**DIRECTORATE GENERAL BORDER ROADS**

**GENERAL MAINTENANCE INSTRUCTION NO- 194**

**ON**

**MAINTENANCE CHECKS**

**OF**

**ALL CUMMINS ENGINES**

## 1. INTRODUCTION

These instructions are issued for guide lines and implementation of maintenance schedule checks to be carried out on all Cummins engines fitted on various types of eqpt held with the organization.

## 2. ACTION BY

User Units: To carry out various maint checks:-

'A' Check - Every day

'B' Check - Every 250 hrs

'C' Check - Every 1500 hrs

'D' Check - Every 4500 hrs

'E' Check - Every 8000 hrs

2.2 FIELD WKSP (GREF): To monitor the records of maint checks as carried out by the Mobile Maint Team (MMT) during its klinspection, repairs when carried not as per user units kin respect of any lapses noticed.

## 3. BASIC MAINTENANCE STEPS

3.1. The basic guide lines for the maintenance of Cummins engines are:-

3.1.1. Keep dirt out of the engine.

3.1.2. Maintain a lubricating film on all bearing surfaces.

3.1.3. Regulate the engine's fuel.

3.1.4. Control operation temperature.

3.1.5. Guard against corrosion.

3.1.6. Let the engine breathe.

3.1.7 Prevent over speeding.

3.1.8. Know your engine's condition.

3.1.9. Correct troubles while they are simple.

3.1.10 Schedule and control your maintenance.

**4. DETAILS**

4.1. Details of various maintenance checks are given in Appendix 'A' to this instruction.

5.1. This is a general maintenance Programme if your engine is not fitted with turbocharger air compressor. Dry type air cleaner etc, omit that particular maintenance steps.

5.2. If your engine is fitted with some special component or mentioned assessors not in the maintenance checks, write and ask for the details from your service representative.

5.3 The maintenance checks have been specially prepared for average Indian conditions. Detailed instructions are mentioned in the operation and maintenance manual supplied with each engine.

5.4 Do not mix brands or grades of oil in the engine.

5.5 The life of the fuel filter, lub oil and other filters will depend entirely upon the amount of dust, dirt and water kin the oil besides operating and maintenance conditions and also the type of the fuel land lub oil used kin the engine. This can be reduced by Project, if so warranted.

5.6 Please acknowledge receipt.

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Dated: 10 Jan 92

Appendix 'A' to GMI NO 194

## MAINTENANCE CHECK: CUMMINS

### A: CHECK EVERY DAY

| | MAINTENANCE STEPS | | REMARKS |
|---|---|---|---|
| 1 | Check previous day's Log book. | 1A | Correct as required |
| 2 | Drain water and sediment from fuel tank and fuel filter through drain cook. | 2A | Before starting the engine |
| 3 | Check engine oil level | 3A | Must be slightly less than or equal to 'H' mark on dip stick when engine is stopped |
| 4 | Check for fuel oil water and exhaust leaks. | 4A | Correct if leaking. |
| 5 | Fill radiator/surge tank with treated water /chromate concentration 3500 PPM | 5A | Radiator cap must be firmly) tightened back into the radiation/ surge tank neck. Engine must not be operated without the radiator cap since this will cause are action and overheating of the coolant. |
| 6 | Check air cleaner oil level and change oil, if required (if oil bath type) clean dust pan and pre cleaner of dry type air cleaner. | 6A | Use clean engine oil. |
| 7 | Check air line connections for leaks | 7A | Correct as required. |
| 8 | Remove and clean air compressor, breather if equipped. | 8A | Fill with clean oil, upto the mark |
| 9 | Drain air receiver tank at the beginning of each shift and then close the drain cock. | | |
| 10 | Clean crankcase breather | 10A | Discard paper type element, if clogged. |
| 11 | Check oil level in hydraulic governor if provided | 11A | Check for leaks. Use engine oil for topping up. |

| | MAINTENANCE STEPS | | REMARKS |
|---|---|---|---|
| 12 | Start the engine and note the oil pressure both at idling and maximum speed. | 12A | If there is a change in oil pressure from that recorded in the log book on earlier occasion then strip engine and check through trouble-shooting technique. The cause for oil pressure change and correct if necessary (for substance in diagnosing the change in oil pressure call your service representative if necessary. |
| 13 | Record oil pressure | 13A | Refer O&M manual page 1-6 for lub oil pressure limits. |
| 14 | Fill fuel tank at the end of the shift | 14A | Use clean fuel and a strainer. Also clean the cap and surrounding area before opening the filler cap |

