulic shovels. (Stratton, 2007). Indeed, the CAT 637G is a versatile machine which is capable of multitasking: loading, hauling, and spreading of loose material. Not only is the earthmoving scraper used in road construction and maintenance, but it is also used in mining field because of its high productivity and performance. According to Jim Balmer, “This is the first exposure I've had to using scrapers for mining” (Stratton, 2007).

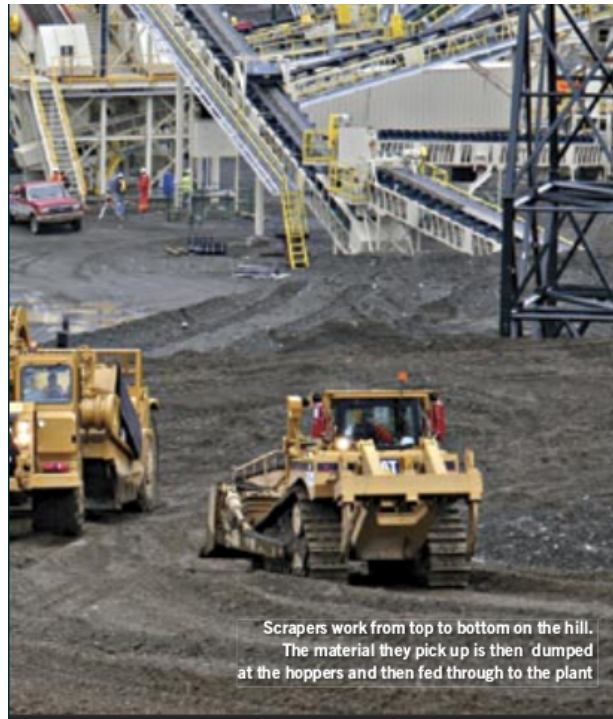


Figure 4

Sources: (Stratton, 2007)

WEAKNESSES AND ONGOING ISSUES

The CAT 637G as well as other scrapers usually work in a dusty environment such as mining, field or road construction. Therefore, some components, such as bearing lubrication, filters, air dryer desiccant are susceptible to contamination. Thus, heavy duty technicians are responsible to maintain equipment properly based on a preventative plan. (Caterpillar, 2010) Unlike other machines, an earthmoving scraper has two parts: tractor and scraper which are both exposed to contamination. Therefore, a scraper doubles the components exposed to contamination.

PREVENTATIVE MAINTENANCE OVERVIEW

As Wireman advised, “Preventive maintenance is defined as a fundamental, planned maintenance activity designed to improve equipment life and avoid any unplanned maintenance activity” (p. 1). Indeed, a component is not properly maintained positively causing the secondary damage. For example, lacking of lubricant can cause bearing roller wear prematurely. Secondary damages incur high cost and unexpected downtime. For this reason, the manufacturers compose a list of maintenance tasks and instructions that technicians should perform regularly in order to keep equipment in shape. Those makers know their components’

lifespan; hence, they can suggest when the operator should replace components or take proactive measures, such as lubrication. Likewise, the CAT 637G do need a proper preventive maintenance strategy. Caterpillar classifies its maintenance plan to two categories: before operation and maintenance intervals.

Before operation

Operators are required to fill a checklist prior to operate the equipment. If defects are presented, the operator must report to his or her supervisor and get them fixed. Prompt reporting of equipment problems prevents major system failure. In addition, the proactive measure also improves safety for technicians. In this maintenance stage, the operator mainly performs a visual inspection on the equipment, such as checking for any leakage or damage in major components. This inspection ensures that the equipment will work properly and safely.

The following picture illustrates components and their locations that need to be inspected before operating.

