BUREAU OF INDIAN STANDARDS

DRAFT FOR COMMENTS ONLY
(*Not to be reproduced without permission of BIS or used as an Indian Standard*)

भारतीय मानक मसौदा

अंतर्दाही इंजन - विकिरक - विशिष्टि

(दूसरा पुनरीक्षण)

Draft Indian Standard

INTERNAL COMBUSTION ENGINES RADIATORS — SPECIFICATION

(Second Revision)

ICS: 43.060.40

Not to be reproduced without permission of BIS or used as standard	Last date for receipt of comments is XX/XX/XXXX

B U R E A U O F I N D I A N S T A N D A R D S
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Automotive Primemovers, Transmission Systems and Internal Combustion Engine Sectional Committee, TED 2

FOREWORD
(Formal Clause to be added later)

This Indian Standard was first published in 1976. In first revision of this standard, material requirements were rationalized and the tests were classified for type and production conformity approvals. Tests like leakage tests for filler neck seating, pressure impulse, internal cleanliness were included. A separate standard IS 13687 covering heat dissipation performance of radiators is already available.

In this second revision following changes have been incorporated:

a) References, ICS No. have been updated; and

b) Other editorial changes have been done to bring the standard in the latest style and format of Indian Standards.

This standard is also an important adjunct to IS 13686 'Internal combustion engines — Radiators — Methods of test'.

While preparing this standard, assistance has been derived from the following publications:

CSN 302620: 1961 'Water radiators, dimensions', issued by Czechoslovakia. [Ceskoslovenska Statni Norma]

DIN 71550: 1954 'Beading for inlet and outlet pipe of indicators', issued by Deutscher Normenausschass.

SAE J 164: 1982 'Radiator caps and filler necks', issued by Society of Automotive Engineers, USA.

SAE J 631: 1982 'Radiator nomenclature', issued by Society of Automotive Engineers, USA.

SAE J 868: 1982 'Large size radiator filler necks', issued by Society of Automotive Engineers, USA.

The composition of the Committee responsible for the formulation of this standard is given at **Annex A (Will be added later).**

For the purpose of deciding whether a particular requirement of this standard is compiled with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2: 2022 ‘Rules for rounding off numerical values (*second revision*)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Draft Indian Standard

INTERNAL COMBUSTION ENGINES RADIATORS — SPECIFICATION
(Second Revision)

1 SCOPE

1.1 This Indian Standard specifies the type, material, performance requirements for radiators used in automotive vehicles. It also covers wherever applicable, radiators for off-highway vehicles including tractors.

1.2 It does not include radiators for cooling oil such as in transmission unit and engine lube oil.

2 REFERENCES

The following standards contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

IS No.	*Title*
193: 2000	Soft solder - Specification (*fifth revision)*
407: 1981	Brass tubes for general purposes (*third revision*)
410: 1977	Cold rolled brass sheet, strip and foil (*third revision*)
IS 513 (Part 1) : 2016	Cold reduced carbon steel sheet and strip: Part 1 cold forming and drawing purpose (*Sixth Revision*)
IS 513 (Part 2): 2016	Cold reduced carbon steel sheet and strip: Part 2 high tensile and multi - Phase steel (*Sixth Revision*)
554: 1999	Dimensions for pipe threads where pressure tight joints are required on the threads (*fourth revision*)
1079: 2017	Hot rolled carbon steel sheet and strip (*seventh revision*)
2500 (Part 1): 2000	Sampling inspection tables: Part 1 Inspection by attributes and by count of defects (*third revision*)
3331: 2007	Copper and brass strips/ foils for radiator cores (*second revision*)
13686: 1993	Internal combustion engines — Radiators — Methods of test
13687: 1993	Internal combustion engines — Radiators — Methods of test

for heat dissipation performance

3 TYPES

3.1 Sheet metal type of radiators shall be as per Fig. 1 and 2. Figure 3 is applicable for bolted type. The cast or fabricated types are indicated in Fig. 4, 5 and 6. Tube and fin types are shown in Fig. 7, 8 and 9.

4 MATERIAL

4.1 The material for the radiators and their components shall comply with the following:

Component	*Conforming to*
Core	IS 3331
Headers, filler neck, pressure cap, etc.	IS 410
Steel sheets	IS 1079 : 1988 or IS 513 (part 1) or IS 513 (part 2)
Tubes	IS 407

5 DIMENSIONS

5.1 The dimensions of filler necks, for small and medium sizes shall be as given in Table 1 and for larger size as shown in Fig. 10. The radiator dimensions shall be as specified. The threads for drain cock shall be in accordance with IS 554. The dimensions of pipes for water inlet and outlet shall conform to Table 2.

