MIL-C-7488A(USAF)

6 AUGUST 1974

SUPERSEDING
MIL-C-7488(USAF)
8 January 1953

MILITARY SPECIFICATION

COOLERS, OIL, PLATE, AIRCRAFT

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

1. SCOPE

1.1 This specification establishes the general requirements for a plate type air-cooled oil cooler to provide oil temperature regulation for aircraft engines, turbo propeller gear boxes and helicopter transmission gear boxes.

*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 the specification to the extent specified herein.

SPECIFICATIONS

Federal

TT-S-735	Standard Test Fluids, Hydrocarbon

Military

MIL-P-116	Preservation-Packaging , Methods Of
MIL-T-5021	Tests; Aircraft Welding Operator's Certification
MIL-O-6081	oil; Lubricating, Jet Engine
MIL-L-6082	Lubricating Oil, Aircraft Engine
MIL-C-6529	Corrosion, Preventive , Aircraft Engine
MIL-P-7105	Pipe Threads, Taper, Aeronautical National Form, Symbol ANPT
MIL-S-7742	Screw Threads; Standard, Aeronautical
MIL-C-11796	Corrosion Preventive Compound, Petrolatum, Hot Application
MIL-C-16173	Corrosion Preventive Compound, Solvent Cutback, Cold Application

STANDARDS

Military

MIL-STD-100	Engineering Drawing Practices
MIL-STD-129	Marking for Shipment and Storage
MIL-STD-143	Standards and Specifications, Order of Precedence for the Selection Of
MIL-STD-794	Parts and Equipment, Procedures for Packaging and Packing Of
MIL-STD-889	Dissimilar Metals
MS 33786	Fitting Installation, Flared Tube and Hose, Swivel

(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 Components. The plate type oil cooler shall consist of the core assembly, which is made up of plates and fins, the warm-up passages, the inlet and outlet ports, a drain plug and a thermostatic temperature control valve.

3.2 Materials.

*3.2.1 Selection of specifications and standards. Specifications and standards for necessary commodities and services not specified herein shall be selected in accordance with MIL-STD-143.

3.2.1.1 AN or MIL standard parts. AN or MIL standard parts 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, cotter pins, etc., may be used, provided they possess suitable properties and are replaceable by the AN or MIL standard parts without alteration, and provided the corresponding AN or MIL part numbers are referenced in the parts list and, if practicable, on the contractor's drawings. In the event there is no suitable corresponding AN or MIL standard 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 Metals. Metals shall be of a corrosion-resistant type or suitably treated to resist corrosion in fuels, salt spray or atmospheric conditions likely to be met in storage or normal service.

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

*3.3.2 Non-metals. Non-metallic 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 an approved preservative compound such as MIL-C-11796 or MIL-C-16173, to insure satisfactory operation under all conditions specified herein.

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

3.5 Manufacturing process. Porcesses used for the manufacture of oil coolers shall be consistent with high quality aeronautical practice, suitable for the purpose, and shall conform with 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.

3.6 Design and construction.

3.6.1 General. The oil cooler shall be designed to transmit heat from liquids through the plate walls to an air stream flowing between the plates. Baffles, or turbulators, may be used to insure uniform distribution of oil flow through the core. Oil coolers shall be constructed to withstand strains, jars, shocks, vibrations and other conditions incident to shipping, storage, installation, and ordinary service use.

*3.6.2 Flanges. Oil Inlet and outlet flanges shall be provided on the oil cooler, in accordance with MS 33786.

3.6.3 Oil. The oil cooler shall be designed for operation with oil conforming to Specification MIL-L-6082, Grade 1100.

3.6.4 Temperature regulation. The specification shall be applicable to plate oil coolers designed to control the outlet oil temperature to 185°F or less. The cooler shall incorporate a by-pass warmup jacket which, in conjunction with the temperature control valve, controls temperature and hastens warmup by by-passing oil, as required.

*3.6.4.1 Temperature control valve. The thermostatic temperature control valve 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 exceeds 40 psi differential pressure. The valve housing shall be so arranged as to mix oil from the oil cooler by-pass warmup jacket and cooler core, to control final oil-out temperature. The valve shall incorporate MS 33786 flanges on all ports.

3.6.5 Ratings.

3.6.5.1 Rated oil flow. The oil cooler shall be designed for an oil flow commensurate with the rated oil flow of the aircraft engine, or oil system, for which the oil cooler is designed.

3.6.5.2 Rated air flow. The oil cooler shall be designed for a rated air flow commensurate with the properly corrected static air pressure drop available in the aircraft installation for which the oil cooler is designed.

