SURFACE VEHICLE RECOMMENDED PRACTICE

J631™ APR2025

Issued 1949-05
Revised 2025-04

Superseding J631 OCT2018

Radiator Nomenclature

RATIONALE

Five-Year Review.

1. SCOPE

This SAE Recommended Practice documents nomenclature in common use for various types of radiator and radiator core construction, as well as for various radiator-related accessories.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

SAE J151 Pressure Relief for Cooling System

SAE J164 Cooling System Metallic Caps and Filler Necks

2.2 Related Publications

The following publications are provided for information purposes only and are not a required part of this SAE Technical Report.

2.2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

SAE J1004 Glossary of Engine Cooling System Terms

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: **http://www.sae.org**

For more information on this standard, visit
https://www.sae.org/standards/content/J631_202504/

3. DEFINITIONS - RADIATOR NOMENCLATURE

3.1 BAFFLE

A barrier plate used to direct fluid flow within a tank, as under a filler neck or through an in-tank oil cooler, or to divide a tank into separate chambers, as in a deaeration tank or multi-pass radiator tank. See Figure 1.

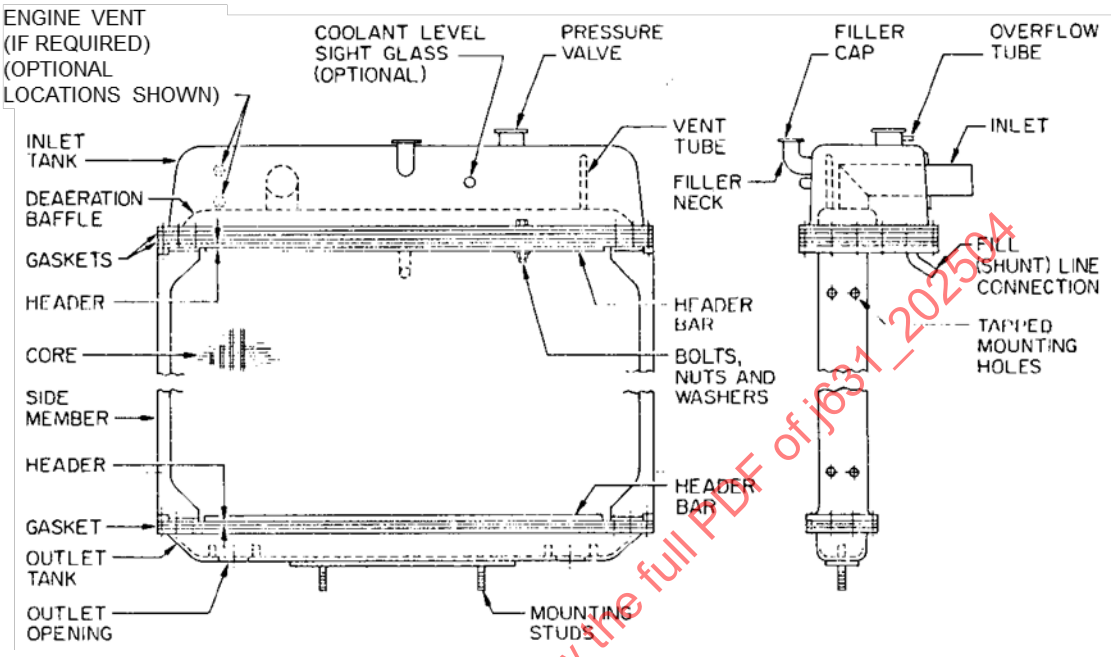

Figure 1 - Bolted-type radiator, drawn tanks (typical deaeration system shown)

3.2 BOLTED RADIATOR

A radiator whose inlet and outlet tanks are bolted to the headers of the core, usually with an O-ring or gasket seal between tank and header and bolting strips to back up the header. See Figures 1, 2, 3, and 4.