6 WORKMANSHIP AND FINISH

6.1 The solder used for fabrication shall conform to IS 193. The steel components shall be solder dipped or made out of tin or laed coated solder sheets to prevent corrosion. The radiator shall be free from dents, breakages or cracks. Joints in core, inlet and outlet shall be properly soldered and shall be free from any manufacturing defects, like discontinuities, cracks. The filler necks shall be finished smooth both from inside and outside. The radiators may also be painted when agreed between the manufacturers and the purchasers.

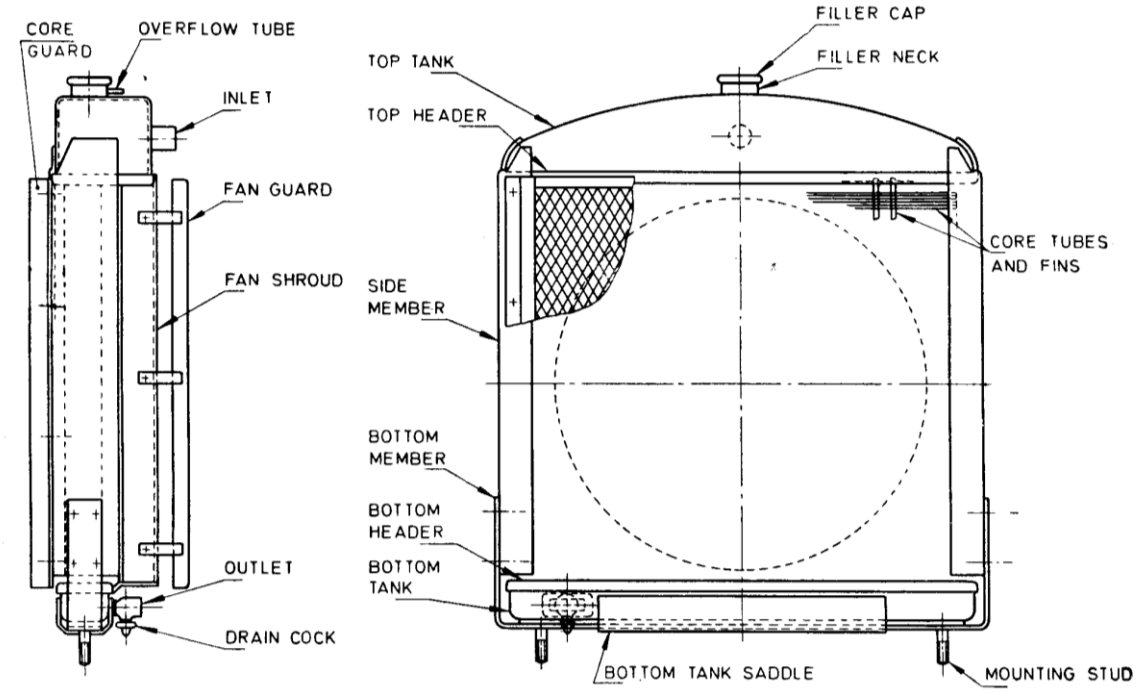


FIG. 1 SHEET METAL RADIATOR

