



SURFACE VEHICLE INFORMATION REPORT

J3142™

OCT2025

Issued 2018-11
Revised 2025-10

Superseding J3142 NOV2018

Thermal Flow Control Valve Nomenclature and Application

RATIONALE

SAE Five-Year Review.

INTRODUCTION

Mobile and industrial equipment operate in a wide range of ambient conditions, which often poses operational challenges. Very hot ambient conditions and very cold ambient conditions each pose unique operational challenges and must be accounted for in basic system design.

Thermal flow control valves work in concert with the rest of the cooling system design and are critical components in facilitating start-up processes and overall machine functionality across the range of ambient conditions (temperature and humidity) that are anticipated globally.

Thermal flow control valves ensure that a continuous flow of coolant or oil circulates in the system under all conditions to provide lubrication, sealing, and cooling. Furthermore, they maintain overall system temperature to promote efficient operation.

In some applications, such as portable air compressors, thermal flow control valves are integrated for purposes of preventing overcooling and to regulate system temperature above the pressure dew point to preclude internal condensation of ingested ambient moisture.

1. SCOPE

The purpose of this SAE Information Report is to define common industry terminology and nomenclature relative to thermal flow control valves and to describe common thermal flow control valve applications in automotive, highway truck, mobile construction equipment, and industrial applications.

This document is primarily directed at internal combustion engine or electric powered applications and the downstream systems to which power is provided, such as transmissions, hydraulics, air compression, etc. The information contained herein does not constitute an SAE Standard.

SAE Executive Standards Committee Rules provide that: "This report is published by SAE to advance the state of technical and engineering sciences. The use of this report is entirely voluntary, and its applicability and suitability for any particular use, including any patent infringement arising therefrom, is the sole responsibility of the user."

SAE reviews each technical report at least every five years at which time it may be revised, reaffirmed, stabilized, or cancelled. SAE invites your written comments and suggestions.

Copyright © 2025 SAE International

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, or used for text and data mining, AI training, or similar technologies, without the prior written permission of SAE.

TO PLACE A DOCUMENT ORDER: Tel: 1-877-606-7323 (U.S. and Canada only)
Tel: 1-724-776-4970 (outside U.S. and Canada)
Fax: 724-776-0790
Email: CustomerService@sae.org
http://www.sae.org

SAE WEB ADDRESS:

Full document details: SAE J3142_202510

For more information on this standard, visit
https://www.sae.org/standards/content/J3142_202510/

Documents

Standard, visit Sharing Hub

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 (U.S. and Canada only) or +1 724-776-4970 (outside U.S. and Canada), www.sae.org.

SAE J3136 Low-Temperature Coolant Circuit Nomenclature and Applications

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 (U.S. and Canada only) or +1 724-776-4970 (outside U.S. and Canada), www.sae.org.

SAE J631 Radiator Nomenclature

SAE J1004 Glossary of Engine Cooling System Terms

SAE J1148 Engine Charge Air Cooler (CAC) Nomenclature

SAE J1244 Oil Cooler Nomenclature and Glossary

SAE J1393 Heavy-Duty Vehicle Cooling Test Procedures

SAE J1468 Oil Cooler Application Testing and Nomenclature

SAE J1994 Laboratory Testing of Vehicle and Industrial Heat Exchangers for Heat Transfer and Pressure Drop Performance

SAE J3073 Battery Thermal Management

3. DEFINITIONS

3.1 MIXING THERMAL FLOW CONTROL VALVE

Thermal flow control valves installed in mixing applications are installed in fluid systems upstream of the heat source and mix a stream of hot fluid recycled from the heat source and a stream of cold fluid returning from the cooling circuit to maintain an inflow temperature to the heat source at or above a specified temperature. A mixing thermal flow control valve circuit is depicted in Figure 1.

