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SUPERSEDING
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5 October 1956

MILITARY SPECIFICATION

COOLERS, LUBRICATING OIL, AIRCRAFT ENGINE, SYNTHETIC OIL, GENERAL SPECIFICATION FOR

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

1. SCOPE

1.1 Scope. This specification establishes the general requirements for an extended surface air-cooled oil cooler to provide oil temperature regulation for aircraft gas turbine engines utilizing high temperature synthetic lubricating oil.

1.2 Classification. The model designation will be assigned by the Government and shall be specified in the contractor's detail specification.

2. APPLICABLE DOCUMENTS

*2.1 The following specifications, standards, and publications, of the issue in effect on date of invitation for bids, form a part of this specification.

SPECIFICATIONS

Federal

QQ-C-320	Chromium Plating (Electrodeposited)
QQ-P-416	Plating, Cadmium (Electrodeposited)
UU-P-553	Paper, Wrapping, Tissue
PPP-B-591	Box, Fiberboard, Wood-Cleated
PPP-B-621	Box, Wood, Nailed and Lock Corner
PPP-B-636	Box, Fiberboard
PPP-B-665	Box, Paperboard, Metal Edged and Components

Military

MIL-P-116	Preservation-Packaging, Methods Of
MIL-B-130	Barrier Material, Paper, Noncorrosive
MIL-D-1000	Drawings, Engineering and Associated List

MIL-T-5021	Tests; Aircraft and Missile Welding Operators Qualification
MIL-P-7105	Pipe Threads, Taper, Aeronautical National Form, Symbol Anpt, General Requirements For
MIL-S-7742	Screw Threads, Standard, Optimum Selected Series, General Specification For
MIL-A-8625	Anodic Coatings, For Aluminum and Aluminum Alloys

STANDARDS

Military

MIL-STD-129	Marking For Shipment and Storage
MIL-STD-130	Identification Marking of U S Military Property
MIL-STD-143	Standards and Specifications, Order of Precedence For The Selection Of
MIL-STD-794	Part and Equipment, Procedures For Packaging and Packing Of
MIL-STD-889	Dissimilar Metals
MIL-STD-1186	Cushioning, Anchoring, Bracing, Blocking, and Waterproofing, With Appropriate Test Methods
MIL-STD-1523	Age Control Of Age-Sensitive Elastomeric Material
MS20995	Wire, Safety or Lock
MS33786	Fitting Installation, Flared Tube and Hose, Swivel (ASG)

OTHER DRAWINGS

Air Force-Navy Aeronautical

AND10068	Nuts and Plate Nuts-Self-Locking, Functional Limitations OF (Use MS33588)

(Copies of specifications, standards, drawings, and publications required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

3. REQUIREMENTS

3.1 First Article. This specification makes provisions for first article testing.

3.2 Component parts. The oil cooler shall consist of the core assembly which is made up of extended surfaces, the inlet and outlet ports, and a drain plug. A thermostatic temperature control valve and warm-up passages shall be provided unless otherwise specified in the contractor's detail specification.

*3.3 Selection of specifications and standards. Specifications and standards for necessary commodities and services not specified herein shall be selected according to MIL-STD-143 except as provided in 3.3.1 and 3.3.2.

3.3.1 Commercial parts. Commercial parts having suitable properties may be used where, on the date of invitation for bids, there are no suitable standard parts. In any case, commercial utility parts, like screws, bolts, nuts, cotter pins, having suitable properties may be used provided:

a. They can be replaced by the standard parts (MS or AN) without alteration.

b. The corresponding standard part numbers are referenced in the parts list and, if practical, on the contractor's drawings.

3.3.2 Standard parts. With the exception in 3.3.1, MS or AN standard parts shall be used where they suit the purpose. They shall be identified on the drawings by their part numbers.

3.4 Materials.

3.4.1 Metals. Metals shall be of a corrosion-resistant type or suitably treated to resist corrosion in fuels, salt spray, or atmospheric conditions to which the oil cooler shall be subjected when in storage or during normal service life. Copper shall not be used.

*3.4.1.1 Dissimilar metals. Unless suitably protected against electrolytic corrosion, dissimilar metals shall not be used in intimate contact with each other. Dissimilar metals are defined in MIL-STD-889.

3.4.2 Non-metals. Non-metallic materials shall be suitably resistant to the synthetic high temperature lubricating oil specified in the contractor's detail specification.

3.5 Castings. Castings shall be of high quality, clean, sound, and free from blow-holes, porosity, cracks and any other defects.

3.6 Manufacturing process. Processes used for the manufacture of oil coolers shall be consistent with high quality aeronautical practice, suitable for the purpose, and shall conform to the applicable Government specifications. Processes conforming to the contractor's specifications may be used, provided they are released by the Government and contain provision for adequate tests. The use of contractor's process specifications will not constitute waiver of Government inspection.

3.7 Design and construction.

3.7.1 General. If the oil cooler is to be installed in the inlet duct of the engine or if the cooler airflow is directed through or past any portion of the engine, it is imperative that the cooler be structurally sound to insure no oil leakage. Construction and design shall provide adequate plate thickness and sound joints capable of withstanding the strains, jars, shocks, vibrations, or other conditions incident to shipping, storage, installation, and ordinary service. The maximum outlet oil temperature, the maximum allowable back pressure on the engine scavenging system, and the maximum pressure drop across cooler shall be as specified in the contractor's detail specification.

