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MACHINERY INDUSTRY STANDARD
OF THE PEOPLE'S REPUBLIC OF CHINA

ICS 27.020

J 95

Record No.: 53624-2016

JB/T 10505-2016

Replacing JB/T 10505-2005

Internal Combustion Engines – Oil Radiators - Specification

内燃机 机油散热器 技术条件

Issued on: January 15, 2016

Implemented on: June 1, 2016

Issued by: Ministry of Industry and Information Technology of the People's Republic of China

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Internal Combustion Engines – Oil Radiators – Specification

1 Scope

This Standard specifies the terms and definitions, technical requirements, test methods, inspection rules, marking, packaging, transportation and storage of oil radiators of internal combustion engine.

This Standard applies to tube-sheet type, tube-band type, seal type and expansion type oil radiators (hereinafter referred to as radiators) of internal combustion engine.

2 Normative References

The following documents are essential to the application of this Document. For the dated documents, only the versions with the dates indicated are applicable to this Document; for the undated documents, only the latest version (including all the amendments) is applicable to this Document.

GB/T 2423.17 Environmental testing for electric and electronic products - Part 2: Test method - Test Ka: Salt mist

GB/T 2828.1 Sampling procedures for inspection by attribute - Part1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection

GB/T 3821 Small and medium power internal combustion engines - Cleanliness measurement

GB 11122-2006 Diesel engine oils

JB/T 6003.3 Internal combustion engines - Oil coolers - Part 3: Test method for heat transfer capability

JB/T 10408 Internal Combustion Engines - Heat Exchangers - Reliability Test Method

JB/T 11798 Internal Combustion Engines - Heat Exchangers - Wind Tunnel Test Equipment

t_{o1} – oil inflow temperature, in °C.

4 Technical Requirements

4.1 Materials

The materials that are used for the radiator's heat pipes, main plates and oil chamber shall not corrode in the oil.

4.2 Sealing performance

4.2.1 During exit-factory test, dry compressed air with a pressure of 800 kPa is passed into the radiator; and the pressure is maintained for 60 s; in this case, no leakage shall occur.

4.2.2 During type test, dry compressed air with a pressure of 1000 kPa is passed into the radiator; and the pressure is maintained for 300 s; in this case, no leakage shall occur.

4.3 Vibration resistance

The radiator is filled with clean water and fixed on the vibration test bench according to the installation method during work. It is vibrated at an acceleration of 40 m/s^2 at a frequency of 20 Hz, 30 Hz, 40 Hz, and 50 Hz for 3 h, respectively, for a total of 12 h. The vibration direction is vertical up and down. After 12 h of vibration, the radiator shall not leak nor the parts have damage.

4.4 Pressure alternating cycle resistance

Apply an alternating pressure from below 25 kPa to 800 kPa to the inner cavity of the radiator, with a pressure alternating cycle of 1 s to 6 s. After 3×10^4 pressure cycles, the radiator shall not leak, desolder, or permanently deform.

4.5 Heat shock resistance

When the inlet temperature difference of the radiator is $100^\circ\text{C} \pm 2^\circ\text{C}$, after 3×10^3 hot and cold alternating cycles, there shall be no leakage nor the parts have damage.

4.6 Static pressure strength

Apply a static pressure of 2.5MPa to the inner cavity of the radiator and maintain the pressure for 5 min. The radiator shall not leak or permanently deform.

4.7 External corrosion resistance

After 200 h of neutral salt spray corrosion, the radiator shall not have coating peeling. After the test, it shall meet the requirements of 4.2.2 for sealing performance.

radiator shall comply with the provisions of the product drawings; and its limit deviation is ± 2 pieces.

4.11.3 The limit deviation of the fin spacing of the tube-fin radiator fins is ± 0.2 mm; and the two fins shall not be pressed together. The limit deviation of the wave crest spacing of the heat dissipation strip of the tube-strip radiator is ± 0.5 mm.

4.11.4 The fins (strips) on the two sides of the radiator shall not be curled, fallen over, or have broken edges; the difference between them shall not exceed 1 mm.

4.11.5 There shall be no floating solid residue inside the radiator.

4.11.6 There shall be no obvious solder accumulation on all welds of the radiator.

4.11.7 The anti-corrosion layer on the external surface of the radiator shall be uniform and beautiful, and there shall be no coating peeling.

4.11.8 The number of blocked heat tubes of the radiator shall not exceed 1% of the total number of heat tubes.

5 Test Methods

5.1 Sealing performance

5.1.1 The sealing test can be carried out on the wet or dry sealing test bench. When the conclusions obtained by the two methods are inconsistent, the conclusions obtained on the wet sealing test bench shall prevail.

5.1.2 The exit-factory test shall be carried out in the following manner:

- a) On a wet sealing test bench, the radiator submerged in the water tank is fed with 800 kPa dry compressed air as specified in 4.2.1 and maintained for 60 s. No more than 3 bubbles shall appear at the same position;
- b) On a dry sealing test bench, the radiator is fed with 800 kPa dry compressed air as specified in 4.2.1 and maintained for 60 s. The air leakage shall be less than 12 mL (standard state).