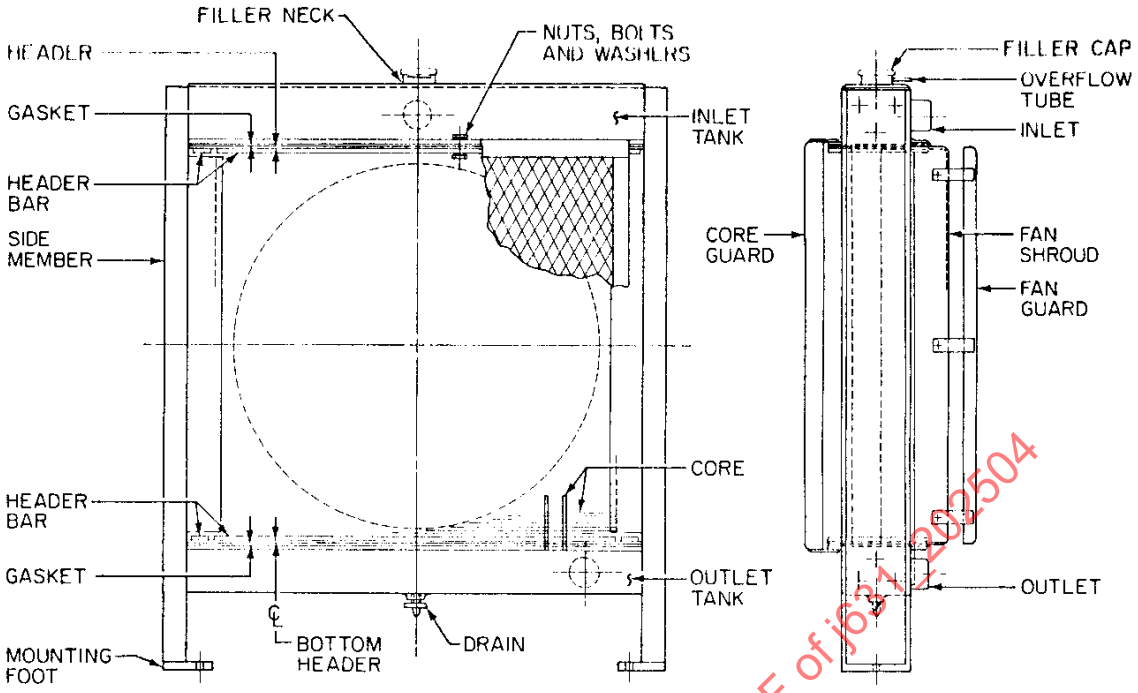

Figure 2 - Fabricated-type (one-piece core) radiator

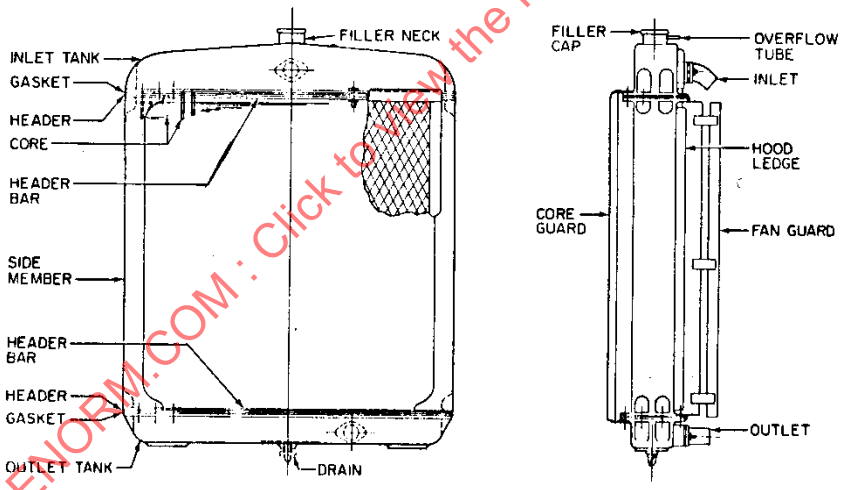

Figure 3 - Cast-type (one-piece core) radiator

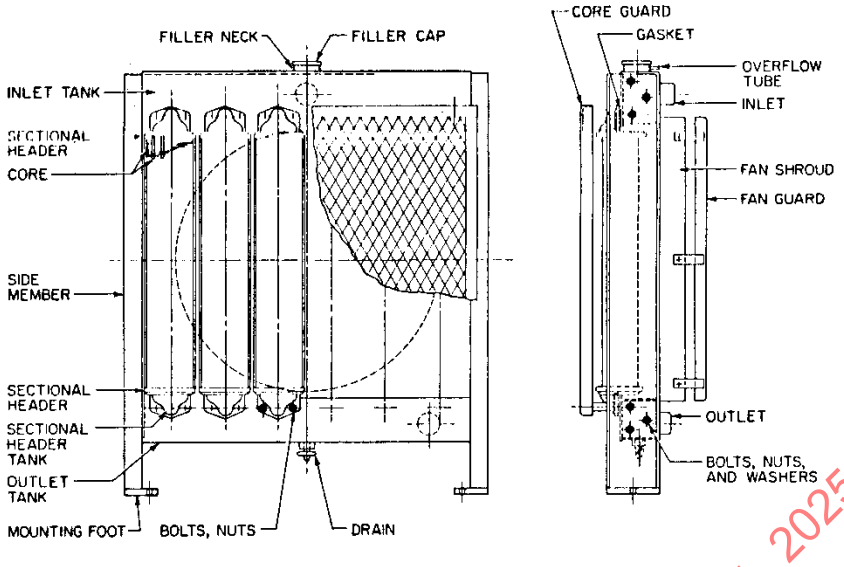

Figure 4 - Cast- or fabricated-type (sectional core) radiator

3.3 BOLTING STRIP

A strip of metal having a series of holes matching the bolting hole pattern of the tanks and headers of a bolted radiator and placed on the side of the header opposite to the tank and gasket for the purpose of clamping the joint between the tank and header by means of bolts and nuts; also called header bar. Some radiators with very light gauge tanks have bolting strips on the tank flange as well; also known as core washer. See Figures 1, 2, and 3.

