



BI001974
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Operation and Maintenance Manual

SU488 DN

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About this manual

This chapter provides important information making it easier for you to use this manual. You will also be given information on the structure of the manual and the symbols and characters used.

Before starting to work

applicable operating manual

Take care to ensure that the operating manual available to you is applicable for the type of equipment or machine used.

machine type

This operating manual is intended for:

SU488 DNN Scoop
Serial No.: N/A

and is only permitted to be used for equipment of this type.

new operation manual

The operating manual must be accessible at all times to all persons working on or with the machine. It should, if possible, always be available at the place of operation.

Send for a new operation manual immediately if the present manual is no longer complete or has become illegible.

Who is this operating manual intended for?

This operating manual is intended for those persons who work with or on the machine. Every person working on the face or in the intersection between face and entry or in the entry must read this operating manual.

This includes persons who:

- are in charge of transport
- perform assembly / disassembly work
- operate the machine
- eliminate faults
- perform daily routine work on the face or in the entry
- perform maintenance work
- perform repair work

supervisory personnel who:

- initiate and/or supervise the activities just indicated.

Safety instructions

General rules:

general	<p>Always work with full concentration.</p> <p>Familiarize yourself with your working environment.</p>
noise emissions	<p>Always wear your personal protective equipment. This includes ear protection as the noise emitted by other equipment in the area may at times exceed 85 db(A).</p> <p>Inform your colleagues of:</p> <ul style="list-style-type: none">■ your exact location.■ the work you are performing.■ the time that you will probably require.
safety equipment	<p>Start the machine only when it is in a good and safe operating condition and all protective devices, cover plates, etc. are correctly installed.</p> <p>Observe the acoustic and optical start-up warnings of the machine.</p>
symbol plates	<p>Observe the symbol plates on the machine.</p>
cordon off working area	<p>Cordon off your working area widely for the machine.</p>
moving parts	<p>Never allow parts of your body to come between parts which could move, such as:</p> <ul style="list-style-type: none">■ bucket■ pivot points■ ejector
steering lockout	<p>Connect the steering lockout device before performing maintenance or repairs on the machine.</p>

3

Storage and transport

Pre-installation check list

NOTICE!

The machine was inspected prior to shipment from the factory to ensure proper functioning and installation of all components. However, to ensure that no transit damage has occurred, the following pre-startup checks should be performed:

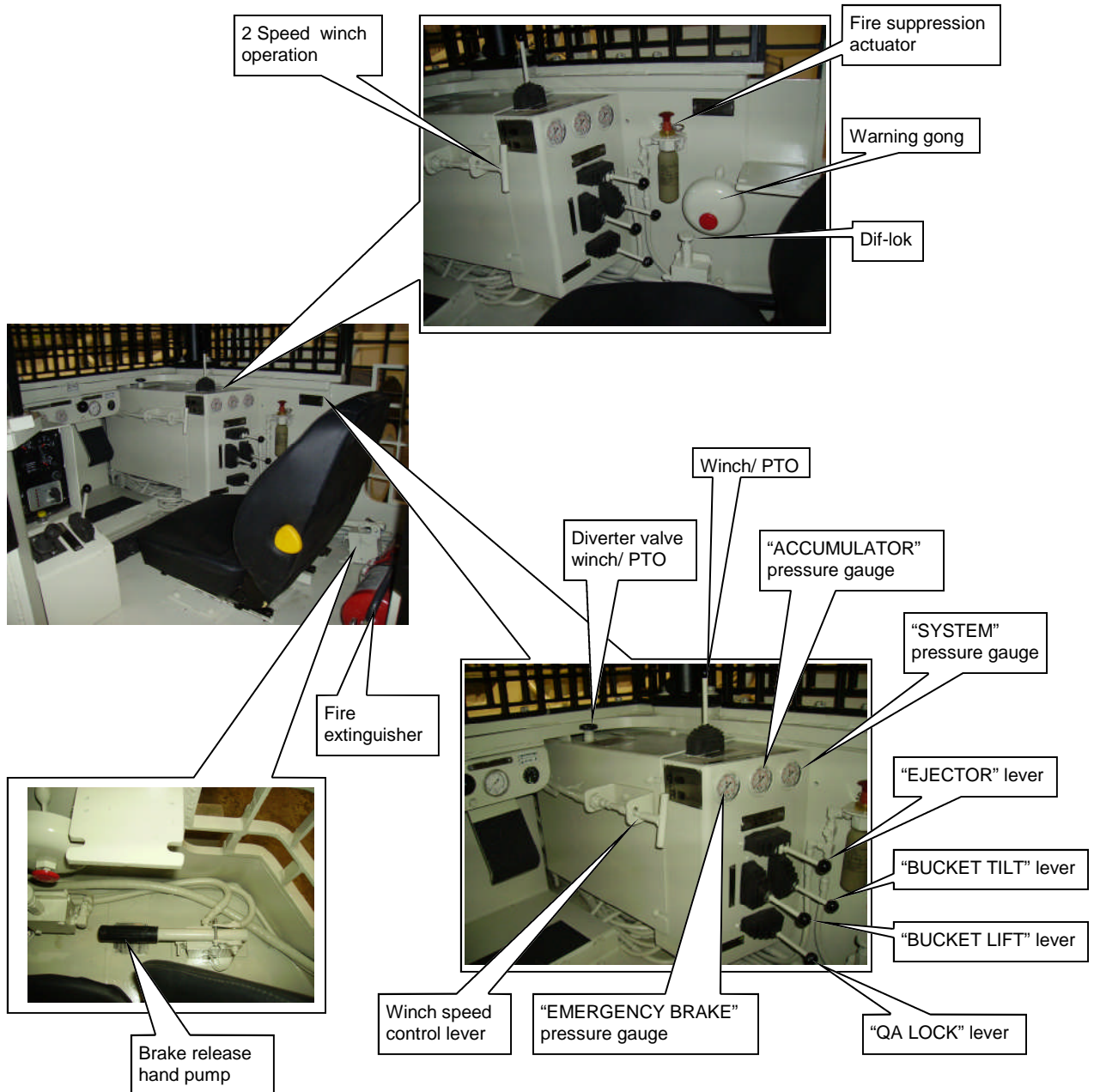
- perform daily maintenance
- visually inspect all hydraulic hoses and electrical cables for damage
- clean any foreign material from the operator's compartment
- if equipped with bucket, clean any foreign material from behind the ejector blade
- check safety provisions for operational condition on fire suppression system
- check that all covers and guards are in place and secure
- check that all tags and instruction labels are in place and secure
- check that operator's canopy is secure and in place
- start the machine and allow the hydraulic system to warm up for five (5) to ten (10) minutes
- check hydraulic system pressures (refer to the hydraulic schematic supplied for your particular machine for pressure settings)
- check all engine gauges in the operator's compartment to ensure all systems are functioning properly

