Maintenance Of Low Speed Gas Engines

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The purpose of this paper is to provoke a discussion with field operating personnel in the hope of providing constructive instruction relative to low speed gas engine operation.

It will appear that some of the statements made in this paper are elementary but such is necessary for the basis of discussion.

An internal combustion engine is composed of several complete systems, all of which contribute to the engine's operation. Breaking down these systems into general headings will simplify the discussion and present field problems which you, as an operator, control.

THE FUEL SYSTEM

For this paper we will confine the subject to gas only. Fuel gas, as such, can be divided into four headings:

a. Residue gas.

b. Casinghead, separator or trap gas generally referred to as green or wet.

c. Sour gas or gas which contains various amounts of sulphur, generally available from casinghead, separator, or trap.

d. Sweet gas but untreated. This gas is also available from the casinghead, separator or trap.

The residue gas is by far the best fuel for an engine because it is almost impossible for field operating personnel to mishandle it, and causes the engine very little trouble. Casinghead gas, either sweet or sour, will contribute short engine life if the entrained liquids which the gas carries are allowed to reach the engine's cylinder. Liquid hydrocarbons as such cannot be burned. The catch basins, or traps, in the fuel systems must be drained and kept free of the liquids carried over with the gas. We strongly urge heating the gas pipe and volume tank at the engine with the engine's exhaust heat to raise the gas temperature above the dew point of the entrained liquid. Proper handling of the casinghead gas as fuel should be discussed in detail at some future date.

The gas pressure at the engine must

be kept low. Engines equipped with regulator carburetor combinations require only 4 to 6 ounces PSI at the engine. This combination, when in proper repair, delivers gas below atmospheric pressure at the carburetor jet. Engines not equipped with this combination of gas regulator and carburetor must have low pressures and should be kept as low as possible and the engine still pull its load. The gas pressure regulator should be the sensitive spring loaded type with ample capacity in the valve seat opening. The size of this valve seat opening is determined by the volume required to properly supply the engine. This size then is controlled by the upstream pressure and the downstream demand.

THE IGNITION SYSTEM

The ignition system is composed of a magneto, the spark plug wire, and the spark plug.

The Magneto

Rotary magnetos for slow speed engines have been greatly improved in the last few years. It would appear that jump spark distributors in magnetos, using all ball bearings together with better and heavier insulation of high tension coils, tremendously increase the magnetos' life. All adjustments have been eliminated except the breaker point gap and the lag in the impulse coupling. The gap should be held close to .017 in. The lag in the impulse coupling is extremely important since it provides proper advance spark timing when the impulse coupling disengages.

Engines equipped with a magneto driven at twice crankshaft speed require 40 degrees lag in the impulse coupling in order to give 20 degrees advance spark timing when the impulse coupling disengages.

Engines equipped with magnetos driven at crankshaft speed require 20 degrees lag in the impulse coupling to give a 20 degree advance in the spark timing when the impulse coupling disengages.

This is the reason why trouble is experienced when changing a magneto from one engine manufacturer to another without giving any consideration to the magneto except direction of rotation. We would like to caution those having magnetos repaired to be sure to specify on what make and model engine you intend to use the magneto after the repair. If the impulse coupling lag is too great, the spark advance is too far. If the lag is not great enough the spark is too slow. In either case the engine will not do the work you expect.

Spark Plug Wire

The new plastic covered spark plug wire that appeared on the market immediately following this last war is far superior to anything previously used. Our experience with the new insulation has been such that we no longer consider the spark plug wire a hazard to successful operation. This new insulation is not adversely affected by atmospheric temperatures, either extremely high or extremely low. It is unaffected by water, oil or grease. Corona does not shorten its life and it is imposible to break the insulation by bending or twisting with the hands.

Spark Plugs

Use spark plugs made for commercial services only. Set the spark plug gap in accordance with engine manufacturer's recommendation. The electric load on the spark plug wire in the magneto is related to the engine's compression pressure and the gap in the spark plug electrodes. High compression engines have their spark plug gaps set at .018 inches.

Most oilfield engines are started with the speed control set for maximum acceleration, that is, the governors wide open. This imposes the heaviest load the ignition system has to carry. It is not generally understood that when the magneto's impulse coupling disengages the electrical energy output of the magneto is at the very lowest in the engine's entire speed range, yet at this very instance the electrical load is the very greatest. When starting an engine and it fails to fire when the impulse coupling disengages, shorten the gap in the spark plug. The electrical load is too great for the low speed of the magneto, hence the engine fails to fire. We suggest you give this statement serious consideration. Spark plugs with wide gaps have caused more misadjusted gas systems than all the other troubles combined, simply because the operator will change everything else first and the spark plug gap last.

The spark plug gasket is a very important part of the spark plug's life. The gasket serves a dual purpose. It makes the plug gas tight but it also completes the thermal connection between the spark plug and the water jacket in the cylinder head. Spark plugs screwed in tight against a clean gasket surface will last much longer.