3.4 BRAZED RADIATOR

A radiator in which the bond between the fins and tubes, and between the tubes and headers, is accomplished by brazing. Includes vacuum brazed aluminum radiators and controlled atmosphere brazed aluminum and copper/brass radiators. Brazing is normally conducted inside a furnace. See Figures 6 and 7.

3.5 BREATHER HOLE

A small hole in the side of a radiator filler neck extension for the purpose of venting the air in the expansion volume of a radiator to the filler neck during engine warm-up.

3.6 CAST TANK RADIATOR

A radiator having inlet and outlet tanks of cast metal, usually aluminum, or sometimes cast iron. See Figure 3.

3.7 CELLULAR CORE

A radiator core having a number of fluid passages made by joining metal ribbons at the edges and grouped to form a cellular structure. Parts of the cellular structure may be of formed or flat ribbon, which is not a part of the fluid passages. Typical construction is made by face dipping formed copper alloy components in solder. See Figure 5.

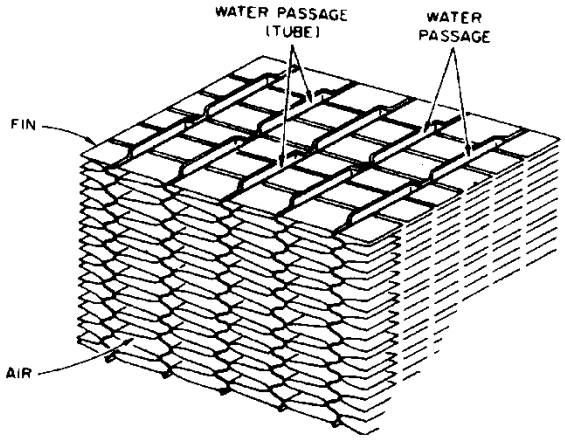

Figure 5 - Cellular core

3.8 COOLANT RECOVERY TANK

A non-pressurized auxiliary radiator tank designed to capture the expansion or after-boil overflow of coolant from the radiator, but not to perform a deaeration function.

3.9 CORE GUARD

A screen-type device sometimes provided to protect the radiator core from damage due to dirt and debris in the cooling airstream. Can also be referred to as an Insect or Rock Protection Grille. See Figures 2 and 4.

3.10 CRIMPING STRIP

A metal strip, separate from the header and usually having tabs, that may be folded or crimped around a (usually plastic) radiator tank flange and a radiator header to clamp the two together with a gasket seal between.

3.11 CROSS FLOW RADIATOR

A radiator whose core tubes run horizontally when installed in the cooling system. See Figure 6.

3.12 DEAERATION BAFFLE

A barrier used to separate chambers in a radiator top tank or auxiliary tank to form a deaeration tank. See Figure 1.

3.13 DEAERATION TANK

A tank designed to be capable of removing entrained air or combustion gas, or both, from the circulating coolant. The deaeration tank may be integral with the radiator inlet tank or may be mounted remotely.

3.14 DISHED HEADER

A header for a radiator in which the portion of the header through which the core tubes pass is depressed from the portion that makes up the header flanges, as in a dish; usually used in connection with bolted radiator construction. Allows cores to be connected end-to-end with a gasket but without the use of a filler frame.

