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## GLOSSARY OF ENGINE COOLING SYSTEM TERMS

**Foreword**—This reaffirmed document has been changed only to reflect the new SAE Technical Standards Board format.

1. **Scope**—The objective of this glossary is to establish uniform definitions of parts and terminology for engine cooling systems.

2. **References**—There are no referenced publications specified herein.

### 3. Definitions

3.1 **Aeration**—The entrainment of gas (air or combustion gas, or both) in the coolant.

3.2 **Afterboil**—Boiling of the coolant after engine shutdown caused by residual heat in the engine.

3.3 **Afterboil Volume**—The quantity of coolant forced from the engine by afterboil. This may or may not be displaced from the system depending upon the system design or coolant level, or both.

3.4 **Air-to-Boil Temperature**—The ambient temperature at which the coolant at the radiator inlet reaches its boiling point. The coolant boiling point is a function of the absolute pressure and the characteristics of the coolant. However, the term is also quite commonly used without consideration for the absolute pressure or the coolant characteristics. In this case, an open radiator at sea level pressure with water, boiling point 100 °C (212 °F), as the coolant is assumed. The Air-to-Boil Temperature is computed as follows: Boiling temperature (or design temperature, which may be less than the boiling temperature) of the system coolant minus the highest coolant temperature plus ambient temperature.

3.5 **Air Recirculation—Fan**—The recycling of air already discharged by the fan.

3.6 **Air Recirculation—Radiator**—The recycling of hot air already passed through the radiator, usually caused by engine enclosure pressure.

3.7 **Ambient Temperature**—The environmental air temperature in which a unit is operating. In general, the temperature is measured in the shade (no solar radiation) and represents the air temperature for engine cooling performance measurement purposes. Air entering the radiator may or may not be the same as ambient, due to possible heating from other sources or recirculation.

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- 3.8 Approach Temperature Differential**—The temperature difference between hot fluid leaving and cold fluid entering the heat exchanger.
- 3.9 Auxiliary Tank**—A separate tank in the cooling system provided to perform one or more of the following functions: (a) filling, (b) coolant reservoir, (c) de-aeration, (d) retention of coolant expelled from radiator by expansion or afterboil, or both, and (e) visible fluid level indication.
- 3.10 Blocked Open Thermostat**—A normal thermostat mechanically blocked open to the position representing its maximum open position; usually used during cooling tests.
- 3.11 Blower Fan**—A fan positioned in a cooling system such that the air passes through the fan before entering the radiator.
- 3.12 Coolant**—A liquid used to transport heat from one point to another.
- 3.13 Cooling Differential (Inlet Temperature Differential)**—The temperature differential existing between the ambient air temperature and the coolant temperature at the radiator inlet.
- 3.14 Cooling System**—A group of inter-related components to effect the transfer of heat.
- 3.15 Cooling System Capacity (Volume)**—The amount of coolant designated in liters (quarts) to completely fill a cooling system to its designated cold level mark.
- 3.16 De-aeration**—The removal or purging of gases (air or combustion gas, or both) which have been entrained in the coolant.
- 3.17 De-aeration Baffle**—A barrier used to separate chambers in a top tank or auxiliary tank to form a de-aerating tank.
- 3.18 De-aeration Capability**—The ability of the cooling system to de-aerate the coolant expressed in terms of time or performance, or both, under specified test procedures.
- 3.19 De-aerating Tank**—A specially designed tank capable of removing entrained air or combustion gas, or both, from the circulating coolant.
- 3.20 Drawdown**—The quantity of coolant which can be lost before impairing the cooling system performance, or grade cooling level, under normal operating conditions.
- 3.21 Expansion Volume**—The volume of space in a cooling system (such as in the radiator top tank or auxiliary tank) which allows for the expansion of coolant resulting from temperature rise.
- 3.22 Fan Air Flow**—The rate of air flow usually in units of cubic meters (cubic feet) per minute that a fan can deliver at standard air conditions and a specified static pressure and speed.
- 3.23 Fan Drive—Temperature Controlled**—A fan drive which can be turned on or off or whose speed can be modulated in accord with temperature conditions of either the coolant or the circulated air. The purpose of the drive is to operate the fan as required for cooling, but when cooling demands permit, allows the fan speed to be reduced or the fan to free-wheel to reduce fan horsepower or fan noise, or both. The clutch may be any of the following types: (a) Dry Clutch, (b) Wet Clutch, (c) Viscous Shear Coupling, (d) Dump and Fill, or (e) Electronically Controlled.

