

CHAPTER 5

FUEL OIL SYSTEMS

5-1. Minimum maintenance activities for fuel oil systems

The tables located at the end of this chapter indicate items which must be performed to maintain systems and equipment at a minimum level of operational readiness. The listed minimum action items should be supplemented by manufacturer-recommended maintenance activities and procedures for specific pieces of equipment. Maintenance actions included in this chapter for various modes of operation, subsystems, or components are summarized in table 5-1, Fuel Oil System.

5-2. General maintenance procedures for fuel oil systems

This section presents general instructions for maintaining the types of components associated with fuel oil systems.

a. Inspect fuel oil system. Start at the outdoor fuel oil storage tanks and follow the fuel oil system piping all the way to the diesel engine-generators. Inspect for the following.

- (1) Leaking pipe joints and/or corrosion
- (2) Missing identification tags on system valves and components
- (3) Sagging or misalignment of piping
- (4) Fuel oil leaks or spills. Inspect containment area for the storage tanks for cracks or any other inconsistencies.

b. Exercise valves. Exercise all valves in the fuel oil system.

- (1) Inspect packing gland and tighten if necessary.
- (2) Check for correct positioning and operation.
- (3) Check for leaking seals.
- (4) Adjust operator linkages and limit switches on control valves.

c. Clean strainer. Change strainer basket by turning change valve handle to isolate one of the baskets from service. Remove cover and basket screen. Clean and reinstall screen in strainer in same position as before and tighten cap. Place cleaned basket in service by turning the change valve handle. Clean other basket screen.

d. Replace filter elements. Replace coalescing filter elements when differential pressure has increased above design standard. Follow manufacturer's instructions for filter element replacement.

e. Check fuel levels. Check the level of fuel oil in each storage tank. Check these levels from the central control console and from each tank mounted level indicator. Fill the storage tanks as required.

f. Check level controls. Check the operation of level controllers by draining fuel oil from the day tanks. Allow the fuel oil transfer pumps to start and stop automatically. Note the level in the day tanks at which the pump starts and stops, and the respective control opens and closes. This procedure should be done on one day tank at a time.

g. Test alarms. Verify that the horns sound and all annunciator lights illuminate by pressing the appropriate test push buttons. Press the ACKNOWLEDGE and RESET push buttons when proper operation has been confirmed.

h. Check tank heaters. Verify that all fuel oil heaters are operating correctly.

i. Dewater day tanks. Drain water and sediment from day tanks by momentarily opening drain valve to flush out these contaminants.

j. Lubricate rotating equipment. Grease all zerks at the manufacturer-recommended service interval. Grease gently with a handgun to avoid damage to grease seals. Do not overgrease.

(1) Ball or roller bearings tend to heat up when overgreased and will cool down to normal running temperatures when the excess grease either oozes out or is wiped off. The normal operating temperature of a bearing may be well above 140°F, which is "hot" to touch. Temperatures should be checked with a thermometer and any temperature readings over 180°F should be questioned. If a drop of water placed on a bearing sizzles, the bearing is in distress and should be changed before it seizes and ruins the shaft. For sleeve bearing assemblies with oil reservoirs, service reservoirs at manufacturer's recommended interval with recommended viscosity lubricating oil. Do not overfill reservoir as overheating may result. When new sleeve bearing units are placed in service, drain and flush the oil reservoir after about two weeks of operation and refill the reservoir with new lubricating oil of the proper viscosity.

(2) During equipment overhauls, bearing assemblies should be thoroughly cleaned, inspected, and adjusted in accordance with the manufacturer's recommendations. All old grease should be removed from bearings and the bearings repacked with grease a minimum of every two years. Monitor the operation of all recently installed bearings. Check for overheating (alignment, lubrication), vibration (alignment), loose collars, fasteners, etc. Early problem detection can avoid early failure and costly replacement.

k. Packing adjustment. Occasional packing adjustment may be required to keep leakage to a slight weep; if impossible to reduce leakage by gentle tightening, replace packing. A slight weeping through the packing gland is required so that the process fluid provides lubrication for the packing material. Maintain a supply of the recommended type and size of packing required for the equipment. Do not substitute one type of packing with another without verifying the packing types are compatible. Do not use oversized packing. If diameter of oversized packing is reduced by hammering, early failure of packing may result. A too tight packing joint may interfere with equipment operation, can damage equipment, and, again, may result in early failure of the packing. A typical procedure for replacing common types of packing is as follows.

(1) Remove all old packing.

(2) Inspect shaft for wear and replace as required.

(3) Use proper sized packing and cut packing into rings using the shaft as a guide. When cutting to length, hold packing tightly around shaft but do not stretch packing. Cut with a butt joint. **Do not wind packing around shaft.**

(4) Thoroughly clean shaft and housing.

(5) Install one ring at a time. Oil or grease lubrication, if permitted, will assist when packing the ring into the box. Offset joints of each succeeding ring by at least 90 degrees from the previous ring.

(6) If shaft is equipped with a lantern ring, be sure that lantern ring is slightly behind lubrication hole in stuffing box; otherwise, the lantern ring will move forward when the gland is taken up and the packing behind the ring may plug the lubrication hole.