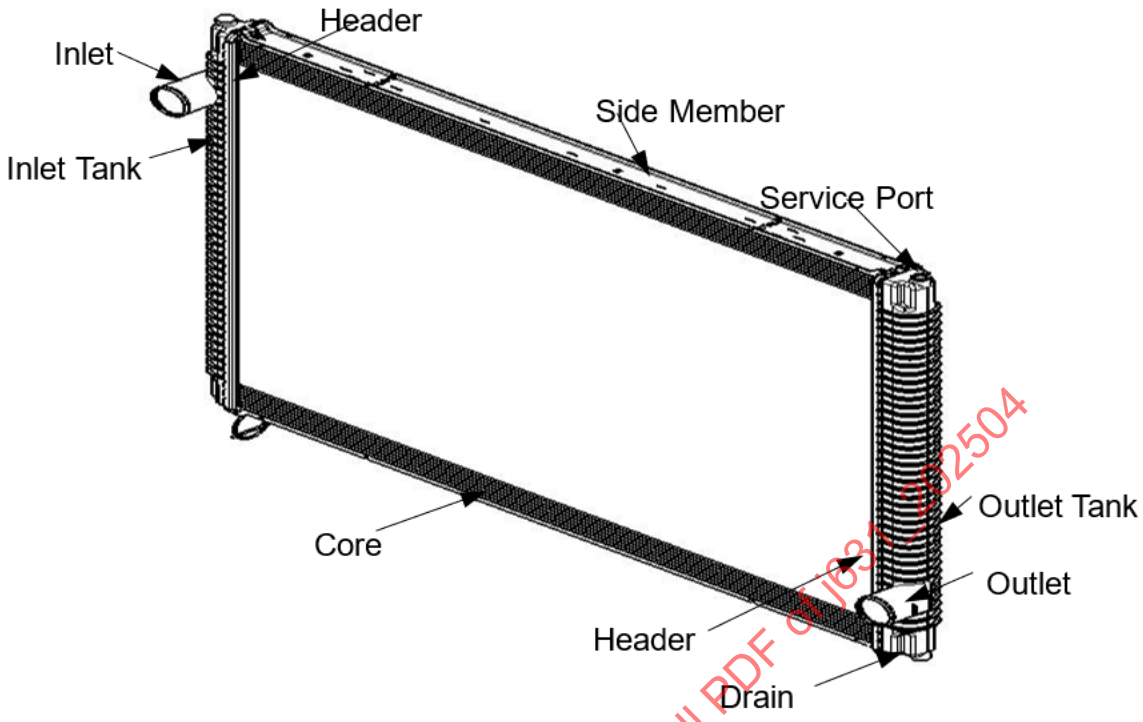

Figure 6 - Brazed automobile radiator (cross flow)

3.15 DOWNFLOW RADIATOR

A radiator whose core tubes run vertically when installed in the cooling system. See Figure 7.

3.16 DRAIN COCK

A device located at the bottom of a radiator that opens, usually by turning, to allow liquid to exit the cooling system by gravity. Also, sometimes referred to as a Drain Port.

3.17 FABRICATED RADIATOR

A radiator whose inlet and outlet tanks are fabricated, as well as its side members. Tank construction is usually made by welding of aluminum or steel plates or sheets. See Figure 2.

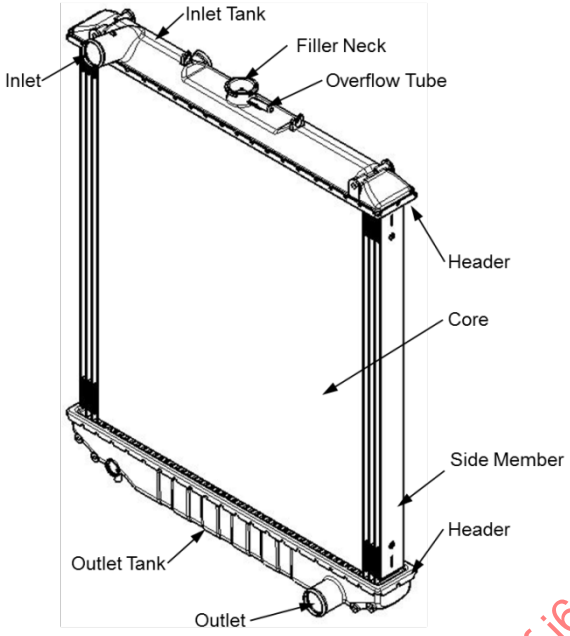

Figure 7 - Brazed automobile radiator (downflow)

3.18 FAN GUARD

A formed wire or screen device for the purpose of preventing injury to personnel by moving fan blades. A fan shroud may also provide some fan guarding function. See Figures 2 and 3.

3.19 FAN SHROUD

A duct to guide the cooling air between the radiator and the fan, increasing fan efficiency and reducing cooling air recirculation. See Figures 2 and 8.

3.20 FILLER FRAME

A frame, usually of metal, bolted between the headers of two cores with gaskets for the purpose of joining the cores end-to-end to make a larger core assembly.

3.21 FILLER NECK

The opening into a radiator inlet or outlet tank through which the cooling system is filled with coolant. Usually formed of drawn sheet metal or molded as part of a plastic tank and designed to accept a cam-lock (bayonet-type) radiator filler cap or a threaded type in many applications. See Figures 1 to 9.

3.22 FILLER NECK EXTENSION

A tubular extension of the filler neck, usually extending into the radiator inlet tank. The length of the extension and the placement of the breather hole define the expansion volume of the tank.

