MIL-C-5637B
15 SEPTEMBER 1964
SUPERSEDING
Mil-C-5637A(ASG)
2 OCTOBER 1953

MILITARY SPECIFICATION

COOLER, LUBRICATING OIL, PETROLEUM BASE, AIRCRAFT ENGINE, TUBULAR

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

L SCOPE

1.1 This specification covers one type of tubular air-cooled lubricating oil cooler for use with petroleum base oil.

2. APPLICABLE DOCUMENTS

2.1 The following documents, of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein:

SPECIFICATIONS

FEDERAL

TT-S-735-Standard Test Fluids; Hydrocarbon.

MILITARY

MIL-P-116-Preservation, Methods of.
MIL-T-5021-Test; Aircraft and Missile Welding Operators' Qualification.
MIL-L-6081-Lubricating oil, Jet Engine.
MIL-L-6082-Lubricating Oil; Aircraft Reciproating Engine (Piston).
MIL-C-6864-Cleaning Compound, Solvent, Oil-Cooler.
MIL-P-6906-Plates Information and Identification.
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-P-7936-Parts and Equipment, Aeronautical, Preparation for Delivery.
MIL-N-25027-Nut Self -Locking, 250° F', 450° F, and 800° F, 125 KSI Ftu, 60 KSI Ftu, and 30 KSI Ftu.
MIL-D-70327-Draw wings, Engineering and Associated Lists.

STANDARDS

MILITARY

MIL-STD-105-Sampling Procedures and Tables for Inspection by Attributes.
MIL-STD-130-Identification Marking of U.S. Military Property.
MIL-STD-143-Specifications and Standards, Order of Precedence for the Selection of.
MIL-STD-831-Test Reports, Preparation of.
MS20995-Wire, Lock.
MS29590-Cooler-Lubricating Oil, Aircraft, Tubular, Round.
MS29591-Cooler-Lubricating Oil, Aircraft, Tubular, Elliptical.
MS33540-Safety Wiring, General Practices for.
MS33586-Metals, Definition of Dissimilar.
MS33588-Nuts and Plate Nuts, Self-Locking, Aircraft Design and Usage Limitations of.

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

3. REQUIREMENTS

3.1 Qualification. The coolers furnished under this specification shall be products which have been subjected to and which have passed the qualification tests specified herein, and which have been listed on or approved for list-

748-864 O—64——1

FSC 2935

ing on the applicable Qualified Products List (see 6.3).

3.2 Materials. Materials shall conform to applicable specifications and as specified herein. Materials which are not covered by applicable specifications, or which are not specifically described herein, shall be of the lightest practicable weight, and suitable for the purpose intended.

3.2.1 Metals. All metals used in the construction of oil coolers shall be of a corrosion-resistant type or shall be suitably protected to resist corrosion during the normal service life of the oil cooler. The use of dissimilar metals, especially brass, copper, or steel, in contact with aluminum or aluminum alloy, shall be avoided whenever practicable. Dissimilar metals are defined in Standard MS33586. The use of magnesium is prohibited.

3.2.1.1 Castings. Castings shall be clean, sound, and free from blow-holes, porosity, cracks, and any other defects.

3.2.2 Nonmetals. Nonmetallic materials shall be suitably resistant to MIL-L-6082, grade 1100 oil; mixtures of up to 50 percent by volume of either TT-S-735, type I or III fluids with grade 1100 oil and any approved preservative compound; and MIL-C-6864 oil cooler solvent cleaning compound to insure satisfactory operation under all conditions specified herein.

3.2.2 Selection of materials. Specifications and standards for all materials, parts, and Government certification and approval of proceses and equipment, which are not specifically designated herein and which are necessary for the execution of this specification, shall be selected in accordance with MIL-STD-143, except as provied in 3.2.3.1.

3.2.3.1 Standard parts. Standard parts (MS or AN) shall be used wherever they are suitable for the purpose and shall be identified on the drawing by their part numbers. Commercial utility parts, such as screws, bolts, nuts, and cotter pins may be used provided they possess suitable properties and are replaceable by the standard parts (MS or AN) without alteration, and provided the corresponding MS or AN part numbers are referenced in the parts list and, if practicable, on the contractor's drawings. In the event there is no suitable corresponding MS or AN part in effect on date of invitation for bids, commercial parts may be used, provided they conform to all requirements of this specification.

3.3 Design and construction. The cooler shall be designed to transmit heat from liquids, through the tube walls, to an air stream flowing through the tubes. Baffles may be used to insure uniform distribution of oil flow through the core. Oil coolers shall be designed to withstand stranins, shocks and vibrations, and other conditions incident to shipping, installation, and ordinary use.

3.3.1 Cleaning and repair. The cooler shall be readily cleanable of sludge, metal particles, and other foreign matter. It shall be practicable to retube damaged or defective coolers such that they are suitable for reuse.

3.3.2 Ratings.

3.3.2.1 Rated oil flow. The oil cooler shall be designed for a rated oil flow of 1 pound per minute per square inch of cooler core-frontal area.