Controls and indicators

Operator's compartment – right side

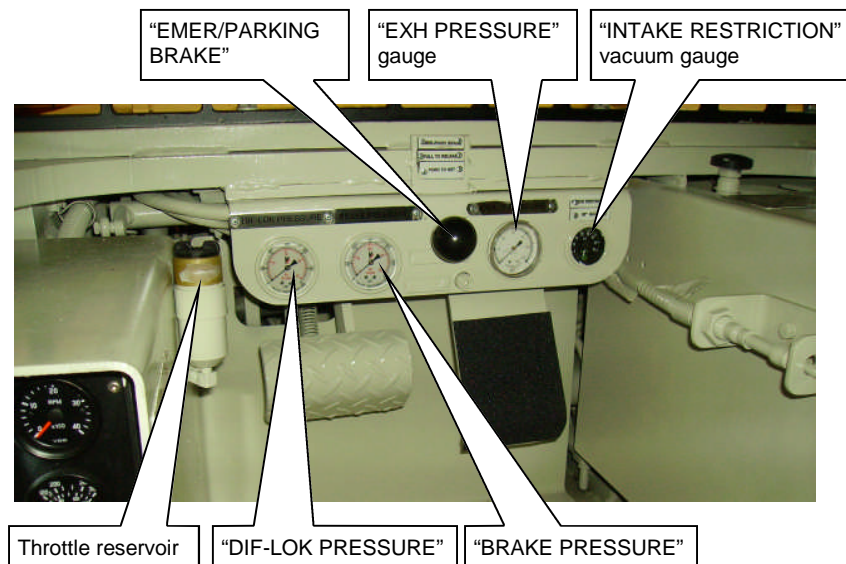
The primary controls for the machine are located in the operator's compartment (Fig.9).

Fig. 9: Operator's compartment – right side



Note:
Typical operator's compartment shown, location of controls may vary.

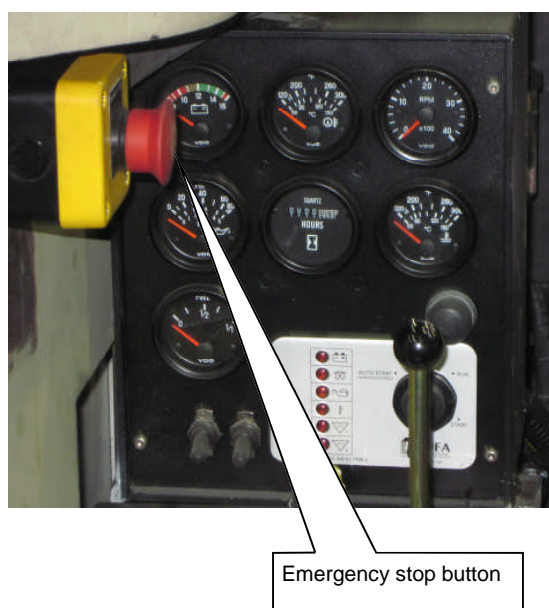
Fig. 18: Operator's compartment



emergency stop button

The emergency stop button (Fig. 19), located in the operator's compartment, can be used to shutdown the machine in emergency situations. This button should not be used for normal machine shutdown. Pressing the emergency stop button will shutoff the fuel to the engine. If the emergency stop button is depressed, it must be manually reset by pulling out the button.