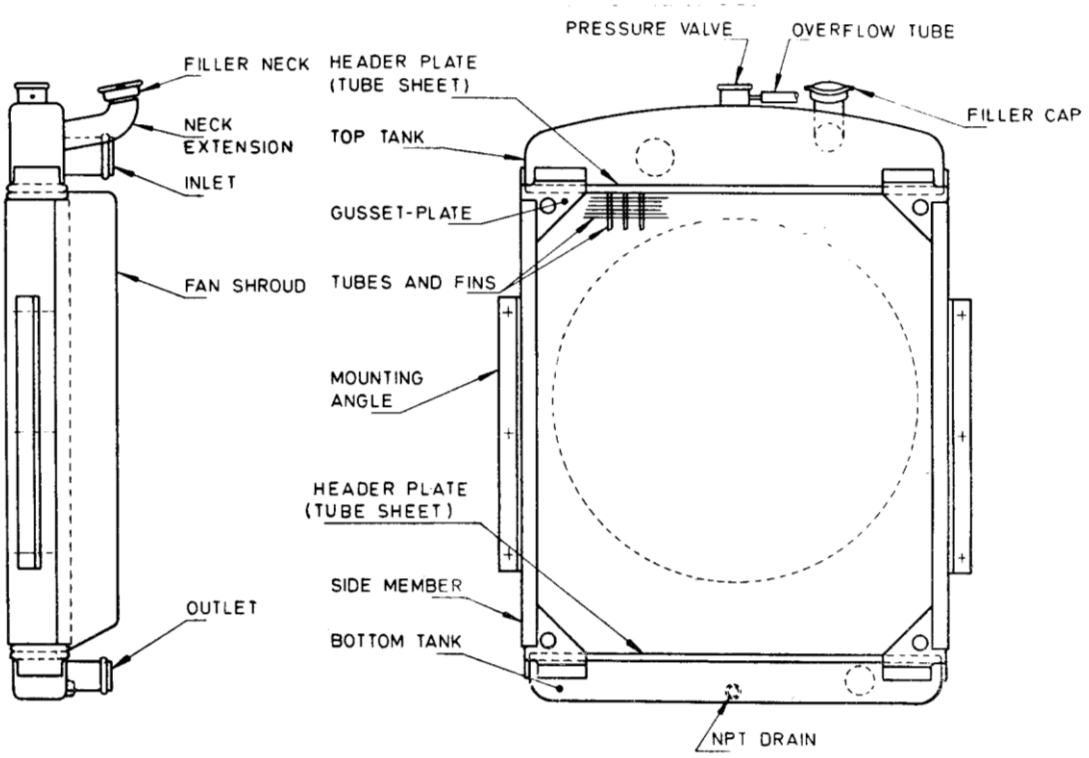


FIG. 2 SHEET METAL RADIATOR

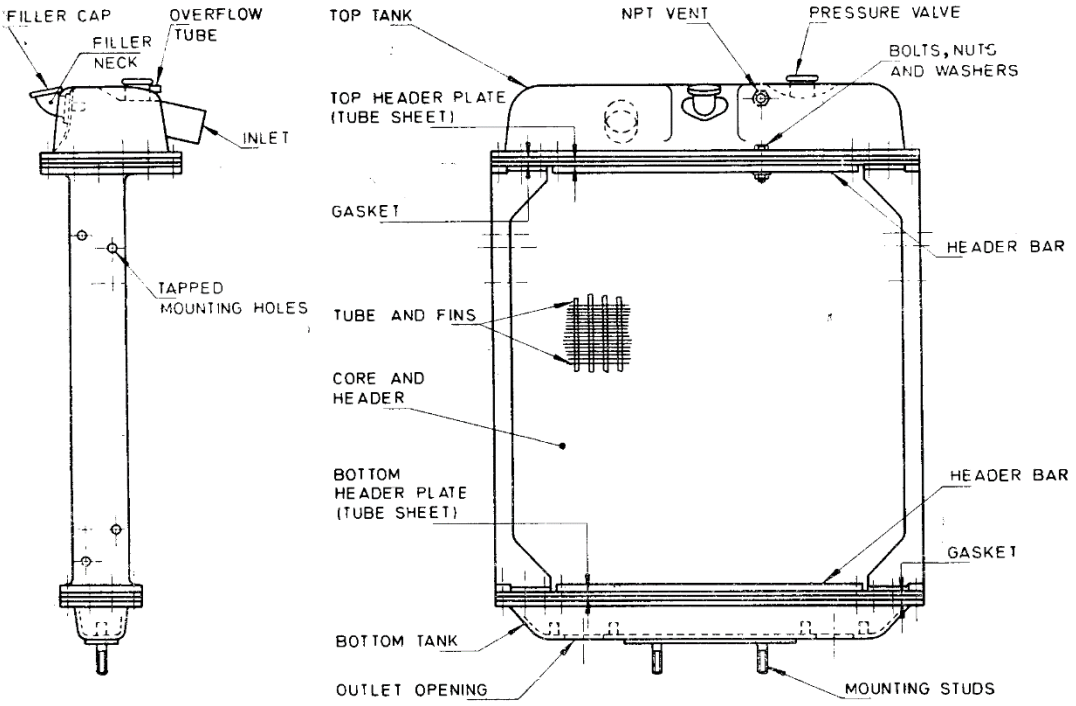


FIG. 3 BOLTED TYPE RADIATOR, DRAWN TANKS

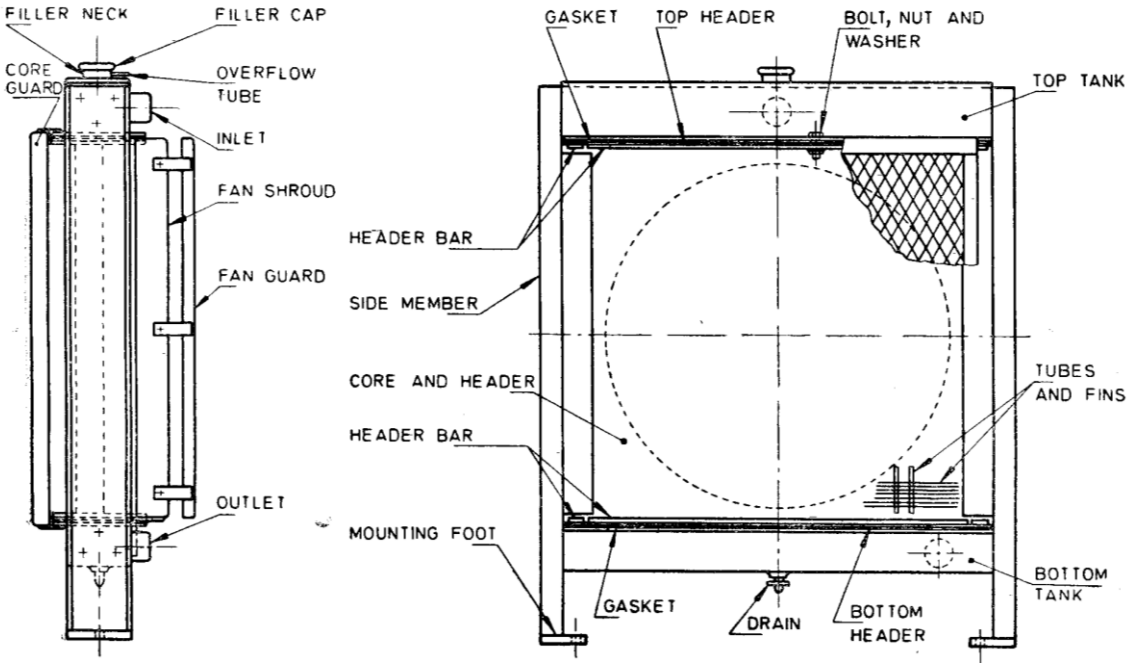


FIG. 4 CAST OR FABRICATED RADIATOR ONE PIECE CORE

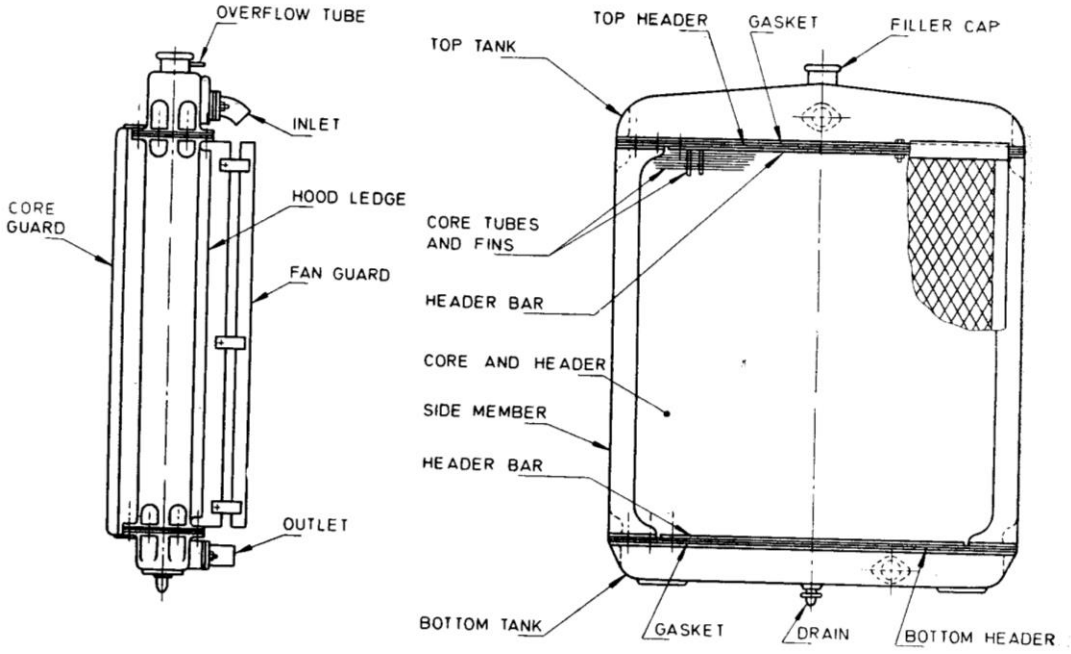


FIG. 5 CAST OR FABRICATED RADIATOR (ONE PIECE CORE)

