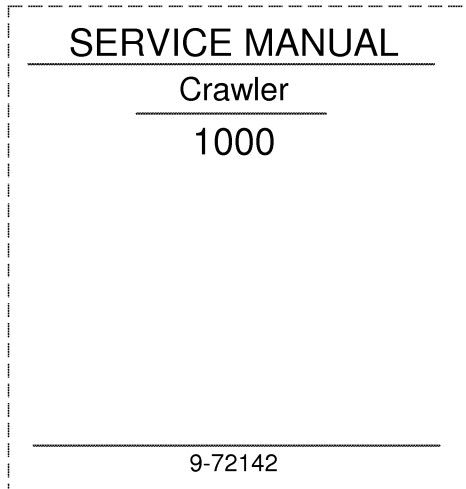
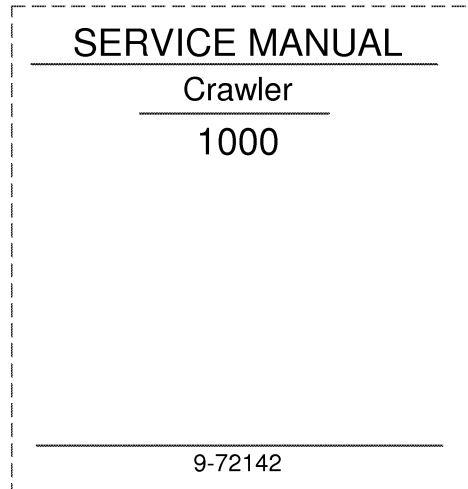




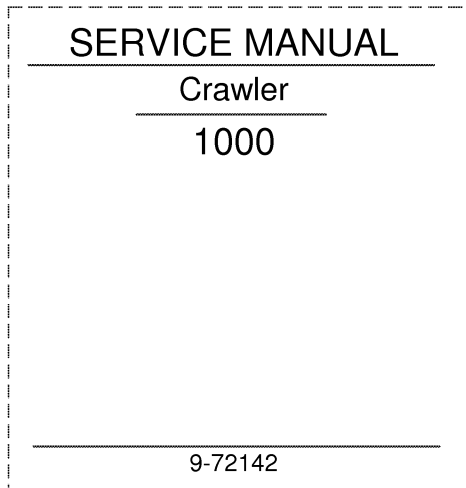
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TYPE 1-4



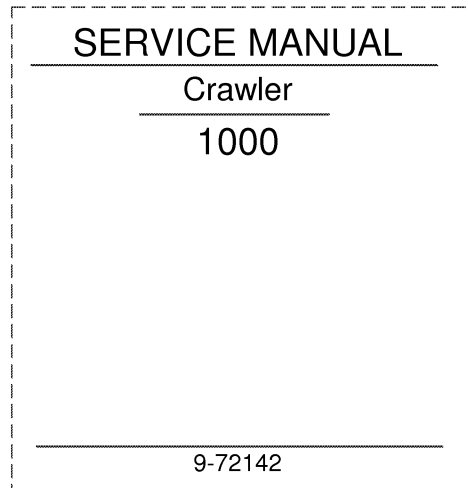
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TYPE 1-4



1. Trim along dashed line.
2. Slide into pocket on Binder Spine.

TYPE 1-4



1. Trim along dashed line.
2. Slide into pocket on Binder Spine.

TYPE 1-4

1000D CRAWLER

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1. BASIC CRAWLER SPECIFICATIONS

Engine

Model (Continental)	JD-382
*Horsepower, maximum (gross)	93
net flywheel hp	85
Fuel	No. 2 Diesel
No. cylinders	4
Bore and stroke	4-1/2" x 6"
Piston displacement (cu. in.)	382
RPM (governed at full load)	1800
Max. torque, lbs. ft. @ 1200 RPM	278
Fuel injection	Roosa-Master
Starting	24-volt electric

*Sea level (calculated) maximum horsepower (based on 60° F. and 29.92" Hg.). Manufacturer's rating.

Dimensions and Weight

Overall Length	115-1/2 Inches
Height (over fuel tank cap 6 ft. 1-1/2 inches)	8 Ft. 4 Inches
Overall Width	6 Ft. 3 Inches
Ground Clearance (at drawbar)	12 Inches
Ground Pressure	6.0 P.S.I.
Weight (approximate working - fuel and operator)	14,185 lbs.

Tracks

*Track Gauge	60 Inches
Standard Shoe Width	15 Inches
Lower Track Rollers (each side)	6
Upper Support Rollers (each side)	2
*Length of Track on Ground	79 Inches
Total Area of Ground Contact (std. shoes)	2370 Square Inches

Travel Speeds , MPH

	Forward	Reverse
1st (Lo-Lo)	0 to 1.7	0 to 2.0
2nd (Hi-Lo)	0 to 2.9	0 to 3.5
3rd (Lo-Hi)	0 to 3.4	0 to 4.1
4th (Hi-Hi)	0 to 6.0	0 to 7.1

Capacities

Fuel Tank	52 U.S. Gallons
Transmission and Torque Converter	13 U.S. Gallons
Final Drive (each side)	1-1/2 U.S. Gallons
Track Roller Reservoir (each side)	8-1/2 lbs.
Equipment Hydraulic System	16 U.S. Gallons
Cooling System	11 U.S. Gallons
Crankcase	11-1/2 U.S. Quarts

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Torque Converter

Type	Single Stage
Torque Ratio Increase at Stall	1.92 to 1
Fluid Used (type)	Case Hi-Lo TCH Oil

Maximum Drawbar Pull

1st (Lo-Lo)	35,000 lbs.
2nd (Hi-Lo)	20,000 lbs.
3rd (Lo-Hi)	17,000 lbs.
4th (Hi-Hi)	11,000 lbs.

Manufacturer's rating. Drawbar pull figures are maximum at converter stall and assume adequate traction.

