SERVICING SCHEDULES

Introduction

Operators are advised that the following Servicing Schedules constitute the minimum recommended servicing requirements and should be used as a basis for the preparation of a Schedule to suit whichever type of maintenance system (i.e. Planned Maintenance, etc) that is adopted by the operator.

Apart from the Daily Inspection and the servicing of installation components, and heat exchangers, all inspection periods are based on recorded engine running hours, and a log of engine hours run should be maintained. To provide a degree of flexibility a tolerance is permitted on each inspection, but this tolerance is not cumulative; that is every inspection is due to be carried out at the time specified regardless of any delay on previous inspections.

When more than one inspection is due at the same time (for example the 50 and 250-hour inspections at the 500-hour inspection) the relevant tolerance for each inspection must not be exceeded. The tolerances are as follows:-

At 50 hours and multiples of 50 hours . . . + 5 hours
At 250 hours and multiples of 250 hours . . . + 25 hours
At 500 hours and multiples of 500 hours . . . + 50 Hours

The importance of using clean fuel and clean lubricating oil cannot be over-emphasised. Materials used for engine cleaning must not include either cotton waste or gasoline.

DAILY INSPECTION BEFORE RUNNING

If the engine has been idle for a period of 4 weeks or more, the engine must be turned by hand turning tool, before starting. The engine must also be hand-turned before starting after any major component has been replaced.

General

1. Check that all air intake and exhaust outlet blanks have been removed.

Lubricating System

1. Check the level in the service oil tank
2. Check the system for leaks
3. Open the inlet cock (if fitted)

Cooling System

1. Check the level in the coolant header tank
2. Check the system for leaks
3. Open the sea-water cocks

Fuel System

1. Check the level in the fuel tanks
2. Check the system for leaks
3. Check for the presence of water in the fuel, and drain off any water
4. Open the cock in the main fuel pipe line.

Control System

1. Check the engine controls for security and for free operation
2. Check that the engine control lever is at NEUTRAL and the shut-down lever is at STOP

Starting System

1. Check that the air pressure in the system is sufficient to start the engine and open the main air supply cock
2. Check the system for leaks

INSPECTION AFTER RUNNING

Lubricating System

1. Check the level in the service oil tank and top up as necessary
2. Check the system for leaks and rectify as necessary
3. Shut the oil inlet cock (if fitted)

Cooling System

1. Check the level in the coolant header tank and top up as necessary
2. Check the system for leaks and rectify as necessary
3. Shut the sea-water cocks

Fuel System

1. Check the level in the fuel tanks and top up as necessary
2. Check the system for leaks and rectify as necessary
3. Shut the cock in the main fuel pipe line

Control System

1. Check the control lever is at NEUTRAL and the shut-down lever is at STOP

Starting System

1. Check the system for leaks and rectify as necessary
2. Close the main air supply cock

Cold Weather Precautions

Close all air intake ducts, exhaust outlets and engine room hatches. In extreme low temperature maintain engine room temperature at a minimum of 50°F (10°C)

EVERY 50 HOURS

A plus 5-hour tolerance is permitted

Engine

1. Check that all pipes and joints are secure and free from fractures
2. Check that all air-inlet duct drains are clear
3. Apply a grease gun, containing the grease specified to all grease nipples

Cooling System

Ensure that the sea-water strainer is clear

Control System

1. Smear the control rod fork ends on the engine and the connecting couplings between the fuel injection pumps with the appropriate grease.

EVERY 250 HOURS

A plus 25-hour tolerance is permitted

Engine

1. Check all external nuts, bolts and lockings for security
2. Inspect the exhaust manifold gaskets for leaks, and the nuts for tightness.
3. Check the tightness of the engine holding-down bolts.
4. Check the setting of the clutch delay switch
5. Grease the Cardan shaft coupling with the grease taking care not to overcharge the coupling

Lubricating System

1. Analyse the oil and change it if necessary
2. Remove, clean and replace the scavenge pump and trailing oil pump strainers
3. Remove, clean and replace the turbo blower supply strainer
4. Remove, clean and replace the pressure reducing valve strainer
5. Remove, clean and replace the priming pump oil strainers
6. Remove, clean and replace the Vee drive oil strainer

Coolant System

Check the specific gravity and pH value of the ethylene glycol solution.