Fig. 19: Emergency stop button



Hazard zone

Fig. 26: Hazard zone

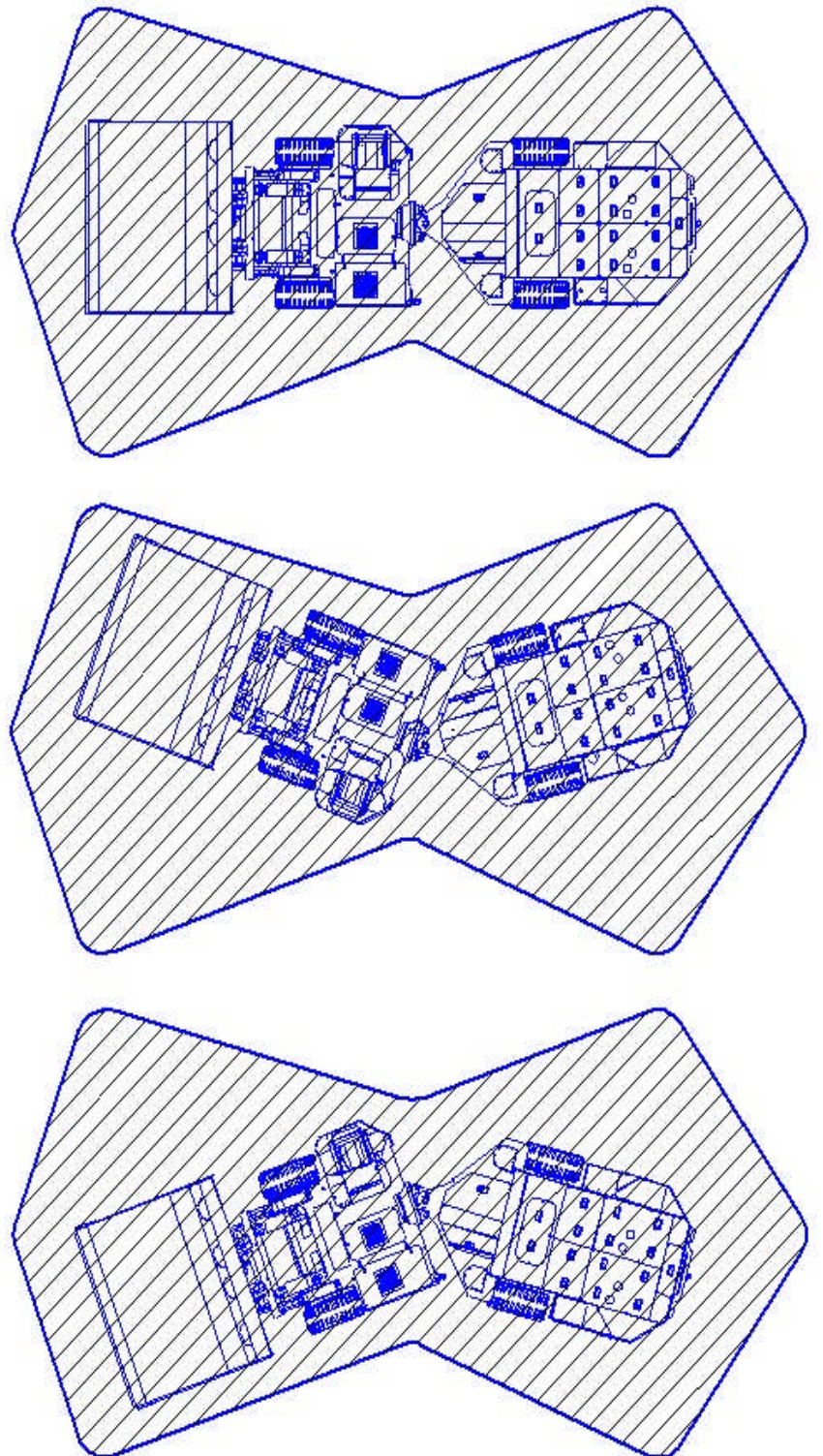


Table 3: Lubrication and maintenance schedule (continued)

Item	Description	Places	Lubricant	Specification
	Every three months			
43	Axle oil (Change)	2	Hypoid gear oil SAE 90W	
44	Planetary wheel end oil (Change)	4	Hypoid gear oil SAE 90W	
45	Wet disc brake oil level (No service required)	4	Cooling oil	
46	Hydraulic oil (Change)	1		Spec. 100-12
47	Tank suction strainer (Clean/change)	1		
48	Pressure filter (Change)	1		
49	Return filter (Change)	1		
50	Winch oil (Change) (Optional)	1	API GL4 (140) Gear oil Peragma Grade 8	
	1st 50 Hours of service			
51	Engine oil and filter	Change	10W40 API CF/ 4	
	Every 100 hours of service			
52	Engine air cleaner	Change		
53	Radiator	Clean		
54	Engine oil and filter	Change	10W40 API CF/ 4	
55	Fuel pre-filter	Change		
56	Fuel final filter	Change		
	Every 500 hours of service			
57	Converter/transmission filter	Clean		
58	Radiator coolant	Change	Avia Antifreeze Extra Glysantin G 48 DEA radiator anti- freeze Shell GlycoShell	
59	Scrubber heat exchanger	Inspect		
	Every 1000 hours of service			
60	Scrubber heat exchanger	Clean		

**fasteners
(nuts, bolts and screws)**

Loose fasteners will cause premature wear and failure to machine and components. Visually inspect for loose fasteners and tighten as required.

**electrical cables,
conduits and glands**

Visually inspect all electrical cables, conduits and glands for signs of wear or damage.

**hydraulic hoses and
connections**

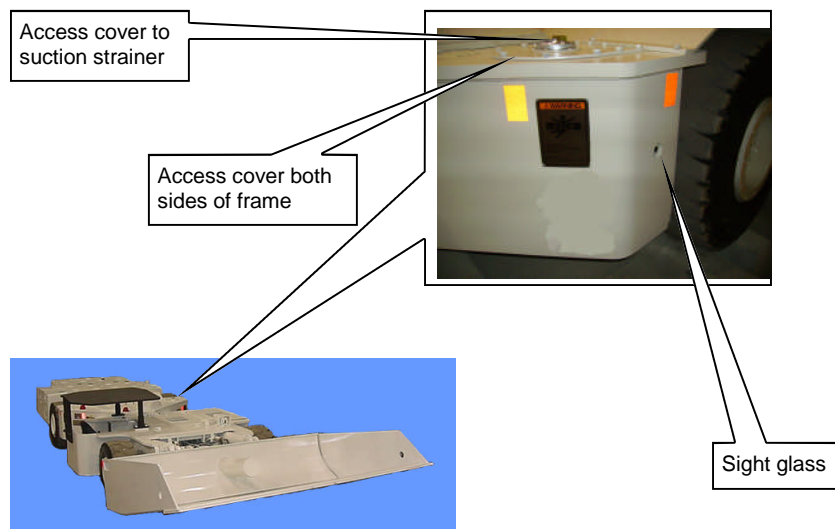
Visually inspect all hydraulic hoses and connections for signs of wear, damage or leakage.

