MIL-STD-759B

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26 November 1965

MILITARY STANDARD

CONDENSERS, AIR COOLED, REFRIGERANT-12

SEAL OF THE

DEPARTMENT OF DEFENSE

FSC 4130

DEPARTMENT OF DEFENSE

Washington D. C. 20301

CONDENSERS, AIR COOLED, REFRIGERANT-12

1. This standard has been approved by the Department of Defense and is mandatory for use by the Departments of the Army, the Navy, and the Air Force, effective 26 November 1965.

2. Recommended corrections, additions or deletions should be addressed to the U. S. Army Natick Laboratories, Natick, Massachusetts. 01760

CONTENTS

1. SCOPE

1.1 Scope.- This standard covers mechanical draft air-cooled condensers for use with Refrigerant-12. The condensers cover a range of capacities or heat rejection rates from 16,000 British thermal units per hour (B.t.u./hr.) to 57,000 B.t.u./hr. when fitted with the applicable fans specified herein.

1.2 Classification.- The condensers shall be of the following types and classes:

Type I - 22,000 B.t.u./hr.
Type II - 35,000 B.t.u./hr.
Type III - 46,000 B.T.u./hr.
Type IV - 57,000 B.t.u./hr.
Type V - 16,000 B.t.u./hr.
Type VI - 28,000 B.t.u./hr.
Class 1 - Copper tubing, aluminum fins, aluminum housing.
Class 2 - Copper tubing, copper fins, aluminum housing.
Class 3 - Aluminum tubing, aluminum fins, aluminum housing.
Class 4 - Steel tubing, steel fins, steel housing.

2. REFERENCED DOCUMENTS

2.1 Governmental.- The issues of the following documents in effect on date of invitation for bids or request for proposal, form a part of this standard to the extent specified herein:

SPECIFICATIONS

FEDERAL

CC-M-636 - Motor, Alternating-Current (Fractional Horsepower).

MILITARY

MIL-C-23122 - Condensers, Air Cooled, Refrigerant-12.

STANDARDS

MILITARY

MIL-STD-279 - Compressor, Reciprocating Power, Driven, Open Type, For Use With Dichlorodifluoromethane (CCL_2F_2).

MIL-STD-773 - Compressors, Hermetic: For Use With Refrigerant 12.

MS 35925 - Connection End, Solder-Joint, Refrigeration.

PUBLICATION

NATIONAL BUREAU OF STANDARDS

Handbook H28, Screw-Thread Standards for Federal Services.

(Application for copies should be addressed to the Superintendent of Documents, Government Printing Office, Washington D.C. 20402).

3. DEFINITIONS

3.1 Condenser.- The term "condenser" shall include the coil, shroud and fan orifice, and fan.

3.2 Coil.- The term "coil" shall include the tubes, fins, return bends (if used), tube sheets, mounting flanges, headers (inlet and outlet), and top and bottom plates.

3.3 Fan.- The term "fan" shall include the propeller blade and hub, with components specified in table III.

3.4 Heat rejection capacity.- The term "heat rejection capacity" shall designate the rate in Btu/hr. that the condenser is capable of rejecting when fitted with the specified fan and when operating at 25 degrees Fahrenheit (F) temperature difference.

3.5 Temperature difference.- The term "temperature difference" is the difference in F. between the saturated refrigerant-12 temperature equivalent to the refrigerant discharge pressure and the dry-bulb temperature of the air flowing across the condenser coil (see table II).

4. GENERAL REQUIREMENTS

4.1 Refrigerant.- The condensers shall be designed for operation with dichlorodifluoromethane (CCL_2F_2), refrigerant-12.

4.2 Equipment.- The condensers shall be provided with belt-driven or direct electric motor driven fans (see 5.2), when operating in conjunction with reciprocating compressors conforming to MIL-STD-279 and with direct motor driven fans (see 5.2 and 5.3) when operating in conjunction with hermetic type compressors conforming to MIL-STD-773.