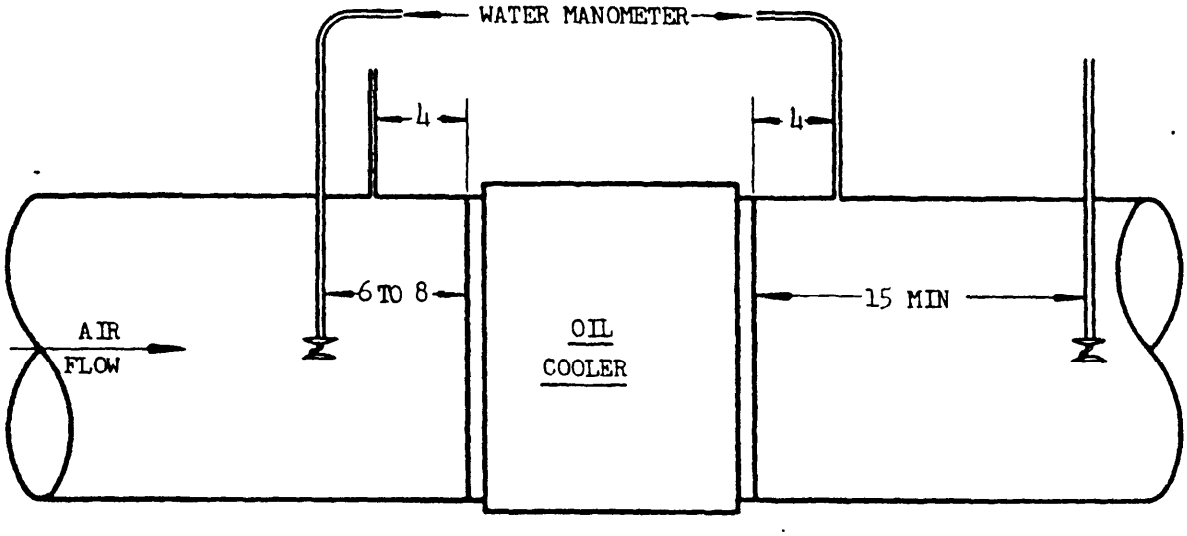
3.3.2.2 Rated airflow. The rated airflow for coolers shall be in accordance with table T. If air pressure drop at the rated airflow measured in accordance with figure 1. properly corrected, exceeds 4.2 inches of water, the rated airflow shall be reduced to a value corresponding to that pressure drop, but lower pressure drops shall not be considered a basis for increasing the rated airflow.

TABLE I. *Airflow ratings*

Tube diameter, inches	Rated airflow through cooler lb./min./sq. in. of core frontal area
0 268	1. 80
0. 210	1. 58

3.3.3 Dimensions. The overall dimension flange dimensions, shapes, and weights shall be as specified on MS29590 and MS29591.

3.3.4 Warmup passages. Warmup passages shall be provided integral with the cooler to reestablish oil flow after the oil in the core is completely congealed and to maintain liquid oil in the core during normal service conditions.



PRESSURE DROP TO BE UPSTREAM TOTAL MINUS DOWNSTREAM STATIC - TOTAL PRESSURES TO BE MEASURED BY SHIELDED TOTAL PRESSURE TUBES OF REVERE INSTRUMENT COMPANY (PART NUMBER R-302-DP) OR EQUIVALENT, LOCATED WITHIN 1 INCH OF THE CENTER OF THE DUCT. DOWNSTREAM TOTAL PRESSURE TUBE IS NOT REQUIRED BUT IS RECOMMENDED AS A MEANS OF CROSS-CHECKING ACCURACY OF THE REQUIRED PRESSURE MEASUREMENTS.

DIMENSIONS IN INCHES.

FIGURE 1. Method .4 measuring air pressure drop

3.4 Interchangeability. All parts having the same manufacturer's part number shall be directly and completely interchangeable with each other with respec to installation and performance. Changes in manufacturer's part numbers shall be governed by the drawing number requirements of MIL-D-70327.

3.5 Threaded connections.

3.5.1 Pipe threads. Pipe threads shall not be used on coolers, except for permanent closures, in which case they shall conform to MIL-P-7105.

3.5.2 Screw threads. Screw threads shall be in accordance with MIL-S-7742.

3.5.3 Locking of parts. All threaded parts shall be locked by safety wiring, by self -locking nuts conforming to MIL-N-25027, cotter pins, or other approved methods. Safety wire shall be installed in accordance with MS3354O and shall conform to MS20995. Self-locking nuts shall be used in accordance with MS33588. Self-locking nuts shall not be used where loosening or disengagement of the nut could result in the nut or other parts entering the oil system. Lockwashers or staking will not be permitted.

3.6 Finish All external surfaces except corrosion-resistant steel, brass, copper, or bronze working surfaces shall be finished to resist corrosion during normal service life.

3.7 Direction of airflow. The oil cooler shall conform to all performance requirements of this specification with airflow in either direction.

3.8 Oil heat rejection. At rated oil flow, rated airflow, and 100° ± 2° F inlet air temperatue, the unit heat rejection (w 6.4.1) (British thermal unit (B.t.u.) /min.100° F temperature difference) from the oil, shall be not less than the value obtained from the following formula:

$$Q=15.0A-130$$

where

Q=unit heat rejection B.t.u./min./100° F temperature difference

A= cooler core-f rent.al area, square inches

3.9 Performance The oil coolers shall satisfy the performance requirements specified

in section 4, when subjected to the applicable tests.

3.10 Identification of product. The coolers shall be marked for identification in accordance with MIL-STD-130.

3.10.1 Nameplate. The following information shall be permanently and legibly marked on the oil coder or on a nameplate conforming to MIL-P-6906.

COOLER, LUBRICATING OIL, PETROLEUM BASE, AIRCRAFT ENGINE, TUBULAR
Ms part No. (as applicable)
Manufacturer's part No.
Manufacturer's serial No. (if used)
Contract or order No.
Manufacturer's name or trademark
U s .

3.11 Workmanship. All details of workmanship shall be sufficient to insure satisfactory operation and service life of the cooler.

3.11.1 Cleaning. All parts shall be clean. The assembled cooler shall be completely free from sand, metal chips, all soldering, welding and brazing residue, and other foreign matter.

3.11.2 Welding. All welding operations shall be performed by operators certified in accordance with MIL-T-5021, class A, group IV. All welding equipment, materials, procedures, and methods of controlling the welding quality shall be such as to insure suitable production coolers.

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, the supplier may utilize. his own facilities or any other commercial laboratory acceptable to 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) Qualification tests---------- (4. 3)
(b) Quality conformance tests ----- (4. 4)

4.3 Qualification tests. Qualification tests of oil coolers shall consist of all the examinations and tests specified in 4.6 and 4.7.

4.3.1 Qualification test samples. The qualification test samples (see 6.3) shall consist of two oil coolers of each manufacturer's part number upon which qualification is desired. The samples shall be accompanied by two sets of detail and assembly drawings and a complete test report showing results of manufacturer's tests for each manufacturer's part number. Each qualification test sample shall be plainly identified by securely attached durable tags marked with the following information:

Sample for qualification test
COOLER, LUBRICATING OIL PETROLEUM BASE, AIRCRAFT ENGINE, TUBULAR
MS part No. (as applicable)
Submitted by (name of manufacturer) (date) for qualification tests in accordance with Specification MIL-C-5637B under authorization (reference letter authorizing the tests)
Manufacturer's part No.
Name of manufacturer.