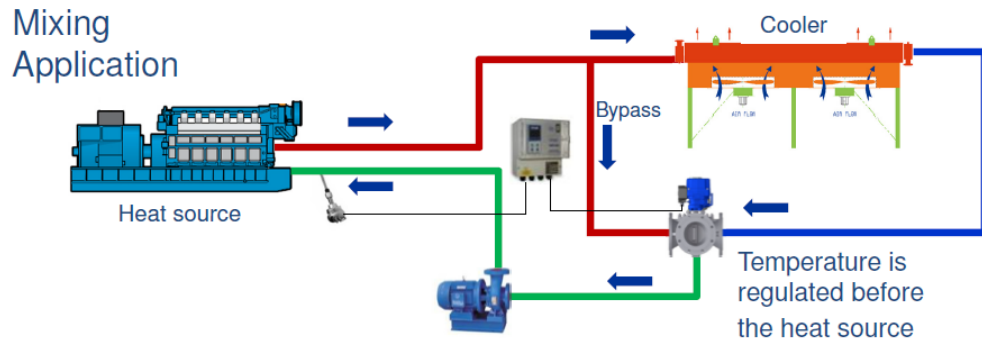


Figure 1

3.2 DIVERTING THERMAL FLOW CONTROL VALVE

Thermal flow control valves installed in diverting applications are installed in fluid systems downstream of the heat source and divert a proportioned amount of flow away from the cooling circuit to maintain the heat producing part of the system at or above a specified temperature. A diverting thermal flow control valve circuit is depicted in Figure 2.

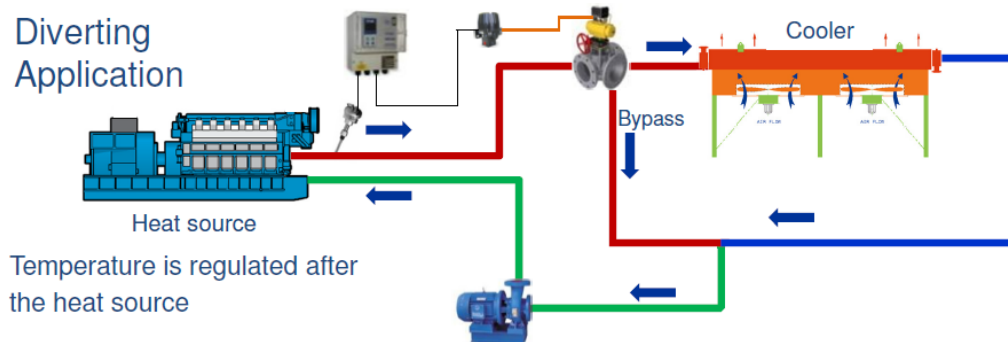
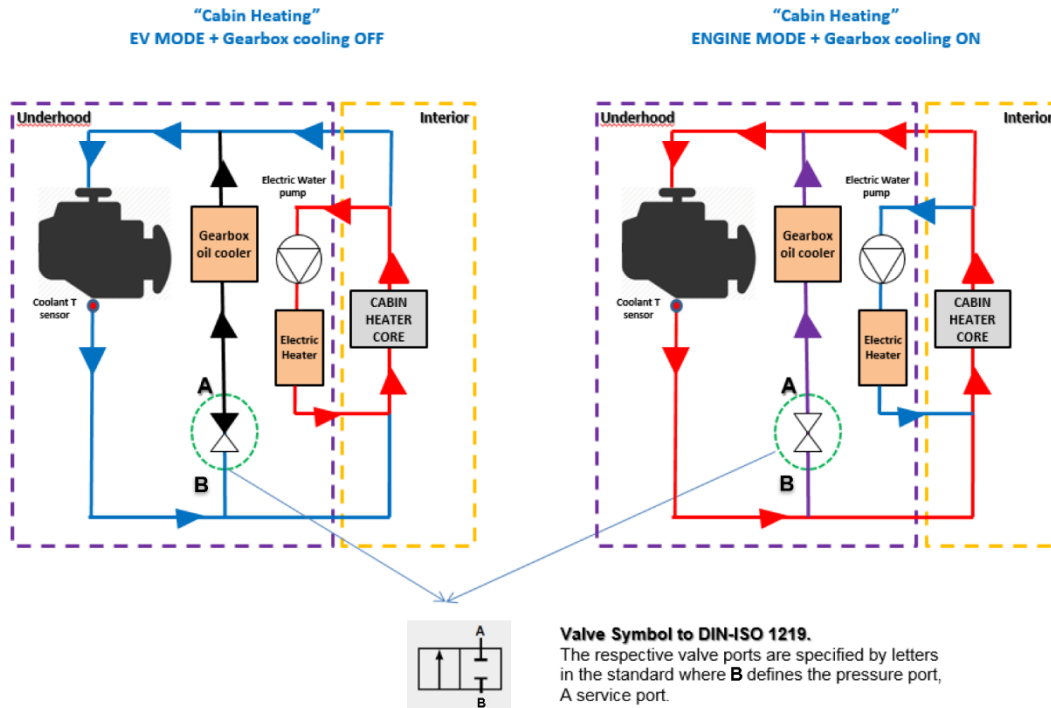