*3.7.2 Flanges. Oil inlet and outlet flanges conforming to Standard MS33786 shall be provided on the oil cooler.

3.7.3 Oil. The oil cooler shall be designed for operation with oil conforming to that specified in the contractor's detail specification.

3.7.4 Drainage. Drainage provisions shall be incorporated either through the use of a drain plug or valve which permits complete drainage of the cooler when installed in the aircraft.

3.7.5 Temperature regulation. The temperature regulation of the cooler assembly shall be designed to control the cooler outlet oil temperature to a value specified in the contractor's detail specification commensurate with the critical design condition. The cooler shall incorporate a bypass warm-up jacket and a temperature control valve unless otherwise specified in the contractor's detail specification.

*3.7.5.1 Temperature control valve. The thermostatic temperature control valve, if provided, shall be supplied as a part of the cooler assembly and shall be removable from the cooler. The valve shall include a standard thermostatic element, which incorporates a relief element, allowing pressure relief of the cooler core when the core pressure drop becomes excessive. The pressure relief setting shall be commensurate with the pressure drop allowable in the aircraft installation. The valve shall be designed and tested in accordance with the contractor's detail specification requirements. The valve housing shall be so arranged as to mix oil from the oil cooler bypass warm-up jacket or inlet, and the cooler core to control final oil-out temperature. The valve shall incorporate MS-33786 flanges on all parts.

3.7.6 Ratings.

3.7.6.1 Rated oil flow. The oil cooler shall be designed for an oil flow commensurate with the critical design conditions of the aircraft engine as specified in the contractor's detail specification.

3.7.6.2 Rated air flow. Rated air flow shall be commensurate with the properly corrected static air pressure drop available in the aircraft installation at the critical design condition as specified in the contractor's detail specification.

3.7.6.3 Oil heat rejection. At rated oil flow, rated air flow, and inlet air temperature commensurate with the critical design condition, the total heat rejection (BTU/min) from the oil cooler shall be equal to or greater than that total heat rejection necessary at the critical design condition.

3.7.6.4 Direction of air flow. Unless otherwise specified in the contractor's detail specification, the oil cooler shall meet performance requirements with the air flow in either direction.

3.7.7 Dimensions and weight. The overall dimensions and weight shall be kept to a minimum and in accordance with best aircraft practice. The size, shape and weight shall be as specified in the contractor's detail specification and shall be subject to the approval of the procuring activity.

3.7.8 Threads.

3.7.8.1 Screw threads. All machine screw threads shall be in accordance with Specification MIL-S-7742.

3.7.8.2 Pipe threads. Pipe threads shall be used only for permanently plugging drilled or cored openings. Where tapered pipe threads are used they shall conform to Specification MIL-P-7105.

*3.7.8.3 Locking threaded parts. All threaded parts shall be securely locked by safety wiring, self-locking nuts, cotter pins, or other approved means. Safety wire shall have a minimum diameter of .032 inch and shall conform to Drawing MS20995. Self-locking nuts shall conform to Government Standards and shall be used in accordance with Standard AND10068. Staking and the use of lockwashers shall not be permitted.

3.7.9 Finish and protective treatment. The finish and protective treatment used shall be specified in the detail specification.

3.7.9.1 Anodizing. All aluminum alloy parts shall be anodized in accordance with Specification MIL-A-8625, or adequately treated in some other acceptable manner for corrosion prevention.

3.7.9.2 Protective treatment. Steel parts, other than corrosion resisting steel, not in moving contact, shall be cadmium plated in accordance with Specification QQ-P-416, Type II. Wearing surfaces may be chromium plated in accordance with Specification QQ-C-320, or adequately treated in some other acceptable manner for corrosion prevention, where galling of cadmium plating would cause malfunctioning. Brass, bronze, and copper alloy parts shall be cadmium plated or adequately treated in some other acceptable manner for corrosion prevention. Stainless steel parts shall be passivated.

3.7.9.3 Paint. Paint shall not be used for a protective finish unless specifically approved by the procuring activity.

3.7.10 Synthetic rubber parts.

3.7.10.1 Marking. All synthetic rubber parts such as diaphragms, but excepting parts with no suitable surface, shall have painted, stamped with ink, or otherwise noted on the part, the quarter and year of the curing date of the part.

3.7.10.2 Curing date tag. A decalcomania or a small metal tag giving the quarter and year of the curing date of the oldest synthetic rubber part in the cooler assembly shall be securely attached to the outside of the cooler.

3.7.10.3 Serviceability. All synthetic rubber parts shall be readily replaceable with a minimum replacement of attaching parts.

3.7.10.4 Uniformity. For coolers which include parts fabricated of synthetic material in contact with oil, manufacturers shall control subsequent batches to provide for uniformity.

3.8 Performance. The oil cooler shall satisfy the following performance requirements when tested as specified in Section 4.

3.8.1 Static pressure. There shall be no leakage or distortion of the oil cooler when subjected to the hydrostatic pressures specified in 4.6.3.

3.8.2 Pressure drop with air flow. The pressure drop across the cooler shall not exceed 20 psi, or the value specified in the contractor's detail specification, when tested in accordance with 4.6.4, with air flow through the cooler as specified.