4.3.1.1 The qualification test samples, drawings, and test reports shall be forwarded to the activity responsible for qualification designated in the letter of authorization.

4.3.1.2 Manufacturer's drawings. The manufacturer's drawings submitted with the qualification test samples shall conform to MIL-D-70327 and shall show a cutaway section showing all parts in their assembled position and shall specify part numbers of all parts and subassemblies.

4.3.1.3 The test reports submitted with the qualification test samples shall conform to MILSTD-831 and shall include the following information:

(a) Description of test equipment: This description shall include the diagram of the general test setup; the type, and capacity of the various components of apparatus and instruments; and methods of controlling the test vari - ables. The description shall include photographs wherever possible of the general setup and of the installation of a cooler. These data need be supplied only once. Compliance with this paragraph in subsequent reports may be made by reference to the original re-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 figures 2, 3, and 4, and a summary of remits in accordance with figure 5.

4.4 Quality conformance tests. Quality conformance tests shall consist of individual tests and sampling tests.

4.4.1 Individual tests. Each oil cooler submitted for acceptance under contract shall be subjected to the following tests:

(a) Examination ---------- (4.6.1)
(b) Static presurr-------- (4.7.1)
(c) Cleaning ---------- (4.7.2)

4.4.2 Sampling tests. A random sample shall be chosen from each lot of oil coolers in accordance with table titled “Sample size code letters” of MIL-STD-105, Inspection Level S-2, acceptance number of zero for all tests, and each sample oil cooler shall be subjected to the following tests, except that only one run of the oil pressure drop test (4.7.8) shall be made with an oil temperature of 120° ±2° F. Samples subjected to the sampling tests will not be accepted in fulfillment of any contract.

(a) Oil pressure drop ---------- (4.7.8)
(b) Pressure cycles ---------- (4.7.4)
(c) Oil leakage (if required) -- (4.7.4.1)

4.5 Test conditions.

4.5.1 Ducting. Straight lengths of duct of the same cross-sectional area and shape as the frontal area of the cooler shall be provided. The inlet duct shall beat least twice as long as its maximum diameter. The outlet duct shall beat least as long as its maximum diameter.

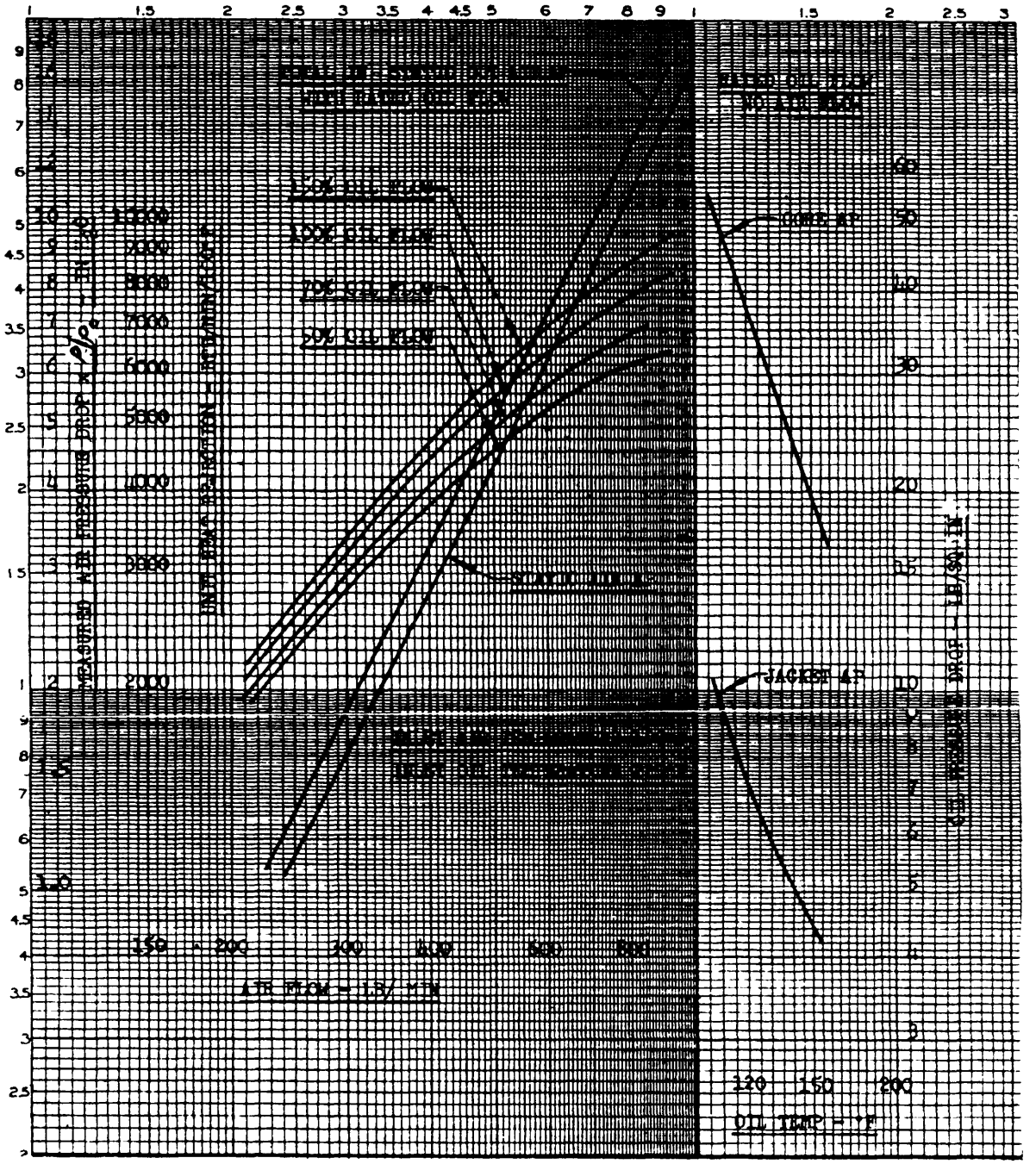
4.5.2 Oil. Unless otherwise specified, oil conforming to MIL-L-6082, grade 1100, shall be used for all oil cooler tests