3.6.5.3 Oil heat rejection. At rated oil flow, rated air flow and 100° ± 2°F inlet air temperature, the unit heat rejection (BTU/min/l00°F Temp. cliff.) from the oil shall be equal to, or greater than, that unit heat rejection for which the oil cooler is designed.

3.6.5.4 Direction of air flow. The oil cooler shall meet the performance requirements of this specification with the air flow in either direction.

3.6.6 Dimensions. The overall dimensions and weight shall be kept to a minimum and in accordance with best aircraft practice. Sizes and shapes shall be as specified on the manufacturer's drawing and shall be subjected to the approval of the procuring agency.

3.6.7 Threads.

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

3.6.7.2 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.

3.6.7.3 Locking threaded parts. All internal or external threaded parts, shall be secured in such a manner so as to prevent loosening under test conditions specified herein, or under normal service usage.

*3.6.8 Part numbering of interchangeable parts. All parts having the same manufacturer's part number shall be functionally and dimensionally interchangeable. The item identification and part number requirements of MIL-STD-100 shall govern the manufacturer's part numbers and changes thereto.

3.7 Performance. The oil cooler shall satisfy the performance requirements specified in Section 4, when subjected to the following tests:

Static Pressure
Warm-Up Without Air Flow
Warm-Up With Air Flow
Core Pressure Drop
Warm-Up Passages Pressure Drop
Oil Pressure Drop With Air Flow
Oil Flow Pressure Resistance
Anti-Congealing Characteristics
Pressure Cycles
Fluid Resistance Test
High Temperature Tests
Low Temperature Tests

*3.8 Identification of product. The physical item shall be marked for identification in accordance with MIL-STD-130. The nameplate shall contain the information presented below.

COOLER, OIL, PLATE, AIRCRAFT
Specification No. MIL-C-7488(USAF)
Manufacturer's Part No._____
Manufacturer's Serial No._____
Order No._____
Manufacturer's Name or Trademark
Us. Property

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

3.10 Welding. All welding operations shall be performed by operators certified in accordance with Specification MIL-T-5021, Class A, Group IV.

3.11 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 inspections. The inspection requirements specified herein are classified as follows:

1. First Article Inspection (See 4.4)
2. Quality Conformance Inspection (See 4.5)

*4*3 Test conditions. Unless otherwise specified by the procuring agency, the following test conditions shall apply during the tests performed in accordance with this specification.

*4.3.1 Ducting. Two diameters, or two major axis minimum length of a straight duct, having inside diameter or major axis equal to nominal cooler diameter or major axis, shall be provided on cooling air inlet to oil cooler. One diameter, or major axis minimum length of similar duct, shall be provided as the outlet duct, or an elliptical section, or "bellmouth", having a major axis equal to cooler major axis at the oil cooler inlet end, shall be provided on the cooling air inlet to the oil cooler. The elliptical section shall be a transition section of ducting, and shall be designed to provide smooth air flow to the oil cooler face.

*4.3.2 Oil. Unless otherwise specified, oil conforming to Specification MIL-L-6082, Grade 1100, shall be used for all oil cooler tests.

*4.3.2.1 011 temperature. Unless otherwise specified, the inlet oil temperature shall be 225°F.

*4.3.3 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.

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

*4.3.5 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 ±2°F for all temperatures, ±2 percent for oil flow and ±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 flew 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 unacceptable.

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

TABLE II

Item	Oil Flow Percent Rated	Air Flow Percent Rated	Inlet Air Temperture
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 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 temp. readings	± 1.0°F
Oil temp. rise (optional) Air temp. rise (Optional)	Series thermocouple	± 1.0°F
Oil flow, lb/rein		1%
Air flow, lb/rein		1%
Oil-in press., psi Oil-out press., psi	Bourdon tube gage,or suitable manometer, connected with non-congealing fluid lines	± 0.5 psi ± 0.5 psi
Air pressure oil cooler static drop	Measured in duct 4 in. upstream and 4 in. down-stream with manometer	± 0.1 in. H 0
Air pressure up-stream	Duct to atmosphere by manometer	± 0.1 in. H 0
Air pressure down-stream	Duct to atmosphere by manometer	± 0.1 in. H 0
Air pressure oil cooler drop	Upstream static head to down-stream static head by manometer, as per Figure 1.	± 0.1 in. H 0
Atmospheric press.	Barometer	± .05 in. Hg.

*4.3.7 The instantaneous specific heat of the oil shall be assumed to be as specified in Table III, unless the contractor submits substantiating data for the use of other values.

TABLE III

Specific Heat of Oil

Average Oil Temperature °F 1/	Specific Heat BTU/°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 = the arithmetical average of the oil-in and oil-out temperature.

