INCH-POUND

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PERFORMANCE SPECIFICATION

VALVE, LUBRICATING OIL COOLER, TEMPERATURE REGULATING WITH SURGE PROTECTION GENERAL SPECIFICATION FOR

This specification is approved for use by the Department of the Air Force and is available for use by all Departments and Agencies of the Department of Defense.

Comments, suggestions, or questions on this document should be addressed to: Oklahoma City Air Logistics Center/ENSDAA, 3001 Staff Drive, Tinker AFB, OK 73145-3036 or emailed to af71@tinker.af.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at http://assist.daps.dla.mil.

AMSC N/A FSC 2935

1. SCOPE

1.1 Scope. This is a general specification for temperature regulating with surge protection lubricating oil cooler valves, incorporating oil pressure relief bypass, for use on oil coolers using petroleum or synthetic base lubricating oils.

1.2 Classification. Lubricating oil cooler valves (valves) will have a maximum continuous oil flow capacity, and will be one of the following types, as specified (see 6.2):

Type I - 300 pounds per minute capacity.
Type II - 425 pounds per minute capacity.

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are cited in sections 3, 4, or 5 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of these lists, document users are cautioned that they must meet the requirements specified in the documents cited in sections 3, 4, or 5 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications, standards and handbooks. The following specifications standards and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

DEPARTMENT OF DEFENSE STANDARDS

MS33786	- Fitting Installation, Flared Tube and Hose, Swivel

(Copies of these documents are available online at http://assist.daps.dla.mil/quicksearch/ or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.3 Non-government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

AMERICAN SOCIETY FOR QUALITY (ASQ)

ASQC-Z1.4	- Sampling Procedures and Tables for Inspection by Attributes (DoD-adopted)

(ASQ documents may be obtained at http://www.asq.org/ or from American Society for Quality, P.O. Box 3005, Milwaukee, WI 53201-3005 or 600 North Plankinton Avenue Milwaukee, WI 53203.)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM-B117	- Standard Practice for Operating Salt Spray (Fog) Apparatus

(ASTM documents may be obtained at http://www.astm.org/ or addressed to the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.)

NATIONAL AEROSPACE STANDARDS METRIC (NASM)

NASM33588	- Sampling Procedures and Tables for Inspection by Attributes

(NASM documents may be obtained at http://www.aia-aerospace.org/ or addressed to Aerospace Industries Association, 1000 Wilson Boulevard, Suite 1700, Arlington, VA 22209-3901.)

2.4 Order of precedence. Unless otherwise noted herein or in the contract, in the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Associated specification. The individual item requirements shall be as specified herein and in accordance with the applicable specification sheet. In the event of any conflict between the requirements of this specification and the specification sheet, the latter shall govern.

3.2 First article. When specified (see 6.2), a sample shall be subjected to first article inspection in accordance with 4.2.

3.3 Recycled, recovered, or environmentally preferable materials. Recycled, recovered, or environmentally preferable materials should be used to the maximum extent possible, provided that the material meets or exceeds the operational and maintenance requirements, and promotes economically advantageous life cycle costs.

3.4 Materials. All materials shall be corrosion resistant or suitably treated to resist corrosion due to electrolytic decomposition, salt fog, and any other atmospheric condition that may be encountered during operational use or storage. The use of toxic chemicals, hazardous substances, or ozone depleting chemicals shall be avoided whenever feasible.

3.4.1 Compatibility. All materials shall be compatible with the lubricating oil specified in the acquisition document (see 6.2). No copper or magnesium shall be used.

3.5 Interface.

3.5.1 Fittings. The oil inlet and outlet fittings shall conform to MS33786.

3.5.2 Interface dimensions and weight. The interface dimensions and weight shall be as specified in the associated specification.

3.5.3 Locking threaded parts. Threaded parts shall be secured to prevent loss during operation. Self-locking nuts, if used shall be in accordance with NASM33588. Staking or the use of lockwashers shall not be permitted.

3.6 Performance.

3.6.1 Leakage. The valve shall not leak when subjected to an air pressure of 85 $\pm$15 psi.

3.6.2 Valve oil pressure drop. The oil pressure drop across the valve shall not exceed 12 psi for both Type I and Type II valves at their maximum continuous oil flow capacity.

3.6.3 Temperature regulation. The valve shall incorporate a thermostatic device which, using a bypass passage, controls the temperature of the oil at the valve outlet to the rated oil temperature and tolerance specified in the associated specification. The thermostatic device shall have temperature ratings for opening and closing as specified in the associated specification. The thermostatic device shall not allow the pressure difference between the oil cooler inlet and outlet to cause an internal pressure that exceeds the oil cooler proof pressure specified in the associated specification.