2. LOADER SPECIFICATIONS

Performance Data

Breakout Force (at ground level)	12,190 lbs.
Hydraulic Lift Capacity (at ground level)	20,000 lbs.
Lift Capacity (fully raised)	7,400 lbs.
Digging Depth	9 Inches @ 8-1/2°
Grading Angle	103°
Bucket Rollback	
At Ground Level	40°
At 18" Carry	45°
At Maximum Lift	61°
Overall Height at Maximum Lift	14 Ft. 8 Inches
Dump Clearance at Maximum Lift (45° dump angle)	8 Ft. 6 Inches
Dump Reach	
At Maximum Lift (45° dump angle)	45 Inches
At 7 Ft. (45° dump angle)	58 Inches

Buckets

	WIDTH	CAPACITY (SAE RATED)
Standard	81"	1-1/2 Cu. Yd.
Heavy Duty	81"	1-1/8 Cu. Yd.
Light Materials	102"	2-1/2 Cu. Yd.
Multi-Purpose	86-3/4"	1-1/2 Cu. Yd.

Dimensions and Weight

Bucket Width	6 Ft. 9 Inches
Tractor Width (standard width)	6 Ft. 3 Inches
Overall Height (to top of exhaust)	8 Ft. 4 Inches
Overall Length to Rear of Counterweight (bucket on ground)	16 Ft. 5 Inches
Weight working (with bucket and counterweight)	23,460 lbs.
Ground Pressure (with heaped bucket)	12.3 P.S.I.

Dump Cylinders (2)	5 Inches I.D. x 22-3/16 Inches Stroke
Lift Cylinders (2)	5-1/2 Inches I.D. x 30 Inches Stroke
Pump Capacity (at 1800 engine R.P.M.)	39 G.P.M.
Main Relief Valve Pressure	1550 to 1650 P.S.I.

Angle - Both Ways (hydraulic)	0° to 20°
Tilt - Both Ways (manual)	0 to 12 Inches
Clearance Under Blade (maximum lift)	31 Inches
Digging Depth Below Tracks	17 Inches

Blade	120 Inches x 31-1/2 Inches
Overall Width (blade straight)	120 Inches
(blade angled)	110-1/2 Inches
Overall Length (blade angled)	15 Ft. 7 Inches
Height Over Fuel Tank Cap	73-1/4 Inches
Ground Clearance at Drawbar	12 Inches
Ground Clearance at Crankcase Guard	16 Inches
Weight (approximate - working)	18,040 lbs.
Ground Pressure	7.6 P.S.I.

Lift Cylinders (2).....	3-1/2 Inches x 31-1/2 Inches Stroke
Angle Cylinders (2).....	3 Inches x 33-1/4 Inches Stroke
Pump Capacity (at 1800 engine R.P.M.).....	32 G.P.M.
Main Relief Valve Pressure.....	1225 to 1275 P.S.I.

Tilt - Both Ways (hydraulic)	0 to 14 Inches
Clearance Under Blade (maximum lift)	33 Inches
Digging Depth Below Tracks	13 Inches

Blade	104 Inches x 31-1/2 Inches
Overall Width	104 Inches
Overall Length	13 Ft. 1/4 Inch
Height Over Fuel Tank Cap	73-1/4 Inches
Ground Clearance at Drawbar	12 Inches

Ground Clearance at Crankcase Guard 16 Inches
Weight (approximate - working) 17,390 lbs.
Ground Pressure 73 P.S.I.

Hydraulics

Lift Cylinders 3-1/2 Inches I.D. x 31-1/2 Inches Stroke
Tilt Cylinder 3-1/2 Inches I.D. x 4-3/16 Inches Stroke
Pump Capacity (at 1800 R.P.M.) 32 G.P.M.
Main Relief Valve Pressure 1225 to 1275 P.S.I.

1. GENERAL INFORMATION AND SPECIFICATIONS

Engine Specifications

	<u>Model 1000</u>
Continental Diesel	JD 382
Number of Cylinders	4
Bore	4-1/2"
Stroke	6
Displacement in Cubic Inches	382
Compression Ratio	15.0:1
Injection System	Roosa Master
Firing Order	1-3-4-2

Elementary Principles of Diesel Engines

In order to dispel any mystery there may be with regard to the diesel engine and how it operates, compare the diesel engine with its gasoline counterpart.

Mechanically, the two are alike. Both have pistons moving up and down in cylinders with connecting rods attached to a crankshaft. Both convert the reciprocating motion of the pistons into a rotary motion. Both have valves in the cylinder heads operated by a camshaft and push rods. An intake valve admits air into the cylinder, and an exhaust valve permits the disposition of the burned gases. The camshaft is driven through a train of timing gears so that the opening and closing of the exhaust and intake valves are properly timed with the stroke of the piston and crankshaft.

The engines are so much alike in exterior appearance that the only way most people are able to distinguish between them is to look for the carburetor and the distributor on the gasoline engine or the injection pump on the diesel.

Both operate on mixtures of liquid fuel and air inside the combustion chambers. The ignition of these mixtures under pressure, and the subsequent expansion furnishes the power to drive the piston downward on its power stroke. The one big difference between the two types of engine lies in the way the fuel is handled and combustion brought about.

In a gasoline engine desired proportions of fuel and air are mixed in the carburetor before entering the cylinder through the intake valve. In a diesel engine, air is drawn into the cylinder through the intake valve and is compressed. At the proper time a measured quantity of fuel is injected into this air thus forming a combustible mixture which is self-ignited by the high temperature of the compressed air.

In a gasoline engine the suction or downward stroke of the piston draws in a combustible mixture of air and gasoline which is compressed in the upward stroke and ignited by an electric spark, whereupon the expansion of this compressed mixture forces the piston down on the power stroke.

In the diesel engine, the piston on the down stroke draws in clean, pure air, which is compressed on the upward stroke. At the proper instant, fuel is injected into this compressed air which then ignites from the heat of compression, causing the expansion of the mixture and forcing the piston down on the power stroke. The compression ratio of diesel engines is twice that of gasoline engines, and it is the heat generated by the comparatively rapid compression of the air which ignites the fuel as it is sprayed in under high pressure.