Fuel System

1. Remove, clean and replace the fuel priming pump strainer

EVERY 500 HOURS.

A plus 50-hour tolerance is permitted.

Engine

1. Remove, clean and replace the cold start fluid nozzles

EVERY TWELVE MONTHS.

Instruments.

Check and calibrate all instruments, thermocouples and exhaust temperature indicators

ENGINE OVERHAUL PERIOD

Clean and flush the pipes and tanks in each system. Dismantle, clean and pressure-test the heat exchanger and oil cooler.

MAINTENANCE INSTRUCTIONS

Lubrication System

Oil Priming

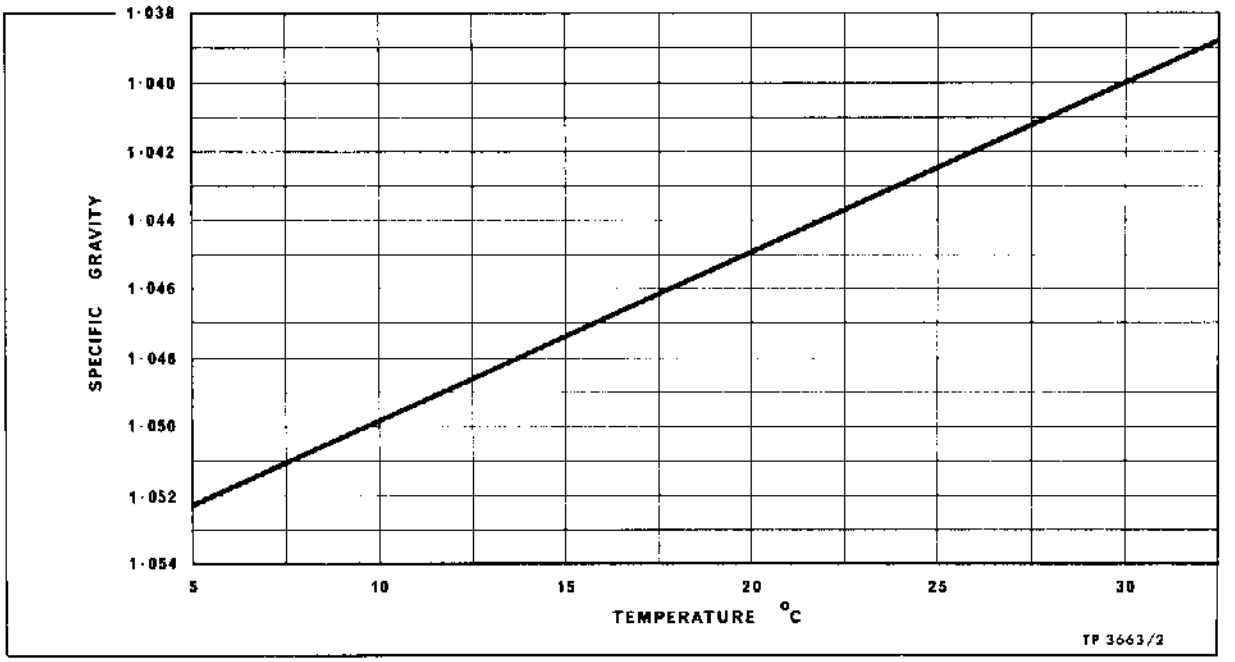
When the lubrication system is broken for any reason (by the removal or replacement of a component, etc.) the system must be primed. Operate the oil priming pump to fill the filter casing and passages while turning the crankshafts through one revolution, 18 turns of the hand turning tool. To avoid overpriming the system, stop priming when the crankshafts have been turned through one revolution. Do not top up the service oil tank until the engine has run a few minutes. Topping up without this precaution may result in overfilling the system.