4.3 Fan rating.- The fans shall operate at the specified revolutions per minute (RPM), plus or minus 5 per cent, for rating purposes. In application, the fans shall operate at the specified RPM, plus or minus 33 per cent, provided this does not exceed the manufacturer's recommended tolerance.

4.4 Condenser.- The condenser coil shall consist of single or multirow tubes with each row of tubes having a vertical or horizontal S-shaped arrangement with or without return bends. The inlet and outlet headers shall have one or more inlets and outlets into and from the coil tubes. The fan shall be centrally located at the orifice provided and the air shall be drawn through the condenser.

4.5 Procurement specification.- The procurement specification for condensers covered by this standard is Specification MIL-C-23122.

5. DETAILED REQUIREMENTS

5.1 Condensers.-

5.1.1 Dimensions.- Condensers conforming to this standard shall conform to the dimensions shown on figures 1 and 2.

5.1.2 Materials.- Condensers conforming to this standard shall conform to the materials shown in table I.

5.1.3 Capacity.- Condensers conforming to this standard shall meet the minimum heat rejection capacities shown in table II when operating at the conditions indicated.

5.1.4 Pressure drop.- The pressure drop through the coil tube between the gas inlet header and liquid outlet header shall be not greater than 12 psi (at rated load).

5.1.5 Construction.-

5.1.5.1 Bonding fin to tube.- Tubes shall be mechanically or hydraulically expanded into fins to form a firm and continuous metal to metal contact. Hydrogen brazing may be used on steel coils in lieu of mechanical or hydraulic expansion.

5.1.5.2 Bonding tube to tube sheet.- Tubes shall be mechanically or hydraulically expanded into drawn collars (3/32-inch minimum draw without splitting) or ferrules to form a tight fit between tubes and tube sheets. Hydrogen brazing may be used on steel coils in lieu of mechanical or hydraulic expansion.

5.1.5.3 Fin shape and spacing.- The shape of the fins shall be optional with a maximum of eight (8) evenly-spaced fins per inch of tube length fitted to form a continuous and firm bond with the tube.

5.1.5.4 Joints.- All permanent joints in refrigerant circuits shall be brazed for copper and steel parts. Joints for aluminum parts shall be inert gas welded.

5.1.5.5 Connections.- Inlet and outlet connections shall be type L tubing and shall be sweat type connections conforming to MS 35925, except tolerances shall be as shown in figure 1.

5.2 Fans.- The fans shall be propeller type.

5.2.1 Dimensions.- The fan dimensions shall conform to the dimensions shown in table III.

5.2.2 Material.- The material for the fan propeller shall be corrosion-resisting steel, steel treated to resist corrosion, or corrosion resistant metal. The material for the hub shall be corrosion-resisting steel or steel treated to resist corrosion.

5.2.3 Characteristics.- The fan characteristics shall be as shown on figure 3.

5.3 Motors.- The fan motors shall conform to CC-M-636 and table IV of this standard.

5.4 Threads.- Threads, if used, shall conform to Handbook H28.

5.5 Fan and fan motor selection.- When required, the applicable fans and fan motors shall be provided with the condensers.

Notice of availability.- Copies of specifications, standards, drawings or publications required by suppliers in connection with specific procurement functions should be obtained from the procurement agency or as directed by the contracting officer.

Copies of this standard for military use may be obtained as indicated in the foreword to the Index of Military Specifications and Standards.

The title and identifying symbol should be stipulated when requesting copies of military standards.