4.521 Oil temperature. Unless otherwise specified, the inlet oil temperature shall be 225° l?.

4.5.3 Oil pressure connections. Oil pressure connections shall be made to the flange in accordance with figure 6.

4.5.4 Data to be obtained-instrumentation. The variables in table II shall be measured for each run.

4.5.5 Control limits and data observations. Unless otherwise specified, the variables specified at fixed values for points and runs are permitted to deviate from the specified conditions ±5° F for all temperatures, ±2 percent for oil flow, and ±2 percent of rated airflow for any airflow. The observed data shall be recorded. Unless otherwise noted, all points for each test shall be recorded only after all variables have been adjusted, and substantially stabilized. The degree of stabilization and accuracy of observation is acceptable if the calculated heat added to the air (air temperature rise times airflow times specific heat of air), checks within 5 percent of the calculated heat transferred from the oil (oil temperature drop times oil flow times specific heat of oil). Heat balance discrepancies of more than 5 percent, for all heat rejection runs other than oil temperature drop with airflow (see 4.7.6.2), are unacceptable.



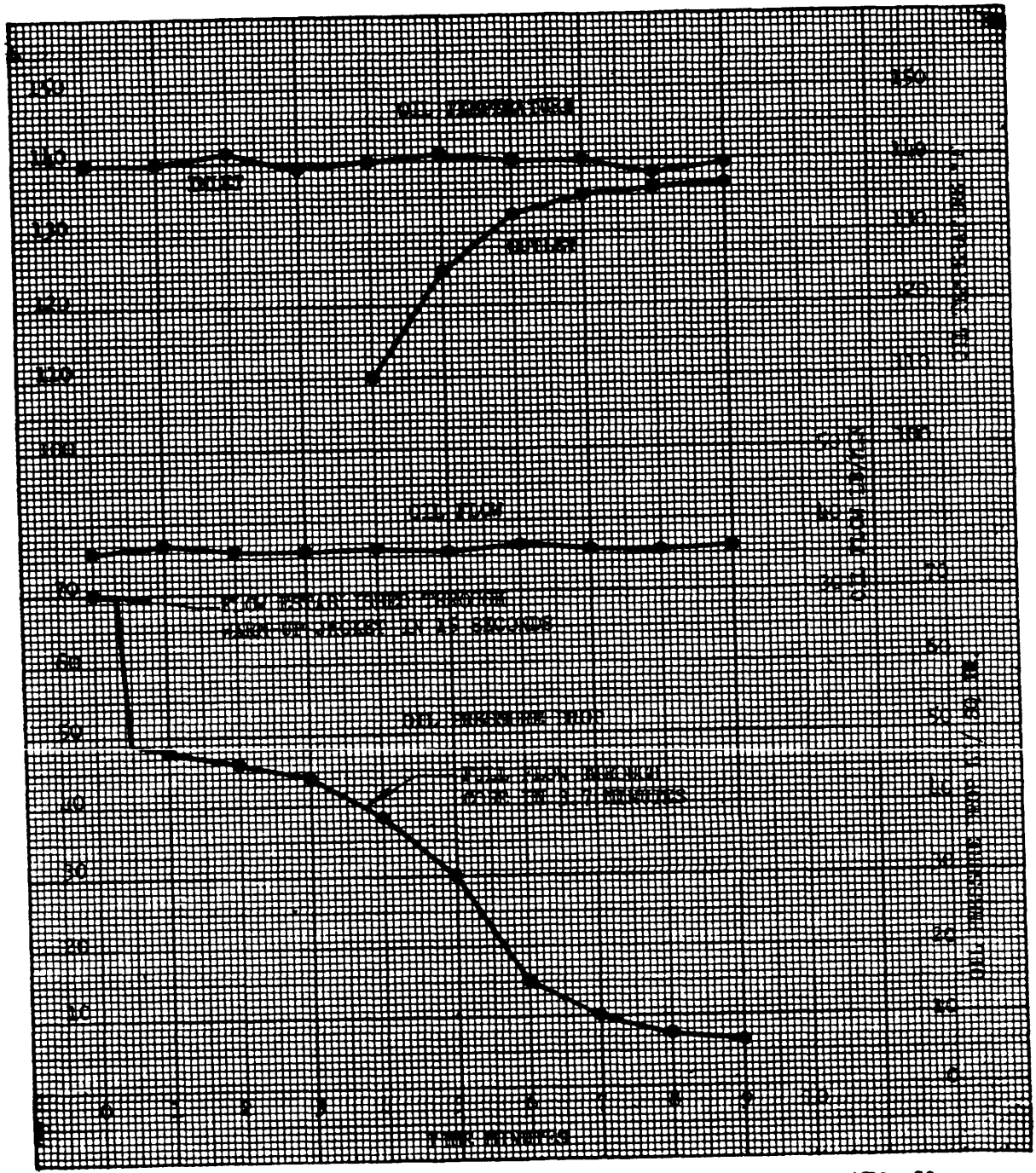
AIR FLOW IN STANDARD DIRECTION _____ MFG. CO.