**'B' CHECKS EVERY 250 HOURS**

| | | | |
|---|---|---|---|
| 1 | Repeat all maintenance steps of check "A" 1 to 14 | 1B | - |
| 2 | Change engine oil | 2B | When lub oil is examined through lub oil analysis in a laboratory. Oil change period may be extended in such cases refer to your service representative |
| 3 | Fit new lubricating oil full flow filter element | 3B | Inspect the changed filter elements and check for metal particles and oil sledging / oxidation. |
| 4 | Remove, clean and inspect dry type air cleaner element. Remove and clean dust pan. Inspect element for holes and tears. Check gaskets and 'O' rings for damage. | 4B | Blow out dust with compressed air in the opposite direction of the normal air flow. If very dirty with oil and carbon wash in solution of warm water (120 -140 degree F) and non-sledging detergent. Allow it to dry first, then use compressed air. Replace if washed two times. CAUTION: Excess air pressure will damage paper. Air nozzle must be kept at least 8" from the element. Must not be used if even one pin hole exists. Discard element if punctured and also change gasket along with element. |
| 5 | Clean oil bath air cleaner tray screen | 5B | |
| 6 | Change lubricating oil by-pass filter element and gasket, if provided. | 6B | Record oil pressure (refer table 1-2 page 1-6 of O&M manual). |

| | MAINTENANCE STEPS | | REMARKS |
|---|---|---|---|
| 7 | Clean float tank and / or main fuel tank breather | 7B | |
| 8 | Check Coolant PH Value / Concentration of DGA / chromate concentration (3500 PPM) | 8B | Change corrosion resistor element if PH value is below normal range 8.5 – 10.5. For DGA refer page 2-25 of O&M manual check chromate concentration at 3500 PPM. |
| 9 | Check magnesium plate in assembly corrosion resistor change water filter element. | 9B | Check magnesium plate for pitting or being eaten away. Change if more than 50% air is lost. Use DCA service element or chromate element bage (AR 95679) if concentration is low. |
| 10 | Change fuel filter element washer and 'O' ring on mounting bolt | 10B | Clean shell fuel filter. Change element when restriction exceeds vacuum 8" of mercury. |
| 11 | Check oil in aneroid control, if equipped | 11B | Use same oil as used in oil pan. |
| 12 | Check and adjust belts. New belts will stretch within one hour of use they must be readjusted. | 12B | Tighten belt tension (use ST-1293) refer page 2-5 of maintenance manual |
| 13 | Tighten foundation bolts and flexible coupling bolts of engine and alternator. | 13B | |
| 14 | Check all air cleaner connections for cracks chafing etc. Tighten all air intake connections. | 14B | Correct as required |
| 15 | Check fan hub and drive | 15B | Use special tool No. ST 845 or ST 893 for tightening the fan hub nut. |
| 16 | Clean / change air compressor breather element | 16B | Change element for naturally aspirated engine clean screen for turbo engine |

## 'C' CHECKS EVERY 1500 HOURS

| | MAINTENANCE STEPS | | REMARKS |
|---|---|---|---|
| 1 | . Repeat all maintenance steps of checks 'A' & 'B' | 1C | |
| 2 | Check thermostat operation | 2C | It should start opening and open fully within range 165 and 175 degree F or 170 and 185 degree F. Discard and fit new thermostat if operation is not satisfactory. |

| | MAINTENANCE STEPS | | REMARKS |
|---|---|---|---|
| 3 | Check fan hub and drive | 3C | Check mounting bolts and bearing and play. |
| 4 | Check impeller water pump for play | 4C | Correct if necessary |
| 5 | Check for turbocharger oil leaks. | 5C | Correct as required. |
| 6 | Tighten turbocharger mounting nuts. | 6C | Tighten to the specified torque do not tighten when engine is hot |
| 7 | Check inlet air restriction. | 7C | Check after cleaning dry type air cleaner element. If restriction is excess of 25" watt a new element must be fitted. |
| 8 | Clean oil bath air cleaner. | 8C | Remove complete assembly and clean inclusive of fixed screws |
| 9 | Clean and tighten all electrical connections. | 9C | |
| 10 | Check generator brushes and connectors. | 10C | Replace and clean as required |
| 11 | Clean entire engine | 11C | High pressure and soap water mixture preferred after spray engine with cleanser taking of protecting electrical system. |
| 12 | Tighten all mounting bolts and nuts. | 12C | Tighten as required. Over tightening may result destroys or damage |
| 13 | Clean aneroid air breather | 13C | Replace breather if necessary |
| 14 | Check sea water pump (Marine application only). | 14C | Check for leaks / operation / performance. |
| 15 | Check heat exchange element (Marine application). | 15C | Clean element tubes / change |
| 16 | Check inlet and exhaust manifold and cap screws | 16C | For V-1710 only |
| 17 | Check engine blow by | 17C | Reading in excess recommends limits. Corrective action must be taken. Through analysis with the help of trouble shooting chart. |
| 18 | Clean radiator. | | Blow air through the radiator core in opposite direction to the normal flow of air. If working under dusty / dirty condition. (Reverse flushing operation) |
| 19 | Check air compressor | 19C | Check shaft end clearance. |
| 19.1 | Check crank shaft end float (end play) | 19.1C | If in excess of recommended limits, corrective action to be taken. |