*4.3.8 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 IV.

TABLE IV

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

*4.3.9 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:

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

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

*4.4 First article tests.

*4.4.1 First article test samples. The First Article Test samples shall consist of two oil coolers representative of the production coolers. 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. (see paragraph 6.5)

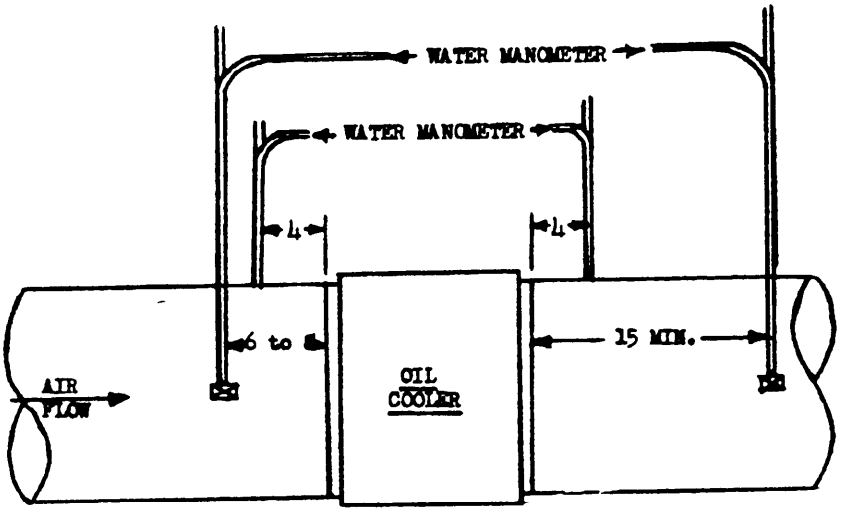
(a) Description of test equipment. -This description shall include the diagram of the general set-up, the type, and capacity of the various components of appratus and instruments, and methods of controlling the test variables. The description shall include photographs, wherever possible, of the general set-up and of the installation of a 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. (see paragraph 6.5)

(b) Copies of original data sheets for all tests required by this specification, including corrected values from which curves are plotted. (see paragraph 6.5)

(c) Curves similar to Figures 2, 3, and 4, and a summary of results, in accordance with Figure 5. (see paragraph 6.5)

Samples shall be plainly identified with securely attached durable tags marked with the following information:

Sample for Qualification Test
COOLER, OIL, PLATE, AIRCRAFT
Manufacturer's Part No.
Name of Manufacturer
Submitted by (name) (date) for qualification test in accordance with Specification MIL-C-7488A(USAF) under authorization (reference authorizing letter)



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 OF 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