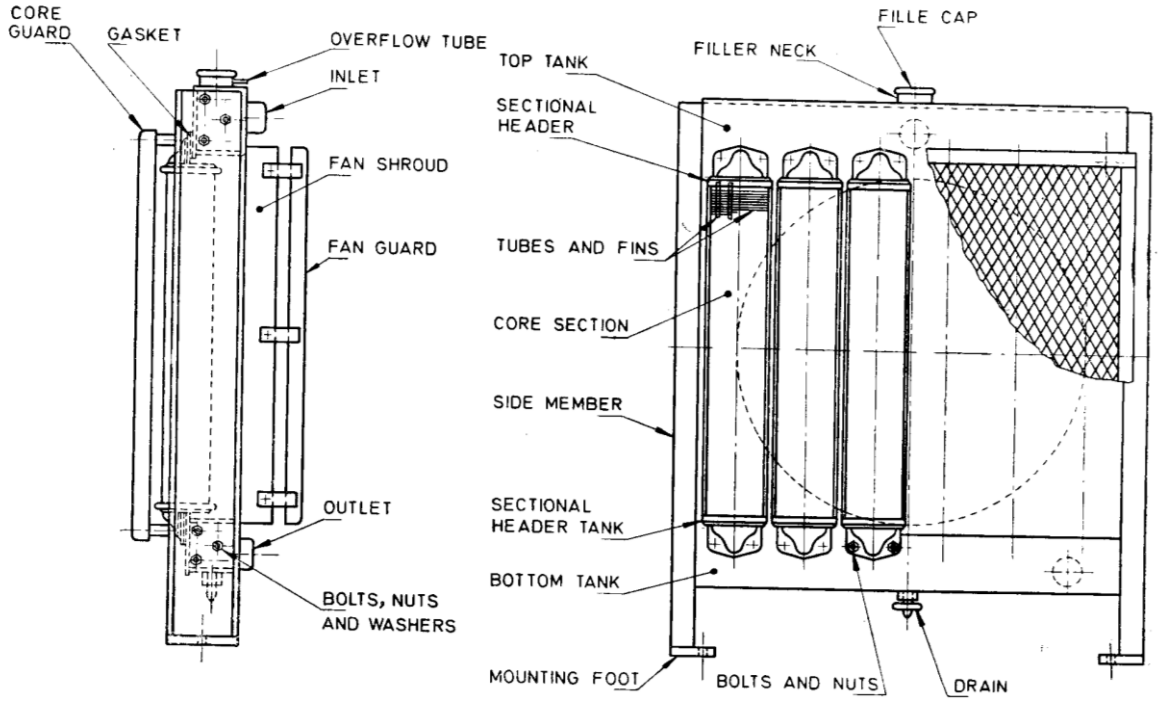


FIG. 6 CAST OR FABRICATED RADIATOR (SECTIONAL)