| | MAINTENANCE STEPS | | REMARKS |
|---|---|---|---|
| 20 | Adjust injectors and valves | 20C | Final adjustments must be carried out with engine hot and with correct torque as specified (Refer page 2-3 of O&M manual) |
| 21 | Clean fuel inlet connections screens | 21C | |
| 22 | Change hydraulic governor oil /aneroid oil. | 22C | Use engine lubricating oil |
| 23 | Check vibration damper. | 23C | Check wobble and eccentricity / alignment marks on rubber type. Discard damper if misalignment is more than 1/16 in. |

## 'D' CHECK EVERY 4500 HOURS

| | MAINTENANCE STEPS | | REMARKS |
|---|---|---|---|
| 1 | Repeat all maintenance steps of checks 'A' , 'B' and 'C' | 1D | |
| 2 | Check exhaust and inlet manifold nuts and cap screws. | 2D | |
| 3 | Tighten all mounting bolts and nuts | 3D | |
| 4 | Clean turbocharger diffuser and impeller and check end float. | 4D | |
| 5 | Check turbocharger bearing clearances. | 5D | Only end float on semi floating bearings, if in excess of limits, replace. |
| 6 | Check crank shaft end float | 6D | If in excess of recommended limits corrective action is indicated |
| 7 | Clean injector inlet screens. | | |
| 8 | Clean and calibrate all injectors | | Must be done only if a performance deterioration is evident. Some of the indications for performance deterioration are :<br>1. Black smoke.<br>2. Change in fuel manifold pressure<br>3. Loss of power<br>4 Malfunction of aneroid. |
| 9 | Check fuel pump calibration | | |
| 10 | Replace aneroid bellows and calibrate aneroid. | | |
| 11 | Replace fuel pump filter screen and magnet | | |
| 12 | Steam clean engine | 12D | If steam is not available, then use clean soap water solution as outlined in 'C' check item- 11C |

**‘E’ CHECK EVERY 8000 HOURS**

1. Repeat all maintenance steps of checks ‘A’, ‘B’, ‘C’ & ‘D’.
2. The ‘E’ maintenance check is necessary only when the engine operating conditions signify deterioration in performance as can be ascertained by the symptoms.

**SYMPTOMS**

1. High blow – bye. 2. Heavy smoke 3. Loss of power. 4. High oil temperature / high water temperature. 5. Loss of lub oil pressure. 6. Unusual noise & vibrations.

The ‘E’ maintenance check is a methodology for inspection of wear or assembly deterioration of parts and assemblies and should be resorted to only after trouble shooting in addition to performing A,B,C & D maintenance check, which may eliminate the engine performance problem and bring the engine back to normal operating conditions it is anticipated that good operating and maintenance particles as prescribed through A, B, C & D checks will ensure that the engine will moved 25,000 hours before the engine must be distant inspection prelude to a major overhaul. The time 8000 hours, is a period at which the engine may described above 1-6 and are indicative of performance due to inadequate A,B,C & D checks failure to identify performance deterioration. This failure has keen arrived at on the basis of current maintenance in the country and should not be treated as an absolute figure for making an ‘E’ check.However,it is that the above routine of analyzing engine performance followed in order to prevent dismantling of engine performance can be simply corrected laky trouble and routine maintenance checks.

3. The maintenance check is often referred to as “In frame inspection where some key parts such as bearings are checks determine if the engine may be operated for another service period likewise, oil consumption, oil pressure and other signs of year should be analysed during the check were limits and other information is available from distributor and dealers. (It must be clearly understood that the decision to inspect key parts lamest be arrived through routing outlined in point two above).