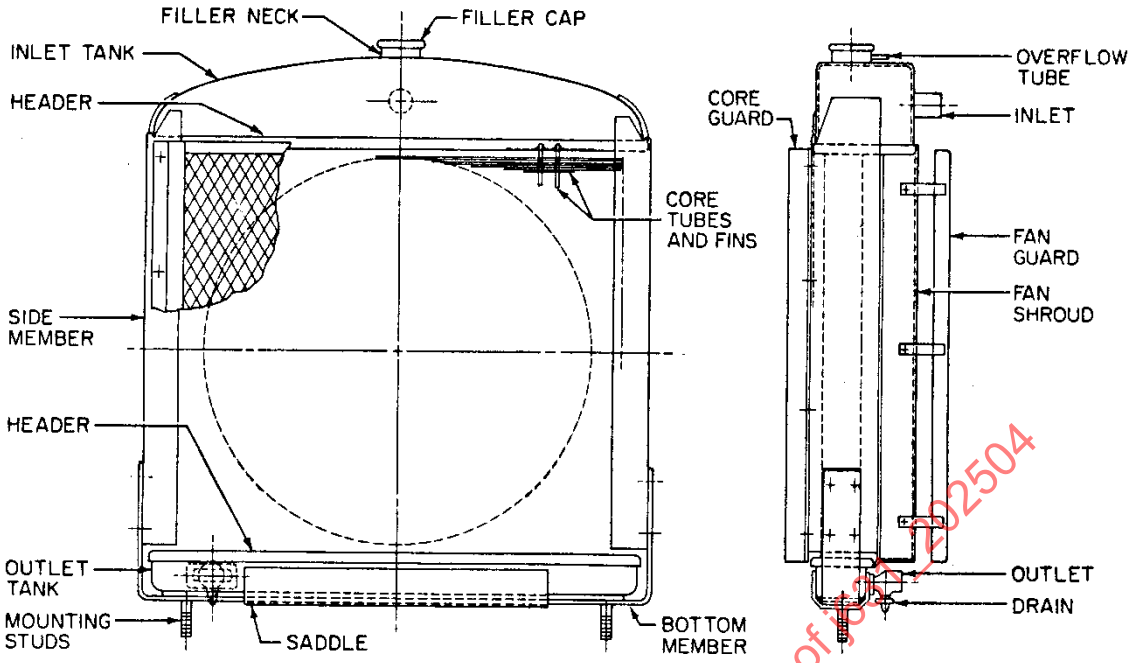

Figure 8 - Sheet metal radiator

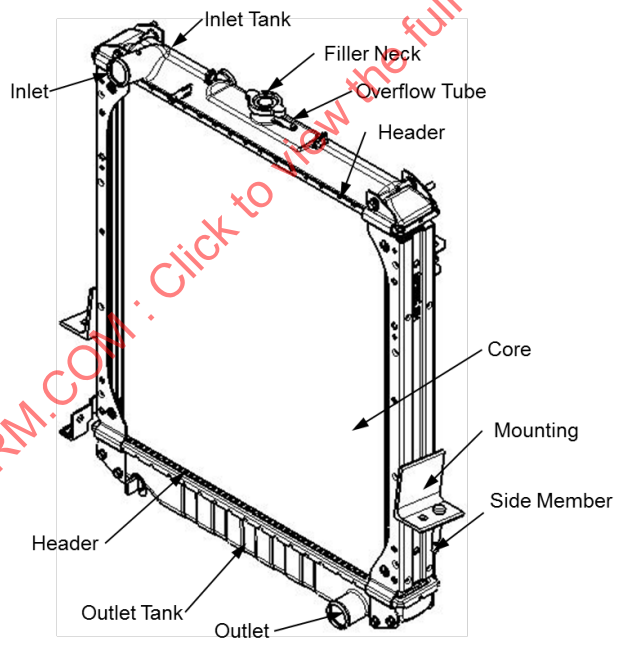

Figure 9 - Heavy-duty radiator, sheet metal-type filler frame

3.23 HEADER

A plate to which all of the fluid carrying tubes of the radiator core are connected. There is usually one header at each end of a core. The headers are, in turn, attached to inlet and outlet tanks for the purpose of guiding the fluid to be cooled from the inlet tank through the core tubes to the outlet tank. See Figures 1 to 9.

3.24 HEADER BAR

See 3.40.

3.25 HEADER REINFORCEMENT

Pieces of metal having holes for core tubes, applied to the header in certain areas to increase the strength of the tube to header joints in those areas. When used, these are applied on the end rows of tubes in a core.

3.26 HIGH TEMPERATURE RADIATOR (HTR)

This is the main radiator in a cooling system where an additional low temperature cooling circuit exists within the overall system that requires an additional low temperature radiator (LTR). In this type of system, the design of the HTR is capable of handling high coolant flows and is responsible for managing the majority of the engine's heat rejection into the coolant. For clarity, the term HTR is normally used only when there is a low temperature circuit and LTR in use. It would otherwise be simply called the radiator. Also known as jacket water radiator.

3.27 IN-TANK OIL COOLER

An oil-to-coolant oil cooler mounted in a radiator tank typically used to cool engine, transmission, power steering, or hydraulic system fluid. If located in the outlet tank of a downflow radiator, it may be referred to as a bottom tank cooler.

3.28 LOCK SEAM TUBE

A radiator core tube made from flat strip by folding the edges together into a locking seam. Usually made of brass with a solder-sealed seam. See Figure 10.