It is a well known fact that the tendency in gasoline engines design is to increase compression ratios in order to obtain more power and greater efficiency out of the engine without increasing the bore and stroke. Compression ratios are however limited by the octane number of fuels available and the desire to keep combustion chamber temperatures down to prevent pre-ignition. A diesel engine is not controlled by these conditions, consequently, compression ratios in the neighborhood of 15 to 1 can be used with entire satisfaction since there is no possibility of the air in this engine igniting until injection of the fuel provides a combustible mixture. This high compression in a diesel causes the temperature of the air to rise under compression to approximately 900° Fahrenheit, far above the ignition point of the fuel, thus igniting the mixture.

To summarize, both engines are heat engines of the internal combustion type, the power in each case being developed from the expansion of the mixture of air and fuel after ignition occurs. Since the expansion is directly related to the compression, the diesel is able to deliver a greater amount of work using a given quantity of fuel. This is basically the reason for its superior efficiency, which results in its saving in fuel cost.

The Diesel Cycle

Intake

Air only is drawn into the cylinder through the open intake valve by the suction created by the Downward moving piston. Figure 1.

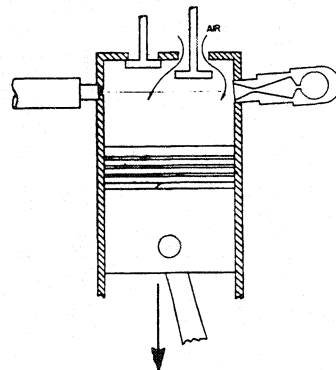


Figure 1

Compression

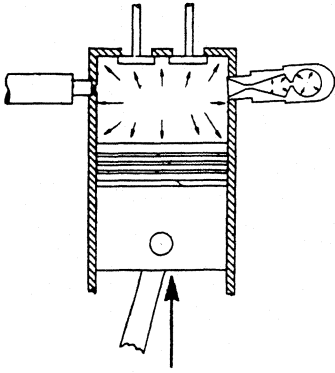


Figure 2

The intake valve is now closed and the air in the cylinder is highly compressed by the Upward Moving piston. This high compression of the air raises the temperature to between 900° and 1000° F. Figure 2.

Injection and Combustion

At a definite point, shortly before the piston reaches the top of its stroke, fuel is injected into the cylinder by the spray nozzle. The fuel is ignited by the heat of the highly compressed air. Figure 3.

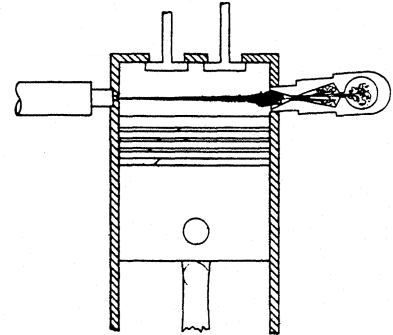


Figure 3

Power

The expansion of the gases resulting from the burning of the fuel exerts pressure on top of the piston, driving it Downward. Figure 4.

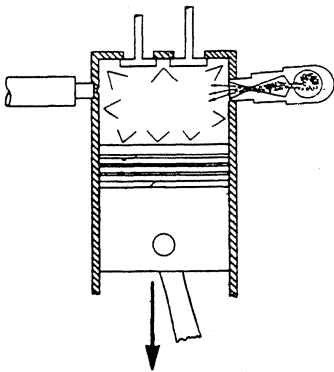


Figure 4

Exhaust

As the piston passes the bottom of its stroke the exhaust valve opens and the burnt gases are expelled by the now Upward moving piston. The intake valve opens about the time the piston reaches the top of its stroke, and a similar sequence of events, often referred to as the cycle, repeats itself. Figure 5.

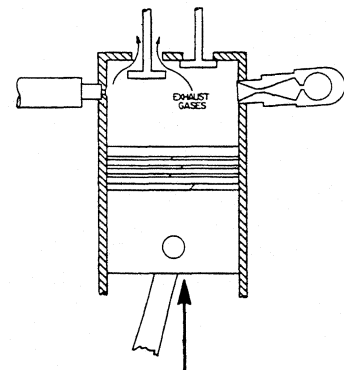


Figure 5

2. FUEL AND LUBRICATION

Fuel Recommendations

Diesel fuel oil selection, handling, and filtration is of great importance. The fuel not only supplies the energy for all the work done by the engine, but it also lubricates the parts of the fuel injection system which operate with very close tolerances. Fuel oil that contains water, abrasives, or sulphur in excess of our recommended specifications can cause extensive damage to the engine.

Fuel Specifications

Continental Red Seal Diesels have been designed and developed to use Grade # 2 Diesel Fuel Oil which can be cracked residual, a blend, or preferably a straight-run distillate having the following fuel characteristics:

DIESEL FUEL CHARACTERISTICS	EFFECTS	INDUSTRIAL & AGRICULTURAL DIESELS 1800 RPM MAX.
A.P.I. Gravity @ 60° F.	Lower Gravity Fuels contain more heat Units per Gallon.	30 Minimum
Cetane Number	Indicative of Ignition Quality, Higher Number, Better Starting and Idling.	50 Desired 45 Minimum
Volatility: Initial Boiling Point	To prevent premature vaporization during hot weather operation.	320° F. Minimum
50% Recovery	Less smoke with fuel at low 50% & 90% Recovery Temperatures.	550° F. Maximum 650° F. Maximum 700° F. Maximum
	Higher end points only partially burn, causing build up of deposits in energy cell and nozzle, causing pintle sticking and smoke.	
Pour Point	Fuel Oil must be in fluid state to prevent clogging due to congealing wax.	10° F. below lowest anticipated operating temperature.

Distillation Recovery	Lower % recovery indicates heavy oil fractions to cause smoke and poor combustion.	98%
Total Sulphur	Sulphurous acids corrode and increase engine wear.	.5% Maximum
Corrosion(Copper)3 hours @ 212° F.	Discoloration or pitting on polished copper strip shows same effect on engine parts.	Pass Test
S. U. Viscosity 100° F. (38° C.)	Viscosity is a measure of flow resistance. The low limit minimizes leakage and lubrication and the higher limit insures penetration and atomizations.	31 - 37 Seconds
Ash	Amount of non-combustible material is abrasive to cause pump wear by weight.	.02% maximum by weight

Warning: Grade # 2 Diesel Fuel Oil should not be confused with # 2 Furnace Oil, which has no definite limits on ash content, sulphur content, and Cetane Value.

