18 DIESEL Q and A

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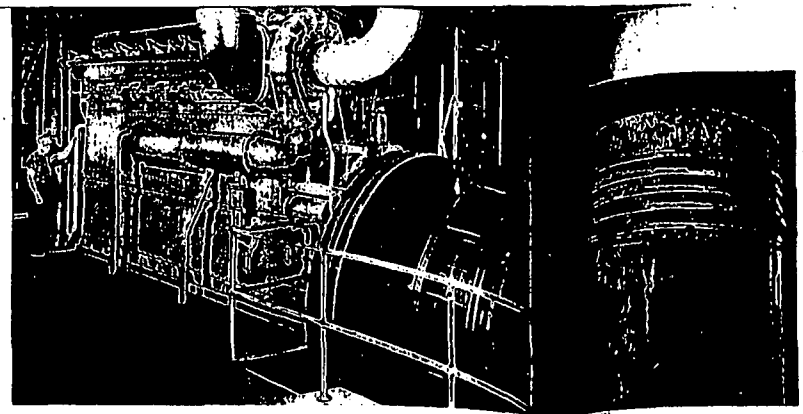

MODERN supercharged diesel gives efficient power to City of Menasha, Wisconsin. Operating know-how will keep this unit running for many years of very hard service.

1 Should bearing clearances be same in 4- and 2-cycle engines?

Some manufacturers have found that reducing 4-cycle engine bearing clearances by almost 50% improves engine operation. A 2-cycle engine has no reversal on main or crankpin bearings. But a 4-cycle engine has inertia forces at higher speed on the exhaust stroke that reverse the load. That causes an impact condition that breaks down the oil film locally. Proper engine alignment and closer bearing clearances in modern engines reduce bearing troubles on 4-cycle engines.

2 How do the new, vertical, radial diesel engines work on gas?

For burning gas, these engines operate on spark ignition at about 260 psi. Each cylinder has a gas-inlet valve, above the scavenging ports. These valves are actuated by rocker arms and push rods from a cam on crankshaft's upper portion.

Valves introduce low-pressure gas into cylinders in path of incoming scavenging air to assure thorough mixing. Two spark plugs are in a vertical plane. They fire at different crank angles, before top dead center. Amount of gas delivered to cylinders varies (depending on load on engine) controlled by valve in gas header that's connected to governor. Volume of scavenging air is also proportioned to load by throttling blower's suction.

3 Does fuel oil in a diesel cylinder stop burning when fuel injector closes and stops spraying oil?

No. There may be considerable afterburning after the injector closes, although theoretically there is none. After-burning depends on ignition temperature inside cylinder, how well fuel is atomized, other factors.

4 Why don't diesel engines have eccentrics instead of cams to open and close the valves?

Eccentric operation is too slow for a diesel engine. The cam, on the other hand, gives quick or slow opening and slow or quick closing, if desired, depending on shape of cam.

5 What is meant by term "torque at firing speed"?

Torque at firing speed is torque demanded by engine at speed that engine starts to run under its own power. This torque is largely used to overcome friction, but also includes torque needed to drive engine auxiliaries, such as fans, supercharger, fuel, water and lube-oil pumps.

Another thing that increases torque at firing speed is effect of compression and expansion. While a large part of energy put into compression is regained on expansion, recovery is not 100%. So additional torque must be supplied to make up these losses.

6 What is the dewpoint temperature of diesel exhaust gases?

Dewpoint of internal-combustion engine exhaust gas is usually from 110 to 130 F at atmospheric pressure. At 500 psi it is about 300 F. Dewpoint temperature may be much higher, depending on atmospheric relative humidity. Temperature also depends on exact composition of combustion products.

7 Where do knocks occur in diesels, and what are some causes?

Knocks often develop in large bearings, valve gear or inside diesel cylinders. Bearing knocks come from too much clearance. This may be from gradual wear or overheated bearing after bearing metal fails. Valve gear may knock because of excessive rocker-arm roller clearance. Also from worn or broken rollers or from sticking valve stems.

Knock inside the cylinder is from too early injection. Also from excessive spray-valve lift at low speeds, spray air pressure too high, or from stuck piston rings. Another knock might be from water in cylinder if liner or head is cracked.

8 Detergent oils are widely used in internal combustion engines today. Do they improve life of all engines?

Some designs, under certain conditions, work best with highly detergent oils.

Other diesel engines work best with medium detergent-dispersant activity, while still others of conservative design and rating work about same as with good, straight mineral oils. So it all depends on type of engine.

9 What are best safeguards against fuel-nozzle troubles?

Most nozzle troubles are from dirt in fuel and from nozzle overheating, not from breakage. First step is to use clean fuel. That means centerfuging or filtering. Next use a 2- or 3-stage filtering system between fuel-supply pump and injector pump. While engine is running, drain filters and strainers of water at set periods. When overhauling injection pumps and nozzles, keep foreign particles out of equipment.

...TYPE piston rings, upper grooves, ...t the hot gases from blowing by

...lder slow-speed engines were oper... with cooling-water discharge and ...l discharge temperatures of 100 ...0 F. Today, engines often run ...water and oil temperatures 180 ...5 F. Is this good practice?