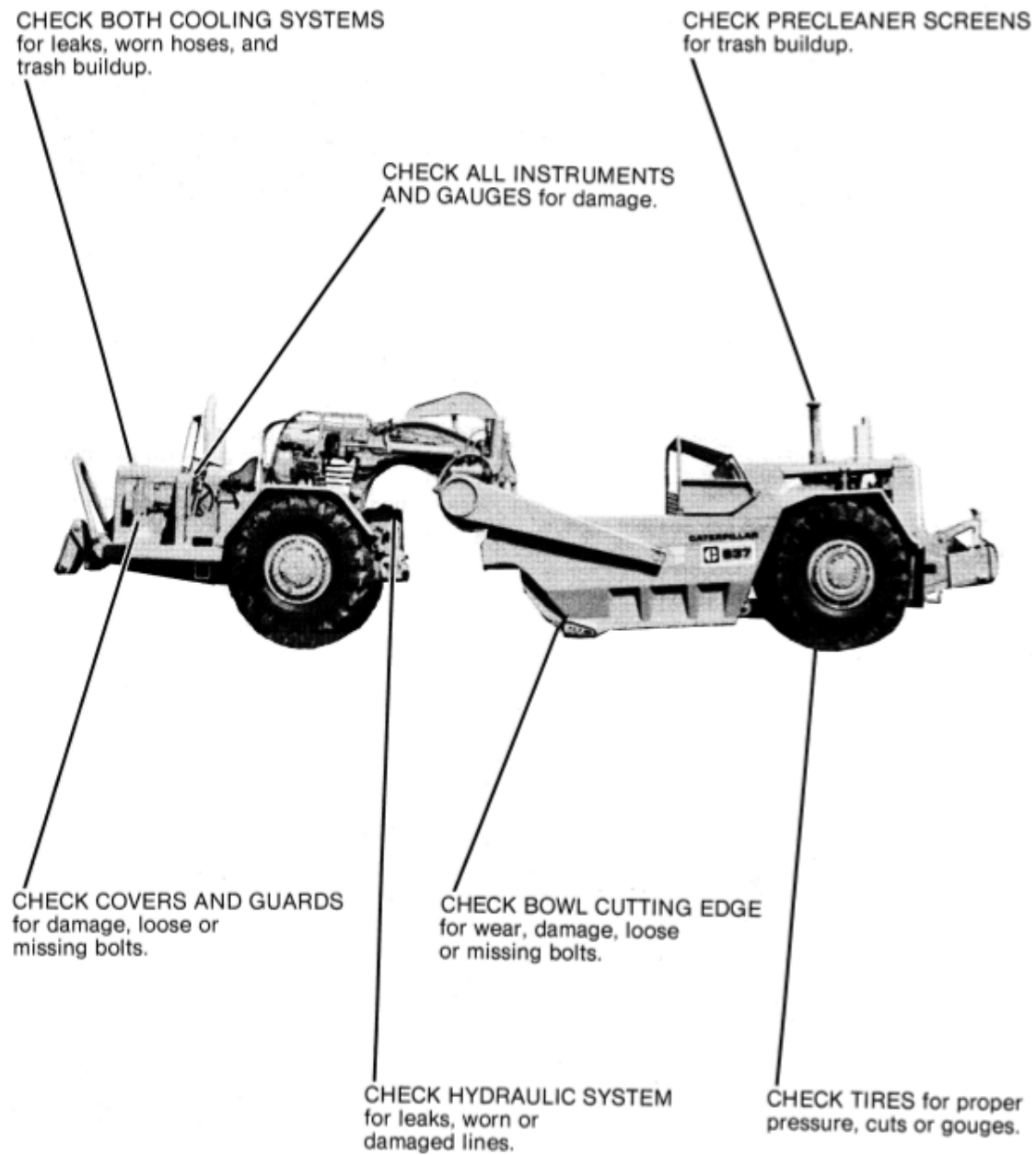


Figure 5
Sources: (Caterpillar, 2010)

Predictive Maintenance Intervals

Maintenance intervals detail step-by-step maintenance instructions that technicians must perform after a period of time in order to keep the equipment healthy. Typically, the CAT 637G have following basic maintenance intervals: daily, weekly, monthly, quarterly, and yearly.