- 3.24 Fan Drive—Torque Limiting**—A drive, usually of a viscous shear type, not controlled directly by coolant or air temperature, which is used to limit maximum fan speed and power absorption.
- 3.25 Fill Rate**—The coolant flow rate usually in liters (gallons) per minute that an empty cooling system will accept up to the full mark without overflowing.
- 3.26 Flow Rate, Coolant**—The rate of flow of coolant through a cooling system component or group of components under specified conditions in liters (gallons) per minute.
- 3.27 Free Flow**—Water flow rate, in liters (gallons) per minute, at a specified water temperature, through a radiator tested in its installed position while maintaining water at atmospheric pressure at seat of pressure cap (or pressure relief valve) for downflow radiator, or at highest point on inlet tank for a crossflow radiator. This rate is used for manufacturing quality control purposes, and for checking suspect radiators which have been in service (and which may be clogged internally).
- 3.28 Grade Cooling Level**—The cooling differential or air-to-boil value obtained while maintaining a specified speed of ascent on a particular percent and length grade.
- 3.29 Heat Dissipation**—The quantity of heat, usually expressed in British thermal units per kilowatts (minute), that a heat transfer component can dissipate under specified conditions.
- 3.30 Idle Time to Boil**—The time required to boil the coolant while idling following other specified conditions.
- 3.31 Inlet Restriction (Coolant Pump)**—The difference between the pressure of the coolant at the pump inlet under no flow conditions with the radiator filler cap removed, and the pressure under full flow conditions with the thermostat blocked fully open and the radiator filler cap removed.
- 3.32 Inlet Tank Temperature**—The temperature of coolant entering the radiator inlet.
- 3.33 Low Flow Cooling System**—A 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 for a charge air cooler.
- 3.34 Multi Pass Radiator**—A radiator configuration where the core is divided into two or more sections which the coolant passes through increasing the velocity of the coolant and the distance it travels through the radiator.
- 3.35 Open Radiator Tank**—A radiator tank that is open to atmospheric pressure.
- 3.36 Outlet Tank Temperature**—The temperature of the coolant leaving the radiator outlet (this would include any temperature gain or loss from any device located in the radiator outlet tank).
- 3.37 Outlet Temperature Differential**—The temperature difference between the ambient air temperature and the coolant temperatures at the radiator outlet.
- 3.38 Overflow Bottle**—See "Auxiliary Tank."
- 3.39 Overheating**—An operating condition where coolant temperature exceeds design intent. This may be caused by a deficiency in the cooling system or by abnormal operating conditions.
- 3.40 Pump Cavitation**—The formation of gas or vapor bubbles, or both, which reduce the pump delivery.

- 3.41 Pump Cavitation Pressure**—The pressure on the coolant existing at the point where a specified degree of cavitation occurs under defined temperature conditions.
- 3.42 Pump Cavitation Temperature**—Temperature of coolant at the point where a specified degree of cavitation occurs under defined pressure conditions.
- 3.43 Radiator Air Restriction**—The air pressure drop, usually expressed in Pa (inches of water), across a radiator at a specified rate of air flow and air density.
- 3.44 Radiator Air Baffle**—Various types of barriers used to enclose or direct air through the radiator to minimize air recirculation.
- 3.45 Radiator Cooling Potential**—The temperature differential between the air temperature entering the radiator and the average temperature of coolant in the radiator, usually under stabilized conditions.
- 3.46 Radiator Shutters**—Automatic or manually operated devices positioned in front or rear of radiators to control engine coolant temperatures by regulating air flow through the radiators.
- 3.47 Radiator Tank Baffle**—A partition or divider in a radiator tank to direct coolant to a particular section of that radiator.
- 3.48 Ram Air Flow**—The amount of air passing through the radiator as a result of vehicle motion or wind.
- 3.49 Specific Heat Rejection**—The heat rejection of the engine expressed essentially in British thermal units per kilowatts (minute) per brake kilowatts (horsepower). It should be further qualified by engine load, speed, and ambient air temperature.
- 3.50 Stabilization**—A condition attained during specified conditions of engine operation when the temperatures of air, oil, and coolant have reached values which will not change regardless of the length of time the unit is run.
- 3.51 Standard Air**—Air at 21.1 °C (70 °F) and 760 Pa (29.921 in of mercury) and weighing 1.200 kg/m<sup>3</sup> (0.07488 lb/ft<sup>3</sup>).
- 3.52 Suction Fan**—A fan positioned in a cooling system so that air passes through the radiator before entering the fan.
- 3.53 Surge Tank**—See "Auxiliary Tank."
- 3.54 System Restriction (Air)**—The static pressure differential which occurs at a given air flow from air entrance through air exit in a system, generally measured in Pa (inches of water).
- 3.55 Temperature Stability on Drift**—The ability of an engine cooling system to maintain coolant temperature on a long vehicular drift (coasting). This is an important characteristic for good heater operation during winter months.
- 3.56 Thermostat**—A self-contained modulating valve in the engine coolant circuit for the purpose of controlling the flow of coolant. The amount of thermostat opening is dependent on coolant temperature; normally it is closed below a specified "start-to-open" temperature and full open at some higher specified temperature.
- 3.57 Top Tank Temperatures**—Same as Inlet Tank Temperature.