Service Letter

General Information
No. 60
January, 1987

Subject: Fuel Related Problems – OMC Outboards and Stern Drives

Dear OMC Marine Product Dealer,

There is a great deal of information, some of it incorrect, being published in articles or advertisements concerning current fuels, their effect on outboard and stern drive engines and most recently additives for fuels to compensate for real or alleged deficiencies in current fuels.

1. TETRAETHYL LEAD – (TEL) has all but disappeared from current fuels. No more than 0.1 gram per gallon remains in "leaded" regular gasoline. This will probably continue since even this small amount helps to raise the fuel octane rating. The addition of TEL does not have a linear effect on octane rating; the first gram per gallon added has a much greater effect on octane number than the second or third, and above three grams per gallon, the increase is minimal. TEL in sufficient amounts lubricated and protected exhaust valve seats in four-cycle engines. 1974 and later engines manufactured have induction hardened valve seats. 1973 and earlier four-cycle engines without induction hardened valve seats, when run on unleaded fuel **at full throttle,** can suffer exhaust valve seat erosion (recession) sufficient to destroy the cylinder heads in 50 to 100 hours. Operation at reduced throttle settings will extend this life, but in no case will the heads last more than 200 to 300 hours in normal service.

1974 and later models with induction hardened valve seats will also suffer damaging valve seat recession in several hundred hours of **full throttle** operation on unleaded fuel. At part throttle "cruising" conditions, head life is greatly extended and should equal that of the earlier heads using leaded fuels.

TEL is not necessary for lubrication in two-cycle engines. Older outboards before 1950 ran on nothing but "Marine White Gas" without lead.

2. OCTANE RATING – Two-cycle and four-cycle engines need fuel of the proper minimum octane rating. Octane is a measure of a fuel's resistance to detonation - ignition due to pressure and temperature in the combustion chamber **before** spark plug firing or a secondary ignition on the far side of the combustion chamber after spark plug firing. TEL was the most economical method of achieving the desired octane rating. Continuous detonation can cause power loss and engine damage in the form of burned pistons and valves. There are two recognized methods for measuring the octane rating of a fuel: the "motor method" (MON) and the "research method" (RON). The octane numbers produced by the two methods of measurement on a given fuel are usually about ten numbers apart, the research method producing the higher number. Naturally the RON was the number used for advertising for many years, hence, we saw 94 octane regular and 100 octane premium gasolines. About ten years ago the government decided gasoline should be rated based on the average of the two rating methods - a number designated as the AKI (antiknock index). This lowered the pump posted rating about 5 or 6 points so we now have 87 to 89 octane regular and 92 to 94 octane "premium." But TEL is almost gone and other additives are now used to boost octane: alcohol, MTBE (methyl tert-butyl ether) and others.

3. ALCOHOL – Alcohol does raise the octane rating but it raises the RON more than the MON. The AKI may be the same, but the two-cycle engines in particular do not respond in the same way; the "old" 89 octane leaded regular and the "new" low-lead or no-lead 89 octane regular do not show equal knock resistance in the engine. For this reason some outboards manufactured five or more years ago had statements in the owner's manual indicating they could operate on leaded or no-lead fuel of 87 octane (AKI). These engines today may need ignition timing adjustments to run on current 87 octane fuels containing alcohol.

Alcohol has about half the heating value (energy) per pound than straight gasoline. Alcohol leans out the effective fuel/air ratio; 10% alcohol reduces the energy of the gasoline/alcohol blend by 5% compared to straight gasoline. Richer mixtures may be necessary to compensate, for good starting, idle and power at full throttle.

Alcohol comes in two forms: Ethanol (distilled from grain, sugar cane) and Methanol (wood alcohol). Both attract and mix readily with moisture. Alcohol and water mixtures are corrosive, particularly methanol and water. They can cause corrosion and failure of metal fuel tanks and carburetor bodies - anywhere where they can sit in the bottom of the bowl or container.

Ingestion of the alcohol/water mixtures into the engine can cause stalling and erratic running - just like water alone. Large water trapping fuel filters are a help, but may contribute to vapor locking problems - see 5 below.

Alcohol also causes deterioration of synthetic rubber compounds frequently used in fuel system components. Swelling of rubber parts in 1984 and 1985 outboard VRO pumps can occur causing fuel pump stoppage. Boat fuel hoses can deteriorate unseen, particularly near end fittings. They should be checked frequently. New alcohol-resistant rubber compounds are now available, and replacement parts are on the market. 1986 and later VRO pumps are alcohol resistant.

Alcohol in gasoline is not as common as it was a year ago. The lowering of gasoline cost has made it less economical to supplement gasoline with alcohol. Several major refiners now advertise the absence of alcohol from their fuels. Some independent "jobbers" in the fuel distribution system may still add methanol, which in bulk is cheaper than gasoline. Alcohol still remains as one of the ways to raise octane ratings.

Alcohol should be avoided, if at all possible. It can cause operational problems, failure of fuel system components and poorer fuel economy.

4. FUEL ADDITIVES – With the disappearance of TEL from gasoline, many additives have already appeared in the aftermarket to provide various benefits - some real, some imaginary. Additives containing lead are not illegal since they are not subject to governmental control. Additives to raise fuel octane level are possible as are those to offer valve seat protection for older engines. Such additives will probably damage catalytic converters on 1972 and later cars, but may be acceptable in older cars or marine engines.

OMC cannot adequately test all additives. This would require many engines, each run for hundreds of hours. We do not recommend for or against their use. Caution and common sense should apply.

Remember, outboards **do not** require lead or other fuel additives - only gasoline of the recommended octane rating. Always use a fuel of at least the motor manufacturer's recommended octane as delivered from the pump - without additives. Claims of increased horsepower for some additives are generally false. Straight gasoline of an octane rating that produces detonation-free operation will develop all the horsepower available from a given motor. Additives blended for the purpose potentially can reduce the valve seat recession process in four-cycle engines.

5. FUEL VAPOR PRESSURE AND VAPOR LOCK – All fluids exhibit a vapor pressure, the pressure developed inside a closed container of fluid. The vapor pressure developed will stabilize and be constant at any given temperature. The more volatile and easily vaporized the fluid, the higher the vapor pressure. Lowering the pressure in the container will speed vaporization. Sufficient lowering of pressure can cause boiling of the fuel the same as raising the temperature.

Typically, "winter grade" fuels with higher vapor pressure are available in the northern states in winter to aid starting and improve cold weather operation. Refineries today produce fuels with higher "aromatic" content and consequently higher vapor pressure. These fuels are more subject to "vapor locking" in the boat fuel system due to the high suction levels necessary to lift fuel up to the motor through anti-siphon check valves and lines from tanks in the bilge. Some cars now have fuel pumps in the fuel tank to push the fuel to the engine, which overcomes vapor problems. This is not allowed in marine fuel systems for safety reasons.

Motors may stop running and refuse to start due to vapor lock, particularly on warm days. Keeping fuel hoses out of the sun may help, but if problems persist, changing fuel brands may be the only answer, if the fuel system is free of abnormal restrictions. Anti-siphon check valves are not required if certain requirements, as cited in the ABYC (American Boat and Yacht Council) Standard H-24, are met. In general, the requirements are:

1. The fuel line is fireproof for at least 2-1/2 minutes (metal or with an approved insulating jacket – USCG Type A hose) at any point lower than the tank top, or
2. The fuel line is supported above the level of the tank top over its entire length so that no break in the line will result in siphoning fuel from the tank or the spilling of more than 5 ounces of fuel in the line.

Sincerely,

Ralph E. Lambrecht

Ralph E. Lambrecht,
Corporate Director of Service