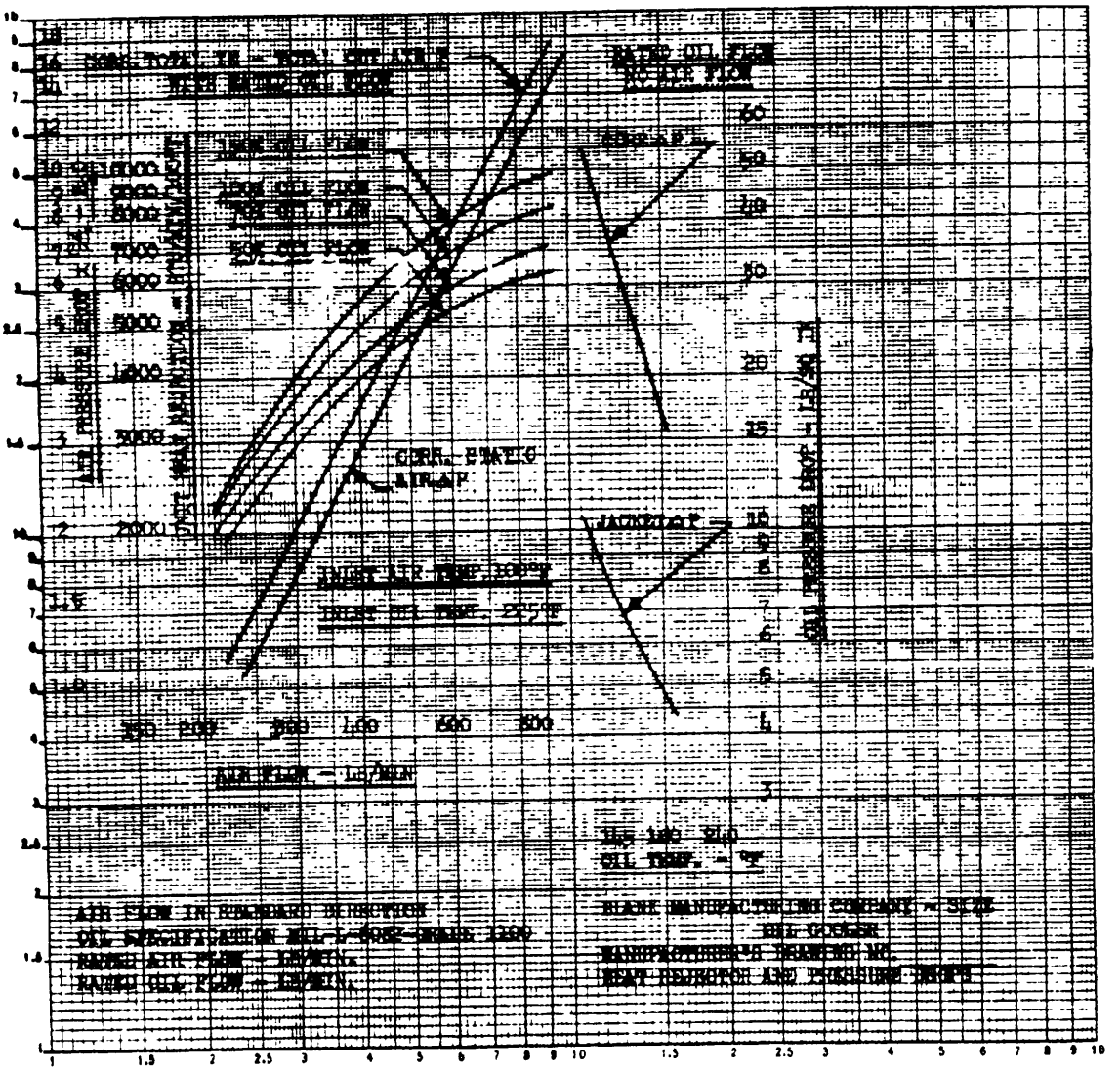


FIGURE 2 PERFORMANCE CURVES

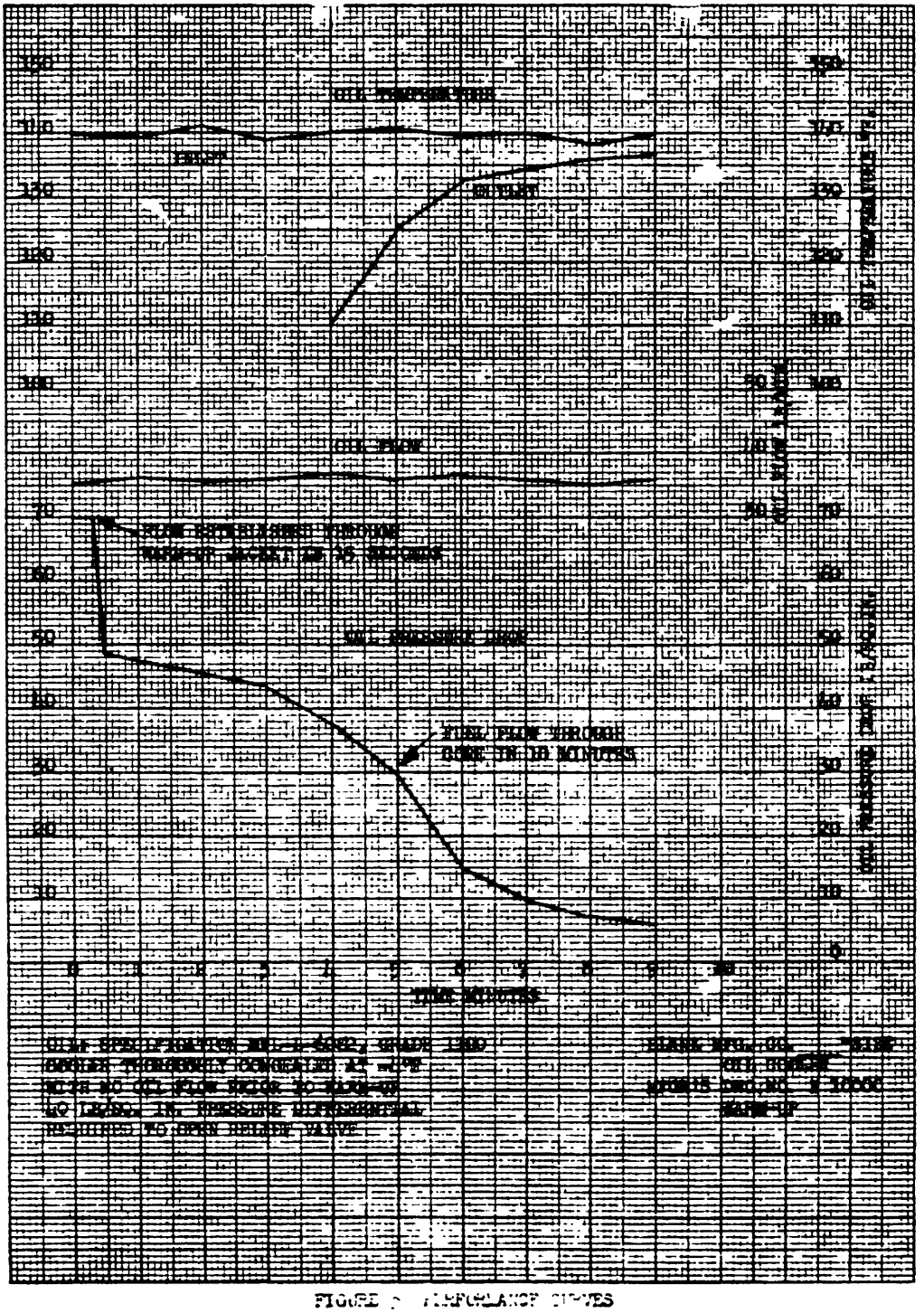


FIGURE 7 - PERFORMANCE CURVES

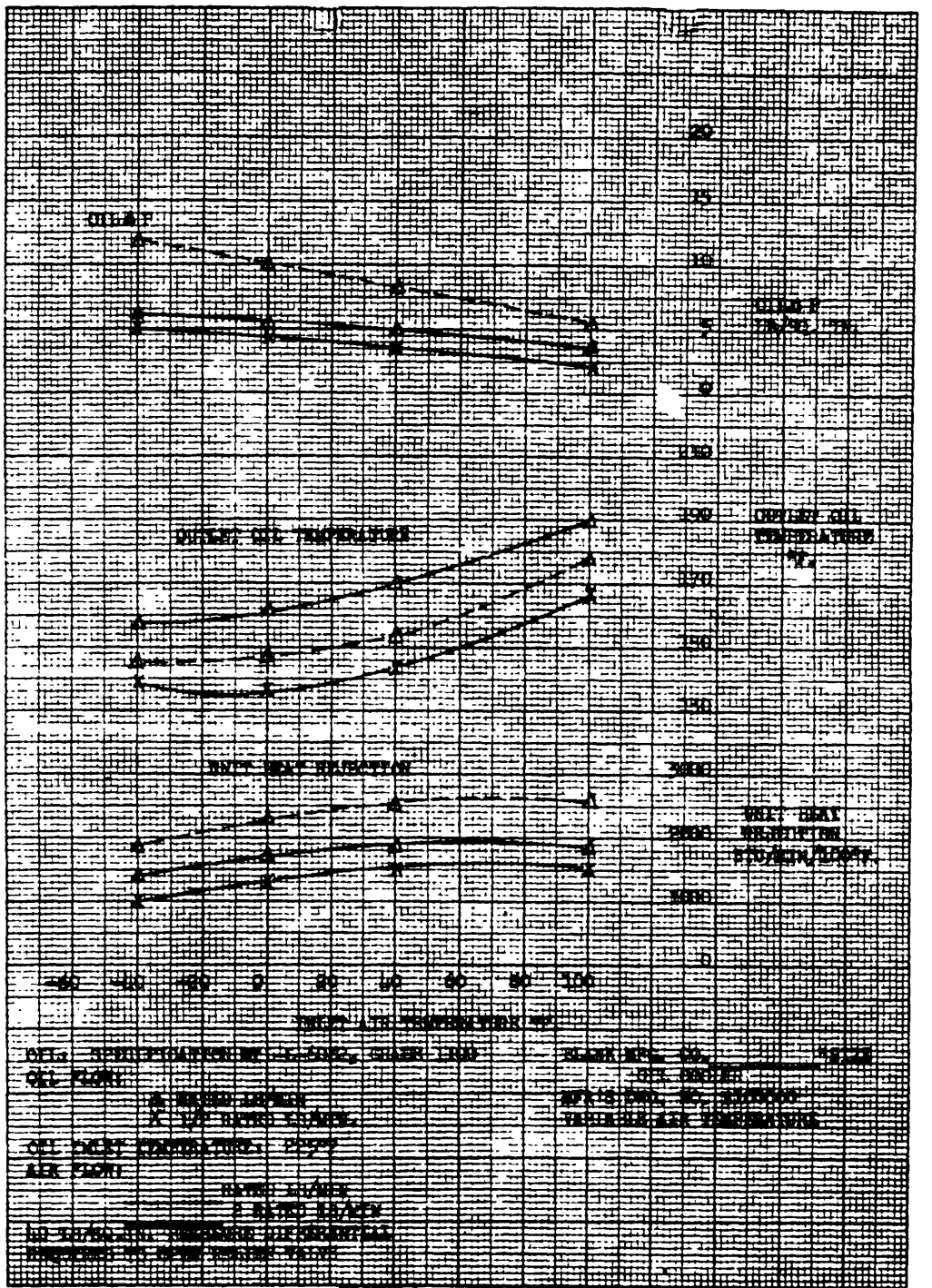


FIGURE 2 - [illegible] CURVES

MANUFACTURER _____ SERIAL NO. _____
COOLER DWG. NO. _____ PLATE SIZE & AIR CENTER CAPACITY.
COOLER SIZE _____ RATED AIR FLOW, lb/Min _____
RATED OIL FLOW, lb/min _____
DIRECTION OF AIR FLOW _____

TYPE RUN	OIL FLOW	AIR FLOW	TIME MIN.	OIL TEMPERATURE °F Inlet	Outlet	Drop 1/	OIL P psi	AIR FLOW lb/min.	AIR TEMP. °F
Heat Loss Thaw	rated	rated	15						
Out	"	"	3						
"	"	"	5						
"	"	"	10						
"	"	"	15						

1/ - Specification Requirement: 30 PSI, Max Oil pressure drop in 10 minutes.

% RATED AIR FLOW	100	100	100	200	200	200	200	50
% RATED OIL FLOW	50	100	150	50	70	100	150	100

Unit Heat Rejection 100°F
at Inlet Air Temp. of -30°F

ITEM	SPECIFICATION REQUIREMENT min.	TEST VALUE OBTAINED
Unit Heat Rejection BTU/min/100°F at 100°F Inlet Air Temperature.		
Oil Pressure Drops, psi	25 max.	
(a) Core		
(b) Warm-Up Jacket		
Warm-Up Time, Minutes	10 max.	

FIGURE 5 - TEST LOG

*4.4.2 Tests. The First Article Test shall consist of the acceptance tests and the following tests:

