

MIL-D-9415A(USAF)  
9 August 1957  

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Superseding  
MIL-D-9415(USAF)  
9 August 1954

## MILITARY SPECIFICATION

### DYNAMIC LOUDSPEAKER LS-184A/AIC-10

#### 1. SCOPE

1.1 This specification covers one type of loudspeaker designated Dynamic Loudspeaker LS-184A/AIC-10. Dynamic Loudspeaker LS-184A/AIC-10 is one item of Intercommunication Set AN/AIC-10A.

#### 2. APPLICABLE DOCUMENTS

2.1 The following documents, of the issue in effect on the date of invitation for bids, form a part of this specification:

#### SPECIFICATIONS

##### Military

JAN-S-23	Switches, Toggle (for Electronic and Communications Use)
MIL-T-27	Transformers and Inductors (Audio, Power, and Pulse)
MIL-E-5272	Environmental Testing, Aeronautical and Associated Equipment, General Specification For
MIL-E-5400	Electronic Equipment, Aircraft, General Specification For
MIL-E-5558	Enamel; Wrinkle-Finish, For Aircraft Use
MIL-T-9107	Test Reports, Preparation of
MIL-W-16878	Wire, Electrical (Insulated, High Temperature)
MIL-P-17555	Preparation For Delivery Of Electronic Equipment; Miscellaneous Electrical Equipment (Except Rotating Electrical Equipment) and Associated Repair Parts

#### STANDARDS

##### Military

MIL-STD-130	Identification Marking of U. S. Military Property
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**DRAWINGS**

U. S. Air Force

53D13469	Dynamic Loudspeaker LS-184A/AIC-10, Assembly Of Wiring Diagram, LS-184A/AIC-10, Dynamic Loudspeaker, Test Circuit Schematic
53B13920	
54D13184	Loudspeaker, Outline Dimensions Of AF Amplifier AM-492B/AIC-10, Outline Dimensions Of
54D13185	
54D13189	Housing, LS-184A/AIC-10 Dynamic Loudspeaker, Outline Dimensions Of
57C12765	Wiring Diagram-LS-184A/AIC-10 Dynamic Loud- speaker, Schematic

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

2.2 Other Publications.- The following publication, of the issue in effect on the date of invitation for bids, shall form a part of this specification to the extent specified herein:

National Defense Research Committee  
Office of Scientific Research and Development  
Report Number 3802                      Articulation Testing Methods II

(OSRD Report No. 3802 may be obtained by the contractor by making application to Armed Services Technical Information Agency, giving OSRD report number, title, and ATI No. 20504.)

**3. REQUIREMENTS**

3.1 Preproduction.- This specification makes provisions for preproduction testing.

3.2 General Specification.- The requirements of MIL-E-5400 for class 1 equipment apply as requirements of this specification. When the two specifications conflict, this specification shall govern.

3.2.1 Substitution of Materials and Processes.- If a manufacturer, either prior to or during production, desires to substitute another material or process for one specified in the specification, or if he desires to substitute for a particular material or process previously approved, he shall first submit to the procuring activity a statement to that effect, describing the proposed substitution and the reason therefor, and shall submit evidence that the substitution proposed will be at least as satisfactory as the specific material or process previously approved. At the discretion of the procuring activity,

samples may be required for use in determining, by laboratory tests, the suitability of the proposed substitution.

3.3 Standard Model.- A model Dynamic Loudspeaker LS-184A/AIC-10 shall serve as a standard of design, material, workmanship, and performance only in those instances not specifically covered by this specification. Each component part of Dynamic Loudspeaker LS-184A/AIC-10, built in accordance with this specification, shall be physically interchangeable with the model and shall comply with the dimensional requirements of Drawing No. 53D13469.

3.4 Component Parts.- Dynamic Loudspeaker LS-184A/AIC-10 shall consist of a loudspeaker (acoustic transducer component), an AF Amplifier A/-492B/AIC-10, and a housing for the loudspeaker, and the amplifier, as shown on Drawing No. 53D13469. The term complete assembly is taken to mean Dynamic Loudspeaker LS-184A/AIC-10, including all component parts.

### 3.5 Loudspeaker

#### 3.5.1 Construction

3.5.1.1 Width of Air Gap.- The difference between the minimum width of the radial air gap and the maximum thickness of the voice coil shall be at least 0.018 inch.

3.5.1.2 Lead Wire Flexibility.- The loudspeaker lead wire shall show no evidence of damage to the conductors or to the insulation as a result of the flexibility test specified herein. Loudspeaker lead wire is the connecting wire between the terminal on the loudspeaker terminal board and the socket connector or connection.