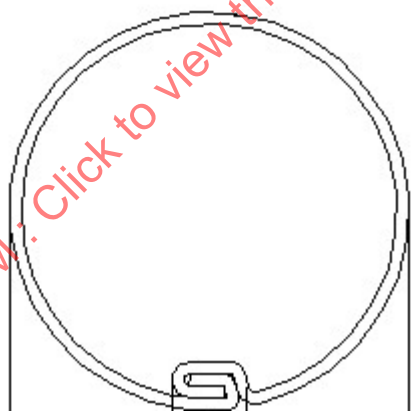

Figure 10 - Lock seam tube

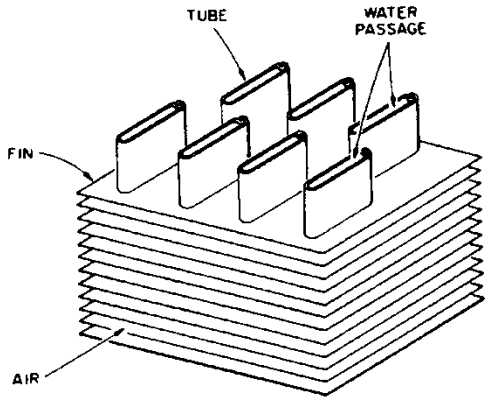

Figure 11 - Tube and plate fin core (shown in staggered tube configuration)

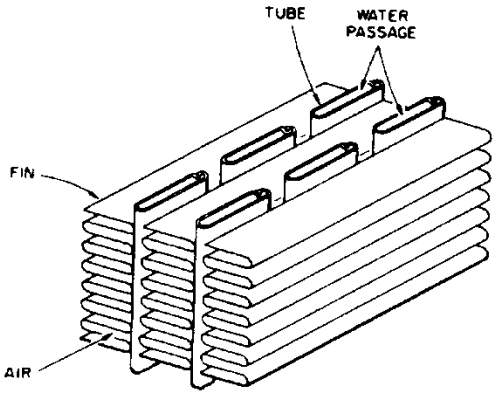

Figure 12 - Typical tube and serpentine fin core (often referred to as tube and center core or CT core)

