

ENGINE FUEL

1. GENERAL

1.01 This section lists fuels for use in stationary engines, describes the use of an inhibitor to reduce the tendency of fuels to form gum, and covers method of cleaning fuel tanks.

1.02 It is reissued to include 2-D diesel oil per D-975 as a preferred diesel fuel, to discuss fuel for kerosene engines of the nondiesel type, and to add a caution against explosions. Changes are marked with arrows.

1.03 For engine fuel there is a stable period, long for some fuels listed herein as preferred and shorter for less stable fuels, during which oxidation, the cause of gum and sludge, progresses very slowly. After this stable period, oxidation progresses swiftly but the stable period can be lengthened enormously by the addition in the fuel of an antioxidant. It can be further extended by the addition of a metal deactivator to reduce the tendency of metals such as copper, brass, and zinc to accelerate oxidation of the fuel. The recommended gum inhibitor includes both an antioxidant and a metal deactivator.

1.04 After a satisfactory fuel has been found, it is desirable that future fuel be of the same kind from the same source. This is because mixing of fuels that were differently processed, made from different crude oils or treated with different additives, may cause precipitation of solids. The use of the gum inhibitor listed herein will be of no assistance in preventing such precipitation.

1.05 When adding fuel to tank, use care to prevent dirt entering the tank. Use only clean equipment when filling tank. If practicable, allow new fuel to settle for at least six hours before starting the engine.

Caution: Keep fire and sparks away from fuel and tanks to avoid fire and explosions. Partially filled tanks and even empty tanks that have held fuel contain explosive gasses.

1.06 Complete cleaning of fuel tanks is usually impracticable but sometimes bad conditions can be improved by pumping out the tank and washing with alkaline

water to remove as much dirt and sludge as possible and counteract any acid condition.

1.07 Information in this section is arranged under the following headings:

1. GENERAL
2. FUEL FOR DIESEL ENGINES
3. FUEL FOR KEROSENE ENGINES
4. FUEL FOR GASOLINE ENGINES
5. GUM INHIBITOR
6. CLEANING FUEL TANKS

1.08 List of Materials

Solvent, KS-8446, 1 pt. containers. Staybalene No. 261, General Bearing Cleaning Co., 4 oz. or 8 oz. containers. Cleaner, Pyrophosphate, 5 lb. or 100 lb. or equivalent.

2. FUEL FOR DIESEL ENGINES

2.01 The preferred fuels for diesel engines are:

- (a) Water white kerosene meeting federal specification VV-K-211b or
- (b) No. 1-D or 2-D diesel fuel oil meeting ASTM specification D-975.

Note: When 2-D is used, check that pour point is at least 10°F below lowest temperature to which it is to be exposed.

Fuels meeting these specifications are cleaner burning, more stable, and less likely to cause corrosion. Where these fuels are used, gum inhibitor is not required. New fuel should be added at least annually but the amount of new fuel need be only as necessary to replace fuel used up in service.

Note: In some areas local ordinances, insurance rulings, or other special requirements must be met. For example, in some areas the required minimum flash point is higher than permitted by the above specifications.

2.02 In emergencies and where justified by supply conditions or otherwise, kerosene or diesel fuel oil not known to be in accordance with the above specifications as well as No. 1 or No. 2 fuel oil may be used. Examples of such conditions would be locations where deliveries are limited or where it is desirable to operate heaters and engines from the same fuel supply. Where such fuels are used, they should have a pour point at least 10°F below the lowest temperature to which they are to be exposed, gum inhibitor should be added to the tank annually as outlined in part 5, and quantities of fuel in the tank should be held to such values that at time of adding gum inhibitor, new fuel can be added to the tank, the amount of new fuel to equal at least 50 per cent of the estimated amount of old fuel in the tank.

Note: The heavier fuels, such as the 2-D grade, tend to result in faster formation of carbon in the engine, particularly at light loads.

3. FUEL FOR KEROSENE ENGINES (Nondiesel type)

3.01 The preferred fuel for kerosene engines of the nondiesel type is water white kerosene meeting federal specification VV-K-211b. With this fuel, gum inhibitor is not required. New fuel should be added at least annually but the amount of new fuel need be only as necessary to replace fuel used up in service.