Every 10 Service Hours or Daily

Drain Air Tank Moisture and Sediment. Moisture and sediment accumulated in the air tanks can lead to low reserve of air. Thus, we need to drain the air tanks daily. Following should be done to drain air tank.

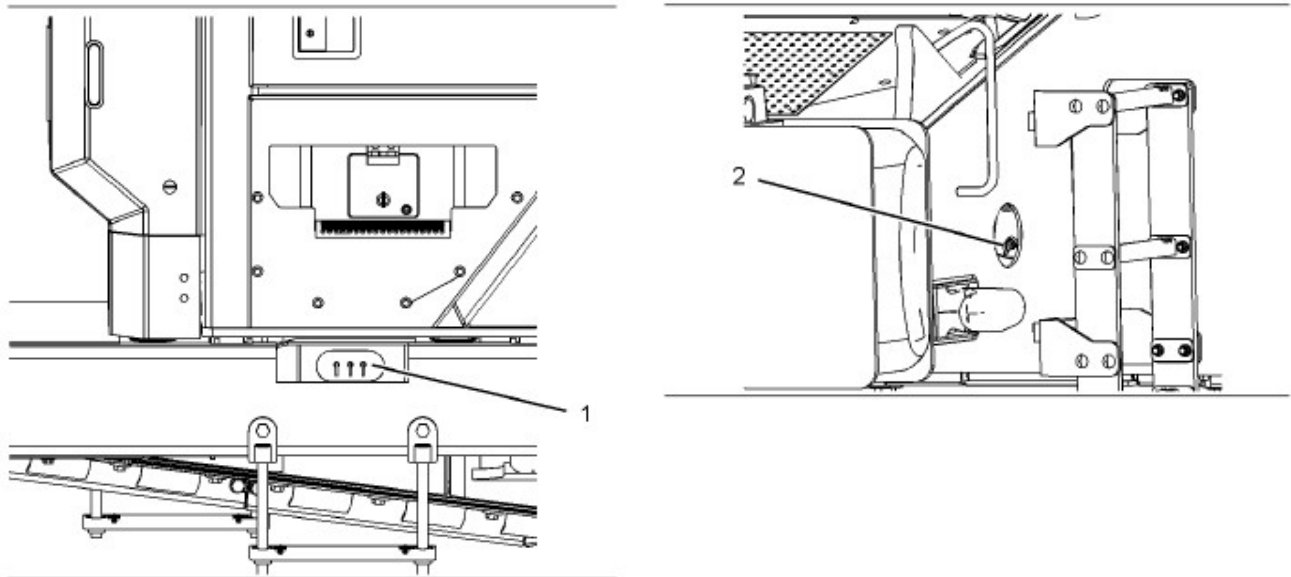


Figure 6

Source: (Caterpillar, 2010)

On the left side of tractor, there are three valves (1) located in the recess for the step. Drain moisture and sediment by lift up on the valves. After draining, close the valves by pushing down on the valves.

There are air tanks on the right and left rear side of the scraper. Drain moisture and sediment by turning the valves counterclockwise. Close the valves by turning clockwise.

Every 50 Service Hours or Weekly

Lubricate Hitch. Eighteen grease fittings are located near the cushion-hitch accumulator. Twelve grease fittings are located on the draft frame. Upon applying grease, operators can access these locations from the back of the tractor.