3.6.3.1 Endurance of thermostatic device. The thermostatic device shall be capable of withstanding 10,000 thermal cycles of opening and closing.

3.6.4 Pressure relief. The valve shall incorporate an oil pressure relief device for bypassing the oil cooler when oil pressure in the oil cooler reaches the oil pressure drop value tolerance specified in associated specification. When operating, the oil pressure drop shall not exceed the maximum oil pressure drop specified in the associated specification.

3.6.5 Surge protection. The valve shall incorporate a surge protection device for bypassing the oil cooler if subjected to an oil pressure at the oil cooler inlet that exceeds the oil cooler proof pressure, or to an oil surge with:

a. viscous oil ($10^{o} \pm 2^{o}$F).
b. pressure at the inlet of twice the oil cooler proof pressure.
c. hot oil ($225^{o} \pm 2^{o}$F for petroleum base oil, $300^{o} \pm 10^{o}$F for synthetic base oil).

3.6.5.1 Endurance of surge device. The surge device shall withstand 100 cycles of oil pressure surges of 400 $\pm$5 psi for a period of 15 seconds each.

3.6.6 Endurance of valve. The valve shall withstand 10,000 oil pressure cycles of opening and closing in the horizontal and vertical position.

3.6.7 Fluid temperature. The valve shall withstand oil temperatures of -65° to 275°F for petroleum base lubricating oil, and -65° to 350°F for synthetic base lubricating oil.

3.6.8 Vibration. The valve shall not leak when subjected to vibration with an acceleration of ±10g and at the rated oil flow specified in the associated specification.

3.7 Maintainability. The valve shall not require the use of special tools for maintenance.

3.8 Identification. The valve shall be permanently and legibly marked with the following (see 6.2):

a. Nomenclature
b. Serial number
c. National stock number
d. Contract number
e. Manufacturer's CAGE code
f. Manufacturer's part number
g. Date of manufacture

3.9 Interchangeability. All parts having the same manufacturer's part number shall be functionally and dimensionally interchangeable.

3.10 Cleanliness. The valve shall be free of foreign materials such as acids, alkaloids, halides, or other foreign materials.

4. VERIFICATION

4.1 Classification of inspections. The inspection requirements specified herein are classified as follows:

a. First article inspection (see 4.2).
b. Conformance inspection (see 4.3).

4.2 First article inspection. When required (see 6.2), first article inspection shall be performed on two valves and shall include all tests in 4.6.

4.3 Conformance inspection. Conformance inspection shall include the tests indicated in 4.3.1 and 4.3.2.

4.3.1 Individual tests. Each valve shall be subjected to the following tests:

a. Examination (see 4.6.1).
b. Leakage (see 4.6.2).

4.3.2 Sampling tests. Sampling tests shall be performed in accordance with the guidance in ASQC-Z1.4. Sampling shall begin at the inspection level (normal, tightened, or reduced)

specified in the acquisition document (see 6.2). The sample of valves shall be subjected to the following tests:

a. Temperature regulation (see 4.6.3).
b. Pressure relief (see 4.6.4).
c. Twice the oil cooler proof pressure oil surge (see 4.6.5.2).

4.4 Test conditions. Unless otherwise specified (see 6.2), all inspections shall be performed in accordance with the following test conditions.

4.4.1 Atmospheric conditions. Tests shall be conducted at standard atmospheric conditions.

4.4.2 Oil. The oil used for all tests shall be specified in the acquisition document (see 6.2).

4.5 Requirements cross-reference matrix. Table I provides a cross-reference matrix of the section 3 requirements tested or verified in the paragraphs below.

4.6 Tests.

4.6.1 Examination. The valve shall be examined for compliance with requirements for materials, compatibility, interface, maintainability, identification, interchangeability, and the presence of foreign materials.

4.6.2 Leakage. The valve shall be submerged in water at $165^{o} \pm 10^{o}$F for 1 minute with air pressure of 85 ± 15 psi applied to the valve inlet with all other valve openings closed. There shall be no leakage.

TABLE I. Requirements cross-reference matrix.