3.8.3 Pressure drop without air flow. The pressure drop across the cooler assembly with no air flow through the cooler shall not exceed the maximum allowable pressures for the oil scavenging system as specified in the contractor's detail specification when tested in accordance with 4.6.5.

3.8.4 Pressure resistance. There shall be no leakage or permanent distortion of the cooler when tested as specified in 4.6.6 for oil flow pressure resistance.

3.8.5 Vibration. There shall be no leakage or distortion of the cooler, nor shall there be any failure of the mounting structure or other structural assembly of the cooler when subjected to the vibration test specified in 4.6.7.

3.8.6 Pressure cycles. There shall be no leakage or permanent distortion of the cooler when subjected to 50,000 pressure cycles as specified in 4.6.8.

3.8.7 Fluid resistance. There shall be no leakage of the oil cooler when subjected to the fluid resistance test as specified in 4.6.9.

*3.9 Interchangeability. All parts having the same manufacturer's part number shall be functionally and dimensionally interchangeable. The drawing number requirements of MIL-D-1000 shall govern changes in the manufacturer's part numbers.

3.10 Identification of product. Equipment, assemblies, and parts shall be marked for identification in accordance with MIL-STD-130.

*3.10.1 Synthetic rubber parts. Equipment and assemblies containing synthetic rubber parts shall also be marked in accordance with MIL-STD-1523.

3.11 Workmanship. All details of workmanship shall be in accordance with high-grade aircraft manufacturing practice for this type of accessory.

3.11.1 Welding. All welding operations shall be performed by operators certified in accordance with Specification MIL-T-5021, class A, group IV.

3.11.2 Cleaning. The assembled cooler shall be completely free of dirt, sand, metal chips, or other extraneous materials. In addition, the cooler shall be cleaned thoroughly of all soldering, welding, and brazing residue.

4. QUALITY ASSURANCE PROVISIONS

*4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the supplier may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

*4.2 Classification of tests. The inspection and testing of oil coolers shall be classified as follows:

a.	First Article	See 4.3
b.	Quality Conformance	See 4.4

*4.3 First Article.

*4.3.1 First article test samples. The first article test samples shall consist of two synthetic oil coolers representative of the production equipment. They shall be tested at a laboratory designated by the procuring activity or, when so stated in the contract, at the contractor's plant under the supervision of the procuring activity. These coolers shall be accompanied by one complete set of detail and assembly drawings, in reproducible form, and a complete test report, insofar as possible, showing results of the manufacturer's tests on a duplicate oil cooler in accordance with this specification. These test reports shall include the following:

a. Description of test equipment.-This description shall include the diagram of the general setup, the type and capacity of the various components of apparatus and instruments, and methods of controlling the test variables. The description shall include photographs, wherever possible, of the general setup and of the installation of the cooler. This data need be supplied only once. Compliance with this paragraph in subsequent reports may be made by reference to the original report. The original data shall be kept up to date by revision, as necessary.

b. Copies of original data sheets for all tests required by this specification, including corrected values from which curves are plotted.

c. Curves similar to those shown on figures 2, 3, and 4.

*4.3.2 First article tests. First articles tests shall consist of all tests described under 4.6 TEST METHODS.

*4.4 Quality conformance. Quality conformance tests shall consist of:

a. Individual Tests
b. Sampling Plan and Tests

*4.4.1 Individual tests. Each oil cooler shall be subjected to the following tests as described under 4.6 TEST METHODS of this specification:

a. Examination of product
b. Cleaning
c. Static pressure test

*4.4.2 Sampling plans and tests. Three coolers shall be selected at random from each lot of 300 or less and subjected to the tests listed below (except that in the pressure drop test only one run, with oil at a temperature of 145° ± 2°F, shall be made). Samples subjected to the pressure cycling tests shall not be accepted by the inspector in fulfillment of any contract, but shall be clearly marked to show that it has been overstressed and returned to the contractor for disposition. A lot shall be defined as all coolers of the same type, manufactured under essentially the same conditions, and submitted for acceptance at the same time:

a. Oil pressure drop test
b. Pressure cycling test

*4.4.2.1 Rejection and retest. When one or more items from a lot fail to meet the specification, acceptance of all items in the lot will be withheld until the extent and cause of failure are determined. After corrections have been made, all necessary tests shall be repeated.

*4.4.2.2 Individual tests may continue. For production reasons, individual tests may be continued pending the investigation of a sampling test failure. But final acceptance of the entire lot shall not be made until it is determined that the lot meets all the requirements of the specification.

*4.4.2.3 Defects in items already accepted. The investigation of a test failure could indicate that defects may exist in items already accepted. If so, the contractor shall fully advise the procuring activity of all defects likely to be found and methods of correcting them.

*4.5 Test conditions. Unless otherwise specified by the procuring activity, the following test conditions shall apply during the tests performed in accordance with this specification:

*4.5.1 Ducting. The cooling air inlet and outlet ducts shall be equivalent in size and shape to that of the aircraft installation on which the cooler is to be used. Dimensions shall be as specified in the contractor's detail specification.

*4.5.2 Oil. Oil as designated in the contractor's detail specification shall be used for all oil cooler tests.