Custodians:

Army - GL

Navy - YD

Air Force - 82

Preparing activity:

Army - GL

Project No. 4130-0187

Review activity:

Army - MD

User activities:

Army - CE, ME
Navy - MC

TABLE I.- Condenser materials

Class	Tube Material	Tube Diameter (inch)	Tube Wall thickness (inch) minimum	Fin Material	Fin *Thickness (inch)	Condenser top and bottom plate and fan shroud Material	Condenser top and bottom plate and fan shroud *Thickness (inch)	Mounting flange and tube sheet Material	Mounting flange and tube sheet *Thickness (inch)
1	Cu	3/8	.016						
1	Cu	1/2	.020	Al	0.010	Al	0.050	Al	0.100
1	Cu	5/8	.020						
2	Cu	3/8	.016						
2	Cu	1/2	.020	Cu	0.009	Al	0.050	Al	0.100
2	Cu	5/8	.020						
3	Al	3/8	.025						
3	Al	1/2	.035	Al	0.010	Al	0.050	Al	0.100
3	Al	5/8	.035						
4	St	---	.035	St	0.012	St	0.045	St	0.054

*Commercial mil tolerances shall apply to specified thickness dimensions.

TABLE II.- Condenser heat rejection capacity

Condenser type	Heat rejection capacity-Btu/hr (min)	Refrigerant-12 saturated gas temperature	*Air volume CFM (max) at 75F and 14.7 cu.ft.perlb.	Air temperature dry bulb
I	22,000	135 F	2,000	110 F
II	35,000	135 F	4,000	110 F
III	46,000	135 F	4,000	110 F
IV	57,000	135 F	5,000	110 F
V	16,000	135 F	1,500	110 F
VI	28,000	135 F	3,500	110 F

* The air pressure drop through the condenser shall not exceed 0.30 inches water pressure at specified maximum air volumes.

TABLE III. Fans 1/

Condenser type	No. of blades	Dia. (inches) and model	Hub						
			Length (inches)	Bore dia. (inches)	Keyway 2/ Width (inches)	Keyway 2/ Depth (inches)	Set screws No.	Set screws Size	Set screws Type
1	4	18	1-1/2 ± 1/4	1/2 + 0.001 - 0.000	-	-	2	5/16" 24NF	ALLEN
II, III, VI	4	24A	1-1/2 ± 1/4	5/8 + 0.001 - 0.000	3/16 + 0.000 - 0.002	3/32 + 1/32	2	5/16" 24NF	
IV	4	24B	2 ± 1/4	3/4 + 0.001 - 0.000	3/16 + 0.000 - 0.002	3/32 + 1/32	2	5/16" 24NF	HEAD
V	4	16	1-1/2 ± 1/4	1/2 + 0.001 - 0.000	-	-	2	5/16" 24NF	

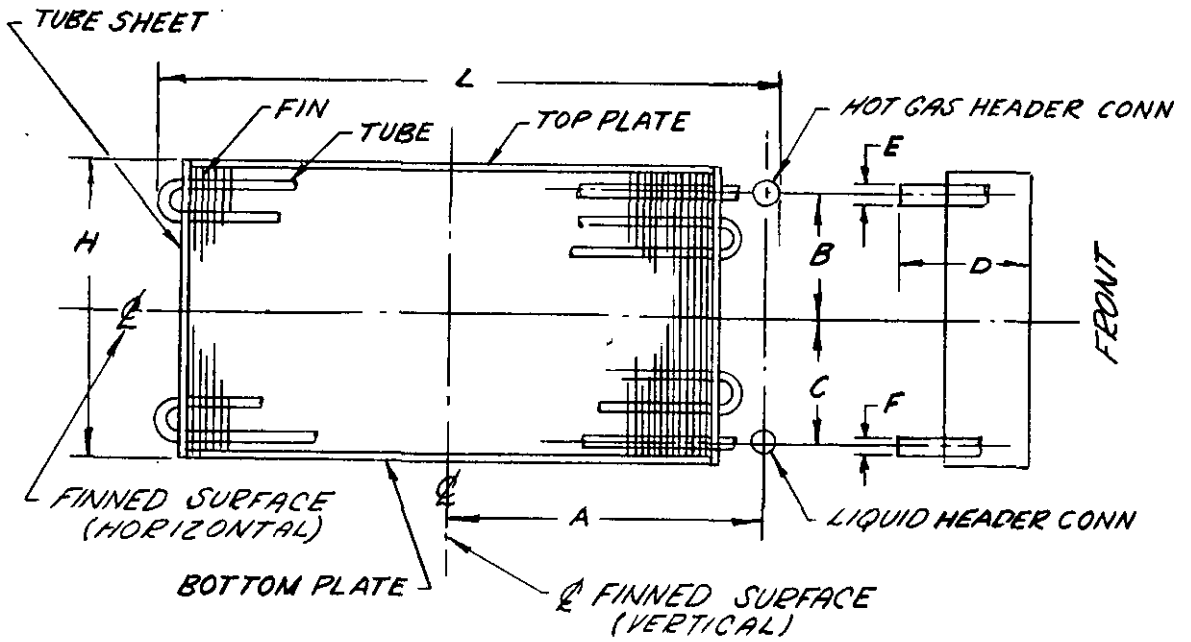
1/ Fan characteristics (see figure 3).