*4.4.2.1 Static pressure. The oil cooler shall be subjected to 400 ± 20 psi hydrostatic pressure for one minute, and checked for leakage or distortion.

*4,4.2.2 Warm-up characteristics.

*4. 4.2.2.1 Warm-up without air flow. With a maximum applied pressure of 70 pounds per square inche, an oil flow of 30 pounds per minute (or 30 percent of rated flow, whichever is greater) through the cooling elements, and a zero flow through the relief valve, shall be established within 10 minutes after oil, at a temperature not exceeding 140°F is made available at the cooler inlet with the cooler filled with oil and chilled to a temperature of -4°F to -6°F for a period of not less than two hours. Provision shall be made to maintain the cooler filled with oil during the freezing period. The oil flow shall no exceed the greater of the two values given above by more than 5 percent at any time during these tests. The pressure relief valve shall be used on the warm-up passage outlet during tests for warm-up characteristics, without air flow. The valve shall be set to open at 40 pounds per square inch differential pressure, and the valve opening shall act to limit the maximum differential at 48 pounds per square inch during any of the tests. Means for indicating when the valve is completely closed shall be provided.

4.4.2.2.2 Warm-up with air flow. The temperature control and pressure relief valve shall be used on the warm-up passage outlet during tests for warm-up characteristics with air flow. Tests shall be run in accordance with Table V and all results shall be plotted with coordinates similar to those shown in Figure 3. The oil pressure through the oil cooler core shall net exceed 25 pounds per square inch, at any time.

*4 .4.2.3 Oil pressure drop.

*4 .4.2.3.1 Core. The oil pressure drop through the core, shall be determined. The test shall be run at rated oil flow, no air flow and oil temperatures of 145, 180, 210, and 240°F. The oil pressure drop through the core shall in no case exceed 15 psi.

* 4.4.2.3.2 Warm-up passages. The oil pressure drop, through the warm-up passages , shall be determined. The test shall be run at rated oil flow, no air flow, and oil temperatures of 145, 180, 210, and 240°F. The oil pressure drop through the warm-up passages shall in no case exceed 8 psi.

TABLE V

(Test Conditions)

% Rated Oil Flow #/min	% Rated Air Flow #/min	Air Temp. To Cooler °F	Oil Temp. To Cooler °F	Oil Temp. Fr. Cooler °F (Approx)	Time Min.
25	6	-4	140	140	5
50	25	-4	180	175	4
75	50	-4	200	180	3
100	100	-4	225	185	3
100	100	-4	225	185	3

NOTE:---Use thermostatic element in valve.