Requirement	Verification	Requirement	Verification
3.2	4.2	3.6.4	4.6.4
3.4	4.6.1, 4.6.11	3.6.5	4.6.5
3.4.1	4.6.1, 4.6.8	3.6.5.1	4.6.6
3.5.1	4.6.1	3.6.6	4.6.7
3.5.2	4.6.1	3.6.7	4.6.8
3.5.3	4.6.1	3.6.8	4.6.9
3.6.1	4.6.2	3.7	4.6.1
3.6.2	4.6.10	3.8	4.6.1
3.6.3	4.6.3	3.9	4.6.1
3.6.3.1	4.6.3.1	3.10	4.6.1, 4.6.12

4.6.3 Temperature regulation. In order to isolate the temperature regulation ability of the valve from any oil pressure relief device effects, the oil pressure at the valve inlet (P_A) shall be less than the oil pressure drop which would start oil flow through the bypass passage. Oil at a temperature of $45^{o} \pm 2^{o}$F shall be circulated through the valve and bypass passage (see figure 1). The oil temperature shall be increased until oil starts to circulate into the oil cooler. This shall not

occur until the oil temperature reaches the valve opening temperature rating. The oil pressure at the oil cooler inlet (P_B) shall not exceed the oil cooler proof pressure. The oil temperature shall be decreased until oil starts to flow through the bypass passage. This shall not occur until the oil temperature reaches the valve closing temperature rating.

4.6.3.1 Endurance of thermostatic device. The valve shall be immersed in oil hot enough to cause the thermostatic device to fully activate. It shall remain in the fully activated position for at least 1 minute. The valve shall be removed from the oil until the thermostatic device has fully inactivated. It shall remain in the fully inactivated position for at least 1 minute. One cycle shall consist of the device completely activating and inactivating once. This shall be repeated 10,000 times. The valve shall then be subjected to the temperature regulation test.

4.6.4 Pressure relief. With the valve bypass closed, oil shall be applied to the valve inlet at rated oil temperature and circulated through the valve at the maximum continuous oil flow capacity. Oil flow into the valve from the oil cooler outlet shall be gradually restricted. The minimum oil pressure drop P_B - P_D (see figure 1) required to start oil flow through the bypass passage of the valve shall be as specified in the associated specification. With the oil cooler outlet closed, the oil pressure drop P_B - P_D shall not exceed the maximum oil pressure drop.

4.6.5 Surge protection. All air shall be eliminated from the system.

4.6.5.1 Viscous oil surge. The valve and oil cooler shall be filled with oil and then chilled to $10^{o} \pm 2^{o}$F. An oil surge of 400 $\pm$5 psi at a temperature not less than 60^{o}F shall be applied to the valve inlet (see figure 1). This oil pressure shall be maintained for a period of 15 seconds. The oil pressure at the oil cooler inlet shall not exceed the proof pressure of the oil cooler. The valve shall then be subjected to the leakage test specified in 4.6.2.

4.6.5.2 Twice the oil cooler proof pressure oil surge. If the valve has a combined temperature control and surge protection device, isolate any thermal effect on the temperature control device. Oil at a temperature of $45^{o} \pm 2^{o}$F and at twice the oil cooler proof pressure shall be applied to the valve inlet (see figure 1). The oil pressure shall be maintained for a period of 15 seconds. The oil pressure at the oil cooler inlet shall not exceed the proof pressure of the oil cooler. The valve shall then be subjected to the leakage test specified in 4.6.2.

4.6.5.3 Hot oil surge. Oil at a temperature of $225^{o} \pm 2^{o}$F for petroleum base oil or $300^{o} \pm 10^{o}$F for synthetic base oil shall be circulated through the valve and oil cooler. Gradually restrict the oil flow at the oil cooler inlet (see figure 1) until the maximum continuous oil flow capacity is established from the valve outlet. Oil shall not start to flow through the bypass passage of the valve until the minimum oil pressure drop, as specified in the associated specification is reached. The oil pressure at the oil cooler inlet shall not exceed the proof pressure of the oil cooler.

4.6.6 Endurance test of surge device. The surge device shall be subjected to 100-cycle endurance test. One cycle shall consist of the following for each applicable surge device.

4.6.6.1 Pressure sensitive surge devices only. The valve and oil cooler shall be filled with oil at a temperature of $-65^{o} \pm 5^{o}$F. An oil pressure surge of 400 $\pm$5 psi at a temperature not less than 60^{o}F

shall be applied to the valve inlet (see figure1). This oil pressure shall be maintained for a period of 15 seconds. The oil pressure at the oil cooler inlet (P_B) shall not exceed the proof pressure of the oil cooler. The valve shall then be subjected to the leakage test specified in 4.6.2.