(7) Tighten the gland bolts all the way to seat the packing. Then loosen the nuts until the nuts are finger tight. In most applications, newly installed packing should be allowed to leak freely on startup. After startup, tighten packing gland until only 2 to 3 drops a second are leaking. **Do not try to stop leakage entirely.** The leakage lubricates the packing and prevents early failure of the packing and shaft.

l. Mechanical seals. There are many different mechanical seal designs. As a result, there are no standard procedures for maintaining and installing mechanical seals. Mechanical seal installations commonly fail because the seal was not placed in the correct position. Seal faces may wear rapidly resulting in early seal failure if the spring has too much initial compression. This results in too much force between the faces of the seal which does not allow proper lubrication of the surfaces. Alternatively, if the spring has too little initial compression, the seal faces will separate at normal operating pressures and leak. It is important that manufacturer's information for the seals used be obtained and closely followed. In general, there are four critical requirements in any seal installation as follows.

(1) Determine that the equipment is ready to have the seal installed, shaft and seal housing have been inspected and repaired as required, and components have been thoroughly cleaned.

(2) Place the seal in the correct position for the right operating length (consult manufacturer's data).

(3) Prevent damage to seal rings.

(4) Prevent damage to seal faces.

m. Transfer pump end clearance adjustment. After long service, the running clearance between the end of the rotor teeth and the head may increase to the point where the pump is losing capacity or pressure. Resetting the end clearance will normally improve pump performance. Refer to the manufacturer's Technical Service Manual.

n. Examine internal pump parts. Periodically, remove the head and examine idler bushing and head and pin for wear. Replacing a relatively inexpensive idler bushing and idler pin after only moderate wear will eliminate the need to replace more expensive parts at a later date.

o. Clean all equipment. Clean all equipment regularly. Clean equipment is easier to inspect, lubricate, and adjust. Clean equipment also runs cooler and looks better.

p. Clean flame arresters. Disassemble the flame arrester and clean dirt and dust from plates and surfaces. Use extreme caution when working around fuel oil vapors. Reassemble the arrester.

q. Inspect engine fuel oil components. Inspect diesel engine mounted fuel oil system components daily. Check for leaks or any inconsistencies.

r. Dewater strainers and filters. Drain water from primary strainer and secondary fuel oil filters daily by momentarily opening drain valves to flush out sediment and water.

s. Inspect fuel oil cooler. Clean coils and check proper setting and operation of thermostats.

t. Flexible coupling installation and alignment. These instructions cover, in general, the installation of flexible couplings of the pin, gear, or grid types.

(1) Verify that equipment the coupling is serving is completely assembled and adjusted before installing drive coupling.

(2) Install each half cover with seals on its shaft. Consult coupling manufacturer's data to determine proper orientation of long and short shanks of coupling.

(3) For non-taper lock hub units, heat coupling to approximately 300°F by means of a hot oil bath or oven. **Do not apply flame to hub teeth.**

(4) Install coupling hubs on motor and driven shafts. Install shaft keys while hubs are still hot. Face of hub should be flush with end of shaft.

(5) Adjust clearance between the coupling faces. Consult manufacturer's data for proper clearance. (Some coupling units may have required clearance stamped on coupling unit.)

(6) When a sleeve bearing motor is used, locate motor so that when the motor rotor is closest to the driven shaft, the motor shaft will not touch the driven shaft. If the motor shaft has a magnetic center marked, base clearance between coupling faces on magnetic center. Otherwise, determine maximum motor shaft movement and base clearance between coupling faces on one half the motor shaft movement.

(7) With tapered wedge, feeler gauges, or dial indicator, verify that faces of coupling hubs are parallel.

(8) Using a straightedge or dial indicator, verify that motor and driven shafts are parallel. Shim and adjust as required.

(9) After alignment of shafts is obtained, recheck spacing between hub faces and verify that faces are parallel to within 0.001 inch.

(10) When alignment is complete, thoroughly clean both sides of the coupling and inspect all parts for damage. Install the gasket and draw the coupling flanges together keeping gasket holes in line with bolt holes. Insert and tighten bolts, lock washers and nuts. Lubricate coupling in accordance with manufacturer's data. When aligning shafts, a general rule is to align large motor shafts so the center of the motor shaft is 0.001 inch lower than the driven shaft for each 1 inch of motor shaft diameter. Turbine shafts or similar large rotating equipment as a general rule are set 0.001 inch lower than the driven shaft for each 1 inch of height from the mounting feet to the center of the shaft. This initial offset provides for thermal expansion of the equipment. After the equipment has been in operation long enough to reach operating temperature, the alignment of the shafts should be checked and adjusted as required.

Table 5-1. Fuel oil system

Fuel Oil System	
<i>Action</i>	<i>Frequency</i>
Inspect engine fuel oil components.	day
Dewater strainers and filters.	day
Check fuel level gauges.	day
Manually check fuel level.	week
Inspect fuel oil system.	mo
Exercise valves.	mo
Exercise fuel circulation system.	mo
Clean strainers.	mo
Replace filter elements.	mo
Check level controls.	mo
Test alarms.	mo
Check tank heaters.	mo
Dewater fuel tanks.	mo
Circulate day tank to main holding tank.	mo
Clean all pumps.	mo
Inspect fuel oil coolers.	mo
Transfer pump packing adjustment.	2/yrs
Clean flame arrester.	2/yrs
Transfer pump end clearance adjustment.	yr
Examine internal pump parts.	yr
Pressure gauges.	yr
Temperature indicators.	yr
Lubricate transfer pumps.	6/yrs
Inspect and clean fuel tanks.	3 mos
Paint fuel tanks.	as required