3.02 Where fuel not known to be in accordance with the federal specification is used, it should be of the water white grade. Gum inhibitor should be added to the tank annually as outlined in part 5 and quantities of fuel in the tank should be held to such values that at time of adding gum inhibitor, new fuel can be added to the tank, the amount of new fuel to equal at least 50 per cent of the estimated amount of old fuel in the tank.

4. FUEL FOR GASOLINE ENGINES

4.01 "Straight run" rather than "cracked" gasolines are preferred as fuel for gasoline engines. They remain stable and gum-free for longer periods, are easier to lift from buried tanks, and are less subject to vapor locks. Where straight run gasoline is used, gum inhibitor is not required. New fuel should be added at least annually but the amount need be only as necessary to replace fuel used up in service. Since straight run gasoline is not available generally, it will usually be necessary to use one of the fuels listed in 4.02 or 4.03.

4.02 Next to straight run gasoline in preference is white (nonleaded) gasoline. With white gasoline, gum

inhibitor should be added every six months as outlined in part 5 and quantities of fuel in the tank should be held to such values that at time of adding gum inhibitor, new fuel can be added to the tank, the added amount to be at least 25 per cent of the estimated amount of old fuel in the tank.

4.03 Where leaded gasoline must be used, it is suggested that it be of the regular or nonpremium grade to reduce the amount of lead likely to be deposited on engine parts. There may be some locations where it will be desirable to use the premium grade because of its slightly easier starting and smoother running under heavy load conditions. With either regular or premium grade leaded gasoline, as with white gasoline, gum inhibitor should be added every six months plus at least 25 per cent of new gasoline.

5. GUM INHIBITOR

5.01 The recommended gum inhibitor for engine fuel is Staybalene No. 261. It has a flash point of about 115°F and when mixed in the quantities recommended, will not interfere with engine operation. Vapor from it is nontoxic under normal conditions of ventilation and contact with the skin will not, in general, produce allergy but such contact should be held to a minimum. It will not dissolve or loosen gum already present in the tank or piping.

5.02 Where there has been trouble from gum in the past or the supervisor feels that some additional work to clean the tank is justified, the old fuel should be pumped out and discarded, the tank should be treated with alkaline water as described in part 6 and in the case of gasoline engines, the carburetors should be removed and cleaned with KS-8446 solvent. When replacing carburetors use new gaskets. In extreme cases of gum, it may be necessary to have diesel engine injectors serviced by the engine manufacturer.

5.03 At intervals recommended in part 2, 3, or 4 add, as nearly as practicable, using 4 and 8 oz. containers, one ounce of gum inhibitor for each 12-1/2 gallons of fuel (sum of estimated amount of old fuel in the tank and new fuel to be added). Pour the gum inhibitor into the tank before adding the new supply of fuel. This is to take advantage of the mixing caused by adding the new fuel.

6. CLEANING FUEL TANKS

6.01 This treatment is to clean a tank as much as practicable and also assure that the water on the bottom of the tank will be alkaline rather than acid. It is not proposed for wholesale application but

there is no objection to its use where local supervision feels that the expense is justified and proper precautions are taken to avoid explosions. Some of the conditions that might justify the treatment are (a) first application of gum inhibitor at locations having had trouble from gum, (b) where tank has been pumped out for other reasons or, (c) where there is suspicion of acidity.

6.02 When authorized, treat tank as follows:

- (a) Be careful to avoid explosions. ←
- (b) Pump out as much of the contents of the tank as can be reached by the water draw off pipe.
- (c) Prepare a well dissolved alkaline concentrate consisting, in order of preference, of approximately 8 ounces of pyrophosphate cleaner (tetrasodium pyrophosphate) to a gallon of water, 8 ounces of TSP (trisodium phosphate) to a gallon of

water, or 24 ounces of washing soda (hydrated sodium carbonate) to a gallon of water. Pour into the tank a gallon of the concentrate for each 32 gallons of tank rated capacity. Example, a 1000 gallon tank would require $1000 \div 32 = 31$ gallons of concentrate. $31 \times 8 = 248$ oz. (say 15 pounds) of pyrophosphate cleaner to make up the concentrate.

- (d) After pouring in the concentrate, fill tank about half full of water using a connection from water system or other pressure as feasible to get as much mixing and washing action as possible.
- (e) Pump off as much of the contents as can be reached by the water draw off pipe.
- (f) Add gum inhibitor if required, and then new fuel.
- (g) Allow to settle for at least 24 hours before starting engine.

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