2/ Fan models 24A and 24B shall have keyways in hubs to fit NEMA standard shafts.

TABLE IV. Fan Motor Requirements

Condenser type	Phase	Class 1/	HP	RPM (full load)	Frequency	Voltage AC	Temp.ref. for rating (C)	Enclosure	Duty	Mounting	Frame No.
I and V	Single	Split-phase	1/6	1140	60	230	50°ambient	Drip-proof	Continuous	Foot mounted	48
II, III, and VI	Single	Capacitor	1/2	1140	60	115/230	50°ambient	Drip-proof	Continuous	Foot mounted	56
IV	Single	Capacitor	3/4	1140	60	115/230	50°ambient	Drip-proof	Continuous	Foot mounted	66

1/ As an alternate, a permanent split capacitor motor shall be acceptable on all condenser types.



DIMEN.	DESCRIPTION	CONDENSER TYPE I	II	III	IV	V	VI	TOLERANCE (INCHES)
		OVERALL DIMENSIONS (INCHES)						
L	length overall	27-5/8	30	41	47	27-5/8	30	± 1/4
H	height overall	22-1/8	34-1/8	32-1/8	34-1/4	18-1/8	27-1/8	+ 1/2 -0
D	depth overall (face of mounting flange to faces of hot gas and liquid connections)	11	11	11	11	11	11	± 1/4
	LOCATION OF HOT GAS & LIQUID CONNECTIONS	DIMENSION (INCHES)						
A	vertical ℄ finned surface to ℄ of hot gas and liquid connections	13-13/16	14-13/16	19-9/16	22-1/16	13-13/16	14-13/16	± 1/8
B	horizontal ℄ finned surface to ℄ of hot gas connection	9-1/2	15-1/2	14-1/2	15-1/2	7-1/2	11	± 1/8
C	horizontal ℄ finned surface to ℄ of liquid connection	9-1/2	15-1/2	14-1/2	15-1/2	7-1/2	11	± 1/8
	TYPE CONNECTIONS	SIZE (INCHES)						
E	hot gas connection (O.D.)	5/8	7/8	7/8	1-1/8	5/8	7/8	+0 -0.003
F	liquid connection (O.D.)	5/8	5/8	7/8	7/8	5/8	5/8	+0 -0.003