Figure 2

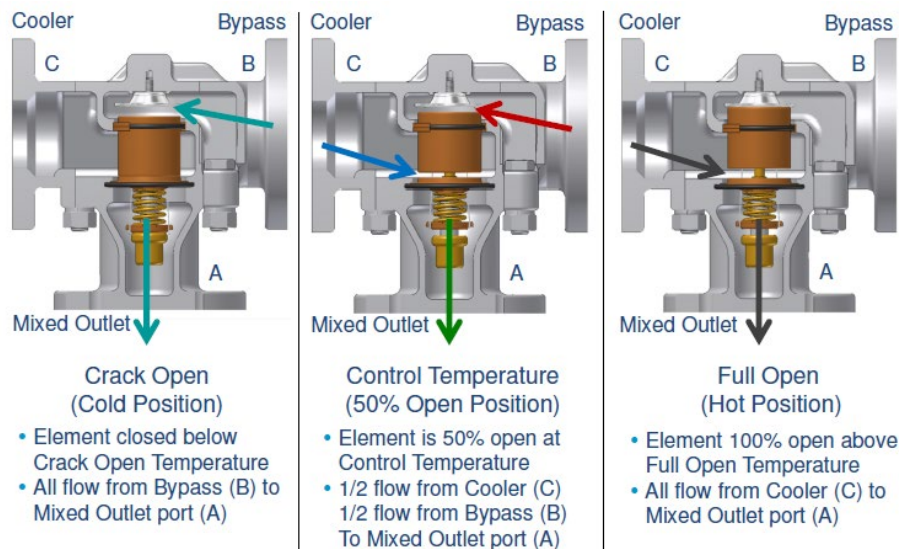
3.3 TWO PORT (ON/OFF) THERMAL FLOW CONTROL VALVE

A two port thermal flow control valve is one with two ports (A and B). Flow goes in one port and out the other. A two port valve may also be referred to as a “two way” valve. These valves work in concert with fluid systems with various flow paths of different resistance. Flow is redirected from one flow path to another when these valves are actuated from their normally open or closed position. Figure 3 illustrates the use of a two port valve to open or close coolant flow to a gearbox in an electric vehicle drivetrain.

**Figure 3**

3.4 THREE PORT (MIXING/DIVERTING) THERMAL FLOW CONTROL VALVE

A three port thermal flow control valve is one with three ports (A, B, and C). One of the ports is "common" to the other two. A three port valve may also be referred to as a "three way" valve. A typical three port thermal flow control valve (in mixing mode) is depicted in Figure 4. It can be seen that port A is common to the B and C ports in that all the flow goes through port A and flow modulates in ports B and C.

**Figure 4**

Three port thermal flow control valves are ubiquitous in automotive, highway truck, mobile construction equipment, and industrial applications. Figure 5 depicts an internal combustion engine coolant-based cab heating application.