...w-water temperatures of 120 F are ...r dewpoint. That causes lube-oil ...ing problems. High cooling-water ...peratures give better fuel economy. ...here are often other problems be... of too high temperatures.

...Raising lube oil above 150 F often ...ases oxidation rate of oil. With ...ed oils, inlet-oil temperature of ...F and outlet of 160 F is good prac... Keep water temperature above ...-oil temperature if engine has air-...ed pistons. Then cylinder will ex... more than piston, thus holding ...rance between piston and cylinder ...t. Run with water inlet of at least ...F and outlet of 170 F. But keep ...two temperatures within 15 de... if possible.

11 What are some common faults to look for in defective fuel nozzles?

...Look for incorrect spring tension. ...haps next most common fault is fuel ...jector valve not seating properly. ...eck for stuck nozzle valve-stems and ... erosion or grooving along stems. ...t inspect orifices for defects. Often ...zzle tips are clogged or carbonized. ...Hardest to find are broken springs or ...oken valves.

12 When diesel bearing fails, is it better to replace one pair or should you replace complete set?

...Some manufacturers recommend replacing bearings in sets. Remove a failed bearing at once, or it may cause other parts to fail. Reason is that bearings are inexpensive compared to crankshafts and other large parts. Best answer to replacing bearings in sets is knowing your engine. Past experience might indicate that only failed bearing need be changed.

13 Do piston-ring combinations have to be changed as an engine ages?

Some firms say yes. Changing to different ring combination as an engine ages might be an advantage, especially on larger engines.

While first set of rings is used, liner wear tapers gradually. There is also groove wear. Study engine performance. If oil consumption is high or engine output low, correct by using right rings for problem when replacing. There are many ring combinations to solve various problems.

14 What type oil filters do diesels have and do they remove all dirt from oil that enters or is produced by the engine during normal operation?

Filters are usually either full-flow or shunt type. One passes all oil through, while other bypasses part of oil. Full flow must be large to handle the volume, while shunt flow can be much smaller.

No filter can remove dirt unless it reaches filter. For example, some dirt settles in sump and remains there. Usually there is little settling if engine is operated normally. Only way an engine can be clean is for filter to remove all dirt. Fuel-flow filtering is popular today as it removes dirt sooner.

15 What is main cause of noisy combustion in a diesel engine?

Chief reason is high rate of pressure rise in cylinder during early combustion stages. During these early stages, increase rate should be about 30 psi per degree of crank angle. Experience shows higher rates usually cause a "rough-running" engine. Best way to know rate of pressure rise is to take "jerk" or "pull" cards. Do this by pulling cord of indicator drum by hand during compression-firing revolution of crank. This cannot be done on high-speed engine.

Such a card shows compression and firing pressure as a peak at top dead center of card. Line starts at zero degree crank angle at bottom center and rises very gradually to about 60 deg. Then rate of rise is more rapid until peak is reached at top dead center. On quiet engine, look for smooth combustion line with about same slope or pressure rise per degree of crank angle as the compression curve. Compression curve is lower part of this curve just before fuel is injected.

16 What determines the lubricating-oil consumption of a diesel engine?

Mechanical condition of engine is important. If piston rings are in poor shape, too much oil is pushed up the cylinder walls and so is lost. If rings fit poorly or are stuck, or if liner is tapered badly, hot combustion gas blows past rings and burns lubricating oil off the liner and piston. These are only some of the more common causes.

17 What are some of main causes of corrosion wear in engine cylinder?

Corrosion wear in diesel cylinders is always present. Under some conditions it is much greater than abrasive wear. Carbonic, sulfurous and sulfuric acids form when fuel oil is burned. These are most serious causes.

Best way to fight them is to use corrosion-resisting materials for cylinders and piston rings—and pistons. Then keep jacket cooling water high as possible and use lube oils with additives to fight your condition. High sulfur diesel-fuels make corrosion a constant problem in any type engine.

18 If your 4-cycle engine's camshaft is removed and the timing completely lost, how do you time the engine in a hurry?

A 4-cycle engine's intake valve opens from 10 to 20 degrees before piston reaches top dead center (TDC) and exhaust valve closes from 10 to 20 degrees past TDC.

For quick timing, jack piston of any cylinder to TDC, with the camshaft gear out of mesh. Then turn camshaft until the inlet valve just starts to open and the exhaust valve just starts to close. Mesh gears while camshaft is in this position. Timing is usually correct to one gear tooth, which is close.

Did You Know . . .

● 15c sent to U.S. Government Printing Office, Washington 25, D. C., will bring you a copy of National Bureau of Standards' Circular 506, *Automotive Antifreezes*. This gives about all the info you want on this subject, whether for stationary engines, trucks, or your own car.

● In first 11 months of 1952, Class 1 railroads installed 2840 diesel-power units. On Dec 1, there were on order 748 diesels, 19 gas turbines, 17 steam and 10 electric locomotives. "Good-by" steam engines.