

TRUCK, MEDIUM, MC2 – UNIMOG – ALL TYPES

TURBOCHARGER FAULT DIAGNOSIS

MISCELLANEOUS INSTRUCTION

This instruction is authorised for use by command of the Chief of Army. It provides direction, mandatory controls and procedures for the operation, maintenance and support of equipment. Personnel are to carry out any action required by this instruction in accordance with EMEI General A 001.

GENERAL

Introduction

1. To prevent unnecessary repair or replacement of turbochargers and components, this EMEI details basic fault diagnosis procedures for problems associated with the vehicle's turbocharger. In addition, some pre-installation and general procedures are added. Table 1 lists the fault diagnosis procedures.

Associated Publications

2. Reference may be necessary to the latest version of the following documents:
- a. [EMEI Vehicle G 603](#) – Truck, Cargo, Medium, MC2 – Unimog – Light Grade Repair;
 - b. [EMEI Vehicle G 604](#) – Truck, Cargo, Medium, MC2 – Unimog – Medium Grade Repair; and
 - c. [EMEI Vehicle G 604-1](#) – Truck, Cargo, Medium, MC2 – Unimog – Base Repair.

DETAIL

Table 1 Fault Diagnosis

Serial	Fault	Cause	Remedy
1	Whistling noises from turbocharger	Air leaks at:	
		a. Gaskets	Replace faulty gaskets
		b. Flange connections at air exhaust/intake lines	Check flanges and connections for distortion and secure fit
		c. Flange gaskets badly fitted/distorted	Check whether gaskets protrude into pipe cross-section. Replace gaskets as necessary
		d. Hose plug connections	Check connections condition and secure fit
		e. Cylinder head cover and/or centre web of cylinder head cover distorted	Check gasket condition at centre web. Check cover for distortion. Replace parts as necessary
	f. Grazing of rotor due to excessive bearing clearance	Remove lines and check housing on turbine and compressor for traces of grazing. If grazing is found, replace turbocharger	
2	Lack of oil pressure	a. Oil pressure relief valve in oil cooler incorrectly installed	Install oil pressure relief valve correctly
		b. Damaged oil pressure lines to turbocharger	Replace oil pressure lines as necessary
3	Oil contamination (Note 1)	a. Oil filter blocked	Check the oil filter condition. Replace as necessary
		b. Wrong oil filter fitted	Check for the correct oil filter. Replace as necessary

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Table 1 Fault Diagnosis (Continued)

Serial	Fault	Cause	Remedy
4	Exhaust smoke visible and drop in engine power	a. Air cleaner heavily soiled	Clean or replace air cleaner as necessary
		b. Turbine or compressor wheels rub against housing	Replace turbocharger
		c. Restriction in exhaust cross-section	Remove restriction
		d. Dirty compressor	Clean compressor
		e. Leak between exhaust manifold and turbocharger	Replace seal (Note 2)
		f. Exhaust brake butterfly valve sticking	Check butterfly valve operation and adjustment. Correct as necessary
		g. Charge air line blocked or deformed	Clear or replace charge air line
		h. Lack of air	Check flange and hose connections between turbocharger and air pipe for leaks. Repair as necessary
		i. Exhaust line down-stream of turbocharger or muffler dirty or damaged	Check, clean and/or repair as necessary
		j. Oil separator on cylinder head cover dirty or damaged	Replace oil separator
5	Oil level in turbocharger rises (oil leaking via the seal on the turbine and compressor sides)	Reduced line cross-section due to carbon fouling leads to an increase in flow resistance in the oil return line	Clean or replace the oil return line
6	Oil feed on the turbocharger leaking	Defective seal	Replace seal at oil connection
7	Oily exhaust lines (other possible causes)	a. Cylinder head cover centre web gasket defective	Replace gasket
		b. Valve shaft seal defective or valve guides worn	Repair as necessary
		c. Piston rings defective or cylinders worn	Repair as necessary
		d. Turbocharger piston ring defective	Repair as necessary
		e. Turbocharger axial bearing worn	Repair as necessary
		f. Oil return line damaged	Repair as necessary
Notes:			
1. Where oil contamination is found, a detailed diagnosis is required to determine and eliminate the cause. The turbocharger requires clean oil to operate efficiently due to the high rpm. Only the correct grade engine oil (SAE Grade 40 (OMD-115)) is to be used.			
2. Later model engines may not have the seals fitted.			