Handling and Storage

Fuel should always be strained or filtered before being put into the supply tank, as it is easier and cheaper to remove dirt from the fuel BEFORE it finds its way into the engine fuel system.

A storage tank should be constructed for fuel oil with provision for removal of accumulated sludge and water. This should be done at regular 10-day intervals.

In addition, the fuel should be filtered between the storage tank and the dispensing pump. Double filtering is preferable, and the filter equipment should be maintained as recommended by the manufacturer..

The open ends of the dispenser funnels, measures, and containers should be covered, when not in use, to prevent the entrance of dirt or moisture, and they should be kept scrupulously clean at all times.

Fuel System Precautions

1. Fill the fuel tank at the end of each day to keep condensation to a minimum. When emptying the drum of fuel oil, agitate it as little as possible, and leave about 1" of fuel, which may contain sediment or water, in the bottom of the drum.
2. Shut off fuel supply valve at fuel tank when disconnecting lines -- to save needless waste of fuel.
3. Drain first stage fuel filter daily. This will also prevent ice damage to the filtering element where freezing temperatures are encountered.
4. DO NOT USE WASTE OR LINTY RAGS AROUND FUEL CONTAINERS OR FUEL INJECTION EQUIPMENT.
5. Use of clean fuel and daily care of the first-stage filter will prolong the life of the final-stage filter. For further details see Section on Fuel Injection.

Fuel Lines

The fuel supply arrangement is with the fuel tank mounted higher than the injection pump and filters. This provides gravity feed to the filters and pump.

The fuel supply lines should be 3/8" copper tubing minimum under 10 feet and 1/2" copper tubing for lines over 10 feet. The return lines should be 5/16" minimum tubing. Return lines must also be piped to the tank and never back to the inlet, as its fuel flow cools, lubricates, and purges air from the tank.

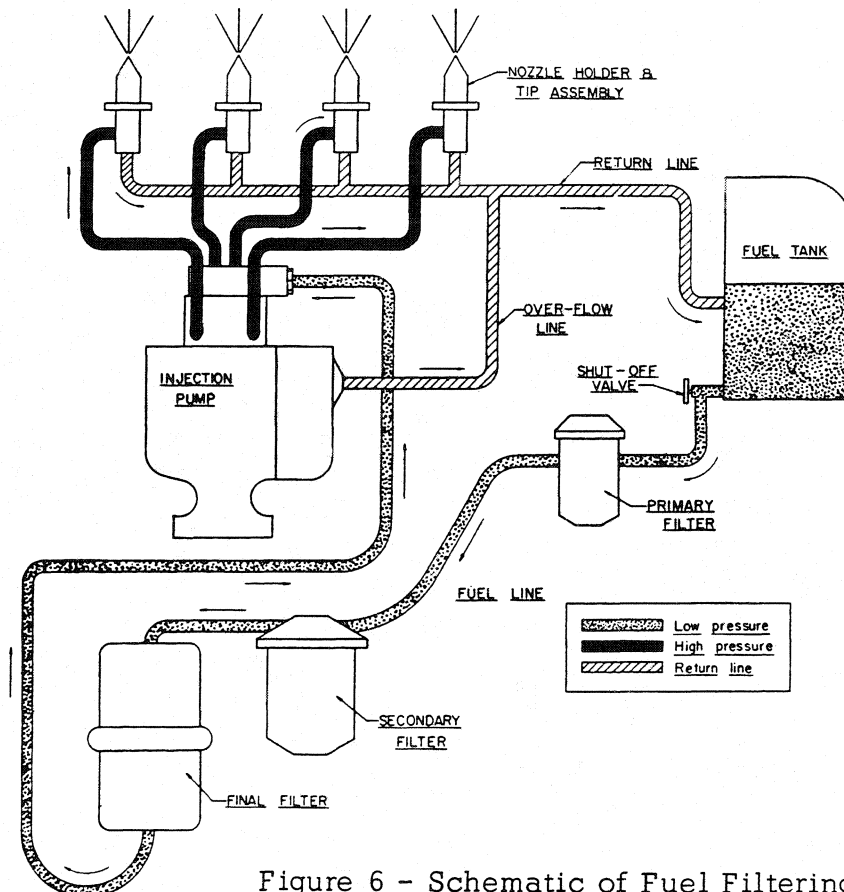


Figure 6 - Schematic of Fuel Filtering System

Servicing Precautions

Eliminate possible damage to diesel engines by preventing the entry of dirt:

1. Use clean fuel, keeping all funnels and measures in dustproof cases.
2. Keep fuel system clean while servicing. Cap lines that must be broken, and wipe clean all openings before closing.
3. Clean and refill oil bath air cleaner at regular intervals.
4. Replace oil filter at every oil change.
5. Hose nozzles, filler flanges, and caps must be thoroughly cleaned before using.
6. Avoid using linty or dirty rags when working on diesel engines.
7. Keep outside of engine clean for maximum cooling.

Dirt and water in the fuel cause scored and sticking plungers in the injection pump and may cause serious damage.

KEEP DIESEL FUEL CLEAN!

Lubrication Recommendations

Diesel engines operate with much higher pressures in the combustion chambers than their gasoline counterparts. Diesel fuels have much higher end points, that is, heavier ends of fuel which do not vaporize readily and burn completely. This results in a tendency to form deposits in the combustion area as well as in the ring grooves which could cause clogging of energy cells, rings sticking in the grooves and poor performance in general with resultant rapid wear and increased maintenance expense.

To counteract these conditions, the choice of fuels and lubricating oils must be made according to the specifications.

Oil used in the lubrication system must have certain qualities to provide a satisfactory oil film on friction surfaces to minimize wear, to protect bearings from corrosion, and to keep engines free from harmful deposits.

Lubricating oils for diesel engines are compounded with additives to provide this protection. They are better able to resist oxidation resulting from the higher operating pressures found in the diesel and at the same time, hold combustion by-products in suspension until removed when the oil is drained. Diesel en-

gines are generally used in heavy duty operation. The American Petroleum Institute has classified oils for three types of service: General Service-DG, Moderate Service-DM, and Severe Service-DS, depending on the type of operation.