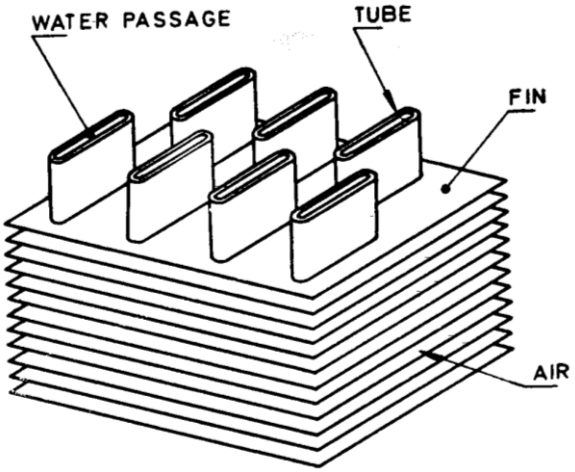


FIG. 7 TUBE AND PLATE FIN CORE

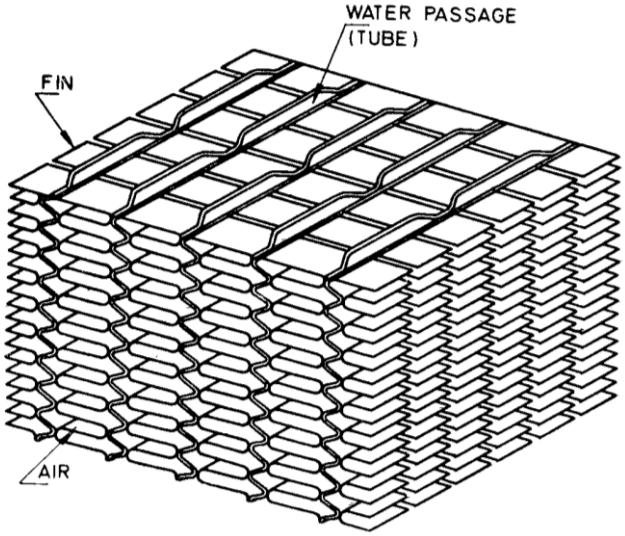


FIG. 8 RIBBON CELLULAR CORE

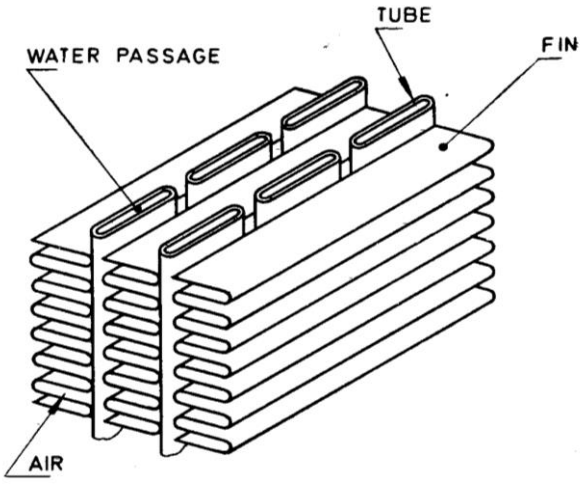
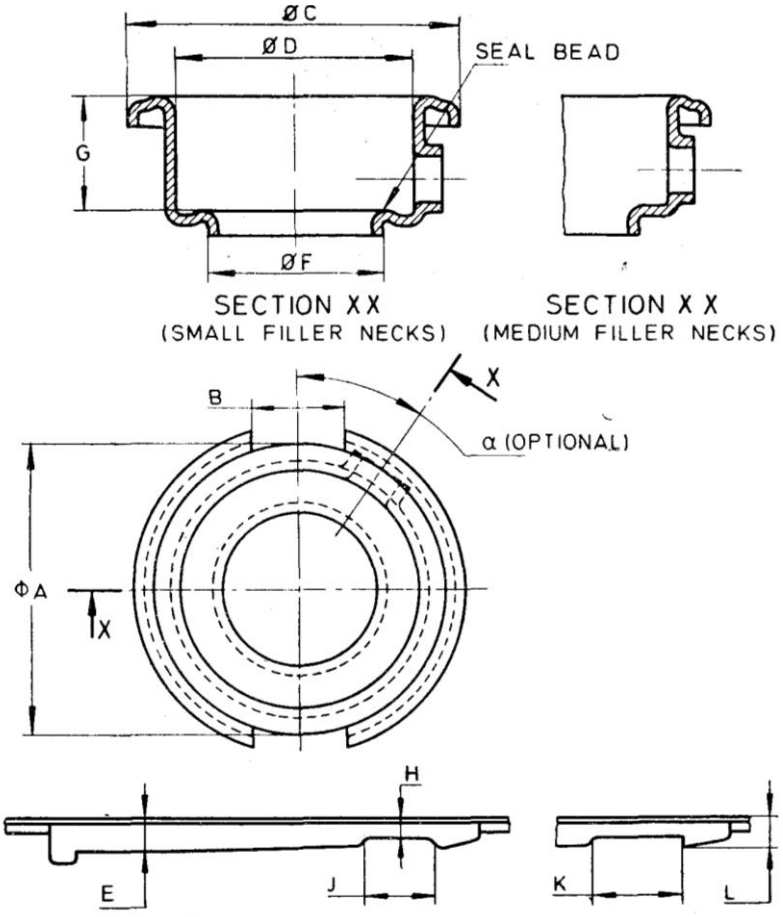