*4.4.2.3.3 Oil pressure drop with air flow. The test procedure shall be as follows: The oil cooler shall be thoroughly thawed out for at least 5 minutes with no air flow and at the specified oil temperature and oil flow passing through the oil cooler. After the oil cooler is thoroughly thawed, the air flow shall be started at the specified flow rate and air temperature for the test. The above conditions shall be maintained for a period of 15 minutes or until the oil-out temperature has stabilized. Immediately following this stabilization period, simultaneously the relief valve on the warm-up passage opening shall be manually opened and the flow of oil to the cooler reduced to one-half of the value specified for the test. These conditions shall be maintained for 5 minutes. During this 5 minute freeze-up period, the pressure under the relief valve shall not exceed 5 pounds per square inch (gage). At the end of the 5 minute period, simultaneously, the relief valve shall be closed and the oil flow restored to the specified value for the test. After restoring the specified oil flow, oil temperatures and pressures shall be recorded at the end of 3, 5, 10, and 15 minutes. Test condition shall be as in Table VI.

TABLE VI

(Test Conditions)

Oil inlet temperature	225° ± 2°F
Air inlet temperature	-55° ± 2°F
Oil Flow Percent Rated / 100	Air Flow Percent Rated / 100

*4.4.2.4 Oil flow pressure resistance. With an oil temperature of less than 100°F. and the warm-up outlet closed, adjust the flow of oil through the cooler 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. Check for leakage or permanent distortion.

*4.4.2.5 Anti-congealing characteristics.

*4.4.2.5.1 Oil coolers designed for use on helicopters when subjected to conditions of rated air flow, rated oil flow, with 225°F inlet oil temperature and -30°F inlet air temperature, with the control valve (thermostatic element) installed, the oil pressure drop through the cooling core shall not exceed 30 pounds per square inch. The oil cooler outlet temperature shall not exceed 185°F for any of the -30°F air inlet temperature runs.

*4.4.2.5.2 Oil coolers designed for use on helicopters when subjected to conditions of rated air flow, rated oil flow, with 225°F inlet oil temperature and 100°F inlet air temperature, without the control valve (thermostatic element) installed, the oil pressure drop through the cooling core shall not exceed 25 pounds per square inch. When subjected to these conditions the oil cooler shall meet the heat rejection requirements specified in paragraph 3.6.5.3. The oil cooler oil outlet temperature shall not exceed 185°F for any of the 100°F air inlet temperature runs.

*4.4.2.5.3 Oil coolers designed for use on aircraft other than helicopters when subjected to conditions of twice rated air flow, rated oil flow, with 225°F inlet oil temperature and -30°F inlet air temperature, with the control valve (thermostatic element) installed, the oil pressure drop through the cooling core shall not exceed 30 pounds per square inch. The oil cooler oil outlet temperature shall not exceed 185°F for any of the -30°F air inlet temperature runs.

*4.4.2.5.4 Oil coolers designed for use on aircraft other than helicopters when subjected to conditions of twice rated air flow, rated oil flow, with 225°F inlet oil temperature and 100°F inlet air temperature, without the control valve (thermostatic element) installed, the oil pressure drop through the cooling core shall not exceed 25 pounds per square inch. When subjected to these conditions the oil cooler shall meet the heat rejection requirements specified in paragraph 3.6.5.3. The oil cooler oil outlet temperature shall not exceed 185°F for any of the 100°F air inlet temperature runs.

*4.4.2.6 Pressure cycles. The oil cooler shall be completely submerged in oil at 300° ±0° -10°F. An air pressure cycle of 3 l 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.

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

*4.4.2.7.1 High temperature tests. A mixture of 50% oil (by volume) and 50% TT-S-735 type III fluid shall be circulated through the cooler at a temperature of 135° ±10°F for a period of 72 hours. The cooler inlet pressure shall be maintained at 35 ± 5 psi. Following this, the cooler shall be tested at room temperature at pressures from 1 psi to 100 psi. The foregoing cycle shall be repeated six times. There shall be no leakage during this test.

*4.4.2.7.2 Low temperature test. Following the high temperature part of the Fluid Resistance Test, the cooler shall be soaked for 72 hours at -65°F ±5°F while filled with a mixture of 50 percent (by volume) TT-S-735, type I fluid and 50 percent oil. While at -65°F, pressure of 1 psi and 100 psi shall be applied alternately at least ten times. There shall be no leakage.

