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GOVERNMENT OF INDIA

MINISTRY OF DEFENCE

DIRECTORATE GENERAL OF QUALITY ASSURANCE

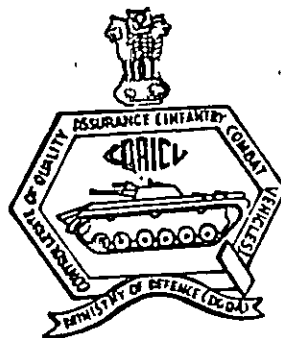
QUALITY ASSURANCE INSTRUCTIONS

No CQA (ICV)/QAI/002A

[SUPERSEEDS C I (ICV)/QAI/002 ISSUE OCT 86]

OIL COOLER

DRG.No. 765-03-SB 161



CONTROLLERATE OF QUALITY ASSURANCE

(INFANTRY COMBAT VEHICLES)

ISSUE :
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SECUNDERABAD

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MINISTRY OF DEFENCE

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QUALITY ASSURANCE INSTRUCTIONS .

NO.CQA(ICV)/QAI/002A

(Superseeds CI(ICV)/QAI/002 issue 19 Oct '86)

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DRG. NO. 765-03-8b161

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(Superseeds CI(ICV)/QAI/002 issue 19 Oct 1986)

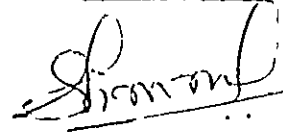
OIL COOLER

DRG.NO. 765-03-Sb161

Prepared By

Shri S THIMMAIAH
Asst Foreman

SIGNATURE



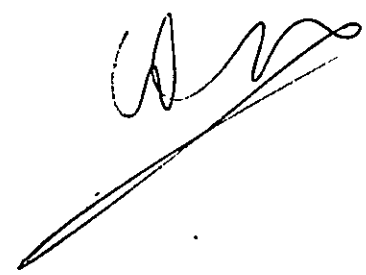
Checked By

Shri AK Das
Pool Officer



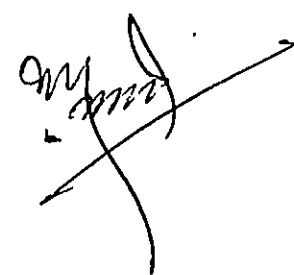
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Shri BV PACHABHAIYYE
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O&fg Controller



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Dt. 6 APRIL 1988

QUALITY ASSURANCE INSTRUCTION FOR
OIL COOLER
TO DRG.NO/PART NO,765-03-Sb161

I. INTRODUCTION/SCOPE :

This Quality Assurance Instruction is the Property of Government of India. This is based on the acceptance standards and inspection methods generally in vogue and has been compiled for guidance of Inspectors during routine inspection of Oil Cooler to drawing No.765-03-Sb161 and relevant part drawings and process sheets used on the engine of Article 675 and thereby to ensure that the stores accepted are qualitatively comparable to original sample in meeting service requirements. This QAI deals with requirements for pilot and bulk for determining the quality and performance of oil cooler assembly.

This QAI also includes certain tests not covered in the original drawings and specifications. In such cases the test parameters and acceptance standards will be jointly considered.

This QAI is liable to be amended as and when required by the Controller, CQA(ICV). During inspection, if the inspector finds any points which could be included in this QAI, he should refer such points to the Controller CQA(ICV) and matter jointly considered with supplier before finalisation. Before commencing the inspection, the inspector will make himself fully conversant with the terms and conditions of the contract including specifications, drawings and other literature. Copies of the QAI will be issued by CQA(ICV) on demand and latest issue is applicable for inspection purpose and should be adhered to strictly.

II. CONSTRUCTION/DESCRIPTION

The oil cooler is of a fin and tube type and is designed to dissipate the heat of engine lubricating oil. The cooler consists of stack of oval-brass tubes fitted with cooling fins, tube plates and headers. The oil cooler is located on the ejector casing under the roof of the armoured grills.