3.5.1.3 Lead Wire Tubing.- The loudspeaker lead wires shall be enclosed in an insulating tubing to insure that the hookup leads are kept close together to improve lead dress. The lead wire tubing shall show no evidence of damage as a result of the flexibility test specified herein.

3.5.1.4 Cable Clamp.- The loudspeaker lead wires shall be capable of withstanding a 5-pound pull in the direction of the clamp axis without evidence of movement of the clamp or slipping of the wires in the clamp.

3.5.1.5 Terminal Board.- The terminal board shall be rigidly mounted to the loudspeaker, and shall have sufficient ruggedness to withstand rough handling and usage. The design of the terminal board shall be such that the soldering or unsoldering of the loudspeaker lead wires

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will not affect the connection of the voice coil leads either at the terminal board or at the voice coil. Voice coil lead is the wire connecting the voice coil to the terminal board of the loudspeaker.

3.5.1.6 Loudspeaker Connector.- The loudspeaker connector shall consist of either two individual sockets or a single two-socket connector. Each socket shall fully engage and fit with a pin of 7/16 inch length and a diameter of between 0.0905 inch and 0.095 inch as specified herein.

3.5.1.6.1 Connector Weight.- The weight of the connector shall not exceed 5 grams.

3.5.1.6.2 Connector Dimensions.- The dimensions of the connector shall be in accordance with Drawing No. 54D13184.

3.5.1.6.3 Connector Disengagement Force.- The force required to disengage a single two-socket connector from two 0.095-inch diameter stainless steel pins, or to disengage either one of two individual sockets from a 0.095-inch diameter stainless steel pin, shall not exceed 4 pounds. Each socket of the connector shall hold securely a 0.0905- and a 0.0950-inch diameter stainless steel pin respectively from each of which is suspended an 8-ounce weight.

3.5.1.6.4 Connector Life.- There shall be no evidence of damage after a single two-socket connector has been subjected to 500 insertions into, and withdrawals from, a simulated plug having 0.095-inch diameter stainless steel pins spaced 11/32 inch apart, or after a connector consisting of two individual sockets has been subjected to 500 insertions into, and withdrawals from, a simulated plug having 0.095-inch diameter stainless steel pins. After completion of 500 insertions and withdrawals, each socket of the connector shall hold securely a 0.091- and a 0.095-inch diameter stainless steel pin respectively from each of which is suspended a 6-ounce weight.

3.5.1.7 Cone Protection.- Screens shall be provided on both sides of the cone as a protection against physical damage which may be caused by handling or gun blast. The protective screens shall exclude spherical particles having a diameter greater than 5/32 inch.

3.5.1.8 Housing.- The housing shall be in accordance with Drawing No. 54D13189.

3.5.1.8.1 Acoustic Dampener.- An acoustic dampener of superfine fiber glass shall be secured to the housing. This dampener shall be secured in such a manner that it does not become loose or damaged during or after any or all of the tests specified herein.

3.5.1.9 Drainage.- Each Dynamic Loudspeaker LS-184A/AIC-10 shall incorporate adequate drainage provisions for any moisture condensing within the unit. When the complete assembly is mounted in any usable position, including horizontal, oblique, vertical, overhead, and sidewise mounting, all closed corners, channels, etc, which would collect and hold water, shall be eliminated or be provided with adequate means for drainage. A properly located round hole of 1/8-inch diameter is considered satisfactory drainage for a corner in a sheet metal box.

### 3.5.2 Performance

#### 3.5.2.1 Magnetic

3.5.2.1.1 Stray Magnetic Field.- Dynamic Loudspeaker LS-184A/AIC-10 shall not cause a deflection of more than 5 degrees on a magnetic compass when the loudspeaker is placed 18 inches away from the compass and oriented for maximum compass deflection.

#### 3.5.2.2 Electrical

3.5.2.2.1 Voice Coil Polarity.- When a direct-current potential of between 1.5 and 6 volts is applied to the voice-coil terminals so that the cone of the loudspeaker moves in a direction away from the magnetic assembly, the terminals of the connector and the terminals of the terminal board that are connected to the battery positive terminal shall be distinctively identified in red. The red markings shall not interfere with the electrical connections and shall not be impaired by soldering or unsoldering operations.

3.5.2.2.2 Voice Coil Impedance.- The impedance of the voice coil shall be between 6 and 8 ohms when measured at the lowest impedance found at a frequency higher than the fundamental resonance of the loudspeaker, and shall be less than 12 ohms at 4000 cycles per second (cps). The frequency at which fundamental resonance occurs shall be below 400 cps.