*4.5.2.1 Oil temperature. Unless otherwise specified, the inlet oil temperature shall be commensurate with the critical design conditions as specified in the contractor's detail specification.

*4.5.3 Oil pressure connections. Oil pressure connections shall be made to a flange which shall mount directly between the oil cooler and the thermostatic control valve. If no temperature regulating valve is used, the connections shall be made to adapters mounted at the cooler inlet and outlet ports.

*4.5.4 Data to be obtained-instrumentation. The variables in Table I shall be measured for each run.

*4.5.5 Control limits and data observation. Unless otherwise specified, the variables specified at fixed values for points and runs are permitted to deviate from the specified conditions $\pm$ 2°F for all temperatures, $\pm$ 2 percent for oil flow and $\pm$ 2 percent of rated air flow for any air flow. The observed data shall be recorded. All points for each test, unless otherwise noted, shall be recorded only after all variables have been adjusted and substantially stabilized. The degree of stabilization and accuracy of observations is acceptable if the calculated heat added to the air (air temperature rise x air flow x specific heat of air) checks within 5 percent of the calculated heat transferred from the oil (oil temperature drop x oil flow x specific heat of oil). Heat balance discrepancies of more than

5 percent, for all heat rejection runs other than "Oil Temperature Drop With Air Flow", are acceptable.

TABLE I

Quantity Measured	Method of Measurement	Overall Accuracy of Instrumentation
Oil-in temperature	Suitable thermometer or thermocouple	± 0.5°F
Air-in temperature	Suitable thermometer or thermocouple	± 0.5°F
Oil-out temperature (To be of mixed stream from core and warm-up passage)	Suitable temperature instrumentation to assure true average oil temperature readings	± 0.5°F
Air-out temperature	Suitable temperature instrumentation to assure true average air temperature readings	± 1.0°F
Oil temp. rise (optional) Air temp. rise (optional)	Series thermocouple	± 1.0°F
Oil flow, lb/min		± 1%
Air flow, lb/min		± 1%
Oil-in press., psi Oil-out press., psi	Bourdon tube gage, or suitable manometer, connected with noncongealing fluid lines	± 0.5 psi ± 0.5 psi
Air press. oil cooler static drop	Measured in duct 4 in. upstream and 4 in. down stream with manometer	± 0.1 in. H_2O
Air press. upstream	Duct to atmosphere by manometer	± 0.1 in. H_2O
Air press. downstream	Duct to atmosphere by manometer	± 0.1 in. H_2O
Air pressure oil cooler drop	Upstream static head to downstream static head by manometer, as per figure 1.	
Atmospheric pressure Barometer		±.05 in. Hg.

*4.5.6 The data furnished shall be as specified in Table II.

TABLE II

Item	Oil Flow Percent Rated	Air Flow Percent Rated	Inlet Air Temperature °F
1	150	50, 100, 150, 200	*
2	100	50, 100, 150, 200	*
3	70	50, 100, 150, 200	*
4	50	50, 100, 150, 200	*
5	100	100	40, 0, -65
6	100	200	40, 0, -65
7	50	100	40, 0, -65

*Use critical design condition temperature of the contractor's detail specification.

*4.5.7 The instantaneous specific heat of the oil shall be assumed to be as specified in Table I of the contractor's detail specification. The method for determining specific heat and the values used, in all calculations, shall be approved by the procuring activity.

*4.5.8 The specific heat of the air shall be assumed to be 0.240 BTU/°F/lb, or it may be taken in accordance with the relative humidity indicated in Table III.

TABLE III

Specific Heat of Air

Temp. °F	Cp. Dry Air	Cp. Saturated Air
30 or less	.240	0.240
60	.240	.241
80	.240	.243
100	.240	.246
120	.240	.250

*4.5.9 Pressure drop corrections. The air pressure drop measurements taken in accordance with figure 1 shall be corrected to standard conditions by use of the following formula:

$$P_o = P\frac{e}{e_o}$$

Where:

P_o = corrected drop
P = measured pressure drop
e = inlet air density lb/ft^3
e_o = standard air density 0.0765 lb/ft^3

*4.6 Test methods.

*4.6.1 Examination of product. Each oil cooler shall be examined to determine general conformance with this specification in respect to material, workmanship, design, construction, and nameplate.

*4.6.2 Cleaning. Steam shall be passed through the oil cooler and a sample of the condensate collected. A portion of the condensate shall be tested with litmus paper. A second portion shall be tested by adding a drop of dilute silver nitrate solution and a few drops of nitric acid. The formation of even a slight precipitation is an indication of the presence of halides. Coolers showing either acid or alkali reaction or the presence of halides shall be rewashed and rinsed until a clean condition is indicated by the test.

*4.6.3 Static pressure test. The oil cooler shall be subjected to 200 ± 10 psi hydrostatic pressure for one minute and checked for leakage or distortion. If the cooler is to be used without a surge protection valve or if the cooler is installed in the inlet duct or if the cooler airflow is directed through or past any portion of the engine, the hydrostatic pressure requirement shall be 400 ± 20 psi. The hydrostatic pressure at which the cooler shall be tested, depending upon conditions as expressed in this paragraph, shall be specified in the contractor's detail specification. There shall be no leakage.