4.6.6.2 Thermostatic surge devices only. The pressure sensitive devices only test (see 4.6.6.1) shall be repeated 6 times. The valve and the oil cooler shall be filled with oil at a temperature of $40^{o} \pm 2^{o}$F. An oil pressure surge of 400 ± 5 psi at a temperature not less than 60^{o}F shall be applied to the valve inlet (see figure 1). This oil pressure shall be maintained for a period of 15seconds. The oil temperature shall be increased to at least 150^{o}F and circulated through the valve and oil cooler. This test shall be repeated 100 times. The valve shall then be subjected to the leakage test specified in 4.6.2.

4.6.7 Endurance of valve. Oil at a temperature of $45^{o} \pm 2^{o}$F shall be applied to the valve first in one direction and then in the reverse direction at an oil pressure to cause the surge device or combination thermostatic and surge device to open and close. One cycle shall consist of the device completely opening and closing once. During that part of the cycle when the device is closed, the oil pressure shall be at least 80 ± 5 psi. The valve shall be subjected to 10,000 cycles with the valve oil cooler mounting flange in the horizontal plane, and 10,000 cycles with the valve oil cooler mounting flange in the vertical plane. The valve shall then be subjected to the leakage test in 4.6.2.

4.6.8 Fluid temperature.

4.6.8.1 High temperature. The high temperature test shall be conducted 6 times. The oil shall be circulated through the valve and oil cooler at a temperature of $135^{o} \pm 10^{o}$F for petroleum base oil or $225^{o} \pm 10^{o}$F for synthetic base oil 72 hours. The oil pressure at the valve inlet (see figure 1) shall be maintained at 35 ± 5 psi. At the end of this period oil at $275^{o} \pm 5^{o}$F for petroleum base oil or $350^{o} \pm 10^{o}$F for synthetic base oil shall be circulated through the valve for96 hours. The oil pressure at the valve inlet shall be maintained at 35 ± 5 psi, except that 5 time in every 24 hour period, the oil pressure shall be raised to 100 ± 5 psi for 5 minutes. Following this, oil at ambient temperature shall be circulated through the valve for 2 hours at oil pressures from 1 to 100 psi varying at a constant rate. There shall be no leakage.

4.6.8.2 Low temperature. Following the high temperature test in 4.6.8.1, the valve shall be soaked for 24 hours at $-65^{o} \pm 5^{o}$F while filled with oil. While at -65^{o}F, oil pressure of 1 psi, 50 psi, and 100 psi shall be applied to the valve inlet alternately for at least 10 times. The oil pressure shall be held for 30 seconds during each test. There shall be no leakage.

4.6.9 Vibration test. The valve shall be installed in a test system with the oil temperature at $225^{o} \pm 2^{o}$F, the rated oil flow as specified in the associated specification, and at the lowest operating oil pressure at the valve inlet. The valve shall be vibrated for 35 hours along each of three mutually perpendicular axes. The frequency and amplitude shall be such as to provide an acceleration of ± 10g. During vibration, oil flow shall be applied to the valve first in one direction, then in the reverse direction to cause the surge device or combination thermostatic and surge device to open and close. One cycle shall consist of the device completely opening and closing once. During that part of the cycle when the device is close, the oil pressure shall be at least 80 ± 5 psi. The

valve shall be cycled for a total 10,000 at a constant rate. The valve shall then be subjected to the leakage test in 4.6.2.

4.6.9.10 Valve oil pressure drop. With the valve bypass closed, oil at $200^{o} \pm 2^{o}$F and at maximum continuous oil flow capacity shall be circulated through the valve. The valve oil pressure drop $(P_A - P_B) + (P_C - P_D)$ shall not exceed 12 psi (see figure 1).

4.6.11 Salt fog. The valve shall be subjected to the salt fog test in ASTM-B117 for 50 hours. The valve shall then be subjected to the individual tests in 4.3.1.

4.6.12 Cleanliness. Cleanliness of the valve shall be demonstrated by industrially accepted test methods and the methods shall be identified (see 6.2).

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the military service's system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. The valves are intended for use with the oil coolers using petroleum or synthetic base oil. The valves have temperature regulation with surge protection incorporating an oil pressure relief device bypass.