For Service DG (Diesel General)

As the name indicates, this DG oil is for use in General or Ordinary service where diesel fuel oil with less than .4% sulphur is used with normal engine operation and maintenance.

For Service DM (Diesel Moderate)

This oil is to be used in diesel engines operating under severe conditions, or using fuel which tends to promote deposits, but where design characteristics or operating conditions make the engine either less sensitive to fuel effects or more sensitive to residues from the lubricating oil.

For Service DS (Diesel Severe)

This oil is to be used when the diesel fuel oil has over .4% sulphur content coupled with severe operating conditions under heavy loads and high temperature conditions, or very light or intermittent operation at low temperatures.

While oils in this category are, by no means, a safeguard against failure to follow proper maintenance procedures, they are absolutely necessary when operating conditions approach those outlined in the preceding paragraph. We recommend using motor oils meeting DS specifications.

OPERATING CONDITIONS

<u>TEMPERATURE</u>	<u>SEVERE</u>	<u>S.A.E. NUMBER</u>
0° F. or Below	Service DS	5W-20
0° to -10° F.	Service DS	10W
0° to 32° F.	Service DS	20W
32° to 75° F.	Service DS	30
75° F. and Above	Service DS	40

As in other internal combustion engines, oils must be selected as to S.A.E. number grades in accordance with the atmospheric temperature where the engine is to be operated.

Except for the break-in period, designated elsewhere in this manual as the first 50 hours, select the grade of oil as shown in the preceding chart.

Continental Diesel Engines have full pressure lubrication through drilled passages in the cylinder block and crank shaft to all main and connecting rod bearings as well as to the timing gears and overhead valve rocker arms, the overflow from which lubricates the tappets. The oil pressure is automatically regulated by a spring loaded relief valve.

Oil Filter

A full flow type oil filter is provided to remove dirt and foreign elements from the oil. The removal of grit, sludge and foreign particles causes filter elements to clog and become ineffective unless they are replaced at regular intervals.

Oil filter elements or cartridges should be replaced at every oil change or approximately every 50 hours operation.

Oil Change Frequency

Engine oil does not "wearout". However, heavy-duty detergents in diesel engines become contaminated from by-products of combustion, dirt, water, and unburned fuel entering the crankcase and the detergents holding the carbon particles in suspension in the crankcase.

In normal industrial operation engines should have the oil and the oil filter element changed after every 50 hours of operation. The oil should be drained when the engine is at normal operating temperature.

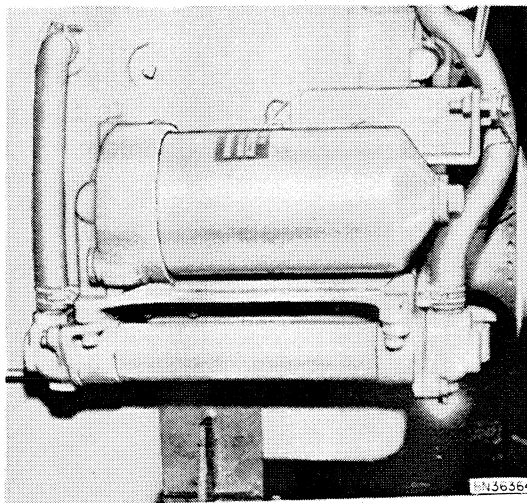


Figure 7 - Oil Filter

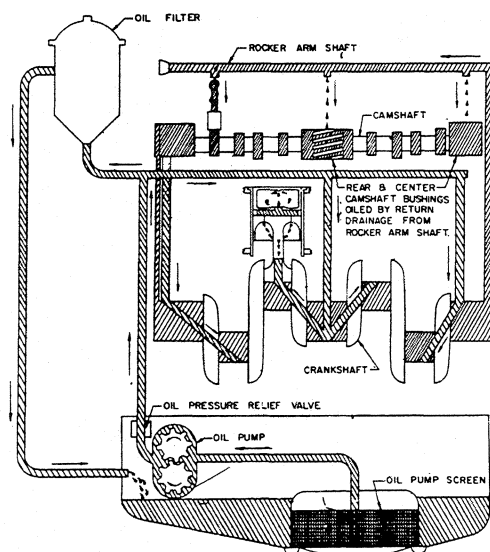


Figure 8 - Lubrication Diagram

(The camshaft has been moved up in order to simplify the schematic drawing.)

Oil Pump

The oil pump is mounted on the rear of the Lanchester Balancer. It is a gear type pump driven by the timing gear on the crankshaft.

The normal oil pressure is 30 to 40 lbs. At idling speed it should not fall below 7 lbs. If the pressure fluctuates or falls below these limits, STOP THE ENGINE IMMEDIATELY, and find the cause to the trouble. Refer to engine overhaul for repairing.

Air Cleaner

Diesel engines, when operating, consume several thousand cubic feet of air per hour. Since dusty air is full of abrasive matter, the engine would soon wear excessively if it was not protected by the air cleaner collecting dust in an oil cup.

Air cleaners are not 100% efficient, and their efficiency is DECREASED by the lack of proper servicing.

Proper servicing means cleaning thoroughly and maintaining air tight connections between the air cleaner and the intake manifold so that all air entering the engine is filtered.

The number of hours an engine may be permitted to run before the air cleaner is serviced depends entirely on operating conditions, and no definite interval can be established. In extremely dusty operations this might be once or twice a day, while in dust free areas the air cleaner should be serviced when changing the oil.

Dirt and foreign particles, removed from the air, settle to the bottom of the air cleaner cup. This deposit must not be permitted to build up to any quantity. The speed at which this builds up indicates how often the air cleaner should be serviced.

IT REQUIRES ONLY A COMPARATIVELY SMALL QUANTITY OF ABRASIVE DUST TO WEAR OUT AN ENGINE. A planned air cleaner servicing program will increase the life of the engine.



Figure 9 - Air Cleaner

3. COOLING SYSTEM

The function of the cooling system is to prevent temperatures, some as high as 3500° F. in the combustion chamber, from damaging the engine.

Maintaining the cooling system efficiency is important, as engine temperatures must be maintained within a specific satisfactory range for efficient operation. Yet overheating must not take place, in order to prevent damage to valves, pistons, and bearings.

