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Service Manual

6-DT-389 & 6-DT-468

Diesel Engine

Service Manual

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BUDA-S-6DT389+

CONTENTS

Introduction Page i

Installation Page iii

Chapter I. General Engine Information.

Miscellaneous Data—Principle of Operation.

Chapter II. Fuel and Lubricating Oils.

General Specifications.

Chapter III. Starting and Stopping.

Starting—Starting after Shutdown—Difficulty in starting.

Chapter IV. Cold Weather Suggestions.

Starting—Timely Hints—Air pre-heater.

Chapter V. Care of Diesel.

Timely hints—Periodic care—Preparing engine for long shut down.

Chapter VI. Fuel Systems.

Fuel circulation—Injection nozzles—Injection pump—Filter—Transfer pump—Governor.

Chapter VII. Lubricating System.

Oil circulation—Oil pump—Pressure relief valve—Oil filter—Oil cooler.

Chapter VIII. Cooling System.

Water circulation—Water pump—Water draining.

Chapter IX. Starting System.

Equipment—General instructions—Care and operation.

Chapter X. Cylinder Heads and Valve Mechanism.

Cylinder heads—Valves, clearance and grinding.

Chapter XI. Timing Gears and Camshaft.

Layout—Timing Gears and Clearance—Camshaft—Camshaft Timing.

Chapter XII. Cylinder and Crankcase Assemblies.

Crankcase description—Main Bearings—Piston and connecting rods—Cylinder sleeves.

Chapter XIII. Diagnosis and Correction of Trouble.

Sudden stopping—Loss of power—Knocking—Overheating.

Chapter XIV. Driving Mechanism

CHAPTER I.

GENERAL ENGINE INFORMATION

MISCELLANEOUS DATA

These engines are of the four cycle, full Diesel, solid injection type. Cylinders are numbered from the timing gear end. Direction of rotation is in one of the two ways i. e., right or left hand. Rotation is determined by viewing engine from timing gear end.

For right hand rotation, the firing order is, for the four-cylinder engines, 1-3-4-2; for the six-cylinder engines, 1-5-3-6-2-4, and for left hand rotation the firing order is 1-2-4-3 and 1-4-2-6-3-5 respectively.

The engine, when not connected for remote control, is operated from the fuel pump side with all levers in easy reach.

PRINCIPLE OF OPERATION

In the four-stroke-cycle Diesel engine, we have the same series of events taking place as in any four-stroke-cycle internal combustion engine, as follows:

1. Inlet stroke.
2. Compression stroke.
3. Expansion or power stroke.
4. Exhaust stroke.

The principle of operation of the Diesel engine is based on the physical law of gases governing the relation of volume, pressure and temperature. For example, a decrease in volume causes an increase in pressure and a corresponding increase in temperature.

All fuel oil, regardless of gravity, has what is known as a firing point; that is, when the fuel oil is raised to a certain temperature, it will ignite and burn. In the process of burning, energy is liberated.

When the piston starts downward on the inlet stroke (1) the inlet valve is open admitting a charge of fresh air into the cylinder through the air inlet manifold. When the piston reaches the bottom of the inlet stroke, the cylinder is filled with air at approximately atmospheric pressure at an assumed room temperature of 70 degrees Fahrenheit. As the piston starts upward on the compression stroke (2) all valves are closed so that the air is compressed to a final volume at the top of the stroke of approximately 1/12 the initial volume. This decrease in volume causes an increase in pressure and

a corresponding increase in temperature to between 900 and 1,000 degrees Fahrenheit.

At the proper moment during the compression stroke, fuel oil is injected into the combustion chamber under a pressure of 2,000 pounds per square inch. As mentioned above, all fuels have a certain temperature at which they will ignite, and since this point is far below the temperature of the compressed air in the combustion chamber, the fuel, in its finely divided form, easily ignites upon coming in contact with this compressed air.

As the fuel oil burns, heat is generated which expands the compressed gases, forcing the piston downward on the power stroke (3). At the end of this power stroke, the exhaust valve opens and the piston starts upward on the exhaust stroke (4), expelling the burned gases, thus completing the cycle.

LANOVA COMBUSTION PRINCIPLE

In the Buda-Lanova combustion chamber the clearance volume above the piston consists of two chambers. The main chamber is in the form of the figure "8" also forming the housing for the intake and exhaust valves. The auxiliary chamber or energy cell is located directly opposite the injection nozzles. See Figure 35.

The air is compressed in the main chamber and also forced into the energy cell during the compression stroke. At the beginning of injection, the air is passing at high velocity through the funnel shaped passage into the energy cell. The injected fuel starts to burn at the mouth of this passage and a predetermined amount of unburnt fuel following the air flow, enters the energy cell, which due to its velocity, is finely atomized and burns. The rate of pressure rise in the energy cell, due to its small volume, is much greater than in the main chamber. This results in a rapid expulsion of the gases from the energy cell, into the main chamber directly against the fuel jet. This causes the air in the main chamber to rotate in a double swirl and because of this turbulence, the fuel and air are thoroughly mixed which is necessary to obtain clean and smooth combustion and the resulting excellent engine performance.

CHAPTER II.

FUEL AND LUBRICATING OIL

FUEL OIL

In selecting a fuel for the Buda-Lanova Diesel engine the following points should be considered:

1. It is important that the fuel selected has a sufficient body to properly lubricate the fuel pump plungers and valves since these obtain their lubrication from the fuel itself. Improper lubrication will cause rapid wear or sticking plungers and valves.
2. The pour test must be low enough to flow freely at the prevailing local temperatures.
3. The fuel must be free from water and dirt. Water and dirt cause more Diesel engine down time than any other one factor.