tires

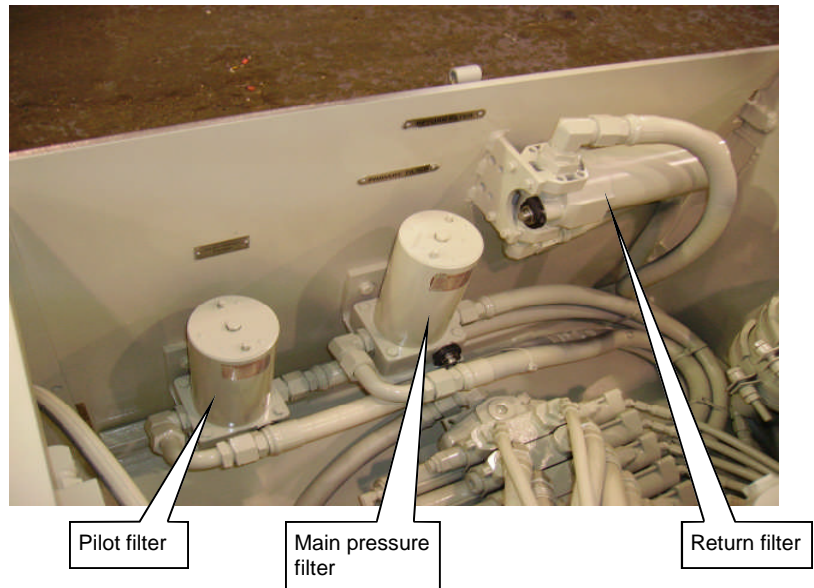
Visually inspect all tires for signs of wear or damage.

hydraulic oil level

Check the hydraulic oil level by looking at the sight glass located on the oil tank (Fig. 41). If the oil level is low, add oil (Spec. 100-12) via the jet fill pump until oil is visible in the sight glass.

Fig. 41: Hydraulic oil level

main pressure filter	Change the pressure filter element (Fig. 53). If the element is extremely dirty, a more frequent interval may be required.
return filter	Change the return filter element (Fig. 53). If the element is extremely dirty, a more frequent interval may be required.
pilot filter	Change the pilot filter element (Fig. 53). If the element is extremely dirty, a more frequent interval may be required.

Fig. 53: Filter location

- winch oil** Change oil in the winch (Fig. 54). (Refer to the winch operation and maintenance manual included in your parts manual)
- ☞ Park the scoop on solid level ground, clean dirt and debris from around the drain plug.
 - ☞ Remove drain plug and allow oil to completely drain from the winch.
 - ☞ Clean and reinstall drain plug.
 - ☞ Clean dirt and debris from around the check plug and remove plug.
 - ☞ Clean dirt and debris from around the breather and remove breather.
 - ☞ Add oil (API GL4 (140) Gear oil Peragma Grade 8) through the breather hole slowly, just until it starts to flow out of the check plug hole. Allow sufficient time for the oil to travel throughout the winch when filling.
 - ☞ Clean and reinstall breather and check plug.

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Diesel emissions maintenance

Introduction

This section provides mechanics and operators of diesel engine equipment with a set of guidelines for an introduction to the maintenance of diesel emission systems.

With the continuing increase in environmental and health concerns, there has been growing trend to cut down on the release of any unnecessary exhaust gas pollutants into the environment. Regulations are in place limiting the maximum pollutant concentrations in diesel engine exhaust gas. Furthermore, sufficient ventilation must be provided in order to ensure that pollutant levels in the working environment don't exceed Threshold Limit Values (TLV). This manual has been developed to address these issues from a maintenance perspective. To better understand the relationship between engine maintenance and engine emissions, it's important to know the factors which affect the formation of the exhaust gas components.

Experience has shown that emission characteristics remain constant during the life of the diesel engines, providing that maintenance is performed in accordance with manufacturers' recommendations. Improper or insufficient maintenance will have a negative effect on the combustion process and lead to accelerated wear of engine components resulting in an increase in emissions. This usually occurs before a decrease in performance becomes noticeable.

The traditional approach towards maintenance operations was to look at it as an expensive exercise not yielding any direct benefit. A piece of equipment will be repaired if and when it fails, not before. This type of approach doesn't make sense from an economical standpoint. Timely maintenance extends the life of the equipment, increases the machine's availability for production, and reduces operating cost. Purchasing and operational cost calculations can easily prove the benefits of timely preventive maintenance.

An improved strategy toward diesel engine maintenance requires not only a firm commitment from management and planners, but an implementable set of best practices that mechanics can adopt into their everyday routine. This guide provides the foundation from which the maintainers of diesel engines can build a system that best suits the needs of their equipment.

The following guide is divided into two categories of equal importance. Part I (Operational Issues) targets the practices of both mechanics and operators concerning diesel engines. The system specific section (Part II) targets the six primary engine systems outlined in previous research and expands on improved practices that address the needs of today's engine technologies.