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Bearing Clearance

3. A major cause of bearing wear is a lack of oil or oil contamination. When oil leaks or oil contamination is found, check the bearing clearance as follows:

- a.** Remove the intake line at the turbocharger intake and the exhaust line from the turbine housing.
- b.** Rotate the rotor at the compressor wheel nut or the turbine housing several times until the rotor is free from oil and contamination. Check for smooth and uniform rotation.

NOTE

The rotor is gyro stabilised and rotates in the bearing with relatively ample clearance.

- c. Check for axial clearance by moving the rotor axially and checking whether the turbine or compressor rub against the housing. If no rubbing occurs, the axial clearance is correct. If rubbing occurs, replace the turbocharger.
- d. Check for radial clearance by pressing the rotor against the shaft in a radial direction and turning it. If no grazing or rubbing is noted, the clearance is correct. If grazing or rubbing occurs, replace the turbocharger.

Oil Leaks

- 4. The turbocharger oil-carrying bearing housing is sealed against the air or gas-carrying spiral by means of piston rings. The functioning of this seal depends upon the higher pressure in the compressor housing. It is possible however, that a vacuum may occur at an increased idling speed and in the over-run which allows oil seepage and will lightly coat the air passages with oil.
- 5. Normal oil vapour development in the air intake system will not damage the engine. A certain quantity of oil is necessary to lubricate the intake valves. If there are minimal traces of oil in the clean air side of the of the charge air passages, there is no reason to replace the turbocharger.
- 6. There are no completely dry intake air passages since there is a light film of oil in the charge air passages due to the oil vapours of the crankcase ventilation. If increased oil seepage occurs, check that the crankcase ventilation is functioning correctly.



Be very careful in any diagnosis regarding oil leaks, as an incorrect diagnosis may lead to an unnecessary turbocharger replacement

- 7. Exterior oil leaks on the turbocharger will usually occur at the oil feed or oil return. Diagnosis of oil leaks can be tricky and every possible cause should be considered before a turbocharger is replaced. If the replacement of a turbocharger cannot be avoided, the leaking spots on the faulty turbocharger are to be marked to facilitate inspection at a later date.

Installation

- 8. Before installing the turbocharger, complete the following:
 - a. Carefully clean the following (replace any damaged items):
 - (1) intake line,
 - (2) manifold flange,
 - (3) exhaust gas line,
 - (4) oil feed line, and
 - (5) oil return line.
 - b. Remove all caps from openings immediately prior to installation.
 - c. Whilst rotating the rotating parts of the turbocharger by hand, fill the bearing housing with SAE Grade 40 (OMD-115) through the oil inlet bore prior to connecting the oil feed line.

Operating the Engine

9. The following precautions are to be followed when operating the engine:



Following a long period of engine non-use and after every engine oil and/or filter change, the engine is to be cranked with the starter motor until oil pressure is indicated on the gauge. This will prevent premature bearing failure.

- a. To prevent the engine starting before oil pressure has built up, apply the engine brake.
- b. Do not operate the starter for more than 20 seconds. If no oil pressure is indicated within 20 seconds, wait one minute before attempting a restart.
- c. Do not rev the engine immediately after starting, but allow it to idle until a constant oil pressure is indicated on the gauge.
- d. Do not shut down the engine from a high rpm, but allow it to idle for a short time until the exhaust temperature is below 90°C.

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END

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