THE COOLING SYSTEM

For this particular discussion, we will confine our remarks to engines equipped with built-in closed cooling systems. The closed system generally used on oilfield production engines have three distinct methods of coolan circulation.

1. Thermo-Syphon circulation radiator cooling.

This method requires that the entire cooling system be full of coolant. Circulation of the coolant through the system is caused by thermo-syphon. Pressurizing this system does not affect the engines operating temperature. Concentration of permanent type anti-freeze does not affect the operating temperature. Alcohol base antifreeze should not be used with this system. It fact, we contend alcohol base anti-freeze should not be used in any cooling system operating unattended.

2. Vapor circulation condensor cooling.

This system requires no water in the radiator. The radiator is a condensor for the vapor generated by the engine's heat. This system is affected by the concentration of antifreeze and you should conform to the manufacturer's recommendation as to the amounts of anti-freeze to use.

3. Water pump circulation radiator cooled.

This method also requires the entire system to be filled with coolant. Concentration of permanent type antifreeze does not adversely affect this system, neither does pressurizing, if the water pump packing can handle the low pressure without failure.

These three cooling systems appear to be very well suited for the engines on which they are applied. It is the engine manufacturer's aim to try to control within limits the engine's operating temperature. The internal parts of the cylinder he would like to hold above the dew point of water, or 212 degrees F. This temperature keeps in gaseous form the water generated by combustion, thus assisting in the lubrication of the cylinder wall. The pressure cap on the radiator used by many engine manufacturers, both with and without water pumps, is a very useful accessory, but does need some explaining. First, if it is a 7 lb. PSI pressure cap, no 100 degree F. water will escape through the overflow until you reach about 230 degree F. If this cap is kept operative, it will prevent the necessity of adding water to the system unless you have a cooling system failure.

High temperature shutdown device for engines using 7 lb. pressure caps should be set at 220 degree F, thus, with a properly designed cooling system, your shutdown device will stop the engine only when you have a cooling system failure. It would hardly seem necessary to suggest brushing the bugs, dust and other debris from the face of the radiator in order to allow the radiator to dissipate its heat into the circulated air, but our observation leads us to believe otherwise.

Engines equipped with water pumps present a packing problem. Keep the packing from leaking either air or water. Do not over lubricate.

TRANSMISSION SYSTEMS

Clutches Fall Into Two Classes

1. Standard power take-off.

This clutch requires a standard V-Belt pulley. The pulley is not part of the clutch mechanism. This clutch requires lubrication of the main bearings and the pilot bearing. These bearings are affected by the load on the engine and the tightness of the V-belts. The manufacturer can figure the bearing and clutch shaft load as far as engine loading is concerned. He makes ample provision for a reasonable safety factor to assure long life. He has no control over how tight you make the V-Belts. Static V-Belt loading can, and often is, destructive to clutch bearings. Do not over tighten the V-belts.

2. Clutches that require a special V-belt sheave, the sheave being part of the clutch mechanism.

The V-belt drive with this type of clutch must be kept in absolute alignment. The pulley floats in a neutral position when the clutch is disengaged. If the V-belts are not in absolute alignment the belts pull the pulley over against one friction plate or the other, depending on the direction of misalignment and the clutch drags.

Over tightening V-belts with this clutch can cause serious engine trouble.

LUBRICATING SYSTEM

We have left this system last because it is so closely related to the engines, the engine design must be discussed with it.

1. Splash lubrication.

This system requires some moving parts to dip into the oil reservoir and splash oil on other moving parts requiring lubrication. This system appears to work best on crosshead type 2-cycle engines since the splash can be considerably more than ample and still cause no oil consumption since the oil in the crankcase of this engine does not come in contact with the piston and cylinder. The oil in such an engine is not contaminated by combustion, the cylinder being separated from the crankcase by a stuffing box and piston rod. The oil in the crankcase stays useable for long periods of time. No oil filter is needed or required.

2. Mechanical oiling system.

a. Force feed lubricator.

A force feed oil metering device is necessary on 2-cycle crosshead type engines to lubricate the moving parts not oiled by the splash in the bed plate. There has been, in the last few years, a great improvement made in force feed lubricating systems. All new lubricators are straight hydraulic systems, giving positive regular metered amounts of oil to cylinders, pistons and rings. Do not over lubricate.

b. Oil pump and splash combination.

This system is used on many of the 4-cycle engines. An oil pump is used for delivering oil under pressure to some parts needing lubrication. The oil is metered past the clearances in these parts and splashed or sprayed to the remaining parts needing oil. All trunk type piston engines can and do affect the crankcase oil. Most manufacturers recommend oil changes or filter changes, or both, after a certain number of operating hours. Maybe your operating conditions are worse or better than the manufacturer expected. Keep the oil in useable condition, either by changing the oil, the filter, or both.

In conclusion, please remember all mechanical devices are compromises. Every manufacturer does the best he can and still sell his product in a competitive market. Keep these mechanical devices in good repair. There is no substitute for mechanical excellence.