The engine oil circulation is by a pump with dry crankcase. The lubrication system incorporates oil tank with oil filler tank, oil priming pump, engine driven oil pump, oil filter, oil cooler, by pass valve and oil pipes. The electrically driven oil priming pump feeds the lubricating oil to the engine before starting. After the engine is started, the engine oil pump starts functioning and feeds the oil continuously from the tank to the engine. The oil after passing through the engine parts flows down into the crankcase unit and is collected in the sump. From there the oil is sucked by suction section of engine oil pump and through the oil cooler is fed back to the oil tank. Gas and oil vapour accumulating in the oil tank are sucked off through non-return valve in the ejector. When the oil priming pump is in operation, a by-pass valve mounted in the pump body protects the system against over pressure and it is adjusted for a pressure of 1.2 ± 0.2 MPa (12 ± 2 kg/cm²). Pressure relief valve of the engine driven oil pump maintains the oil pressure in the main gallery of the engine within 0.6 to 1.2 MPa (6 to 12 kg/cm²). The oils used in the engine lubrication system are MT-16M, MT3-10M or M-16NxM-3 and the total system capacity is 58 litres.

III. QUALITY ASSURANCE PROVISIONS

1. Inspection Responsibility : The supplier is responsible for satisfactory performance of the item during usage and for the performance of all inspection requirements specified herein. Inspection records and the results of the tests

shall be kept complete and available at any time for perusal.

Quantity 4 Nos. (four) samples are required as pilot samples before starting the bulk production for evaluation by the Inspector/CQA(ICV). Clearance for the bulk manufacture will be given only after approval of pilot samples. Inspection of pilot samples and bulk production of oil cooler assembly shall be carried out in accordance with this Quality Assurance Instructions, relevant drawings and material specifications. The following method of inspection shall be adhered:

S.No.	Description of the test to be carried out	Sampling Size	
		Pilot	Bulk
1.	Visual Inspection(as per drg.)	100%	100%
2.	Dimensions (as per drg.)	100%	10%
3.	Materials	1 No.	1 No. against each order
4.	Oil capacity check	100%	10% or 2 Nos. min.
5.	Weighment	100%	10% or 2 Nos. min.
6.	Leakage test	100%	100%
7.	Vibration test on Jolt table	100%	5% subject to min. of 1 No. for each bulk
8.	Endurance test on vibration test rig	1 No.	1 No. against each order
9.	Flow rate test	100%	10% or max. 2 Nos./lot
10.	Heat transfer test (full size)	1 No.	1 No. against each order
11.	Fitment/performance test on vehicle	1 No.	Qualifying test for the supplier
12.	Preservation	100%	100%

IV. METHODS OF TESTS

1. Visual Inspection : 100% visual inspection of oil cooler assembly shall be carried out for satisfactory workmanship. The tubes shall be uniform and assembled in core without bending. Edge bonding of fins shall be within limits specified in drawing and in keeping with sample levels. Ensure good contact between fin and tubes in core to meet the heat dissipation requirements. Ensure building up of core is as per the relevant drawings, care should be taken on quality of soldering and trimming, presence of plugs and seals. There shall be no signs of corrosion or visible damage.

2. Dimensions : During pilot inspection detailed dimensions of all the components as per the relevant drawings of Drg.No.765-03-Sb161 shall be checked before assembling the cooler. During bulk inspection overall dimensions, reference dimensions and threads shall be checked. Number of tubes and fins shall be checked and will be within specified limits.

3. Materials : Raw materials used in the manufacture of each component shall conform to the specifications mentioned in the relevant drawings. Test specimens and test bars representing pilot/bulk shall be drawn from the component production line and tested for chemical analysis and mechanical properties. The results shall be within the specified limits. In case any disputes on the test results, the supplier shall arrange testing at standard laboratory where the samples will be tested in the presence of Inspector.

4. Oil Capacity Check : The aim of this test is to check the amount of oil held by the cooler. Oil holding capacity of cooler in litres shall be checked and the same shall be checked and same shall be comparable.

5. Weight : Weight of each oil cooler assembly shall be 20.3 kg. The supplier will record the weight of all the oil cooler assemblies. Inspector shall verify the above records and check the weight on random samples as per the sampling.

6. Leakage Test : Fill the oil cooler with water at 75-85°C and pressurise upto 8 kg/cm² for a period of 60 seconds min. No leakage or sweating shall be permitted. The oil cooler assembly shall be further be tested with compressed air upto 3 kg/cm² for one minute to check for leaks in water at room temperature if so required.

NOTE : Rectification of leaks by re-soldering shall be permitted. After rectification leakage test shall be carried out.

7. Vibration Jolt Test : After the above leakage test the oil cooler should be mounted in horizontal position and filled with water at room temperature and at a pressure of 1 kg/cm² and subjected to the following vibrations.

Amplitude	50 mm simulating free fall of oil cooler with table on timber resting felt or rubber mat.
Frequency	80 ± 10 cycles/minute
Duration	Pilot & bulk samples for min. 2 minutes.