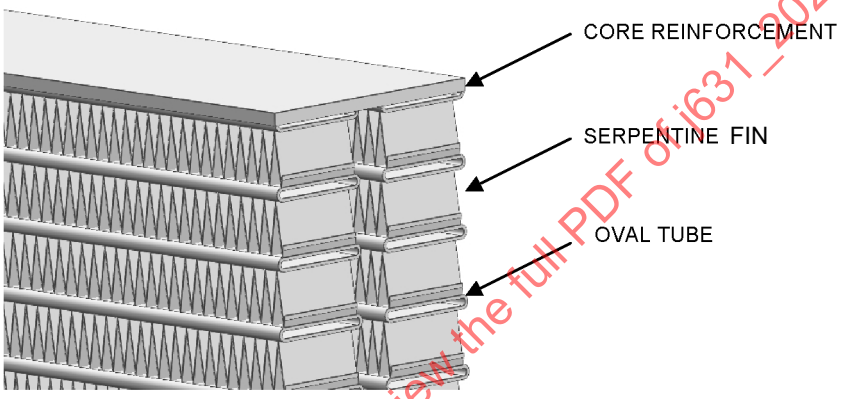

Figure 13 - Typical tube and serpentine fin core

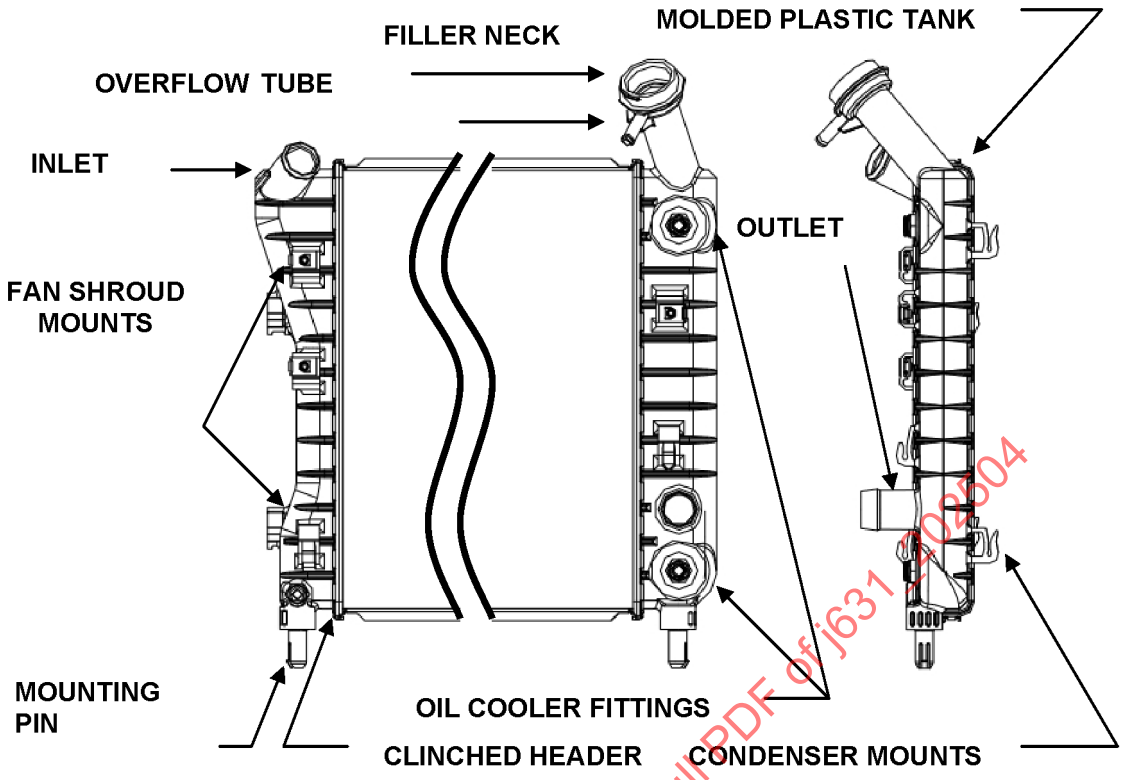

Figure 14 - Automotive cross flow radiator with molded plastic tanks

3.29 B-TUBE

A radiator core tube formed from flat metal strip stock folded to form a flat middle seam that can be brazed together. Typically made from aluminum flat coil stock with a clad exterior layer for bonding the seam and for bonding to the air-fins. See Figure 15.

Figure 15 - B-tube

3.30 LOUVERED FIN

A radiator core fin having louvers for the purpose of reducing the boundary layer thickness by turbulating the cooling air for improved heat transfer performance. The louvers improve heat transfer over a plain fin by repeatedly reducing the air boundary layer thickness. See Figure 16.

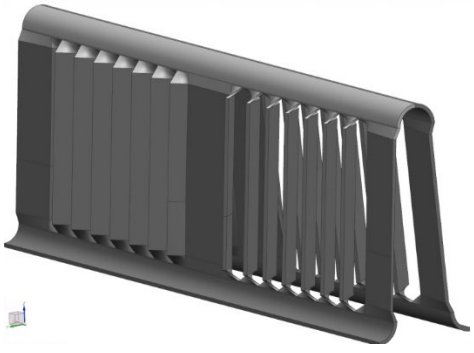

Figure 16 - Louver fin

3.31 LOW FLOW RADIATOR

A radiator for use in a low flow cooling system, which under normal conditions operates at a coolant flow through the radiator of significantly less than full engine coolant flow rate, thus increasing the temperature drop of the coolant through the radiator. Usually used to provide low temperature coolant to a liquid cooled charge air cooler.

3.32 LOW FLOW COOLING (LFC) VALVE

A valve used to vent the radiator to the surge tank or deaeration tank of a low flow cooling radiator to allow air (gas) to escape during system fill and start-up and to allow deaeration but prevent or minimize coolant bypass during normal operation.

3.33 LOW TEMPERATURE RADIATOR (LTR)

A radiator used to cool a low temperature circuit in a cooling system and used in conjunction with the system's high temperature radiator (HTR) to achieve overall engine cooling and emissions needs. This LTR circuit utilizes low coolant flows, and the heat exchanger is often multi-pass. These two factors yield a high temperature delta or low LTR coolant-out temperatures. This coolant is then routed to auxiliary heat exchanger(s) and/or other components, usually related to emissions or charge air cooling, that require lower-than-traditional HTR system temperatures. Also known as low temperature after-cooler or secondary circuit after-cooler.

3.34 MECHANICAL RADIATOR

A radiator in which no metallurgical joints are formed. Tubes are passed through parallel fins and then through full face header gaskets with collars that seat in header ferrules, which are normally made of steel. The tubes are then expanded, making a mechanical joint between tube to fin and tube to header. Finally, plastic tanks are crimped in place, or steel tanks can be bolted in place, thus completing the radiator assembly. No thermal processing equipment is necessary for manufacturing.

3.35 MULTI-PASS RADIATOR

A radiator configuration in which the core is divided into two or more sections through which the coolant passes. This increases the velocity of the coolant, the distance it travels through the radiator, and coolant heat transfer and pressure drop.

3.36 MULTIPLE CORE RADIATOR

A radiator assembly made up of more than one core. These may be set side-by-side and connected to a common header or tank (see 3.48) or may be set end-to-end and connected to each other.

3.37 NON-LOUVERED FIN

A radiator fin that may be a flat, wavy, dimpled, or ribbed plate fin, or a serpentine fin, without louvers.

3.38 ONE-PIECE CORE RADIATOR

A radiator having a single core, as opposed to one having more than one core making up a core assembly.