*4.6.4 Congealing characteristics and oil pressure drop with air. The oil cooler shall be soaked for 72 hours at -65°F while filled with oil. (The temperature regulating valve will be installed if it is to be used in the final installation.) Rated air flow shall be passed through the cooler at -65° ± 2°F throughout the soaking period and the testing period. Oil flow shall gradually be applied to the cooler from 50 percent rated

flow at a temperature the same as that of the oil in the cooler to 100 percent rated flow at a temperature of 325° ± 5°F. At the end of 3 minutes, rated oil flow shall be established, the inlet oil temperature shall be 325° ± 5°F, and the pressure drop across the cooler shall not exceed 20 psi or the value specified in the contractor's detail specification. The oil cooler shall decongeal so that the pressure drop through the cooler shall be compatible with the maximum allowable back pressure on the engine scavenging system. Pressure shall be recorded at approximately 1/2 minute intervals.

*4.6.5 Oil pressure drop without air flow. The oil pressure drop through the complete cooler assembly shall be determined. The cooler assembly shall be defined as the cooler core plus the oil temperature regulating and surge protection valve if required by the contractor's detail specification. The test shall be run at rated oil flow, no air flow, and at oil inlet temperatures of 145°, 205°, 265°, and 325°F. The pressure drop across the cooler assembly shall be compatible with the maximum allowable pressures in the oil scavenging pump system as specified in the contractor's detail specification.

*4.6.6 Oil flow pressure resistance. With an oil temperature of less than 100°F, and the warm-up outlet closed, the flow of oil through the cooler shall be adjusted so that an oil pressure drop of 80 psi occurs from the inlet of the cooler to the outlet of the cooler. The outlet pressure shall be maintained at 10 pounds per square inch maximum. Any leakage or permanent distortion shall be cause for rejection.

*4.6.7 Vibration test. The cooler shall be so installed in a test system that rated flow at 225°F flows through the cooler with a pressure of 20 psig inlet pressure. The cooler shall be vibrated along each of 3 mutually perpendicular axes through a frequency survey of 25 to 150 cps in order to determine whether resonant frequency exists. If a resonant frequency is found, the cooler shall be vibrated at this frequency. If more than one resonant frequency is observed, the vibration frequency should be at the point of most severe resonance. If no resonance is observed, the cooler shall be vibrated at 150 cps. The test shall be conducted for 35 hours for each of the 3 mutually perpendicular axes, or, if using a two-directional vibrator, for 50 hours with the cooler in the horizontal position and 50 hours in the vertical position. The vibration shall be maintained at an amplitude such that an acceleration of 10 G's is imposed upon the cooler. The cooler shall be examined periodically for evidence of leakage, failure, or distortion. If any leaks occur, the cooler shall be rejected. Any failure of the mounting structure integral to the cooler or other cooler structural assembly shall be cause for

rejection. At the completion of the test, the cooler shall satisfy the requirements of the static pressure test, 4.6.3.

*4.6.8 Pressure cycles. The oil cooler shall be completely submerged in oil at 350° ± 10°F. An air pressure cycle of 3 ± 3 to 60 ± 1 pounds per square inch shall be applied to the inlet with the outlet closed and with the pressure rise and fall taking place in 2 to 2-1/2 seconds each. The cooler shall be subjected to the 50,000 cycles without leakage or permanent distortion. Following the pressure cycle test, the static pressure test shall be repeated.

*4.6.9 Fluid resistance test. This test shall be applicable to all oil coolers containing non-metallic parts.

*4.6.9.1 High temperature test. Synthetic oil as specified in the contractor's detail specification at a temperature of 350° ± 10°F shall be circulated through the cooler for 24 hours. Following this the cooler shall be tested at room temperature at pressures of 1 psi, 50 psi, and 100 psi. The pressure shall be held for 30 seconds during each test. There shall be no leakage. The above cycle shall be repeated 7 times for a total test time of 168 hours.

*4.6.9.2 Low temperature test. Following the high temperature part of the fluid resistance test, the cooler shall be soaked for 72 hours at -65° ± 5°F while filled with the synthetic oil specified in the contractor's detail specification. While at -65°F, pressure of 1 psi, 50 psi, and 100 psi shall be applied alternately at least 10 times. The pressure shall be held for 30 seconds during each test. There shall be no leakage.

5. PREPARATION FOR DELIVERY

*5.1 Preservation and packaging.

*5.1.1 Level A, C. Unless otherwise specified in the contract or order, the oil coolers shall be preserved and packaged as determined by the selection of Preservation Packaging Methods of MIL-STD-794, Appendix D, and requirements of MIL-P-116.

*5.2 Packing.

*5.2.1 Levels A, B, C. Unless otherwise specified in the contract or order, the oil coolers shall be packed in containers applicable to the appropriate levels prescribed in MIL-STD-794.

*5.3 Marking.

*5.3.1 In addition to any special marking required by the contract or order, unit packages, intermediate packages and shipping containers shall be marked in accordance with requirements of MIL-STD-129.

6. NOTES

6.1 Intended use. Oil coolers covered by this specification are intended for use in aircraft turbine engine lubricating oil systems.

6.2 Ordering data. Procurement documents should specify the following:

a. Selection of applicable levels of preservation and packaging and packing.