6.2 Acquisition requirements. Acquisition documents should specify the following:

a. Title, number, and date of this specification.
b. Type designation (see 1.2).
c. Issue of ASSIST to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.2.1 and 2.3).
d. Associated specification (see 3.1) containing the following:
   (1) interface dimensions and weight (see3.5.2).
   (2) rated oil temperature and tolerance (see 3.6.3).
   (3) temperature ratings for opening and closing of thermostatic device (see 3.6.3).
   (4) Proof pressure of oil cooler (see 3.6.3)
   (5) minimum and maximum oil pressure drop (see 3.6.4).
   (6) rated oil flow (see 3.6.8).

e. When first article is required (see 3.2 and 4.2).
f. Lubricating oil (petroleum or synthetic base) to be used for testing (see 3.4.1and 4.4.2.)
g. Item identification (see 3.8 items a, c, and d)
h. Sampling inspection level (normal, tightened, or reduced) (see 4.3.2).
i. If the test conditions are other than as specified in section 4 (see 4.4).
j. The requirement for the proposal to identity the industrially accepted test methods to be used to demonstrate cleanliness (see 4.6.12).
k. Packaging requirements (see 5.1).

6.3 Subject term (key word) listing.

Pressure relief
Thermostatic device

6.4 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

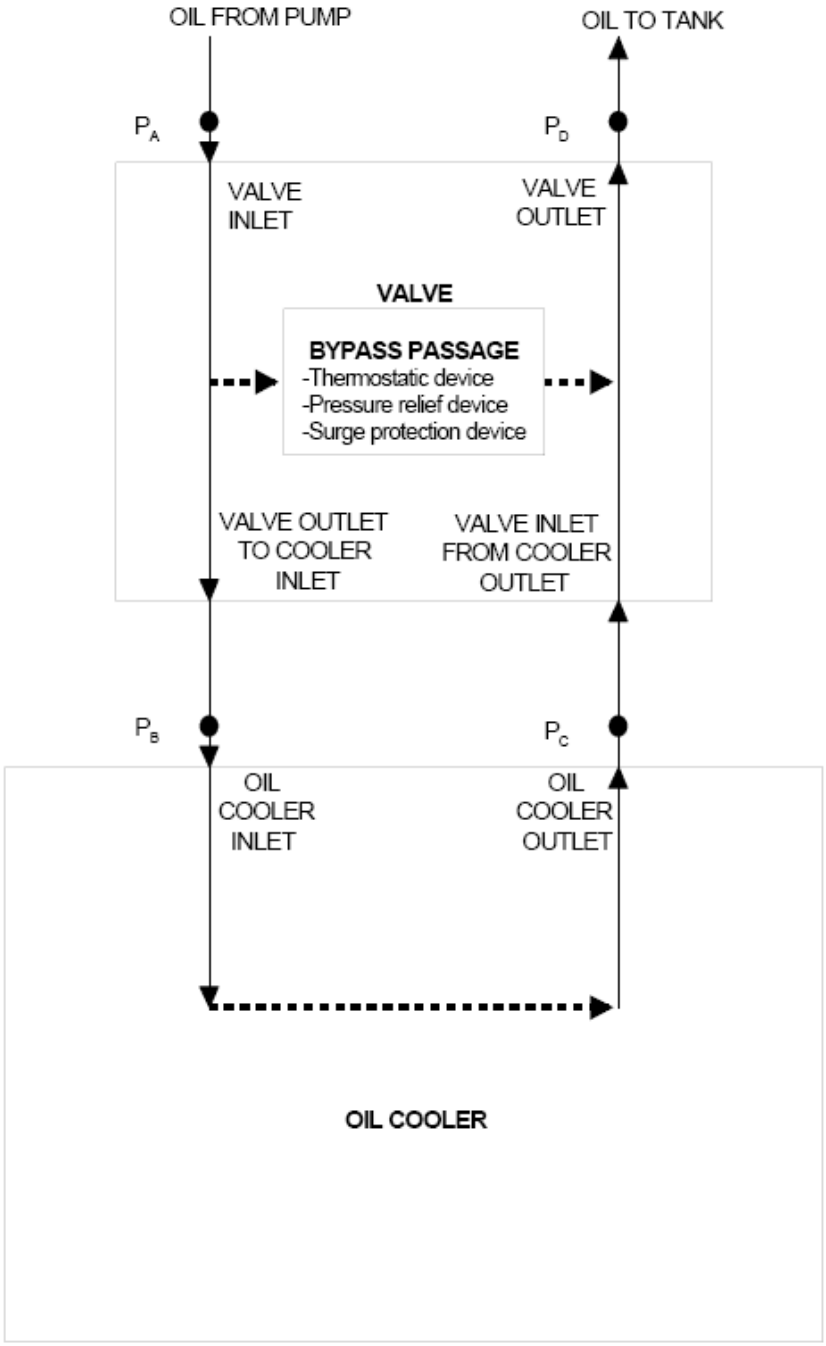

FIGURE 1. Functional valve diagram

Custodians:
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Preparing Activity:
Air Force - 71

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Review Activities:
Air Force - 99
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