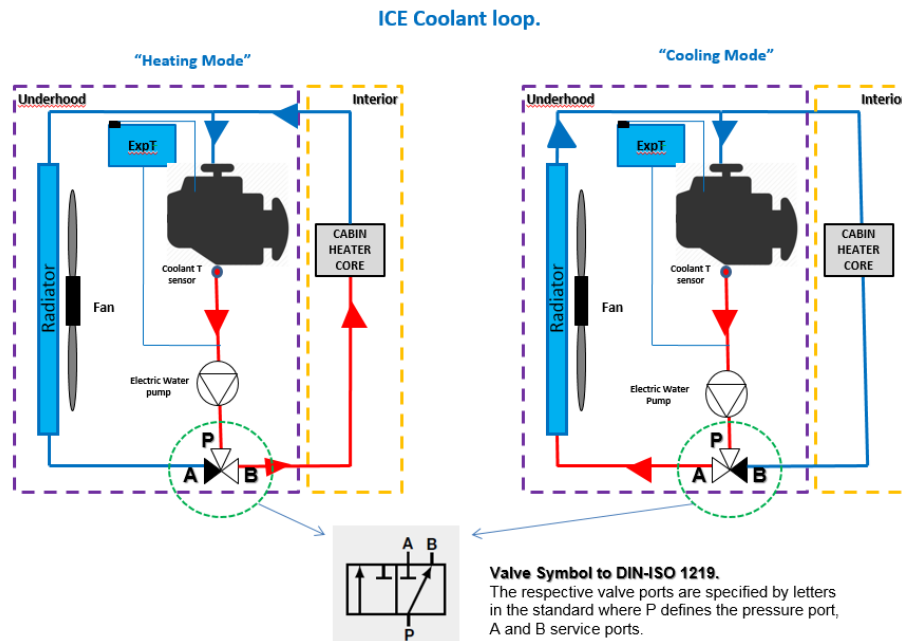


Figure 5

3.5 MULTIFUNCTION THERMAL FLOW CONTROL VALVES

A multifunction thermal control valve is a control valve that integrates multiple two port and/or three port valves into one assembly. This integration can be accomplished by simply combining different valves into one manifold or by using one rotary valve to control several functions. Some of the functions that can be integrated into a multifunction thermal control valve include:

Battery Electric Vehicle (BEV) Coolant System Applications

- Battery heating and cooling coolant flow
- Powertrain electronics coolant flow
- Liquid cooled condenser coolant flow

Internal Combustion Engine (ICE) Coolant System Applications

- Engine water jacket, radiator, heater core flow
- Engine coolant flow to engine or transmission oil plate coolers



Figure 6

Figure 6 depicts a multifunction thermal control valve that uses a rotary valve to control several functions.

3.6 MECHANICAL THERMAL FLOW CONTROL VALVE

3.6.1 MECHANICALLY ACTUATED THERMAL FLOW CONTROL VALVE

A mechanically controlled thermal flow control valve is one that detects fluid system temperature and actuates purely by mechanical means. Mechanically controlled thermal flow control valves are self-contained such that the fluid temperature sensing element and actuation mechanism are in the same fixture. These valves typically contain a copper capsule containing a wax media of specific chemistry that expands and contracts in response to heat and actuates a piston, which works against a spring mechanism. A typical mechanically controlled thermal flow control valve is depicted in Figure 7.

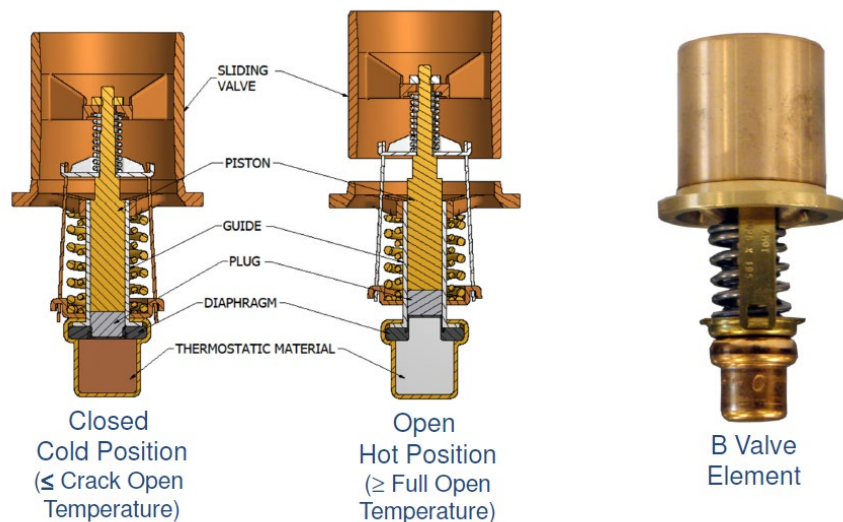


Figure 7