Draining

A suction drain on 'C' side of 'CA' crankcase is connected by pipe to a semi-rotary hand pump. A cock adjacent to the pump permits sump oil to be pumped back to the service tank or, if the tank is full, to conveniently sized container. Shut the lubricating oil inlet cock and operate the sump drain pump until oil ceases to flow. Remove the filter casing drain plugs and drain the filter casing.

Oil Changing

Should it become necessary to change the oil in the lubrication system, drain the engine as above and drain also the service tank and the oil cooler, discard the oil. Remove, clean and replace the scavenge strainer, Fill the service tank with the approved oil and prime the system. Run the engine for two minutes and top up the service tank.



SPECIFIC GRAVITY

Cleaning the Strainers.

Strainers in the lubrication system should be removed and cleaned with clean paraffin or fuel and a soft brush. Do not use rag or cotton waste. Renew joint washers where necessary when re-fitting the strainers.

Inspecting the Main Oil-Filters.

The filter elements must not be cleaned; a choked or damaged filter element must be renewed. Whenever a filter element is removed, new end pads must always be fitted, whether or not the element is renewed.

Ethylene Glycol.

Ethylene glycol is normally supplied in the inhibited state. If uninhibited glycol is used it must be treated with a suitable inhibitor before mixing with water.

To prepare an ethylene glycol and water mixture, pour the required quantity of water into clean carboys and add the correct quantity of inhibited glycol. The glycol must be poured into the water slowly and the mixture constantly stirred. After mixing check the specific gravity of the mixture.

Testing Ethylene Glycol.

Check the specific gravity and temperature of the ethylene glycol mixture, first stirring the mixture thoroughly to ensure that each hydrometer reading is representative of the bulk mixture. The figures obtained must conform to the graph opposite. If the specific gravity is low, add glycol until the figures obtained are correct.

Fuel System.

Priming

Priming of the engine fuel system is effected by operating a hand pump situated in the engine room beneath the control booth window. Open the priming cock and operate the hand pump.

The hand pump delivers fuel to a two stage valve unit mounted on the 'C' side top slope of the phasing gear case. Initially this unit passes the fuel to the starting accumulator and, when this unit is fully charged, a valve within the two stage unit is opened to admit fuel to the engine sytem via the engine driven fuel circulating pump by-pass valve.

If the fuel system has been disturbed by the removal of a component, carry out the priming operation while depressing, in turn, the Schrader valves on each of the fuel injection pumps.

Inspecting the Filters.

The filter elements must not be cleaned; a choked or damaged filter element must be renewed. Whenever a filter element is removed and dismantled for inspection, new end pads must be fitted, whether or not the element is renewed.

Controls

Setting and Checking the Controls.

If control rods, fork ends, pivots or link bolts show signs of wear, the effected parts should be renewed.

Certain settings are carried out on the test bed or component test rig and, once disturbed, cannot be easily restored, Two worm adjusters and one turnbuckle adjuster are provided in the engine control system for setting the controls and no other adjustment should be made.

Setting the Injection Pump Control Shafts.

Phasing the injection pumps control shafts one to another is carried out by turning the worm adjuster at the drive end of 'A' and 'C' camshaft casings. On no account must the worm adjusters between individual pumps be touched; these have been set on a special rig.

Disconnect the governor output linkage from the 'B' injection pumps control shaft lever. Insert the setting pin in 'B' camshaft casing end cover and into the indicator arm. With the pin engaged, check that the reading on all three camshaft casing scales registers 124^{0}. If necessary adjust 'A' and 'C' to conform with this reading, when their respective setting pins may be entered in the same manner as 'B'. After adjustment re-lock the worm adjusters and reposition the setting pins in their respective stowage holes.

Move 'B' injection pumps control shaft lever over the full range of movement from minimum to maximum setting and, at 10^{0} intervals, check that the scales of the three injection pumps control shafts are within $\pm \frac{1}{4}^{0}$ throughout the range.

Return the lever to the minimum setting, connect and secure the linkage between the governor and 'B' injection pumps control shaft lever.