The fuel selected can be a cracked residual, a blend, or a straight run distillate, providing it comes within the scope of the following specifications.

Gravity A. P. I.	30-35
Viscosity, Saybolt Universal at 100° F.	35-40
Flash F° Min.	150° F
Diesel index	48.5 to 65.5
Cetane number	46-60
Pour	0° F
98% Recovery	700° F
Water and sediment	Trace
Ash max.	.02
Conradson carbon, max.	.03
Sulphur, max.	.5

Fuel should be purchased as a high speed Diesel engine fuel and not as a fuel oil as there will be a difference in cleanliness.

It is not alone sufficient to buy a good grade of fuel, but it is of greater importance that every precaution be taken in handling. Be sure the containers are free from rust, sediment, and water.

Inadequate filtration will result in worn parts of the injection system causing hard starting and loss of power. Filter elements should be cleaned periodically. See Chapter VI on filter care.

In buying a new fuel, it is well to obtain a small quantity until it is demonstrated that the fuel will be satisfactory. Careful consideration to the above points on analysis, handling, and filtration will result in freedom from combustion difficulties. The Buda Company offers its fullest cooperation in overcoming difficulty with fuel.

LUBRICATING OIL

Use a good quality oil manufactured by a reliable refiner. The best oil will be found cheapest over a long period of engine operation. We recommend S. A. E. 40 for operating temperatures over 90 deg. F., S. A. E. 30 for 32 degrees to 90 degrees and S. A. E. 20 for temperatures —10 to +32 degrees. These numbers correspond to the grades of oil sold by first class service stations.

The following specifications will serve as a guide in selecting the proper oil for your engine:

	S. A. E. 20	S. A. E. 30	S. A. E. 40
viscosity	120 to 185 at 130 deg	185 to 255 at 130 deg.	over 255 at 130 deg. less than 75 at 210 deg.
Flash	400 deg. to 340 deg.	410 deg. to 350 deg.	425 deg. to 370 deg.
Color	5	6	7
Pour	0 deg. to 15 deg.	0 deg. to 15 deg.	5 deg. to 15 deg.
Carbon Residue	.10% to .60%	.15% to .80%	.25% to 1%
Slight oxidation	25	25	25
Neutralization	.30 or less	.30 or less	.30 or less
Corrosion	Slight stain only after 3 hours at 212 degrees.		

CHAPTER IV.

COLD WEATHER SUGGESTIONS

With proper care, the usual satisfactory operation can be maintained in cold weather. The following instructions are given as an aid to maintaining efficient operation.

STARTING

- (1) Be sure that the lubricating oil is correct for the prevailing temperatures. See Chapter II.
- (2) Be sure that the fuel oil will flow freely and not congeal in the lines. Fuel tends to congeal in the filter and lines although it may be selected in accordance with the recommendation given in Chapter II. If congealed, use a fuel with lower congealing point or warm the fuel.
- (3) Warm the inlet air by means of the air pre-heater.
- (4) If possible, warm water in the cooling system will aid starting.
- (5) Extra precaution is necessary in venting the fuel system as there is more tendency to become air bound due to lack of flow with the cold fuel.
- (6) See that the battery, if used, is fully charged. Under extreme cold conditions, the terminal voltage of a battery drops as much as 30%. This is not sufficient to crank a cold engine fast enough to start. A temporary addition of a 6 volt battery connected in series, to start will make considerable difference in the cranking speed. The additional battery must be removed as soon as the engine is started.
- (7) Set the throttle control lever at stop position and crank the engine a few revolutions by hand to free it up before attempting to start it.
- (8) Proceed as outlined in Chapter II.

AIR PRE-HEATER

Since the fuel is ignited by the rise in temperature of the air due to compression, any means of increasing this temperature will aid starting. An air pre-heater is provided in the inlet manifold to increase the temperature of the inlet air to aid starting in cold weather.

This pre-heater consists of an electric heater grid in the inlet passage which is connected directly across the battery terminals and operated by a switch. The current should be applied for a period long enough to build up residual heat in the air and in the surrounding metal. It is advisable to release the heater button before using the starter, so the load on the battery will be that due to the starting motor only.

In extremely cold weather it may be found advantageous to preheat the oil used in the oil bath air cleaner to a temperature of around the boiling point of water, just before starting the cranking operation. The oil should be heated and then poured into the air cleaner cup. Heating should not be attempted while the oil is in the oil bath air cleaner, as the direct heat will damage the air cleaner unit.

On most installations a manually operated heater switch is used. Where remote control is required, a magnetic switch is used, similar in construction to that used for the cranking motor. This is controlled by a push button switch. The description and maintenance instructions given in Chapter IX under "Magnetic Switch" applies to both.

TIMELY HINTS

- (1) For marine engines running in salt sea water, maintain an operating temperature of 130°. This temperature should not exceed 140° because salt precipitates rapidly in the cylinder casting at higher temperatures. For fresh water installations, maintain as nearly as possible an operating temperature of 170° for best results.
- (2) Drain water and sediment from the filter housings frequently as water collects quickly due to condensation.
- (3) Check the lubricating oil frequently for the same reason, watching carefully for sludge formations and water, draining off as formed. Change oil more frequently. Wash carbon residue from oil pan or base periodically.
- (4) Keep all screens clean.