FIG. 9 TUBE AND CORRUGATED FIN CORE

Table 1 Dimensions for Small and Medium Size Radiator Filler Necks

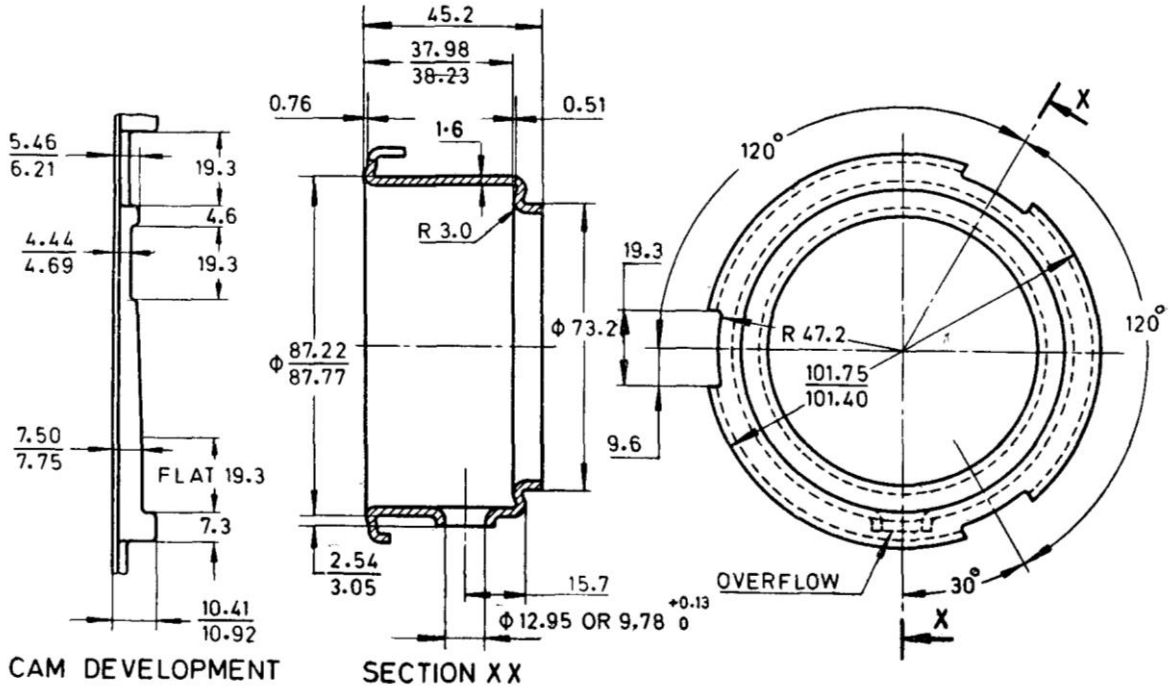
(Clause 5.1)



CAM DEVELOPMENT

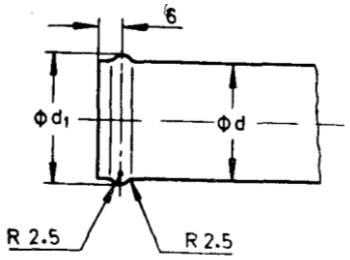
All dimensions in millimetres

Neck Size	Material Thickness	Nominal Pressure Rating kPa (kgf/cm^2)	*A* ±0.25	*B* ±0.50	*C* +0.13-0.25	*D* +0.13-0.25	*E* ±0.13	*F* ±0.13	*G* ±0.13	*H* ±0.13	*J* Min	*K* Min	*L* ±0.1
Small	1	0-35 (0-0.35)	50	12.5	57	41	5.6	30	19.5	3.3	12.5	12.5	5
	1	35-55 (0.35-0.55)	50	15.8	57	41	5.6	30	19.5	3.3	12.5	15.8	5
	1	80-110 (0.80-1.10)	50	22.5	57	41	5.6	30	19.5	31	—	22.5	5
Medium	1	0-35 (0-0.35)	62	13.2	68.5	54	5.6	42.5	18.8	3.3	—	12.5	5
	1	35-55 (0.35-0.55)	62	18.8	68.5	54	5'6	42.5	18'8	3.3	—	17	5
NOTE — Square safety stop and dimensions K and L are recommended.													



All Dimensions in millimeters.
FIG. 10 DIMENSIONS FOR LARGE SIZE RADIATOR FILLER NECK

Table 2 Dimensions of Water Inlet and Outlet Pipes
(*Clause* **5.1**)



All Dimensions in millimeters.
FIG. 11 DIMENSIONS OF WATER INLET AND OUTLET PIPES

d_1+0·5	27	32.5	40	47	53	58	63
d	25	31.5	38	45	50	55	60
NOTE — These are preferred dimensions. Pipes of dimensions other than these can be used when agreed between manufacturer and purchaser.							