- mechanics**
- Mechanics must communicate with equipment operators. There should be a level of communication and understanding established between the two that allows them to work as a team rather than individuals.
 - Training sessions on basic maintenance practices and emissions as they relate to health need to be set up so that the operators and mechanics are both there.
 - Increase the level of training for mechanics with a "buy in as related to health matters" approach.
 - It is important that mechanics understand the effects of diesel emissions on their own health and that of the operators, as well as the results of proper maintenance on emissions.
 - Target the best people for relevant tasks. The best problem solvers should be used for diagnostic situations and their skills used to utmost advantage. By the same token, the person who works full time on the service pit performs an equally important role in maintaining the equipment in good operating condition and should be trained to perform the necessary service and repairs when required.
 - Set up a knowledge transfer program where individuals train their peers in informal hands-on environment. This could involve the diagnostic specialist sharing skills with the person on the service pit and vice versa. This training will take place at the same time as the training on emissions as related to health issues.
- supervision**
- Supervision on both operations and maintenance sides play a pivotal role in becoming proactive and empowering the people under their responsibility.
 - Leadership for proactive engine maintenance practices comes from the top down and supervision must take the initiative with this.
 - In this leadership role supervision must ensure that the operating and maintenance people are trained in using a proactive approach and thus are empowered to implement the appropriate procedures to correct poor practices.
 - It should be the role of supervision to implement regular monthly meetings with the maintenance personnel to review new engine maintenance techniques.

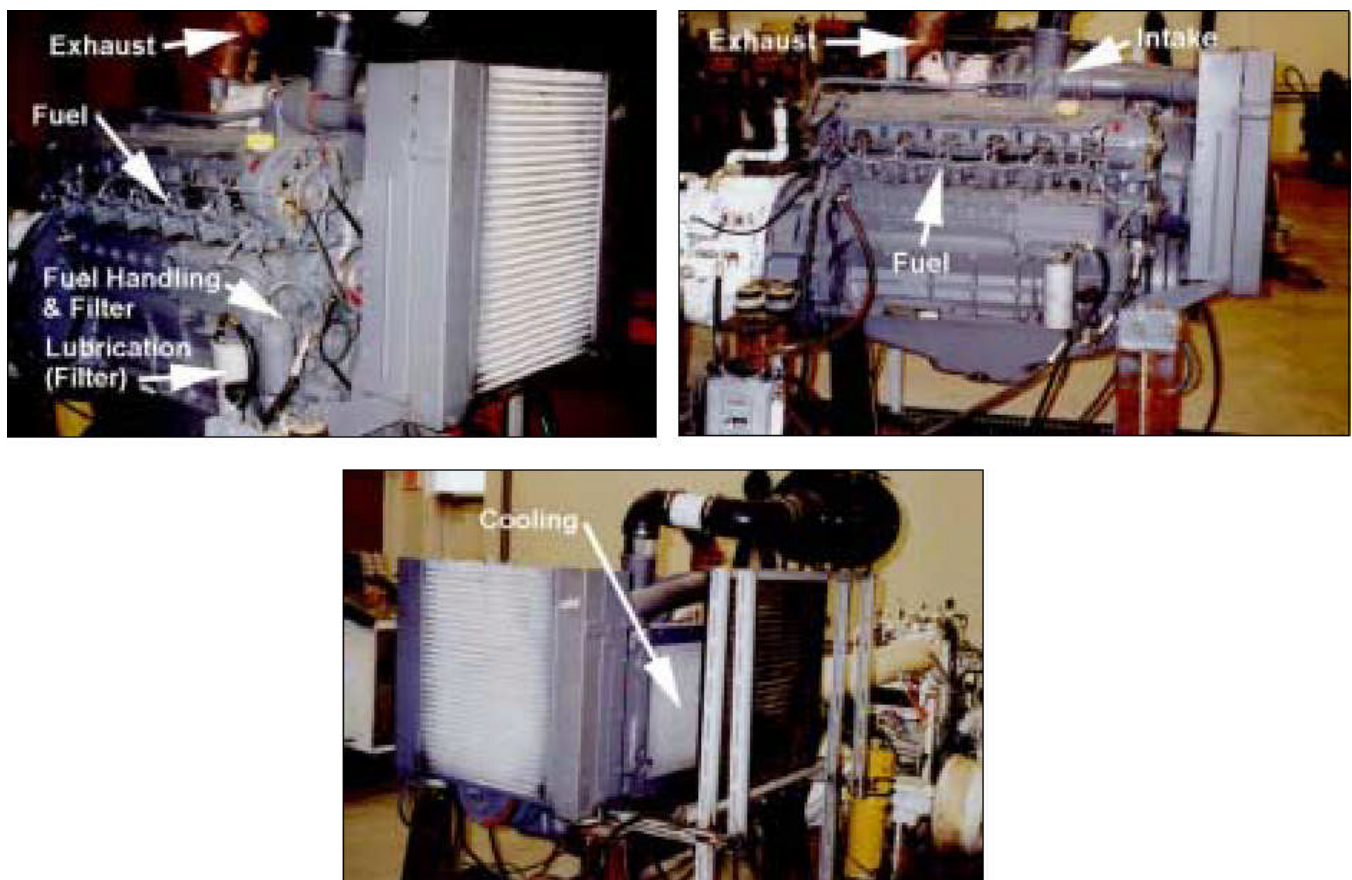
Overview of the six engine systems

Introduction

This section presents an overview of the six engine systems (Fig. 69), the factors affecting exhaust quality, and how proper engine preventive maintenance can ensure long diesel engine life. Improper, insufficient or lack of preventative maintenance will lead to accelerated wear of engine components. This will result in an increase in emissions usually before a decrease in performance becomes noticeable.

Lack of proper maintenance, failure to follow manufacturer's recommendation or abuse of the equipment, will lead to accelerated wear, decreased performance, excessive oil consumption and increased hydrocarbons (HC), carbon monoxide (CO), oxides of nitrogen (NOx), and oxides of sulfur (SOx) emissions.

Fig. 69: Diesel engine and components



Exhaust system recommendations

Relatively minor and basic maintenance practices can have a large impact on emissions reduction. Monitoring the physical properties of exhaust such as gas concentrations, pressure and temperature is absolutely essential to proper maintenance.

