SECTION DB

FAULT FINDING

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CHAPTER 1

STARTING DIFFICULTIES

Starting and running difficulties are often caused by incorrect adjustment as well as by neglect. Care should be taken to avoid making unnecessary adjustments to an engine which is performing satisfactorily. The reason for, and the effect of each adjustment must be clearly understood before commencing. This applies particularly to such equipment as the fuel injection pumps and nozzles. Any adjustments should be carefully logged for future reference.

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| SYMPTOM | POSSIBLE CAUSE | REMEDY | REFERENCE |
| Engine does not turn. (Engine should turn at about 120 rev/m in) | Starter batteries discharged  Fault in starter motor contacts or relay  Fault in starter motor solenoid | Recharge batteries.  Check operation of starter motor contacts and main field relay.  Check operation of solenoid. | Section ND  Section NA  Section NA |
|  | Start circuit locked out due to shutdown by control system | Check for shutdown due to fault condition. Clear fault to re­instate start circuit. |  |
|  | Starter motor pinion jammed | Bar engine round to release pinion. If pinion continues to jam on further start attempts remove starter motor,strip and clean. Refit motor and check pinion tooth backlash and end clearance. | Section NA |
|  | Starter motor fails to turn | Motor overheated, start circuit locked out by internal thermo­static switch. Allow to cool before attempting restart. | Section NA |
|  | Starter motor damaged | Renew starter motor. |  |
|  | Motor turns but pinion does not engage with starter ring | Check pinion moves freely over its full travel. Check operation of pinion actuating solenoid. | Section NA |
|  | Load engaged | Disengage load. |  |
|  | Water in cylinders, or other engine mechanical problem | Check if engine can be turned by hand. |  |

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| SYMPTOM | | POSSIBLE CAUSE | REMEDY | REFERENCE | |
| Engine turns but does not fire | | Lack of compression | Check compression on all cylinders. Check tappet clearances. |  |  |
|  | |  | Check for bent and sticking valves and/or broken springs.  (A sticking valve can sometimes be eased by pouring a 50/50 mixture of lubricating oil and fuel oil through the valve springs). | Section FA | |
|  | |  | Check pistons and liners for wear and/or broken or sticking piston rings. | Section FB | |
|  | NOTE | Excessive vapour from the crankcase breather indicates that attention is necessary to the piston rings and liners | | |  |
|  | |  | Check cylinder head joint(s) for leaks. Tighten cylinder head nuts. If this not effective, renew joint(s). | Section FA | |
|  | | Valve and fuel injection timing incorrect | Check timing and set, if necessary. | Section CC | |
|  | | Ambient temperature too low | Pre-heat engine, or use cold starting equipment. | Section NA | |
|  | | Lack of fuel at injection pumps | Check fuel tank is full and supply turned on. |  |  |
|  | |  | Check for obstruction in piping. Inspect fuel piping for leaks. Check air vents are closed. |  |  |
|  | |  | Clean fuel filters and coalescer filter. | Section GE | |
|  | |  | Check fuel feed pump. | Section GB | |
|  | |  | Vent fuel system. | Section DA | |
|  | | Unsatisfactory fuel | Drain fuel tank and system and refill with fuel oil of recommended specification. | Section GA | |

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| SYMPTOM | POSSIBLE CAUSE | REMEDY | REFERENCE |
| Engine turns but does not fire (Contd) | Water in fuel | Drain fuel tank, coalescer(s) and filters. Disconnect and clean out supply piping to engine,  (low bends must be disconnected). Refill, prime and vent the system. | Section DA |
|  | Excessive fuel delivery at fuel injection pumps | Check that fuel limiter is functioning. Excessive fuel delivery under starting conditions may prevent starting. | Section HB |
|  | Injector nozzles dirty or sticking. Low release pressure | Fit reconditioned assemblies or clean and test existing injectors. | Section GH |
|  | Fuel injection pump(s) not functioning | Refer to notes on pump faults and servicing. | Section GF |
|  | Governor defective | Check oil level in governor. If oil usage is high, check drive shaft seal. Check piping joints to starting accumulator. Check that fuel racks open when the engine is cranked. Check operation of governor drive. Fit replacement governor, if necessary. | Section HA |
|  | Fuel racks do not operate | Check that linkage is free and correctly set. | Section HC |
|  | Overspeed trip and/or air shutdown valve operated | Reset overspeed trip governor and/or air shutdown valve. | Section HB and HD |
|  | Air filters blocked | Clean. | Section LA |
|  | Control system | Check that system is not giving a shutdown to governor during 'run-up'. |  |

CHAPTER 2

RUNNING DIFFICULTIES

The satisfactory performance of the engine depends on three essential factors - correct fuel injection, correct compression and efficient lubrication