FIG 1 - CONDENSER COIL

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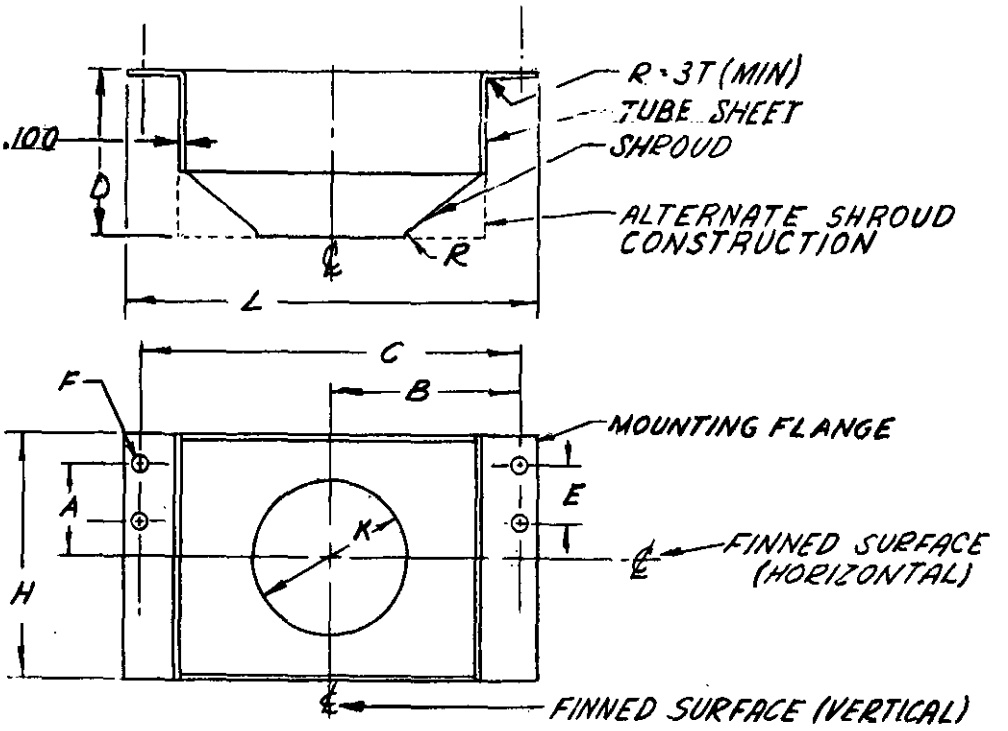

DIMEN.	DESCRIPTION	CONDENSER TYPE I	II	III	IV	V	VI	TOLERANCE (INCHES)
		OVERALL DIMENSIONS (INCHES)						
L	length overall	30-1/8	32-1/2	43-1/2	49-1/2	30-1/8	32-1/2	± 1/8
H	height overall	22-1/8	34-1/8	32-1/8	34-1/4	18-1/8	27-1/8	+ 1/2 - 0
D	depth overall	11	11	11	11	11	11	± 1/4
		MOUNTING DIMENSIONS (INCHES)						
A	horizontal ℄ finned surface to ℄ top bolt holes	9	15	15	15	7-1/2	12	± 1/32
B	vertical ℄ finned surface to ℄ bolt holes	14-3/4	15-7/8	20-5/8	23-7/8	14-3/4	15-7/8	± 1/32
C	horizontal distance between bolt hole ℄'s	28-7/8	31-1/4	42-1/4	48-1/4	28-7/8	31-1/4	± 1/32
E	bolt hole ℄ distance	9	10	10	10	7-1/2	8	± 1/32
F	diameter of bolt holes	7/16	7/16	7/16	7/16	7/16	7/16	+ 1/16 - 0
	number of bolt holes each mounting flange	3	4	4	4	3	4	
		FAN ORIFICE DIMENSIONS[1] (INCHES)						
K	diameter	18-1/2	24-1/2	24-1/2	24-1/2	16-1/2	24-1/2	± 1/16
R	radius of bell	1/2	1/2	1/2	1/2	1/2	1/2	± 1/8

NOTE: 1. THE CENTER OF THE FAN ORIFICE SHALL BE WITHIN 1/16 INCH OF THE LINE FORMED BY THE INTERSECTION OF THE PLANES THROUGH THE VERTICAL ℄ AND HORIZONTAL ℄ OF THE FINNED SURFACE.