During vibration test no leakage of water or sweating shall be permitted. After vibration test oil coolers shall be immersed in water bath and testing using compressed air at 1 kg/cm² for 60 sec. minimum. No air leakage shall be permitted. Leakage noticed can be repaired soldering/brazing but must be retested for leakage as in 6. above.

8. Endurance Test on High Frequency Vibration Test Rig : To ensure the fabrication process and the material specification meet operational requirements, the pilot lot must be tested on a vibration/rig hydraulically or otherwise similarly /test

actuated. The oil cooler will be mounted on the table of the rig resting on a rubber pads and held securely in position. The oil cooler will be filled with water at room temperature and maintained at pressure of 1kg/cm^2 . The following parameters will be selected for test :

- i) Acceleration .. 4 g in up and down direction
- ii) Amplitude .. 3 to 5 mm
- iii) Test duration .. 10 hours

No leak is permitted when tested with compressed air at 1 kg/cm^2 in water at room temperature.

9. Flow Rate Test : This is to ensure oil flows freely through the oil cooler without undue obstruction. Oil at temperature $95 \pm 2^\circ\text{C}$ is pumped through oil cooler at flow rate 60 to 170 litres per minute. The pressure drop between inlet and outlet will be recorded and plotted on a curve. This will be compared with original sample. Vibration will be within $\pm 10\%$.

10. Heat Transfer Test : The aim of this test is to evaluate the quantum of heat dissipated by the oil cooler in a wind tunnel with a heating capacity of 75 KW at stipulated oil flow. Arrangement to measure oil flow, inlet-outlet oil pressure drop, inlet-outlet oil temperature, air flow and air temperatures must be provided. The test can be carried out on full size sample at following parameters.

- Oil inlet temperature .. $95^\circ\text{C} \pm 2^\circ\text{C}$
- Oil flow .. 160 litres per min.
- Air velocity .. 10 to 40 km p.h.,
at room temperature.

The quantum of heat dissipated is expressed as K.Calories per hour per $^\circ\text{C}$ temperature gradient between inlet oil temperature and inlet air temperature.

The readings recorded may be tabulated as per the

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appendix 'A'. The amount of heat dissipated by the cooler shall be comparable to imported stock sample. Variation within $\pm 10\%$.

11. Fitment/Performance Test : The representative samples shall be fitted on the tank and subject to cross country running, gradient climbing and maximum speed running. The total trial run shall not be less than 500 km. The following information is for the trial group.

The vehicle should be operated within the following limits during trials.

- | | | |
|--|----|---------------------------|
| a) Oil temperature | -- | 80 - 100°C |
| b) Oil pressure at 2200 rpm | -- | 6 - 12 kg/cm ² |
| c) Oil pressure at minimum idle speed | -- | 2 kg/cm ² |
| d) Oil pressure during engine warming up | -- | 14 kg/cm ² |

During trial run record of above parameters shall be maintained with the following details.

- a) Ambient condition/temperature
- b) Terrain condition
- c) Speed
- d) Oil level
- e) Water (radiator) temperature

Imported sample of oil cooler assembly will be tested as above under the same conditions and the results should be compared. The difference between oil inlet and ambient temperature for imported and indigenous sample should be comparable.

12. Preservation : After testing each oil cooler shall be washed and flushed free from traces of flux Zn - Salts and other chemicals. Traces of Zn or chloride salts more than 0.025 g/litre of oil cooler volume shall not be permitted. Each cooler should be dried with jet of hot air. Care must

be taken to ensure that no traces of water are left inside the cooler. Presence of free solder inside the headers shall not be permitted. To remove such solder, oil cooler shall be shaken on suitable rig and flushed by circulating engine oil. Each oil cooler shall be flushed with passivating solution for corrosion resistance. The two openings in each oil cooler shall be plugged firmly using wooden or plastic plugs painted red in colour and tied in position with wire and sealed.

V. PAINING & MARKING

External surfaces of headers including beading of tube boards shall be given a coat of primer and sprayed enamel brown as IS:2933/JSS:8010-1. Fin surfaces and flange threads shall be protected. The following should be stencilled or rubber stamped at location shown (14) on the header.

- a) Manufacturer's symbol
- b) Supply order No. and date
- c) Code and Part No.
- d) Nomenclature and Serial No.

VI. PACKING

Each cooler shall be packed in wooden case firmly supported at the joints or headers. The core surfaces should be protected suitably. Each case shall bear the following markings.

- a) Manufacturer's Name
- b) Supply order No. and date
- c) Part No. and date of manufacture
- d) Part description.