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| SYMPTOM | | POSSIBLE CAUSE | REMEDY | REFERENCE | |
| Low lubricating oil pressure | | Low sump level | Top up with oil of the same grade and make, to the level on the dipstick. | Section JA | |
|  | | Suction strainer or piping choked. | Drain and clean out sump. Clean strainer. Flush out suction piping. |  | |
|  | | Oil pressure gauge faulty | Test gauge, and replace if necessary. |  | |
|  | | Oil filter or cooler dirty or blocked | Clean or replace as necessary. | Section JF | |
|  | | Loose oil connections | Check all connections and joints for security. |  | |
|  | | Pressure circuit relief valve not functioning correctly | Examine valve for sticking Check the blow-off pressure. Re-adjust to correct setting, if necessary. | Section JE | |
|  | NOTE | Mark the pressure relief valve assembly before dismantling so that the same setting can be retained. | | |  |
|  | | Oil pumps worn or leaking | Remove pump from engine and check for wear or leakage. | Section JC | |
|  | | Engine bearings worn | Examine crankshaft and bearings. | Section FF | |
|  | | Oil overheated | Check oil cooler and clean. Check operation of lubricating oil thermostat. | Section KF | |
|  | | Fuel dilution | Check injectors, fuel injection pumps, non-return valves, and fuel spill drains in cylinder heads and fuel feed pump. | Section GH | |

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| SYMPTOM | POSSIBLE CAUSE | REMEDY | REFERENCE |
| Loss of speed and power | Overload, (if exhaust is black) | Load control portion of governor not operating correctly. Fit new governor. | Section HA |
|  | Obstruction in fuel supply to injection pumps | Change filter element. Disconnect and clean out fuel piping. Vent the fuel system. | Section GE Section GB |
|  | Air in fuel system | Check all pipe connections and joints for leaks. Prime and vent the system | Section GB Section DA |
|  | Unsuitable fuel oil | Drain service tank,filters and piping. Refill with recommended fuel oil. | Section GA |
|  | Low fuel feed pressure | Check relief valves in fuel feed pump, and fuel reservoir for correct operation. | Section GC |
|  | Water in fuel system | Drain coalescer, chip filter and all associated piping. Drain water from supply tank. Refill with water-free fuel. | Section G |
|  | Faulty injectors | Fit new or reconditioned injectors, or clean and test existing assemblies. | Section GH |
|  | Faulty injection pumps(s) | Refer to notes on injection pump faults and servicing. | Section.GF |
|  | Fuel injection pump control linkage incorrectly set | Check that linkage has correct movement. Check fuel limiter operation. | Section HC Section HB |
|  | Fuel injection timing incorrect | Check and readjust if necessary. | Section CC |
|  | Defective turbocharger | Change turbocharger. | Section M |
|  | Air filters choked | Remove and clean. | Section LA |
|  | Lack of compression | See remedies listed in Chapter  1 under Starting Difficulties. |  |

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| SYMPTOM | POSSIBLE CAUSE | REMEDY | REFERENCE |
| Loss of speed and power (Contd) | Engine requires de­carbonising | Remove cylinder heads. Examine heads and piston crowns for carbon deposits. | Section FA |
|  | Partial piston or bearing seizure | Remove pistons and bearings and examine for seizure. | Section FB |
| Speed  fluctuation  (hunting) | Abnormal fluctuations of load  Air in fuel system | Check clutches and drive belts if fitted, for slipping.  Prime and vent the system. Check correct operation of fuel reservoir vent. | Section DA |
|  | Water in fuel | Check fuel filters for water. Drain and change element. | Section GE |
|  | Incorrect fuel supply pressure | Check fuel feed pump. | Section GC |
|  | Blockage in fuel supply | Check filter and supply line. | Section GB |
|  | Defective governor | Check governor operation. Fit new assembly if necessary. | Section HA |
|  | Fuel injection pump control linkage faulty | Check the linkage for excessive wear or seizure. Check for broken return springs. | Section HC |
|  | Fuel injection pump(s) faulty | Refer to Notes on injection pump faults and servicing. | Section GF |
|  | Dirty or sticking injector nozzles | Clean and test. | Section GH |
|  | Partial engine seizure | Bar engine round by hand. Check bearings and pistons for seizure. |  |