OIL: SPECIFICATION MIL-L-6082, GRADE 1100 _____ DIA. OIL COOLER

RATED AIR FLOW - _____ LB/MIN MFR'S. DWG. NO. _____

RATED OIL FLOW - _____ LB/MIN HEAT REJECTION AND PRESSURE DROPS

FIGURE 2. *Performance curves*



OIL: SPECIFICATION MIL-L-6082, GRADE 1100

COOLER THOROUGHLY CONGEALED AT -4°F

WITH NO OIL FLOW PRIOR TO WARM-UP

_____LB/SQ IN. PRESSURE DIFFERENTIAL REQUIRED TO OPEN RELIEF VALVE

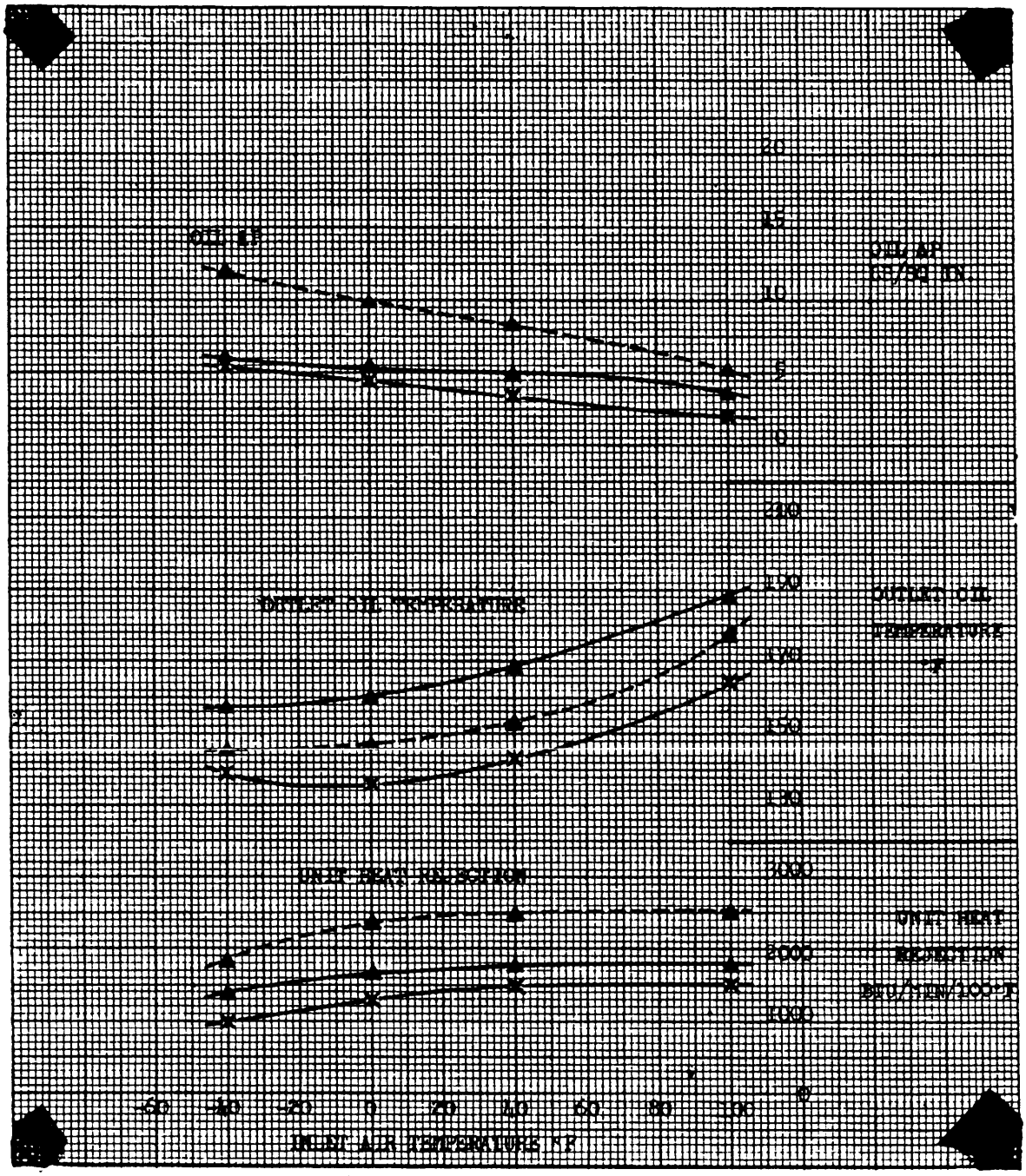
_____ MFG. CO.

_____ DIA. OIL COOLER

MFR'S. DWG. NO. _____

WARM-UP

FIGURE 3. *Performance curves*



OIL: SPECIFICATION MIL-L-6082, GRADE 1100
OIL FLOW:
▲ RATED LB/MIN
× 1/2 RATED LB/MIN
OIL INLET TEMPERATURE: 225°F
AIR FLOW:
_____ RATED LB/MIN
- - - - - - - TWICE RATED LB/MIN
___ LB/SQ IN. PRESSURE DIFFERENTIAL REQUIRED TO OPEN RELIEF VALVE

_____ MFG. CO.
_____ DIA. OIL COOLER
MFR'S. DWG. NO. _____

VARIABLE AIR TEMPERATURE

FIGURE 4. *Performance curves*

MANUFACTURER _____

COOLER DWG. NO. _____ SERIAL NO. _____

COOLER SIZE _____ TUBE SIZE _____

RATED OIL FLOW _____ lb/min RATED AIR FLOW _____ lb/min

DIRECTION OF AIR FLOW _____

TYPE RUN	OIL FLOW	AIR FLOW	TIME MIN	OIL TEMPERATURE, °F			OIL ΔP psi	AIRFLOW lb/min	AIR TEMP°F
				Inlet	Outlet	Drop 1/			
Heat Loss	Rated	Rated	15						
Thaw Out	"	"	3						
"	"	"	5						
"	"	"	10						
"	"	"	15						
Heat Loss	1/2 Rated	Rated	15						
Thaw Out	"	"	3						
"	"	"	5						
"	"	"	10						
"	"	"	15						
Heat Loss	Rated	2 Rated	15						
Thaw Out	"	"	3						
"	"	"	5						
"	"	"	10						
"	"	"	15						
Heat Loss	1/2 Rated	2 Rated	15						
Thaw Out	"	"	3						
"	"	"	5						
"	"	"	10						
"	"	"	15						

1/ Specification Requirement: 40°F oil temperature drop in 10 minutes.