Continental Diesel Engines operate most efficiently with water temperatures of 165° - 185° F. A thermostat and by-pass system is used to control these temperatures. The normal operating temperature when a pressurized cooling system is used is 175° - 210° F. The thermostat valve remains closed and only allows the water to recirculate within the engine itself until normal operating temperatures are reached. This provides for both rapid and even temperature increase of all engine parts during the warm up period. When the desired temperature is reached, the thermostat valve opens and allows the water to circulate through both engine and radiator.

The cooling water is circulated by a water pump located at the front of the engine block. The radiator cooled water enters the pump at the lower or suction opening and is directed through integral distribution passages cast in the cylinder head to areas in and around the valve seats and combustion chambers. This method provides the coolest water at the parts in the engine subjected to the highest temperatures.

The cylinder walls, in turn, are cooled by convection currents only, which keep the cylinder barrels at a more uniform temperature, thereby greatly reducing crankcase oil dilution and sludge formation.

Upon leaving the cylinder head, water enters the thermostat housing through a by-pass type thermostat, which controls the opening to the radiator.

Radiator

The radiator consists of tubes through which the cooling water is circulated. In standard radiator design fins are connected to the tubes to give an extended surface through which heat can be dissipated. It is important that these tubes be kept clean on the inside and the fins free of dirt on the outside so that maximum heat transfer can take place in the radiator.

Keep the cooling surfaces of the core free of dirt and other foreign particles.

Each 250 hours of operation the radiator and cooling system is to be well cleaned and flushed with clean water.

Wherever possible, use only soft clean water in the cooling system. Hard water will cause scale to form in the radiator and the engine water jackets and cause poor heat transfer. Where the use of hard water cannot be avoided, use an approved anti-rust and water pump lubricant.

Cleaning Cooling System

Deposits of sludge, scale, and rust on the cooling surfaces prevent normal heat transfer and in time render the cooling system ineffective. The appearance of rust in the radiator or coolant is a warning that the corrosion inhibitor has lost its effectiveness, and the radiator is to be cleaned before adding fresh coolant.

Use dependable cleaning compounds. Follow the procedure recommended by the supplier. This is of prime importance because different cleaners vary in concentration and chemical composition. After cleaning and flushing, fill the system with an approved anti-freeze compound containing a rust and corrosion inhibitor or water with a corrosion inhibitor.

Radiator Pressure Cap

The practice of operating the cooling system under pressure is used because of the reduction in evaporation losses, because of the increase in engine operating temperatures possible without overflow loss from boiling, and because of a desire to increase the radiator cooling capacity. This is possible because the increased pressure within the system raises the boiling point of the coolant.

The Case Model 1000D Crawlers, before serial number 7104001, use a 4 P.S.I. valve on the overflow tube to regulate system pressure. Model 1000D Crawlers, serial number 7104001 and after, use a 7 P.S.I. pressure cap on the radiator filler spout to regulate system pressure. In these pressurized systems, an air tight cooling system is required and particular attention must be paid to insure tight connections.

Engine Oil Cooler

The Model 1000D Crawler employs heat exchangers to cool the engine lubricating oil. Figure 10. Located on the right side of the engine block, the cooler is designed so that oil passes through tubing surrounded by the coolant. The oil is cooled and thus helps to reduce engine heat.

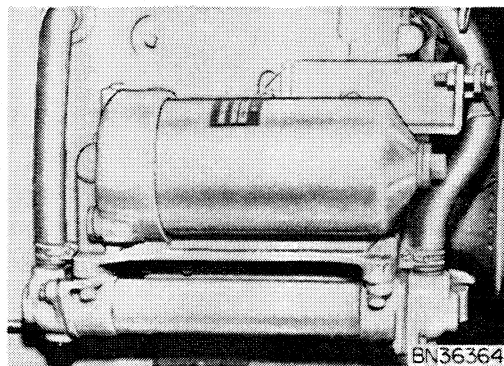


Figure 10 - Engine Oil Cooler

4. COLD WEATHER STARTING AND MAINTENANCE

Cold Weather Starting

The requirements for satisfactory cold weather operation of diesel engines differ somewhat from those of gasoline engines. This is brought about, to a large extent by a difference in methods of ignition.

The diesel engine depends on the heat from the air compressed in the combustion chamber to ignite the fuel when it is injected into this air. It requires a temperature of approximately 900° F. in the combustion chamber to institute this combustion process.

With engines standing out in temperatures below freezing, difficulty may be expected in raising the temperature of the air in the combustion chamber to the point where it will ignite fuel, even though compression pressures do meet the required minimum of 325 pounds per square inch, and the starter will turn the engine over at a desirable minimum of 150 RPM.

Ether Bomb Starting

An ether spray bomb, Case Part Number R13939, is available to insure cold weather starts. The bomb is used as follows:

1. Make sure both track speed controls are in neutral position.
2. Open shut-off cock in the fuel line beneath tank.
3. Using the ether spray bomb, direct spray into screen mesh of air cleaner cap. At the same time crank the engine with the starter. Repeat until engine has fired. Figure 11.
4. Under extremely windy conditions, it is advisable to remove the air cleaner cap and spray directly into the opening. Be careful, however not to saturate air with ether.

CAUTION

Use every precaution against igniting or excessively inhaling ether fumes.

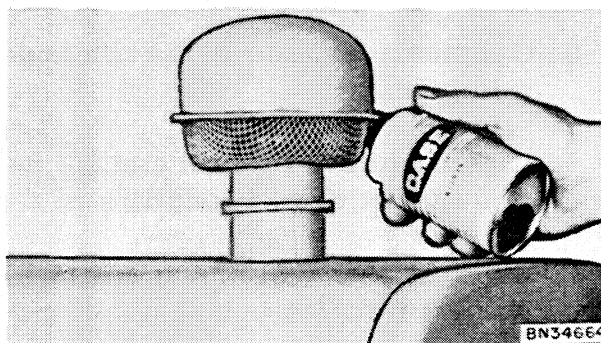


Figure 11 - Ether Spray Bomb

Equipment Maintenance

Certain maintenance operations must be checked more carefully in cold weather, than during summer operation. For instance, the thermostat and water temperature control must be maintained so that the engine is warmed up as quickly as possible to 185° F. and remains at this minimum or above during operation.