- Monitor exhaust backpressure at regular scheduled service intervals using one or a combination of mechanical gauges, or the UGAS analysis system. Backpressure is a prime indicator of how both the engine and exhaust systems are performing with respect to baseline values.
- Inspect the installation of exhaust after treatment systems. Verify that they are properly sized (not too small or too big) and that they are close enough to the exhaust manifold for maximum operating temperature.
- Establish a method of evaluating the condition and performance of after treatment devices. This can be done by measuring backpressure and gases with tools such as the UGAS system.
- Inspect the installation of the piping on the exhaust system. Look for dents, leaks, damage, and possible causes of restriction that could increase back pressure. When possible use heat wrap for protection and also to maximize exhaust temperatures for after treatment performance.
- Inspect the condition of the turbocharger assembly. When inspecting the fins make sure to look from the top inside and not from the end. Check the compressor wheel on the intake side for a sandblasted effect indicated by a smooth worn down blades on the compressor wheel . Aftercooler pressure differential should be measured regularly to ensure proper cooling. Operators should be trained in the proper operation of turbo-equipped engines as to the start up and shut down procedures.

Exhaust after treatment system maintenance

Diesel oxidation catalysts (DOCs)

These devices are designed to convert carbon monoxide (CO) to carbon dioxide (CO₂). In addition, they also reduce hydrocarbons (HC) and the HC fraction of DPM. Diesel oxidation catalysts are very effective due to the excess oxygen present in diesel combustion and the reaction between the oxygen and the catalyst element.

In order for these systems to operate efficiently they must work with exhaust temperatures in excess of 200°C. This requires that the installation of the system be such that the purifier is mounted as close as possible to the exhaust manifold for maximum temperature. It is also important to use low sulfur fuel with DOCs as the catalytic element can be poisoned and neutralized by excess sulfur. It should also be noted that DOCs do not reduce NO_x emissions.

Thermal optical method

In brief, NIOSH method 5040, speciation of organic and elemental carbon is accomplished through temperature and atmosphere control, and by an optical feature that corrects for pyrolytically generated "EC" (or char) formed during the analysis of some materials (e.g., cigarette and wood smoke). A light from a pulsed diode laser is passed through the filter to allow continuous monitoring of filter transmittance. The analysis process is done in two stages.

In the first stage, organic carbon and carbonate carbon (if present) are volatilized from the sample in a pure helium atmosphere. The temperature is stepped to a maximum (about 860°C). Evolved carbon is catalytically oxidized to CO₂ in a bed of granular MnO₂, reduced to CH₄ in a Ni/firebrick methanator, and quantified as CH₄ by a flame ionization detector (FID).

During the second stage of the analysis, a pyrolysis correction (if needed) and EC measurement are made. The oven temperature is reduced, an oxygen (2%)-helium mix is introduced, and the oven temperature is again raised. As oxygen enters the oven, pyrolytically generated EC is oxidized and a concurrent increase in filter transmittance occurs. Correction for the char contribution to EC is accomplished by identifying the time at which the filter transmittance reaches its initial value. This point is defined as the "split" between organic and elemental carbon. Carbon evolved prior to the split is considered "organic" (including carbonate), and carbon after the split and prior to the peak used for instrument calibration (final peak) is considered "elemental."

The 5040 method was used to analyze the first set of samples that were taken on quartz fiber filters. This was done due to inconsistencies measuring total weight due to high humidity combined with quartz fiber filters. There were 21 samples in the first set analyzed with 5040 and quartz fiber filters. For correlation purposes and verification of accuracy, three samples with silver membrane filters were measured with 5040 and correlated to previous samples on the same vehicles with quartz fiber.

Distributor pump systems

The distributor pump system basic concept is shown in the illustration (Fig. 104). The pump is so named because it works something like an ignition distributor in a gasoline engine, in that a spinning internal rotor distributes the fuel. They can deliver, as well as producing lower injection pressures than in a Individual Jerk Pump system. The distributor pump is used extensively on smaller-displacement high-speed automotive and diesel engines. This figure illustrates a typical distributor pump fuel injection system for a V8 diesel engine. In this system a fuel lift pump delivers fuel at low pressures between 3 and 5 psi (21 to 34 kPa) to a vane pump housed within the end of the injection pump housing. The vane pump produces fuel supply pressures to the pumping chamber between 90 and 130 psi (621 to 896 kPa).

This system uses two fuel filters: a primary filter located between the tank and a transfer pump, and a secondary fuel filter located after the transfer pump which removes all impurities from the diesel fuel before it enters the injection pump, or the unit injectors in a low-pressure fuel system or to the injector nozzles on a high-pressure injection system.

Fig. 104: Typical distributor pump



Cummins PT fuel system

The PT (pressure-time) fuel system is unique to Cummins engines (Fig. 105). This system uses a gear-type fuel supply pump along with a governor plunged and operator controlled throttle to distribute fuel to the individual injectors. The speed of the diesel engine determines the pump pressure curve and the available time during which the injector can meter the fuel required for injection.

Fig. 105: Cummins PT fuel system



Sulfur content

The sulfur content in diesel fuel affects engine wear and SO_x exhaust emissions. Low sulfur fuels (less than 0.05 %) are most desirable from an engine wear and environmental standpoint.

Sulfur is a non-metallic element present in diesel fuel that will cause combustion chamber deposits and wear on pistons, rings, and cylinders. This contributes to elevated particulate emissions. The use of diesel fuel with a sulfur content as low as possible is desirable.

Cetane number

The cetane number is a measure of the ignitability of the fuel. The cetane number affects the ignition delay, which has an effect on engine performance, fuel economy, and emissions.

From a diesel engine standpoint, diesel fuels having a cetane number of 50 or greater should be used for best results. Diesel engines that are run on low cetane fuels will suffer from excessive CO, HC, particulate and smoke emissions, especially at low speed/low load/low temperature operation.