FIGURE – 2

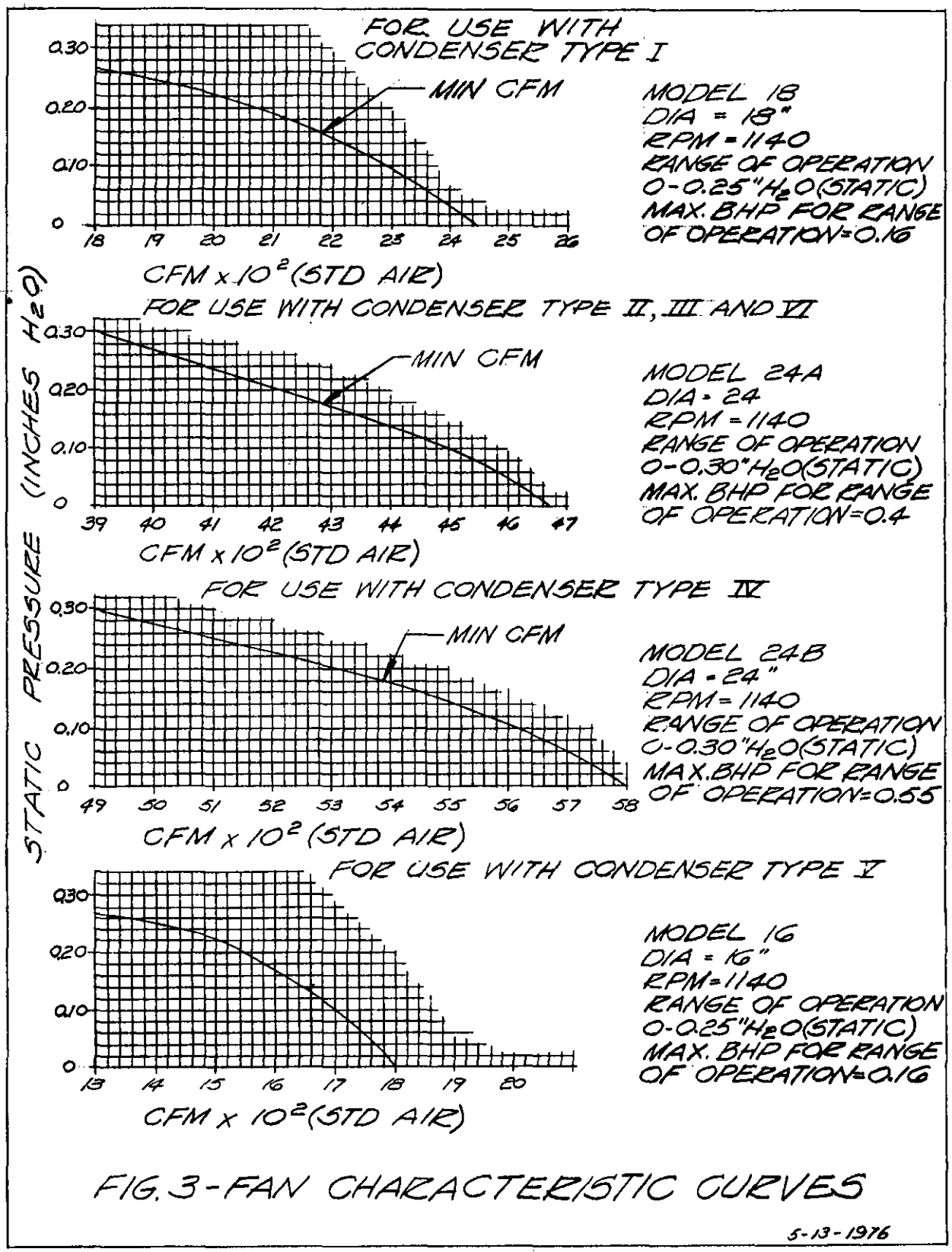

FIG. 3 - FAN CHARACTERISTIC CURVES

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