Filters must be checked more often, particularly the primary stage filter, to remove all the moisture and condensation separated from the fuel; otherwise it may freeze and stop the fuel flow.

Lubricating oil must be watched more carefully in cold weather to be sure that dilution is not building up in the crankcase, since despite all precautions, there may be occasions when small quantities of raw fuel condense and wash down the cylinder walls. This is likely to occur in engines that do not operate for extended periods of time.

A good clean fuel delivered by a reliable source and having a minimum cetane number of 45, is a definite requirement. The more nearly the cetane number approaches 55, the easier the engine will start, and the better and more efficient the operation will be. Obtain fuel from a reliable source.

EIGHT "MUSTS" FOR CONTINENTAL DIESEL USERS

1. Use only # 2 Diesel Fuel Oil.
2. Use lubricating oil of recommended grade for operation and weather conditions. Change filter element each time oil is changed.
3. Maintain 175° F. operating temperatures. It will pay dividends in economy, performance, and engine life.
4. Check for leaks-fuel, oil, water, and air in lines.
5. Operating engines in recommended range provides increased performance and reliability.
6. Cleanliness of fuel oil and its handling is most important to provide trouble-free operation and long life of the fuel injection system.
7. Idling Engine - Slow engine down to low idle for approximately 5 minutes before stopping engine, but do not allow it to run for prolonged periods at idle.
8. Follow recommended preventive maintenance program.

5. ENGINE REPAIR AND OVERHAUL

This section includes instructions for repair and overhaul of the component units of diesel engines.

Provide a clean place to work and clean the engine exterior before you start disassembling. Dirt causes engine failures.

Use only genuine parts in diesel engines as years of development and testing have gone into these specifications to assure maximum life and proper performance.

Cylinder Head

The cylinder head is one of the most important parts of the engine assembly, since it contains the complete combustion chamber including valves, fuel injection nozzles, energy cells, and cored passages for air, exhaust, and water flow.

REMOVING CYLINDER HEAD

1. Drain water from engine and disconnect radiator or heat exchanger outlet hose.
2. Remove the valve cover by taking out the screws holding it to the rocker arm supports.
3. Remove rocker arm shaft assembly and push rods. Grip the push rods and snap them sideways out of the tappet sockets as shown in Figure 13. This serves to break the hydraulic connection and permits lifting the push rods out and leaving the tappets in place. If tappets are lifted out of the guides, they will have to be reassembled through the opening in the block if only the cylinder head is removed for servicing.

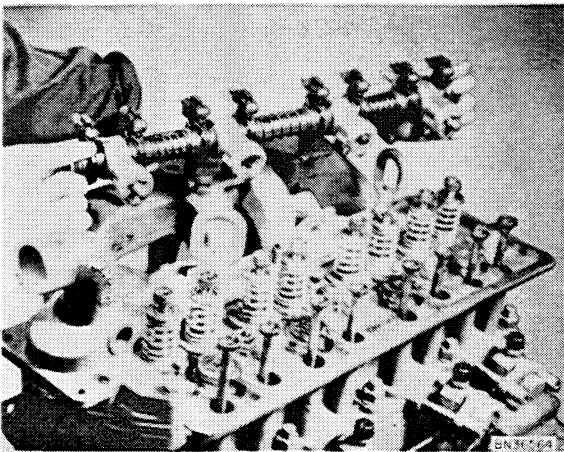


Figure 12 - Removing Rocker Arm Shaft Assembly

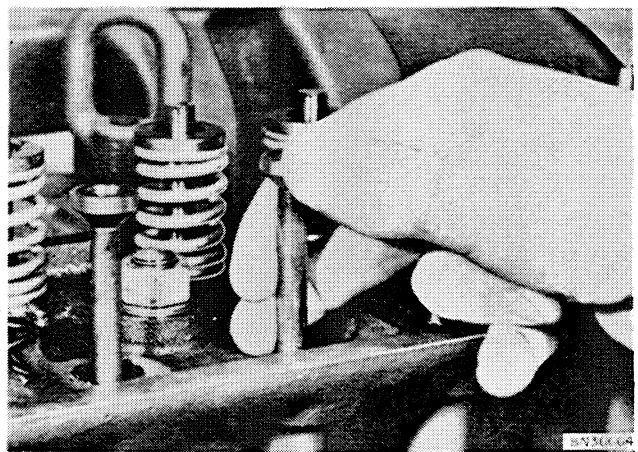


Figure 13 - Snapping Push Rod Out of Ball Socket of Tappet

4. Disconnect the injection and leak-off lines at both the nozzle and pump connections. Immediately cap the fittings to prevent dirt entering.
5. Loosen and remove the nuts holding the cylinder head to the block.
6. Lift cylinder head off engine and carry to clean bench for further disassembly.