(1) Level B preservation and packaging is intended to provide economical but limited protection, and should be specified only when it is determined to be appropriate. The effective period of protection shall be 180 days from the date of initial packaging.

6.3 Storage surveillance. Items preserved and packaged in accordance with level B requirements must be inspected to determine condition when not used within the time period indicated. Items not used within the time period specified must either be represerved or repackaged in accordance with level B requirements in this specification or with level A requirements if storage beyond an additional year is anticipated.

6.4 Definitions.

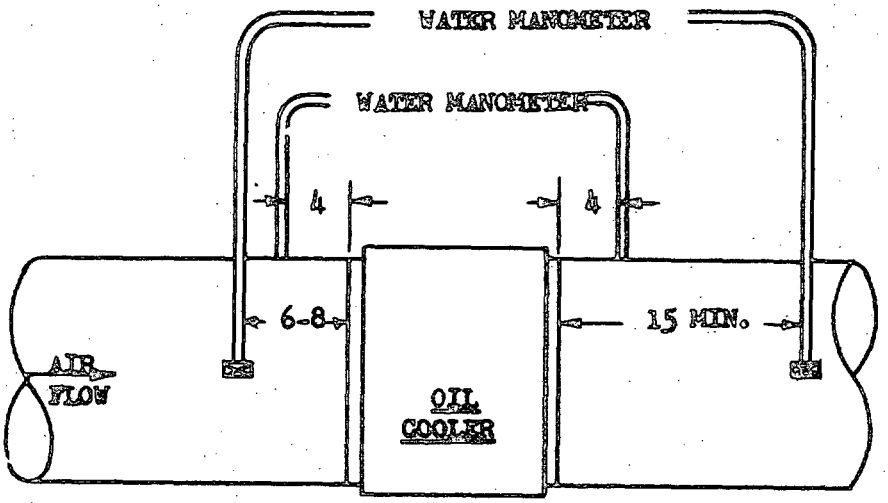
6.4.1 Critical design condition. The critical design condition is that condition at which maximum air-oil cooling is required.

*6.5 Changes. The margins of this specification are marked with an asterisk to indicate where changes (additions, modifications, corrections, deletions) from the previous issue were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous issue.