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| SYMPTOM | | POSSIBLE CAUSE | REMEDY | REFERENCE | |
| Blue exhaust | |  |  |  | |
|  | NOTE: | Bluish-grey appearance is an indication that lubricating oil is being burnt in the combustion chamber, usually accompanied by poor compression. | | |  |
|  | | Unsuitable lubricating oil | Drain and clean out sump, filters and piping. Fill with recommended oil. | Section JA | |
|  | | Worn cylinder liners pistons and rings | Check cylinder liner wear. | Section FH | |
|  | | Piston rings tight in grooves | Remove pistons and examine. | Section FB | |
|  | | Crankcase breather blocked | Clean breather and breather pipework. |  | |
|  | | Excessive lubricating oil level | Drain oil to correct level. |  | |
|  | | Extensive running on light load | Exhaust will clear after a period of running on higher load. |  | |
| Black exhaust | | Engine over-loaded | Defective governor. | Section HA | |
|  | | Choked air filters | Remove, clean or renew, dependant upon type. | Section LA | |
|  | | Unsuitable fuel oil | Drain service tank, filters and system, and refill with fuel of the recommended grade. | Section G | |
|  | | Turbocharger impeller dirty. Excessive carbon deposits on turbine and nozzle | Remove and overhaul turbocharger. | Section M | |
|  | | Injector nozzles leaking or sticking | Remove injectors, overhaul and reset. | Section GH | |
|  | | Faulty fuel injection- pumps(s) | Refer to notes on injection pump faults and servicing. | Section GF | |
|  | | Incorrect valve clearances | Reset and check for sticking valves. | Section FA | |

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| SYMPTOM | POSSIBLE CAUSE | REMEDY | REFERENCE |
| Black exhaust (Contd) | Faulty valve seats | Check for sticking and bent valves. Remove cylinder heads and examine valve seats. | Section FA |
|  | Excessive carbon deposits in cylinder heads | Remove and clean. | Section FA |
|  | Partial seizure | Examine bearings and pistons for seizure. | Sections FB,  FF, and FH |
|  | Air or water sides of charge air heater/cooler dirty  Restriction in water flow to charge air heater/cooler | Remove, dismantle and clean.  Check and clean all pipework to and from cooler. Check sea water pump. Check control valve operation. | Section KD |
| White exhaust | Improper combustion | Check all compressions. Check fuel injection system for correct functioning. |  |
|  | Water in combustion chamber | Remove cylinder heads and check for cracks or leakage from injector housings. | Section FA |
|  | Low ambient temperature and cold engine | Warm up engine to running temperature. | Section CB |
|  | Water in air intake | Check for leaks in charge air heater/cooler. | Section KD |
| Engine  overheats | Blocked oil cooler | Clean. | Section KF |
|  | Blocked heat exchanger | Clean. | Section KF |
|  | Blocked charge air heater/ cooler | Check for correct operation of sea water control valve. Clean tubestack. | Section KD |
|  | Insufficient coolant circulation | Check coolant level. Check system is fully vented. Check operation of coolant thermostats. Check coolant pump. Check for obstruction in system. | Section K |

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| SYMPTOM | POSSIBLE CAUSE | REMEDY | REFERENCE |
| Engine  overheats  (Contd) | Insufficient raw water circulation | Check flow rate. Check raw water pump and drive. Check for correct operation of sea water control valve. Check for obstruction in system. | Section KC |
|  | Scale in water jackets | Inspect coolant spaces for excessive scale. | Section KA |
|  | Incorrect fuel injection pump timing | Check timing. | Section CC |
|  | Incorrect valve timing | Check timing. | Section CC |
|  | Defective turbocharger | Change. | Section M |
| Engine  misfires | Faulty injectors | Fit new assemblies or clean and test existing assemblies. | Section GH |
|  | Faulty fuel injection pump(s) | Refer to Pump Faults and Servicing. | Section GF |
|  | Sticking or badly worn valves | Check for sticking valves or broken valve springs. | Section FA |
|  | Excessive blow-by | Check piston rings for wear. | Section FB |
| Engine  knocking |  |  |  |

Any knock occurring whilst the engine is running at normal speed and load should be investigated immediately; serious damage may arise through failure to ascertain the cause and take appropriate action. The cause may be either faulty combustion or a mechanical defect and can usually be distinguished by an engineer with extensive diesel experience. The possibility of faulty combustion may be checked by cutting out the injector of the cylinder in which the knock is suspected, thus avoiding extensive dismantling of the engine

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| Unsuitable fuel oil | Drain fuel tank and system and refill with fuel of the recommended grade. |
| Engine running too cold | Check coolant outlet temperature. |
| Faulty fuel injection pumps | Refer to Pump Faults and Servicing. |

Section GA

Section CB

Section GF

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| SYMPTOM | POSSIBLE CAUSE | REMEDY | REFERENCE |
| Engine | Injection pump linkage | Check, and if necessary reset | Sections |
| Knocking | incorrectly set | linkage. | GF and HC |
| (Contd) | Fuel injection pumps | Advanced timing can cause | Section CC |
|  | incorrectly timed | engine knocking. |  |
|  | Excessive valve | Check for loose adjusting | Section FA |
|  | clearance(s) | screws, bent or sticking valves and broken valve springs. |  |
|  | Valve striking piston | Check that pistons are correctly assembled in the cylinder bores. Check valve timing. Check valves and valve gear for damage. | Section FB |
|  | Excessive carbon deposit | De-carbonise. |  |
|  | Excessive bearing | Check large-end bolts for | Sections FB |
|  | clearances | slackness. Check large-end and small-end bearing clearances. | and CD |