Operating a diesel engine with fuel that has a low cetane value will result in a poor combustion process.

Viscosity

The term "viscosity" refers to the measure of the liquidity of the fuel, which affects its ability to vaporize. Viscosity is measured by observing the time required for a specific volume of fluid to flow under steady state conditions through a short tube with a specific size bore. The flow is measured with a viscometer.

The viscosity of fuel oil is measured at 77°F and at 12°F. Viscosity of diesel fuel affects the pattern of spray in the combustion chamber. A low viscosity fuel produces a finer mist, which is desirable.

Flashpoint

The term "flashpoint" refers to the temperature of the fuel at which the vapors it produces ignite when a flame is exposed over the surface of the liquid fuel. The flashpoint of diesel fuel is 100°F for 1-D, and 125°F for 2-D fuel.

Most manufacturers recommend the use of 1-D diesel fuel for their diesel engines.

Unloading valve

The unloading valve (Fig. 115) is located next to the main pressure filter, fitted inside the component bay of the front frame, directly opposite the operator's compartment. The recharge "low limit" pressure that should be noted during normal operation is around 1,800 psi.

WARNING!

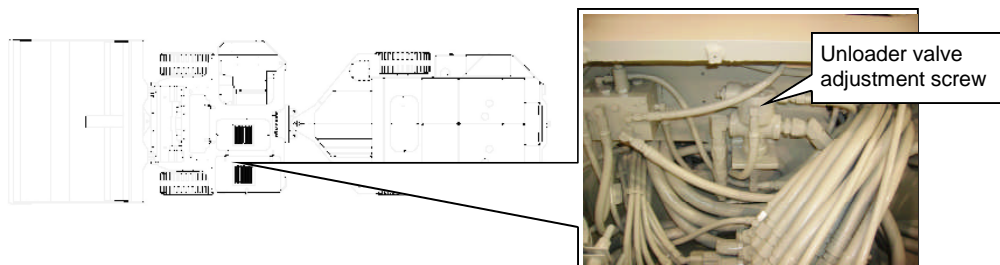
If the "low limit" falls below 1,700 psi (Designed operating pressure of brake system), adjustment or replacement of the valve is necessary to insure that undue brake drag is prevented and performance of the brake system is optimally maintained.

Adjustment of this valve is achieved via a hex head adjustment screw near the top of the valve assembly once it's jam nut has been loosened (ccw). The adjustment process with this valve should be initiated by minimizing the valve setting and bleeding any stored pressure off the accumulator's by cycling a machine function, such as the brake pedal, so the unloading valve will be positioned to charge the accumulator's once the pump is started. After the machine is started, note the accumulator pressure achieved on the gauge in the operator's compartment and then make 1/4, 1/2 or full turn increments of the adjustment screw. If the adjustment made fails to cause the unloading valve to cycle, simply cycle the brake pedal to bleed the pressure off the system, causing it to recharge and note the gauge pressure again. Cycle the brake pedal several times also to insure that the "low limit" of the valve is repeatable at a level higher than 1,700 psi. To increase the setting of this valve, the adjustment screw must be turned in (cw) and to decrease it's setting the adjustment screw must be turned out (ccw).

NOTICE!

The maximum adjustment of this valve is 3,000 psi, which cannot be achieved unless the main relief for the accumulator circuit is set higher than this. Prolonged operation of the pump motor under such a load (valve doesn't shift to unloaded condition) will severely damage the pump and/or pump motor. This valve positively diverts all the output flow of this pump section to the accumulator's, until they reach their designed limit and then it will "unload" the pump, allowing full output flow to pass through the valve in an unrestricted fashion.

Fig. 115: Unloading valve adjustment



Hydraulic cylinders

Table 9: Hydraulic cylinder troubleshooting

Trouble, symptom or cause	Probable cause	Test, check and/or remedy
cylinder drifts	<ul style="list-style-type: none"> ☞ Piston seal leak. ☞ Control cartridge by-passing. ☞ Other circuit leaks. 	<ul style="list-style-type: none"> ☞ Repair seals or replace cylinder. ☞ Replace cartridge or cylinder as required. ☞ Correct leaks.
cylinder fails to move the load when actuated	<ul style="list-style-type: none"> ☞ Pressure too low. ☞ Piston seal leak. ☞ Piston rod broken at piston end. ☞ Contamination in hydraulic system resulting in scored cylinder bore. 	<ul style="list-style-type: none"> ☞ Check pressure of circuit controls and cylinder to insure designed system pressure is being attained. ☞ Repair seals or replace cylinder. ☞ Repair as required or replace cylinder. ☞ Replace cylinder. Check oil - change if needed.
erratic or chatter in operation	<ul style="list-style-type: none"> ☞ Excessive friction due to misalignment and/or side loading. ☞ Air in circuit. 	<ul style="list-style-type: none"> ☞ Inspect cylinder installation for correct operation and/or foreign objects that inhibit the normal operation of the cylinder. ☞ Cycle cylinder to full stop positions to purge air.
excessive or rapid piston seal wear	<ul style="list-style-type: none"> ☞ Excessive system pressure due to over adjustment. ☞ Excessive friction due to misalignment and/or side loading. 	<ul style="list-style-type: none"> ☞ Check and correct pressure adjustment to rated limits. ☞ Inspect cylinder installation for correct operation and/or foreign objects that inhibit the normal operation of the cylinder.
cylinder body seal leak	<ul style="list-style-type: none"> ☞ Excessive pressure. ☞ Seal is pinched or extruded. ☞ Seal deterioration (soft or gummy). 	<ul style="list-style-type: none"> ☞ Check and correct pressure adjustment to rated limits. ☞ Replace seal or cylinder as required. ☞ Check for fluid contamination. Flush system and refill with correct fluid. Replace seal or cylinder as required.
piston leaking	<ul style="list-style-type: none"> ☞ Dirt has scored the piston or the rod. 	<ul style="list-style-type: none"> ☞ Replace cylinder.
piston freezes to tube	<ul style="list-style-type: none"> ☞ Scoring in the piston. 	<ul style="list-style-type: none"> ☞ Replace cylinder.
packing and gasket leaks develop	<ul style="list-style-type: none"> ☞ Excessive heat/wear. 	<ul style="list-style-type: none"> ☞ Replace seals or cylinder as required.