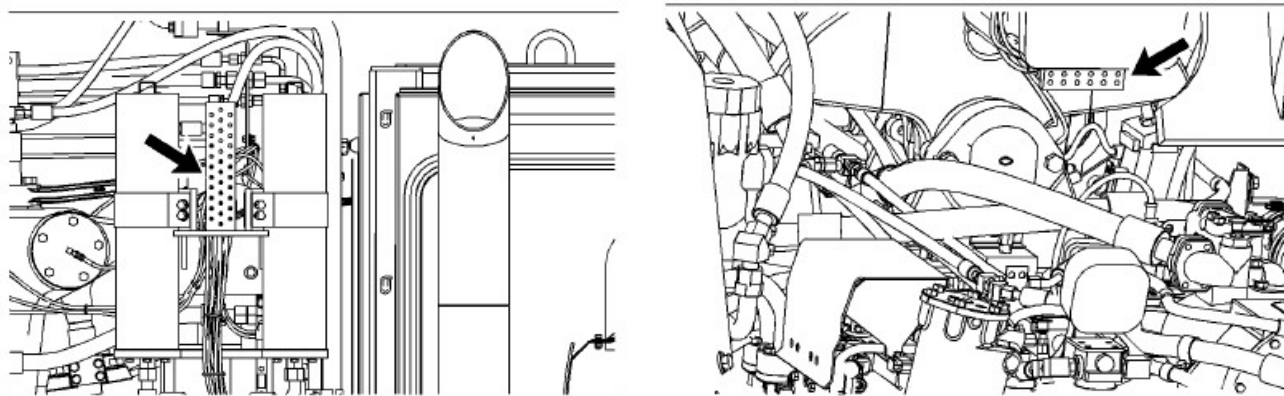


Figure 7

Source: (Caterpillar, 2010)

Every 250 Service Hours or Monthly

Clean and Check Battery. To do so, following should be done.

1. Turn off the engine and turn all switch to the OFF position.
2. Turn the battery disconnect switch to the OFF position. Remove the key.
3. Disconnect the negative battery cable that is connected to the frame.
4. Check the battery terminals for corrosion. Clean the battery terminals with a wire brush if corrosion is present.
5. Coat the battery terminals with petroleum jelly, if necessary.
6. Connect the negative battery cable
7. Install the key and turn it to the ON position.

Every 500 Service Hours or Quarterly

Replace Auger Hydraulic System Oil Filter. Three filters need to be replaced at the same time.

- Charge pump filter (1) is located behind the transmission filter
- Case drain filter (2) for the piston pump is located on the right side of the transmission case.
- Motor case drain filter (3) is located above the steering arm of the machine.

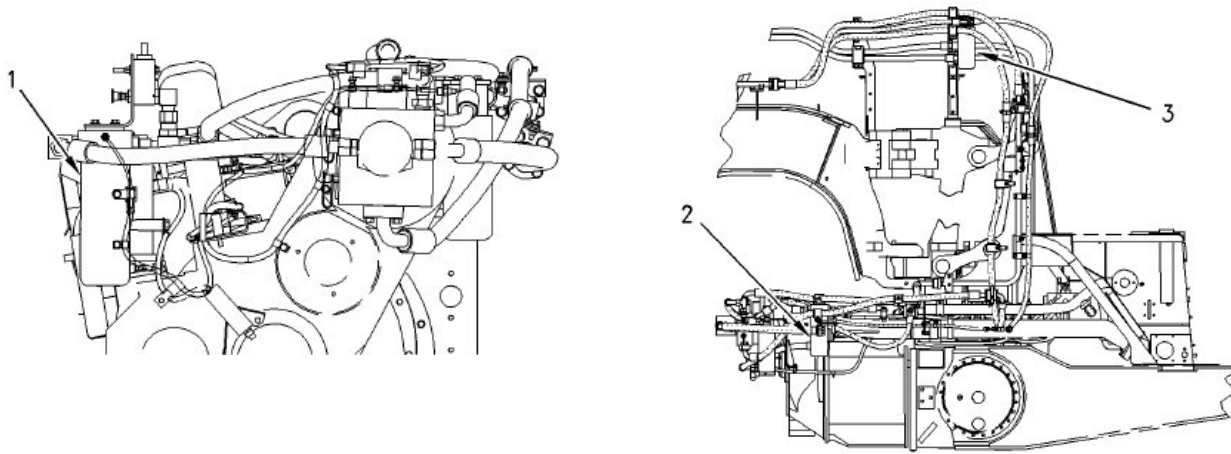


Figure 8

Source: (Caterpillar, 2010)

To do so, the following must be done.