DISASSEMBLY OF CYLINDER HEAD

1. Remove all carbon from combustion areas using scraper and wire brush.

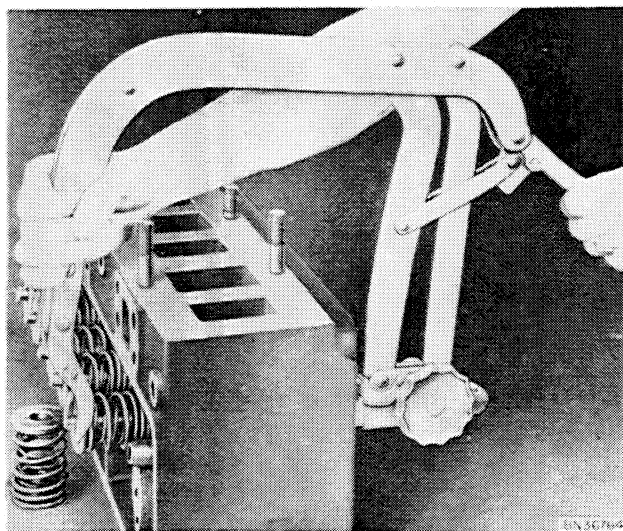


Figure 14 - Removing Valve Springs with "C" Type Valve Spring Compressor

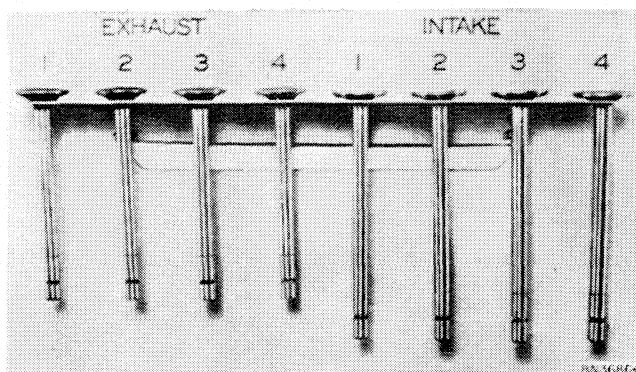


Figure 15 - Correct Order of Exhaust and Intake Valves Placed in the Rack

5. Remove hex-head plug holding the energy cell retainer against the cap and the energy cell firmly against the seat. Then remove the cap.
6. Remove the injection nozzle assemblies by removing the slotted nuts and clamps and pull the nozzle holder as shown in Figure 16. See section R on page III - 42

2. Using a "C" type valve spring compressor, remove the valve spring retainer locks, retainers, and springs, Figure 14. Place all parts in a container of solvent.

3. Remove the valves in order and place them in a rack with holes numbered for both intake and exhaust so they will not be mixed in handling. Figure 15.

4. Clean the cylinder head thoroughly with solvent or degreasing solution and blow it off with air pressure. Inspect carefully for cracks.

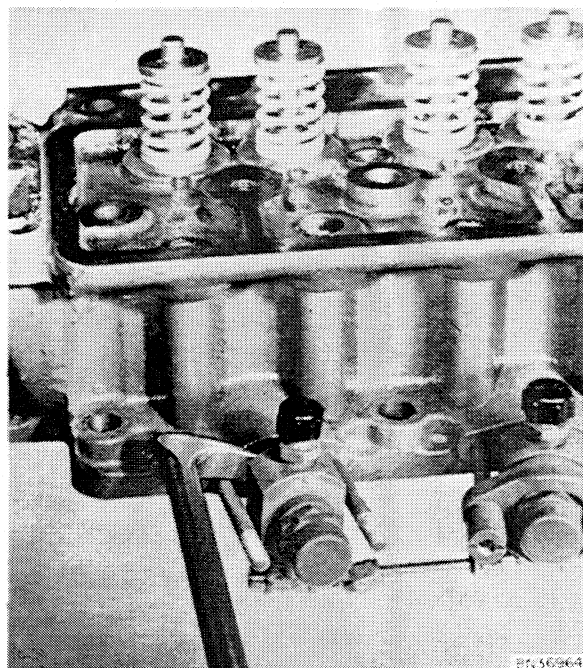


Figure 16 - Removing Fuel Injector



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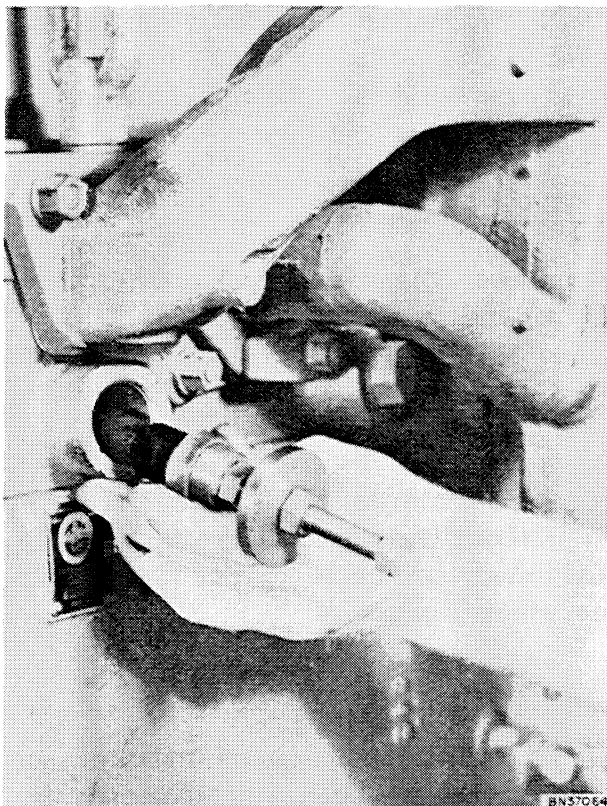


Figure 17 - Pulling Energy Cell With Special Tool

7. Pull the energy cells with special tool as shown in Figure 17.

NOTE: Should difficulty be experienced in pulling the energy cell due to being firmly embedded in the counterbore and held there by carbon, use a brass drift with a spherical head. Insert it through the nozzle opening and give it a sharp rap with a hammer while tension is applied with a puller. Never use a steel or similar metal drift or one without a spherical nose as damage will result to the conical entrance of the metered opening.

Valve Guides

1. Clean the valve stem guides, removing lacquer or other deposits by running a valve guide cleaner or wire brush through the guides.
2. Check guides for wear by using "Go and No-Go" plug gauge or a telescope gage and 1" micrometer. Replace all guides that are worn bellmouthed and have increased .0015 in diameter. See Limits and Clearance Section for maximum diameter permissible to determine actual amount the diameter has increased. Remove all valve guides when necessary by pressing them out from the combustion chamber side.
3. Replace worn guides as required by pressing in new guides from the combustion side to the correct depth below the valve seat as given in the Limits and Clearance Chart.
4. Ream new valve stem guides to size given in Limits and Clearance Chart, using a straight reamer ground to correct size and having a pilot which will properly locate it and keep it from wandering from the original reamed hole.

Valve Seat Inserts

1. The exhaust valve seat insert is held in place by a shrink fit. Inspect all exhaust valve inserts in the head and replace any that are loose, cracked or otherwise damaged. Use puller for removing faulty insert.
2. When it is necessary to replace with a new insert, clean and counterbore, for .010 larger insert using a counterbore tool with correct fitting pilot. When machining the counterbore, be sure to go deep enough with the tool to clean

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