Table 13 (continued): Converter troubleshooting

Trouble, symptom or cause	Probable cause	Test, check and/or remedy
noisy converter	<ul style="list-style-type: none"> ☞ Worn coupling gear. ☞ Worn oil pump. ☞ Damaged bearing. ☞ Worn drive gears. 	<ul style="list-style-type: none"> ☞ Replace coupling gear. ☞ Replace oil pump. ☞ A complete teardown will be necessary to determine this. Call the manufacturer. ☞ Replace drive gears.
low clutch pressure	<ul style="list-style-type: none"> ☞ Transmission malfunction. ☞ Worn oil pump. ☞ Regulator valve stuck open. 	<ul style="list-style-type: none"> ☞ Close pressure line to transmission control valve. If clutch pressure returns to normal, trouble is in transmission. ☞ Replace oil pump. ☞ Clean and check valve for worn or dirty parts, replace if necessary.
high clutch pressure	<ul style="list-style-type: none"> ☞ Regulator valve stuck closed. 	<ul style="list-style-type: none"> ☞ Clean and check valve for worn or dirty parts, replace if necessary.
lack of power	<ul style="list-style-type: none"> ☞ Improper engine function. ☞ Engine stall speed below normal. ☞ Low converter out pressure. ☞ Air in the oil.. ☞ Incorrect oil. 	<ul style="list-style-type: none"> ☞ Call the manufacturer. ☞ Adjust high and low idle to specifications. ☞ See "low converter OUT pressure". ☞ See "suction line taking air". ☞ Replace with correct oil.
oil in engine flywheel housing	<ul style="list-style-type: none"> ☞ O-ring between impeller cover and impeller damaged. ☞ Oil baffle o-ring damaged. ☞ Oil baffle oil seal damaged. 	<ul style="list-style-type: none"> ☞ Replace o-ring. ☞ Replace o-ring. ☞ Replace oil seal.

Power box troubleshooting

Table 20: Power box troubleshooting

Trouble, symptom or cause	Probable cause	Test, check and/or remedy
one output never activates	<ul style="list-style-type: none"> ☞ Input not active. ☞ Output shorted. ☞ Failed power box. 	<ul style="list-style-type: none"> ☞ See Control system troubleshooting. ☞ Correct fault. ☞ Replace power box/harness assembly.
all outputs never activate	<ul style="list-style-type: none"> ☞ Blown fuse(s). ☞ Faulty connection to battery. ☞ Failed power box. 	<ul style="list-style-type: none"> ☞ Correct fault, replace fuse(s). ☞ Correct battery connections. ☞ Replace power box/harness assembly.
fuel run/stop solenoid pull output remains active	<ul style="list-style-type: none"> ☞ Faulty wiring. ☞ Faulty connection to battery. ☞ Failed power box. 	<ul style="list-style-type: none"> ☞ Correct wiring. ☞ Correct battery connections. ☞ Replace power box/harness assembly.

Tightening torques

Table 27: Electrically zinc plated (Coarse thread)

Property class	Torque	Recommended torque setting			Nominal diameter			
		Ma	M33	M4	M5	M6	M7	M8
5.6	Nm	0.56	1.28	2.50	4.3	7.1	10.5	21
	Ft-lbs	0.41	0.94	1.84	3.1	5.2	7.7	15
8.8	Nm	1.28	2.90	5.75	9.9	16.5	24	48
	Ft-lbs	0.94	2.14	4.24	7.3	12.1	17.7	35
10.9	Nm	1.80	4.10	8.10	14	23	34	67
	Ft-lbs	1.33	3.02	5.97	10.3	16.9	25	49
12.9	Nm	2.15	4.95	9.70	16.5	27	40	81
	Ft-lbs	1.59	3.65	7.15	12.1	19.9	29	59

Table 27: Electrically zinc plated (Coarse thread, continued)

Property class	Torque	Recommended torque setting			Nominal diameter			
		Ma	M12	M14	M16	M18	M20	M22
5.6	Nm	36	58	88	121	171	230	
	Ft-lbs	26	42	54	89	126	169	
8.8	Nm	83	132	200	275	390	530	
	Ft-lbs	61	97	147	202	287	390	
10.9	Nm	117	185	285	390	550	745	
	Ft-lbs	86.2	136	210	287	405	549	
12.9	Nm	140	220	340	470	660	890	
	Ft-lbs	103	162	250	346	486	656	

Table 27: Electrically zinc plated (Coarse thread, continued)

Property class	Torque	Recommended torque setting			Nominal diameter			
		Ma	M24	M27	M30			
5.6	Nm	295	435	590	800	1030	1340	
	Ft-lbs	217	320	435	590	759	988	
8.8	Nm	675	995	1350	1830	2360	3050	
	Ft-lbs	497	733	995	1349	1740	2249	
10.9	Nm	960	1400	1900	2680	3310	4290	
	Ft-lbs	708	1032	1401	1902	2441	3163	
12.9	Nm	1140	1680	2280	3090	3980	5150	
	Ft-lbs	840	1239	1661	2278	2935	3798	

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