Custodian:
Air Force - 71

Preparing Activity:
Air Force - 71

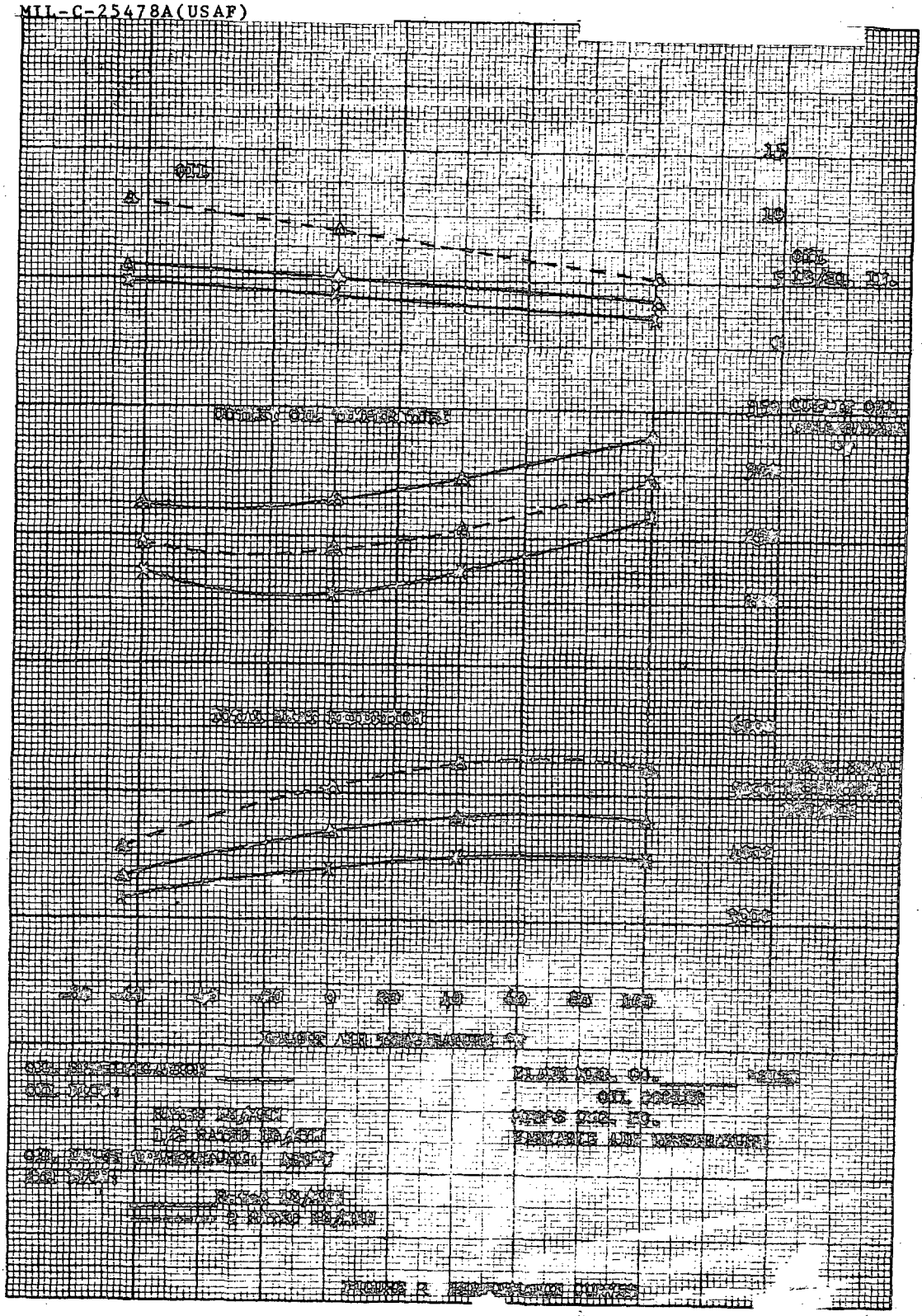
Project Number:
2935-F002



PRESSURE DROP TO BE UPSTREAM STATIC MINUS DOWNSTREAM STATIC - TOTAL PRESSURE TUBES ARE NOT REQUIRED BUT ARE RECOMMENDED AS A MEANS OF CROSS-CHECKING ACCURACY OF THE REQUIRED PRESSURE MEASUREMENTS. TOTAL PRESSURES TO BE MEASURED BY SHIELDED TOTAL PRESSURE TUBES OR REVERE INSTRUMENT COMPANY (PART NUMBER R-302-DP) OR EQUIVALENT, LOCATED WITHIN ONE INCH OF THE CENTER OF THE DUCT.

DIMENSIONS IN INCHES.