1. Park the machine on a level surface. Engage the parking brake.
2. Stop engine. Lower the bowl.
3. Clean the area around the filters.
4. Remove oil filters with a strap type wrench.
5. Clean the bottom of the filter mounting bases.
6. Apply a thin coat of clean hydraulic oil to the seal of the new filters.
7. Install the new filters, hand tight until the seal of the filters contact the filter mounting bases.
8. Tighten the filters according to the instruction that are printed on the filters.
9. Start the engine. Check for leak at the filters.
10. Check the hydraulic oil level. Add hydraulic oil if necessary.

Every 2000 Service Hours or Yearly

Inspect and Replace Brake Shoes and Drums. Operators need to inspect brake shoes and drums of all the wheels on scrapers and tractors. To do so, the following must be done.

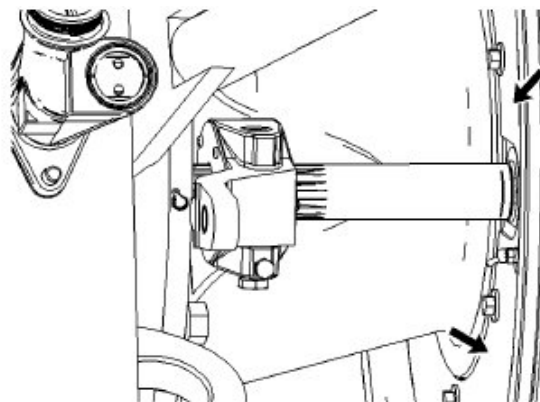


Figure 8

Source: (Caterpillar, 2010)

1. Remove the wheel brake dust covers.
2. Check the brake shoes for wear or damage. Measure the thickness of the brake linings. If the thickness of the brake linings is less than 7.2 mm (0.28 in), replace the brake linings.
3. Check the brake drum for wear or damage. Repair or replace brake drum if necessary.
4. Install the wheel brake dust cover.

PREDICTIVE MAINTENANCE OVERVIEW

Predictive maintenance somewhat likes preventive maintenance; however, predictive maintenance is much more. According to Keith, “[Predictive maintenance] is the means of improving productivity, product quality, and overall effectiveness of manufacturing and production plants.” He also noted that predictive maintenance is a condition-driven preventive maintenance program. Caterpillar mentioned in their manuals that the hitch should be lubricated weekly. Nevertheless, some working environments, such as coal mine can have a lot of contamination. Some mining companies may demand their employers to lubricate the hitch twice a week. Likewise, instead of changing oil quarterly according to specs, sample oil should be obtained and checked before determining proper time frame for changing oil.

CONCLUSION

Minimizing cost and maximizing productivity is the business objective. To reach that goal, preventive and predictive maintenance strategies provide an excellent mechanism to take care of the equipment. Companies which follow the belief “If it’s not broken, don’t fix it” actually have no such thing as maintenance. In short term, this practice can save some labour and parts costs. However, the equipment health is unpredictable. Once a failure occurs, it probably causes other secondary damages; thus, resulting in unscheduled downtime, transportation costs, additional labour cost, etc. To eliminate these unwanted situations, preventive maintenance provides a good maintenance practice by periodically inspecting and replacing components based on manufacture specs. On the other hand, predictive maintenance is somewhat higher level of preventative maintenance. In fact, it offers a condition-driven preventative maintenance by scheduling maintenance tasks based on actual statistics from the equipment. By applying predictive maintenance, the owner also maximizes equipment lifetime, therefore saving money from costly equipment replacement. In long term, a well-maintenance equipment with a recorded maintenance schedule has more value in trade. Finally, predictive maintenance increase equipment safety. In long term, it can build a good reputation for the company; thus retaining and attracting skilled workers.