PERCENT RATED AIR FLOW		100	100	100	200	200	200	200	50
PERCENT RATED OIL FLOW		50	100	150	50	70	100	150	100
Unit Heat Rejection at Inlet Air Temp of	100°F								
	-30°F								

ITEM	SPECIFICATION REQUIREMENT	TEST VALUE OBTAINED
Unit Heat Rejection BTU/min/100°F at 100°F Inlet Air Temperature.	min	
Congealing Ratios		
(a) Rated Air Flow & Rated Oil Flow	0.85 min	
(b) Twice Rated Air Flow & Rated Oil Flow	.70 min	
(c) Rated Air Flow & 1/2 Rated Oil Flow	.55 min	
Oil Pressure Drops, psi		
(a) Core	max	
(b) Warm-up Jacket	8 max	
Warm-up Time, Minutes	10 max	

FIGURE 5. *Test log*

TABLE II. *Instrumentation*

Quantity measured	Method of measurement	Overall accuracy of instrumentation
Oil-in temperature	Suitable thermometer or thermocouple	±0.5° F.
Air-in temperature	do	±0.5° F.
Oil-out temperature (to be of mixed stream from core and warmup passage).	Suitable temperature instrumentation to assure true average oil temperature readings.	±0.5° F.
Air-out temperature	do	±1.0° F.
Oil temperature rise (optional)	Series thermocouple	±1.0° F.
Air temperature rise (optional)		±1.5° F.
Oil flow, lb./min		± 1 percent.
Air flow, lb./min		± 1 percent.
Oil-in pressure, psi Oil-out pressure, psi	Bourdon tube gage or suitable manometer connected with noncongealing fluid lines.	±0.5 psi.
Air pressure oil cooler static drop	Measured in duct 4 in. up stream and 4 in. down stream with manometer.	±0.1 in. H_2O.
Static air pressure up stream	Duct to atmosphere by manometer and 4 in. up stream.	±0.1 in. H_2O.
Air pressure oil cooler drop	Inlet total head to down stream static head by manometer as shown on fig. 1.	±0.1 in. H_2O.
Atmospheric pressure	Barometer	±0.05 in. Hg.

4.5.6 The data furnished shall be as specified in table III.

4.5.7 The instantaneous specific heat of the oil shall be assumed to be as specified in table IV.

4.5.8 The specific heat of the air shall be assumed to be 0.240 B.t.u./° F/lb., or it may be taken in accordance with the relative humidity indicated in table V.

4.5.9 *Pressure drop corrections.* The air pressure drop measurements shall be corrected to standard conditions by use of the following formula:

$$\Delta P_o = \Delta P \frac{\rho}{\rho_o}$$

where

ΔP_o = corrected drop

ΔP = measured pressure drop

ρ = inlet air density lb./ft.^{3}

ρ_o = standard air density 0.0765 lb./ft.^{3}

4.6 Examinations.

4.6.1 *Examination of product.* The oil coolers shall be examined carefully to determine conformance with the material, workmanship, design, construction, dimensions, and applicable drawing requirements of this specification.

4.6.2 *Preservation, packaging, and packing inspection.* Preparation for delivery shall be examined for conformance with section 5.

TABLE III. *Data furnished*

Item	Oil flow percent rated	Airflow percent rated	Inlet air temperature °F
1	150	50, 100, 150, 200	100.
2	100	50, 100, 150, 200	100.
3	70	50, 100, 150, 200	100.
4	50	50, 100, 150, 200	100.
5	100	100	40, 0, −30.
6	100	200	40, 0, −30
7	50	100	40, 0, −30

TABLE IV. *Specific heat of oil*

Average oil temperature ° F [1]	Specific heat B.t.u./ °F/lb.
100	0 460
120	469
140	479
160	. 488
180	497
200	. 507
220	517
240	. 526
260	. 535

[1] Average oil temperature = arithmetical average of the oil-in and oil-out temperature

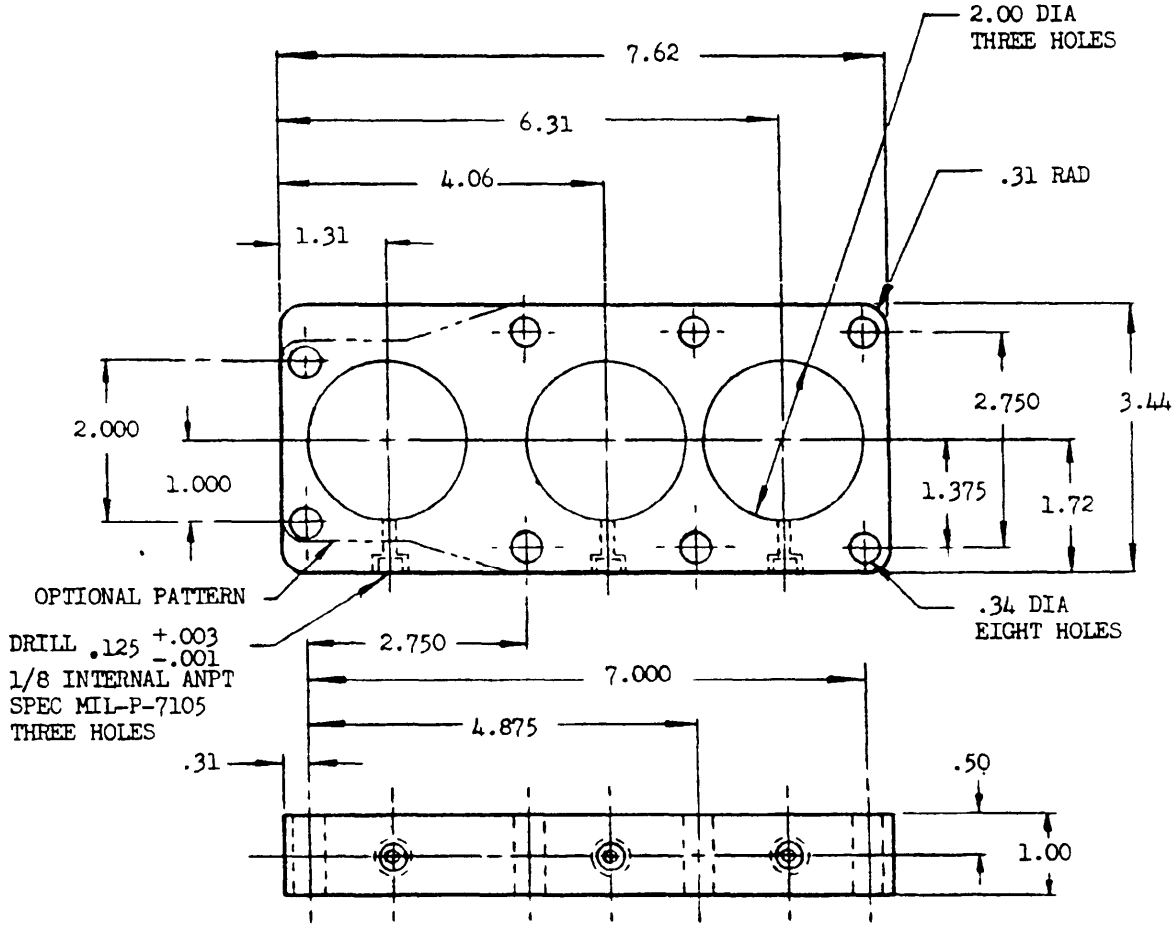
TABLE V. *Specific heat of air*

Temperature, ° F	C_p, dry air	C_p, saturated air
30 or less	0. 240	0. 240
60	. 240	. 241
80	. 240	. 243
100	. 240	. 246
120	. 240	. 250