7 TESTS

7.1 Type Test

The following shall constitute the type tests for acceptance purposes. These tests shall also be carried out when any major modifications on approved types are carried out:

a) Pressure test;
b) Leakage test for filler neck;
c) Internal cleanliness test;
d) Heat transfer performance;
e) Pressure impulse;
f) Vibration; and
g) Resistance to paint (only for painted radiators).

7.2 Routine Tests

The following tests shall be carried out on each radiator:

a) Pressure tests; and
b) Leakage test for filler neck.

7.3 Acceptance Tests

The following tests shall constitute tests for the purpose of acceptance and shall be carried out on sampling basis:

a) Dimensions; and
b) Internal Cleanliness.

7.4 Pressure Test

When tested in accordance with **3.6** of IS 13686 the radiator sha1l be free from any leakage.

7.5 Leakage Test for Filler Neck Seat

7.5.1 The radiator shall comply with **3.7** of IS 13686.

7.6 Internal Cleanliness Test

7.6.1 The test shall be carried out in accordance with **3.8** of IS 13686.

7.7 Heat Transfer Performance

7.7.1 The test shall be carried out as outlined in IS 13687. The performance shall be within $\pm$ 10 percent of the value recommended by the manufacture.

7.8 Pressure Impulse Test

7.8.1 The test shall comply with requirements given in **3.10** of IS 13686.

7.9 Vibration Test

7.9.1 When tested in accordance with **3.11** of IS 13686, leakage, drop in pressure crack in mountings or any noticeable failure shall not be permitted.

7.10 Resistance to Paint (Only for Painted Radiators)

7.10.1 The test shall comply with requirements given in **3.13** of IS 13686.

7.11 Optional Tests

7.11.1 The following tests shall constitute optional tests and they shall be carried out if agreed between manufacturer and purchaser:

a) Test on engine dynamometer; and
b) Vehicle testing on road.

8 MARKING

8.1 Each radiator shall be legibly and indelibly marked with indication of source of manufacture, month and year of manufacture and any other markings required such as part number, volumetric capacity.

8.2 BIS Certification Marking

This product may also be marked with the Standard Mark.

8.2.1 The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act*, 2016 and the Rules and Regulations made thereunder. The details of conditions under which the license for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

9 PACKING

9.1 The packing shall be as per agreement between the purchaser and the manufacturer. Care shall be taken to prevent damage in transit particularly to the core.

10 SAMPLING

10.1 Lot

In a consignment all the radiators of the same type and size manufactured from the same material under similar conditions of production shall be grouped together to constitute a lot.

10.2 Unless otherwise agreed to between the supplier and the purchaser, the procedure as given in IS 2500 (Part 1) shall be followed for sampling inspection. The inspection level, acceptable quality level (AQL) and type of sampling plan to be followed for various characteristics shall be given in as per IS 2500 (Part 1).

10.2.1 For dimensions, workmanship, finish and internal cleanliness, a single sampling plan with inspection level IV and AQL of 1.5% as given in Tables 1 and 2 of IS 2500 (Part 1) shall be followed.

11 INFORMATION ON ENQUIRY/SUPPLY

A typical format is given below:

a) Indication of the source of manufacture;

b) Details of engine:
   1) Rating, kW;
   2) Speed at full load, rpm;
   3) Type of coolant, flow rate;
   4) Details of fan, if any, including flow characteristics; and
   5) Rate of heat to be dissipated.

c) Site conditions (where radiator is expected to function). Ambient temperature K, percentage humidity;

d) Over all dimensions;

e) Maximum temperature of engine outlet water at:
   1) Specified ambient conditions;
   2) Specified water flow; and
   3) Specified air flow.

f) Heat transfer performance curves;

g) Vibration characteristics of mountings and type of mounting ─ Amplitude; Frequency.... Duration.....

h) Any other auxiliary fittings (condenser, oil coolers, etc.)

j) Location of any other heat exchangers with reference to radiator;

k) Any other parameteer/special requirements.

ANNEX A
(*Foreword*)

COMMITTEE COMPOSITION

AUTOMOTIVE PRIMEMOVERS, TRANSMISSION SYSTEMS AND INTERNAL COMBUSTION ENGINE SECTIONAL COMMITTEE, TED 02

Will be added later