REFERENCES

- Caterpillar (2010). *637G Wheel tractor-scraper - Before operation*. Retrieved from <https://safety.cat.com/cda/layout?m=388580&x=7>
- Caterpillar (2010). *637G Wheel tractor-scraper - Maintenance intervals*. Retrieved from <https://safety.cat.com/cda/layout?m=388580&x=7>
- Dawson, C. (2012, August 5). *Caterpillar 637G scraper* [Photograph]. Retrieved from <https://flic.kr/p/cKV6vY>
- Department of Army. (2000, June 15). *Earthmoving operations*. Washington, DC. Retrieved from <http://www.globalsecurity.org>
- Haddock, K (1998). *Giant Earthmovers : An Illustrated History*. Osceola WI: MBI.
- Heavyequipment.org (2005). *637G wheel tractor-scraper with C-9 engine*. Retrieved from <http://www.heavyequipments.org/blog/203-manual-cat-637g-wheel-tractor-scraper-components-systems-operation>
- Keith, M. R. (2002). *An Introduction to Predictive Maintenance*. Woburn, MA: Butterworth-Heinemann
- Orlemann, E. C. (2000). *Building giant earthmovers*. Osceola, WI: MBI.
- Stratton, T. (2007). *A new extraction approach. Tracks and Treads*. Retrieved from <https://www.finning.ca>
- Wireman, T. (2008). *Preventive maintenance*. New York, NY: Industrial Press.

APPENDIX A: Preventative Maintenance Schedule



Preventative Maintenance Checklist

Equipment: Caterpillar 637G

Operator/Inspector: _____

Date: _____

Time: _____

Frequency & Task	✓	Comments
DAILY / EVERY 10 HOURS		
Drain air tank and moisture and sediment		
Clean hydraulic oil cooler		
Check engine oil level		
Check transmission oil level		
Drain fuel system water separator		
WEEKLY / EVERY 50 HOURS		
Lubricate bail bearings and push plate spring		
Lubricate hitch		
Check tire inflation		
Lubricate bowl lift cylinder bearings		
MONTHLY / EVERY 250 HOURS		
Test brake air system pressure		
Check battery		
Test brake system		
Check air dryer		
QUARTERLY / EVERY 3 MONTHS / EVERY 500 HOURS		
Replace auger hydraulic system oil filter		
Lubricate brake camshaft bearing		
Inspect/Replace auger shoes and cutting edges		
Check accumulator (Cushion Hitch)		
YEARLY / EVERY 2000 HOURS		
Inspect/Replace brake shoes and drums		
Change auger oil bearing oil		
Inspect hitch		

APPENDIX B: Predictive Maintenance Schedule



Predictive Maintenance Checklist

Equipment: Caterpillar 637G

Operator/Inspector: _____

Date: _____

Time: _____

Frequency & Task	Service time				
	Daily	Weekly	Monthly	Quarterly	Yearly
Drain air tank and moisture & sediment	X				
Clean hydraulic oil cooler	X				
Check engine oil level	X				
Check transmission oil level	X				
Drain fuel system water separator	X				
Lubricate push plate	X				
Lubricate bail bearings and push plate spring		X			
Lubricate hitch		X			
Check tire inflation		X			
Lubricate bowl lift cylinder bearings		X			
Clean/Replace cab air filter		X			
Test brake air system pressure			X		
Check battery			X		
Test brake system			X		
Obtain hydraulic system oil sample			X		
Check air dryer			X		
Replace auger hydraulic system oil filter				X	
Lubricate brake camshaft bearing				X	
Inspect/Replace auger shoes & cutting edges				X	
Check accumulator (Cushion Hitch)				X	
Inspect/Replace brake shoes and drums					X
Change auger oil bearing oil					X
Check/Adjust ejector carrier Rollers					X
Inspect hitch					X