Phasing the Governor and Control Linkages.

Hold the governor output lever firmly at the idling setting on the governor output scale (0^{0}). Adjust the length of the link rod between the governor output lever and the bell crank lever on 'B' injection pumps control shaft until the scale on 'B' camshaft casing indicates 96^{0}.

Phasing the Givernor to the Hydraulic Control Unit.

Remove the detent plunger and housing from the hydraulic control unit cable wheel cover. Remove the circlips and caps over the restrictor tubes and slide the tubes upward. Remove the cable wheel cover.

Unscrew the setting pin from its stowage position in the governor hand lever, and screw it into the setting hole so that the pin engages the blind hole in the cable wheel cover. Unscrew the pillar nut and push the camshaft inward to disengage the splined coupling and enable the cable wheel to turn freely. Thread the control cable through the governor cable wheel housing and through the conduit until the end enters the hydraulic control cable wheel housing. Secure the cable end to the hydraulic control unit cable wheel with the cable clamp.

Turn the hydraulic control unit cable wheel to the neutral position and replace and secure the cable wheel cover. Replace the detent plunger ensuring that the roller engages the notch in the lock ring. Fit a distance piece of suitable length in place of the detent plunger spring and replace the housing thus firmly locking the roller into the groove in the lock ring. Re-position the restrictor tubes and replace the caps and circlips.

Pull the governor speed-control camshaft outward to engage the splines with the cable wheel hub, turning the cable conduit adjuster as necessary to permit the splines to mate without moving the hydraulic control unit cable wheel from the neutral position. Replace and tighten the pillar nut, connect the control cable at the break unit and adjust both the bridge and control booth levers to NEUTRAL by means of the cable conduit adjusters. Remove the detent plunger housing on the hydraulic control unit, remove the slave distance piece and replace the spring. Replace the housing. Remove the setting pin from the governor hand lever and replace it in its stowage hole.

To check the operation of the controls over the full range of travel without running the engine it will be necessary to manually withdraw the hydraulic gate plungers. Remove the plugs and screw a 3 inch 2 B.A. bolt into each plunger. The plungers may then be lifted by pulling on the bolts.

Hunting in Neutral.

In the event of an engine "hunting" when the engine is set at NEUTRAL under steady running conditions and the "hunt" is not associated with starting, the governor may be considered suspect and should be changed.

Setting the Retractable Maximum Stop.

When a governor has been changed the maximum stop setting on the replacement governor may not be the same as the one it replaced. The setting is marked in degrees, stamped in $\frac{1}{4}$ inch (6m.m.) characters on the mounting flanges of the governor and the phasing gear casing. If necessary, the retractable maximum stop on the replacement governor must be reset to agree with the setting marked on the phasing gear casing.

Emergency Control

Should damage to the control levers or cables prevent normal operation of the controls, the cable should be disconnected at the break unit and the engine operated from the governor hand control lever.

Setting the Gear Change Delay Switch

Disconnect the 'C' injection pumps control rod by removing the bolt. Using a test lamp adjust the switch so that it closes at a fuel pumps control shaft setting of 103 to 104° and opens at a setting of 110 to 111. To adjust the switch slacken the clamping bolt and turn the shaft with a screwdriver. To increase or decrease the angular difference between the opening and closing, the switch must be moved on the bracket which has slotted holes for the fixing bolts. After adjustment connect the control rod.

Starting System

Air Starting Valve

To clean and test the air starting valve, remove the small union from the valve body and the nut from the end of the valve stem. Withdraw the poppet valve, spring and valve piston. Clean all components with fuel and lap the valve and seating if necessary. Renew the piston rings on the piston. Assemble the valve components without lubricant.

Apply air pressure at 450 lb/in^2 (31.65 kg/cm^2) to the large union. Check for leaks at the valve seating and at the small union with soapy water. No leaks should be apparent at the poppet valve or at the union. Apply air pressure at 450 lb/in^2 (31.65 kg/cm^2) to the small union and check that the valve opens immediately.