3.39 PLASTIC TANK RADIATOR (PTR)

A radiator whose inlet and outlet tanks are made of plastic, usually glass fiber reinforced. Figures 6 and 7 can represent radiators having plastic inlet and/or outlet tanks. Inlet and outlet ports are integral with the appropriate tank. The filler neck and other parts and/or fittings may also be integrated with the tanks. Tanks are gasketed and secured to the headers, usually by tabs on the header, or by crimping strips, that are crimped onto or over the tank flange compressing the tank gasket. See Figure 17.

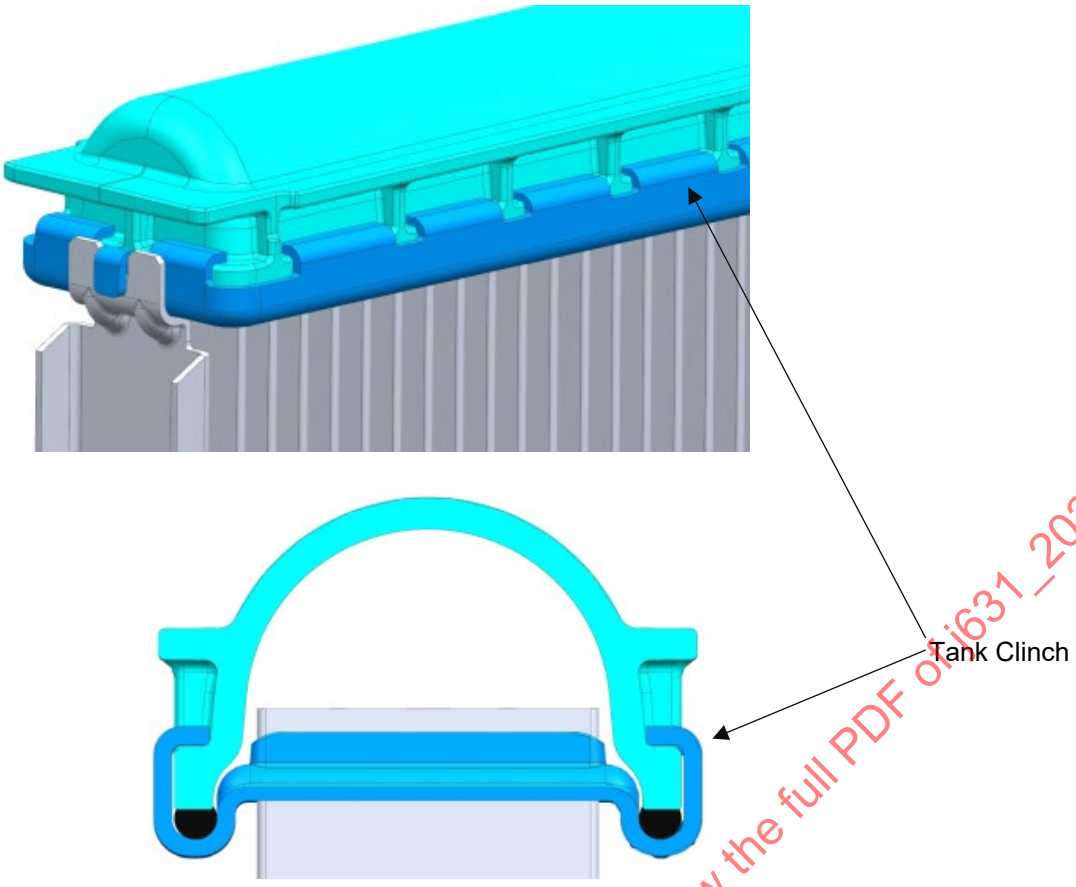

Figure 17 - Radiator tank clinch

3.40 PLATE AND BAR RADIATOR

A radiator core array made up of external fins and internal turbulators are stacked against an aluminum two-side clad sheet. The water passages with turbulators are formed by inserting aluminum bars along the front and rear of these passages, which braze to the aluminum clad sheet. Header bars are placed between the passages at the ends and brazed to the aluminum clad sheet. A single-side clad plate is brazed into place on the two outside rows of external fins. The radiator core assembly is brazed, normally by vacuum brazing. Typically, fabricated or cast aluminum tanks are welded into place, forming the inlet and outlet.

3.41 PLATE FIN

A continuous flat fin having holes through which the radiator tubes pass. The holes are usually collared to make a mechanical, soldered, or brazed connection to the tubes. See Figure 11. The length of the collar also determines fin spacing; also called fin density. The fins may be ribbed, dimpled, or louvered to improve heat transfer to the cooling air.

3.42 QUICK DRAIN CONNECTION

A device located at the bottom of a radiator that will allow for a coolant extractor to connect and easily remove liquid from a cooling system.

3.43 RADIATOR CAP, SOLID

A removable device that closes the cooling system fill opening (filler neck). When installed, it permits no leakage under any cooling system operating condition. It must be used in combination with a radiator pressure relief valve. See “Filler Cap” in Figures 1, 4, and 8.