5.1.3 The type test shall be carried out according to the following manner:

- a) On a wet sealing test bench, the radiator submerged in the water tank is fed with 1000 kPa dry compressed air as specified in 4.2.2 and maintained for 300 s. No more than 8 bubbles shall appear at the same position;
- b) On a dry sealing test bench, the radiator is fed with 1000 kPa dry compressed air as specified in 4.2.2, and maintained for 300 s. The air leakage shall be less than 45 mL

5.5.2.2 Test specification

The test specification requirements for the comprehensive performance test of the radiator are as follows:

- a) The test medium on oil side adopts CD 15W-40 diesel engine oil that complies with GB 11122-2006;
- b) The intake temperature during the test is the atmospheric temperature; and the temperature fluctuation shall not exceed $\pm 2^{\circ}\text{C}$; and the total liquid-gas temperature difference is $(55 \pm 1)^{\circ}\text{C}$;
- c) The test oil flow rate is in accordance with the provisions of the product drawing;
- d) The test air volume is 6~8 operating points (including assessment points) within the range of 30%~120% of the rated air flow rate.

5.5.2.3 Test procedure

The test procedure is in accordance with the provisions of JB/T 11798.

5.5.2.4 Recording and collation of test data

For the comprehensive performance test of the radiator, the test data shall be recorded and collated in accordance with the provisions of JB/T 11798; and the heat exchange area of the radiator shall be calculated in accordance with the provisions of Appendix A.

5.6 Determination of cleanliness on oil side

The cleanliness on oil side of the radiator is determined according to the method specified in GB/T 3821; and the maximum hard particle size, W_m , is measured under a microscope with a resolution of no less than 0.001 mm.

5.7 Determination of the diagonal length of the core

At the intersection of BETWEEN the upper and lower ends of the third heat dissipation tube on the left and right sides of the windward side AND the main plate, use a steel ruler or tape to measure the diagonal length.

5.8 Determination of the fin spacing of the heat dissipation fin or the wave crest spacing of the heat dissipation strip

Within the range formed by the third fin (or the sixth wave crest) on the upper and lower ends of the two major sides of the radiator AND the first heat dissipation tube on the left and right sides, visually observe the possible deviation of the fin spacing (wave crest spacing); measure the length across five fin spacings for the tube-fin radiator, and take the average value as the measured fin spacing. Then measure the length across five wave crests for the tube-strip radiator,

and take the average value as the measured wave crest spacing.

5.9 Checking the number of the blocked heat tubes

The core of the tested radiator can be observed by light transmission to determine whether the heat tube is blocked. For doubtful heat tubes, a large amount of clean water can be poured into the heat tubes. When the water injection stops, if the horizontal surface in the tube can be seen, it shall be considered blocked.

6 Inspection Rules

6.1 The supply and demand contract can be inspected for all or part of the items according to the requirements of 4.2~4.10, or other technical requirements can be set in the contract.

6.2 The inspection of items 4.3~4.9 is not required to be carried out on the same test sample.

6.3 The identification of new radiator products, the modification of old products and the localization of products imported from abroad shall all be subject to type test; type test should include all test items in 4.1~4.11.

6.4 Products must be inspected and qualified by the quality inspection department of the manufacturer before they can leave the factory; the exit-factory inspection shall include inspections in 4.2.1, 4.10 and 4.11.1~4.11.7.

6.5 When the purchaser conducts random inspections on product quality, random inspections shall be conducted in accordance with the provisions of GB/T 2828.1. The inspection items, batching principles, sampling plans, judgment and re-inspection rules shall be in accordance with the provisions of the technical documents agreed upon by the manufacturer and the customer.

7 Marking, Packaging, Transportation and Storage

7.1 Marking

7.1.1 The following contents shall be marked on each product:

- a) Manufacturer name or trademark:
- b) Product model and name:
- c) Exit-factory date or exit-factory number.

7.1.2 The following contents shall be indicated on the certificate of conformity:

- a) Manufacturer name or factory logo;

- b) Product name and model;
- c) Exit-factory date or exit-factory number.

7.1.3 The following information shall be marked on the outer surface of the packaging box:

- a) Manufacturer name and address;
- b) Product name and model;
- c) Quantity and total weight of the packaging box;
- d) "Handle with care" and "Pressure proof" signs;
- e) Overall dimensions;
- f) Exit-factory date.

7.2 Packaging

7.2.1 The oil inlet and outlet of each radiator shall be capped to prevent debris from entering the radiator.

7.2.2 The packaging method of the radiator shall ensure that the product is not damaged during transportation and storage.

7.2.3 The packaging box shall be accompanied by a product certificate signed by the manufacturer's quality inspector.

7.3 Transportation

The packaged radiator shall be allowed to be transported by any normal method.

7.4 Storage

The radiator shall be stored in a ventilated, dry warehouse without corrosive substances. Under normal storage conditions, the manufacturer shall ensure that the product shall not rust within 12 months from the date of leaving the factory.

7.5 Others

Marking, packaging, transportation and storage can also be agreed upon by the supplier and the purchaser.

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