FIGURE 1. METHOD OF MEASURING AIR PRESSURE DROP



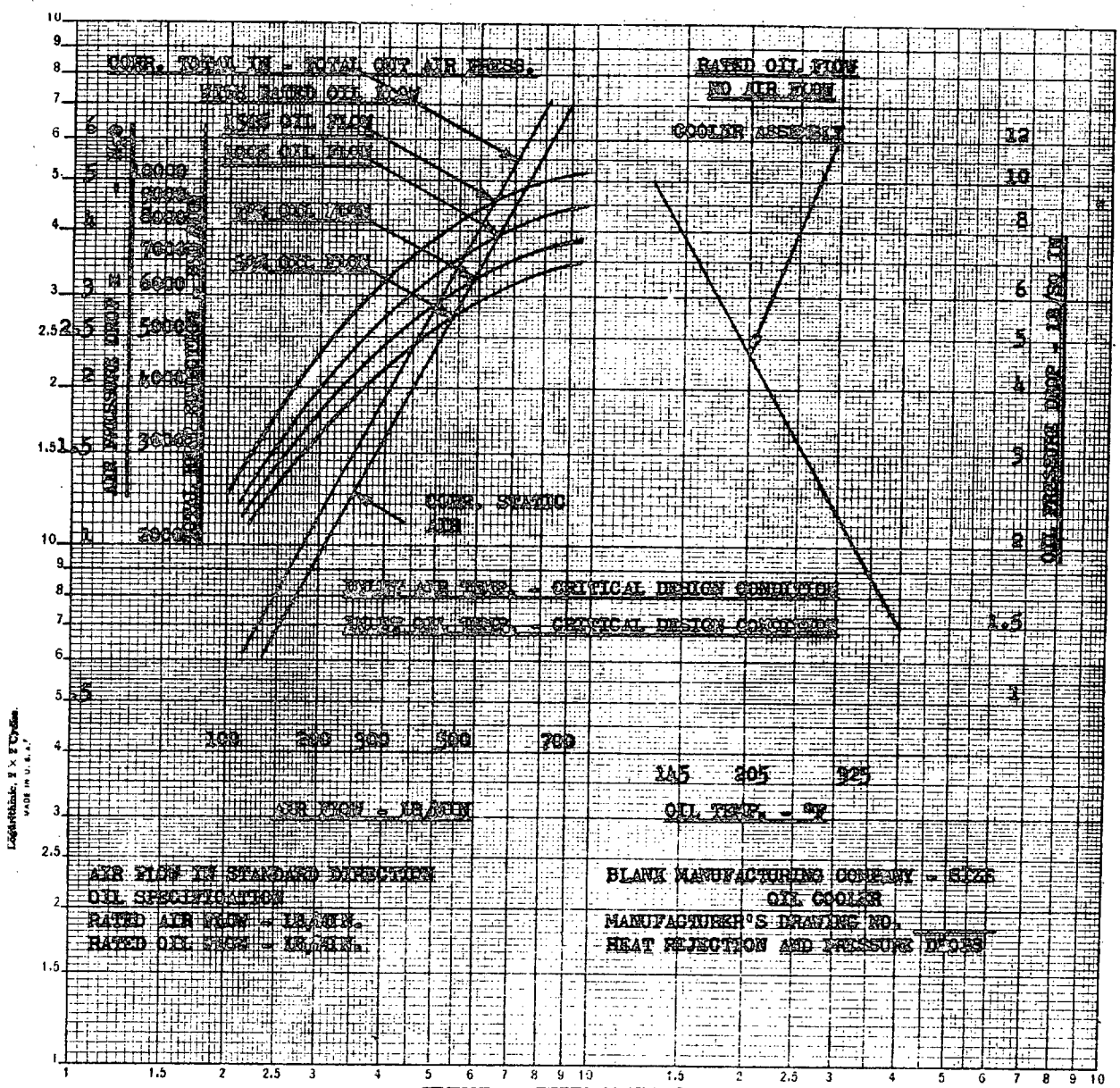
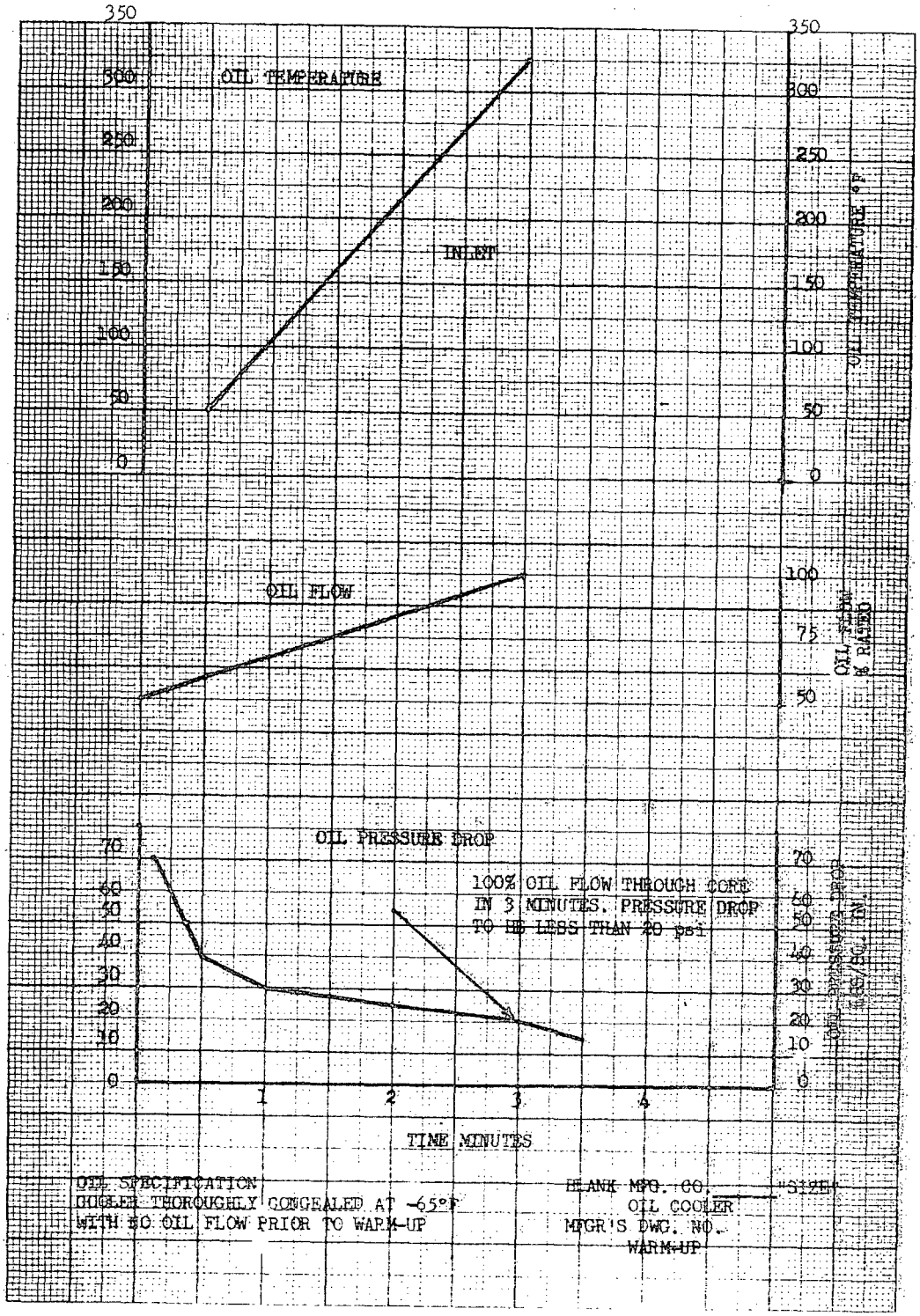


FIGURE 3. PERFORMANCE CURVES



SEE 20.20 TO INCH

FIGURE 4 PERFORMANCE CURVES

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions – Reverse Side)

1. DOCUMENT NUMBER	2. DOCUMENT TITLE

3a. NAME OF SUBMITTING ORGANIZATION	4. TYPE OF ORGANIZATION *(Mark one)*
	☐ VENDOR ☐ USER ☐ MANUFACTURER ☐ OTHER *(Specify)*: _____
b. ADDRESS *(Street, City, State, ZIP Code)*	

5. PROBLEM AREAS

a. Paragraph Number and Wording:

b. Recommended Wording:

c. Reason/Rationale for Recommendation:

6. REMARKS

7a. NAME OF SUBMITTER *(Last, First, MI)* – Optional	b. WORK TELEPHONE NUMBER *(Include Area Code)* – Optional
c. MAILING ADDRESS *(Street, City, State, ZIP Code)* – Optional	8. DATE OF SUBMISSION *(YYMMDD)*

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