4.7 Test methods.

4.7.1 *Static pressure.* All preservative compound or oil film shall be removed from the cooler by cleaning with a suitable solvent. The cooler shall be subjected to 100 pounds per square inch (psi) air pressure, and submerged in water at 150° to 175° F for 1 minute. The pressure shall not be applied suddenly. Permanent distortion shall be cause for rejection. In case of leakage of air, the cooler shall be flushed with MIL-L-6081, grade 1010 oil, and allowed to drain with the valve flange down for 1 hour at a temperature of not less than 60° F, and the above test shall be repeated with an air pressure of 80 psi maintained for 2 hours. There shall be no permanent distortion or free air leakage in excess of 10 cubic centimeters per minute.

4.7.2 *Cleaning.* Steam shall be passed through the oil side of the 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



DIMENSIONS IN INCHES. UNLESS OTHERWISE SPECIFIED, TOLERANCES: TWO-PLACE DECIMALS ±.03, THREE-PLACE DECIMALS ±.010

FIGURE 6. *Flange for measuring pressure drop*

drop of diluted 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 an acid or alkali reaction or the presence of halides shall be rewashed and rinsed until a clean condition is indicated by the test.

4.7.3 Oil pressure drop. The oil pressure drop shall be determined through the core and warmup passages. The pressures shall be determined at the applicable pressure taps on a pressure plate conforming to figure 6.

4.7.3.1 Core. The test shall be run at rated oil flow with the warmup passages outlet blocked, with no airflow, and with oil temperatures of 110° F, 120° F, 135" F, and 150° F. Sufficient data shall be recorded to plot a "Core A P" curve (see fig. 9). The pressure drop from the cooler inlet to core outlet, at a temperature of 120° F, shall in no case exceed 40 psi for coolers with a nominal frontal area of 133 square inches or less; 45 psi for coolers with a nominal frontal area of more than 133 square inches, but less than 254 square inches; and shall not exceed 50 psi for coolers with a nominal frontal area of 254 square inches or greater

4.7.32 Warmup passages. The above test shall be repeated with the core outlet blocked and the warmup passage outlet open. Sufficient data shall be recorded to plot a "Jacket A P" curve (see fig. 2). The pressure drop shall not exceed 8 psi through the warmup passages at a temperature of 120° F.

4.7.4 Pressure cycles. All preservative compound or oil film shall be removed from the cooler by cleaning in a suitable solvent. The cooler shall then be flushed with oil conforming to MIL-L-6081, grade 1010, and allowed to drain with the valve flange down for 1 hour, at a temperature of not less than 60° F. The cooler shall be completely submerged in oil at 295° F, Air pressure shall be applied through the inlet port with the outlet ports closed. The pressure shall be cycled from ±3 psi to 60 ±1 psi and back to 3 ±3 psi at a rate of 6 ± 1 cycles per minute (cpm). The pressure change from 3 to 60 psi and from 60 to 3 psi shall be accomplished in 2 to 2.5 seconds each. The pressure cycle shall be repeated 50,000 times, and the cooler shall be examined periodical y for leakage and distortion. Following this test, the cooler shall be subjected to an air pressure of 80 psi for a period of 2 hours while submerged in water at between 150" and 175° F. Any oil cooler which leaks in excess of 10 cubic centimeters per minute of free air from any point or a total leakage of 50 cubic centimeters per minute shall be subjected to the oil leakage test (4.7.4.1).

4.7.4.1 Oil Leakage. A minimum of 50 pounds per minute of oil at a temperature of 225° F, and at an inlet pressure of 60 psi, shall be flowed through the cooler for a period of 30 minutes. There shall be no oil leakage either during or as a result of this test.

4.7.5 Heatrejection and anticongealing characteristics. For each test run indicated in table III, sufficient data shall be recorded to enable calculation of corrected air pressure drops, unit heat rejection, and anticongealing rations The ratio of unit heat rejection at – 30° F air temperature to unit heat rejection at 100° F air temperature shall be not less than the values specified in table VI with the indicated oil and air flows.

TABLE VI. Congealing ratios

Unit heat rejection ratio	Oil—percent rated flow	Air—percent rated flow
0.85	100	100
.70	100	200
.55	50	100

4.7.6 Warmup characteristics. A relief valve shall be used on the warmup passage outlet during tests for warmup characteristics with and without airflow. The valve shall be set to open at 40 ± 2 psi differential pressure, and the valve open ing shall act to limit the maximum differential to 48 psi during any of the tests. The valve shall include a quick-acting manual opening device and means for indicating when the valve is completely closed.

4.7.6.1 Without airflow. The cooler shall be filled with oil and chilled to a temperature of −5°±1°F for a period of not less than 2 hours. Provisions shall be made to maintain the cooler filled with oil during freezing period. After the freezing period, oil at a temperature of 138° ±2° F and at a maximum applied pressure of 70 psi, shall be made available at the cooler inlet.

The oil inlet pressure shall be controlled to limit the test flow rate to 30 pounds per minute or 30 percent of rated flow, whichever is greater. Within 10 minutes, the oil flow through the relief valve shall be zero and limiting flow rate specified above shall be established through the core of the cooler.