*4.5 Quality conformance inspection. Tests shall consist of:

a. Individual tests (see 4.5.1)
b. Sampling tests (see 4.5.2)

*4.5.1 Individual tests. Each oil cooler submitted for acceptance under contract, shall be subjected to the tests described below, except that the test for cleaning may be waived by the inspector if he is satisfied as to the efficiency and uniformity of the neutralizing process. In addition, the oil cooler -shall be subjected to any other tests specified herein which the inspector considers necessary to determine conformance withthe requirements of this specification.

*4.5.1.1 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.

*4.5. 1.2 Static pressure test. The cooler shall be subjected to 400 pounds per square inch hydrostatic pressure. and checked for leakage and distortion.

*4.5.1.3 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.

*4.5.2 Sampling tests. Two coolers shall be selected at random by the Government inspector from each lot of 200 or less to be subjected to the tests described below (except that only one run shall be made with an oil temperature of 120° ±2°F). 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.

*4.5.2.1 Oil pressure drop. The oil pressure drop, through the core and warm-up passages, shall be determined. The test shall be run at rated oil flow, no air flow and with oil temperatures of 145, 180, 210, and 240°F.

*4.5.2.2 Pressure cycles. The oil cooler shall be completely submerged in oil at 300° +0° -10°F. A 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 following number of cycles without leakage or permanent distortion.

First Article	50,000 cycles
Acceptance	15,000 cycles

Following the Pressure Cycle Test, the Static Pressure Test shall be repeated to determine conformance with the requirements of paragraph 4.4.2.1.

*4.5.3 Rejection. If a pressure cycle random sample fails to withstand 15,000 cycles, acceptance of all items shall be withheld until the extent and cause of failure is determined. For operational reasons, individual tests may be continued pending investigation of a sampling test failure, but the final acceptance of the product is contingent upon the inspector's decision regarding the over-all conformance of the product to specification requirements. If the oil pressure random sample fails to meet the oil pressure drop requirements, the source of this failure shall be immediately remedied to the satisfaction of the inspector. Rejected units shall be replaced or reworked to correct the defects, after which all necessary tests shall be repeated. Rejected equipment shall not be resubmitted for inspection without furnishing all particulars concerning previous rejections and measures taken to correct the defects. If investigation indicates that the defects may exist in items previously accepted, full particulars concerning the defects found, including recommendations for correction, will be furnished to the procuring agency.

*5. PREPARATION FOR DELIVERY

*5.1 Preservation and packaging.

*5.1.1 Level A and 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 cooling aircraft engine lubricating oil, turbo-propeller gear box oil, and helicopter transmission gear box oil.

*6.2 Ordering data. Procurement documents should specify the following:

a. Title, number, and date of this specification
b. Manufacturer's part number
c* Where First Article tests are to be conducted (See 4.4)
d. Level of packing (See 5.2)

*6.3 First Article information. The Government activity responsible for First Article Testing is the Oklahoma City ALC/MMEO, Tinker AFB, Oklahoma 73145. Items for testing will be submitted to this address when directed by the contracting officer in accordance with Armed Services Procurement Regulation (ASPR) 1-1900.

6.4 Definitions.

6.4.1 Unit heat rejections. Unit heat rejection is defined as the total heat rejection in BTU's per minute, times 100, divided by the differential between the average oil temperature and the inlet air temperature in degrees Fahrenheit.

*6.5 Data. Data generated by this document is not deliverable unless specified on the Contract Data Requirements List (DD Form 1423) referencing the appropriate data item description in the military departments' Authorized Data List (ADL).

*6.6 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-F001

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

OMB Approval No. 22-R255

INSTRUCTIONS: The purpose of this form is to solicit beneficial comments which will help achieve procurement of suitable products at reasonable cost and minimum delay, or will otherwise enhance use of the document. DoD contractors, government activities, or manufacturers/ vendors who are prospective suppliers of the product are invited to submit comments to the government. Fold on lines on reverse side, staple in corner, and send to preparing activity. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements. Attach any pertinent data which may be of use in improving this document. If there are additional papers, attach to form and place both in an envelope addressed to preparing activity.

DOCUMENT IDENTIFIER AND TITLE

NAME OF ORGANIZATION AND ADDRESS

CONTRACT NUMBER

MATERIAL PROCURED UNDER A

☐ DIRECT GOVERNMENT CONTRACT ☐ SUBCONTRACT

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

   A. GIVE PARAGRAPH NUMBER AND WORDING

   B. RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES

2. COMMENTS ON ANY DOCUMENT REQUIREMENT CONSIDERED TOO RIGID

3. IS THE DOCUMENT RESTRICTIVE?

   ☐ YES ☐ NO *(If "Yes", in what way?)*

4. REMARKS

SUBMITTED BY *(Printed or typed name and address - Optional)*

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