4.7.6.2 Oil temperature drop with airflow. For each of the four test runs specified in table VII, the procedure shall be as follows:

With no airflow, oil at the specified flow rate and at an inlet temperature of 225° F shall be passed through the cooler for the purpose of thawing out the cooler. When the oil temperature at the cooler outlet is within 5° F of the inlet oil temperature. the airflow shall be started at the specified flow rate, and at a temperature of — 55° F. These conditions shall be maintained for a period of 15 minutes. Immediately following this stabilization period, the relief valve on the warmup passage opening shall be manually opened. Simultaneously, t h e flow of the oil to the cooler shall be reduced to one-hal f of the value. specified for the test. These conditions shall be maintained for 5±0.2 minutes. During this 5-minute freezeup period, the pressure under the relief valve should not exceed 5 psi. At the end of the 5-minute period, the relief valve manual opening device shall be released, and oil flow restored to the value specified for the test. After restoring the specified oil flow, oil temperatures at the cooler outlet shall be recorded at the end of 3, 5, 10, and 15 minutes. At the end of 10 minutes, the relief valve shall be completely closed, and the oil temperature drop shall be not less than 40° F.

TABLE VII Oil and air flows for oil temperature drop with airflow

Test run No	Oil flow percent of rated	Airflow percent of rated
1	100	100
2	50	100
3	100	200
4	50	200

4.7.7 Fluid resistance. This test shall be applicable to oil coolers containing nonmetallic parts.

4.7.7.1 High temperature. A mixture of 50 percent oil (by volume) and 50 percent type 111 fluid, as specified in TT-S-735, shall be circulated through the coder at a temperature of 135° ± 10° F for a period of 72 hours The cooler inlet pressure shall be maintained at 35± 5 psi. At the end of this period, oil at 275°55° F shall be circulatd through the cooler for 96 hours with the cooler inlet pressure maintained at 35&5 psi. The cooler, filled with oil, shall be tested at room temperature at pressures from 1 to '80 psi. The foregoing cycle shall be conducted six times. There shall be no Leaks as a result. of this test.

4.7.7.2 Low temperature. Within 24 hours after the high-temperature test (4.7.7.1), the cooler shall be drained and a mixture of 50 percent oil (by volume) and 50 percent type I fluid conforming to TT-S-735, shall be circulated through the cooler at room temperature for a period of 15 minutes. The cooler and mixture shall then be soaked for 72 hours at a temperature of −67±2° F. Pressures of 1 and 80 psi shall he applied alternately at least 10 times while at a temperature of — 67° F. There shall be no leakage as a result of this test.

4.7.7.3 Oil flow pressure resistance. The oil temperature shall be less than 100° F and the rate of flow adjusted to provide a pressure drop of 80 psi from the inlet of the cooler to the outlet of the core with the warmup outlet closed. The outlet pressure shall not exceed 10 psi. There shall be no damage or permanent distortion.

5. PREPARATION FOR DELIVERY

5.1 Preservation, packaging, and packing. The oil coolers shall be prepared for delivery in accordance with MIL-P-7936, unit, and intermediate packaging to be level A or level C, and exterior shipping cent.ainem levels A, B, or C. Preservation -shrill be Method IA of MIL-P-116.

5.2 Marking. Marking shall be in accordance with MIL-P-7936.

6. NOTES

6.1 Intended use. Oil coders covered by this specification are intended for use in cooling aircraft engine petroleum base lubricating oil.

6.2 Ordering data Procurement documents should specify the following:

(a) Title, number, and date of this specification.
(b) Levels of preservation, packaging, and packing (see 5.1).
(c) MS part number of oil coolers and quantity desired.

6.3 Qualification. With respect to products requiring qualification, awards will be made only for such products as have, prior to the time set for opening of bids, been tested and approved for inclusion in the applicable Qualified Products List, whether or not such products have actually been so listed by that date. The attention of the suppliers is called to this requirement, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government, tested for qualification in order chat they may be eligible to be awarded contracts or orders for the products covered by this specification. The activity responsible for the Qualified Products List is the Bureau of Naval Weapons, Navy Department, Washington 25, D C , and in formation pertaining to qualification of products may be obtained from that activity.

6.4 Definitions

6.4.1 Unit heat rejection. Unit heat rejection is defined as the total heat rejection in B.t.u.'s per minute, times 100, divided by the differential between the average oil temperature and the inlet air temperature in degrees Fahrenheit.

6.5 Marginal indica. The margins of this specification are marked to indicate where changes, deletions, or additions to the previous isssue have been made. This is done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Figures are not so marked. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content as written, irrespective of the marginal notations and relationship to the last previous issue.

Custodians:
Army—MO
Navy-WP
Air Force-(11)

Review activities:
Army-WO
Navy-WT
Air Force-(11) (71)

Preparing activity:
Navy-WP

Project No. 2935-0009

Review\user information is current as of the date of this document. For future coordination of changes to this document, draft cumulation should be based on the information in the current Federal Supply Classification Listing of DoD Standardization Documents.

FOLD

POSTAGE AND FEES PAID

OFFICIAL BUSINESS

Chief, Bureau of Naval Weapons

Engineering Division

Attn: RREN-5

Washington, D.C. 20360

FOLD

SPECIFICATION ANALYSIS SHEET

FORM APPROVED BUDGET BUREAU NO. 119-R004

INSTRUCTIONS

This sheet is to be filled out by personnel, either Government or contractor, involved in the use of the specification in procurement of products for ultimate use by the Department of Defense. This sheet is provided for obtaining information on the use of this specification which will insure that suitable products can be procured with a minimum amount of delay and at the least cost Comments and the return of this form will be appreciated. Fold on lines on reverse side, staple in corner, and send to preparing activity.

SPECIFICATION

MIL-C-5637B Cooler, Lubricating Oil, Petroleum Base, Aircraft Engine, etc.

ORGANIZATION	CITY AND STATE

CONTRACT NO	QUANTITY OF ITEMS PROCURED	DOLLAR AMOUNT
		$

MATERIAL PROCURED UNDER A

☐ DIRECT GOVERNMENT CONTRACT ☐ SUBCONTRACT

1. HAS ANY PART OF THE SPECIFICATION CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE?

A. GIVE PARAGRAPH NUMBER AND WORDING

B. RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES

2. COMMENTS ON ANY SPECIFICATION REQUIREMENT CONSIDERED TOO RIGID

3 IS THE SPECIFICATION RESTRICTIVE?

☐ YES ☐ NO *If "yes" in what way?*

4. REMARKS

(Attach any pertinent data which may be of use in improving this specification If there are additional papers, attach to form and place both in an envelope addressed to preparing activity.)

SUBMITTED BY *(Printed or typed name and activity)*	DATE

DD Form 1426