3.5.2.2.3 Impedance Variation.- There shall be no change in the impedance of the voice coil as a result of any or all of the service-condition tests.

3.5.2.2.4 Power Handling Capacity.- The loudspeaker shall be capable of handling, continuously, signal inputs of 4.5 volts without damage.

3.5.2.2.5 Operation.- Dynamic Loudspeaker LS-184A/AIC-10 shall provide satisfactory performance and shall not adversely affect the performance of any other component of Intercommunication Set AN/AIC-10A when interconnected with, and operated as a part of, that equipment.

#### 3.5.2.3 Acoustical

3.5.2.3.1 Sensitivity.- The average sensitivity of the loudspeaker above a reference level of 0.0002 dyne per square centimeter for each

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of the indicated frequency bands, measured in accordance with the procedure specified herein, shall be not less than the values shown in table I.

**TABLE I**

<u>Frequency Band (cps)</u>	<u>Average Sensitivity (db)</u>
320 - 500	96.0
500 - 800	93.5
800 - 1250	94.5
1250 - 2000	97.0
2000 - 3200	97.5
3200 - 5000	96.5
5000 - 6000	95.5
320 - 1250	95.0
1250 - 6000	97.0
320 - 6000	96.0

**3.5.2.3.2 Sensitivity Variation.**- The average sensitivity of the loudspeaker over the frequency bands specified herein shall not differ from the initial sensitivity by more than 1 db as a result of any or all of the service condition tests.

**3.5.2.3.3 Response-Frequency Characteristic.**- The response-frequency characteristic of the loudspeaker shall be between two parallel horizontal lines 10 db apart from 300 cps to 6000 cps, with the exception that above 3000 cps, one dip and one peak, if less than 1/10 octave wide, may pass through the limits provided that the amount by which the dip or peak extends beyond the limits does not exceed 3 db. One-tenth of an octave shall be considered as 1/10 of the linear length of 1 octave scaled on the semilogarithmic paper on which the response-frequency characteristic is drawn.

**3.5.2.3.4 Response-Frequency Characteristics Variation.**- The acoustic response of the loudspeaker shall not differ from the initial acoustic response at corresponding frequencies by an amount greater than that indicated in table II as a result of service condition tests.

TABLE II

Test	Change from Initial Response in Decibels			
	During Test	Immediately After Test	1 Hour After Test	24 Hours After Test
Extreme operating temperature	1	1	1	0
Temperature cycling	--	1	1	0
Pressure cycling	3	3	--	0
Vibration	--	0	--	0
Shock (15g)	--	0	--	0
Humidity	--	5	--	1
Fungus resistance	--	5	--	1
Salt spray	--	5	--	1
All tests above	--	--	--	3

After the explosive decompression test or gun blast test, the loudspeaker shall show no degradation in acoustic response greater than 2 db at any frequency between 300 cps and 5000 cps and none greater than 5 db at any frequency between 5000 cps and 6000 cps.

3.5.2.3.5 Directional Characteristics.- The sound pressure measured in any plane 3 feet away from the loudspeaker in a free field at the indicated angles with respect to the principal axis shall not deviate from the sound pressure measured on the principal axis by an amount greater than the values shown in table III for the frequencies indicated:

TABLE III

<u>Frequency (cps)</u>	<u>Sound Pressure Deviation (db)</u>	
	<u>15°</u>	<u>30°</u>
500	0.5	1.0
1000	1.0	2.0
2000	2.0	4.0
4000	2.0	4.0
6000	3.0	6.0

3.5.2.3.6 Linearity.- The acoustic output of the loudspeaker shall not deviate from a linear function of the input voltage by more than 1 db when subjected to the linearity test specified herein.

3.5.2.3.7 Distortion-Frequency Characteristic.- The harmonic distortion in the acoustic output of the loudspeaker shall not exceed the values given in table IV for the frequency ranges and inputs indicated.

TABLE IV

<u>Frequency Range (cps)</u>	<u>Signal Input</u>	
	<u>2.65 volts</u>	<u>4.5 volts</u>
200 - 500	7%	8.5%
500 - 6000	3-1/2%	4.0%

3.5.2.3.8 Acoustic Quality.- There shall be no buzzes, rattles, or other spurious sounds in the acoustic output of the loudspeaker during the acoustic quality test specified herein.

3.5.2.3.9 Ruggedness.- The loudspeaker shall be capable of continuous or intermittent operation with a signal input of 4.5 volts at 400 cps for an operating time of 50 hours without producing rattles or appreciable variation in fidelity, or causing deleterious effects to the windings of the voice coil or any other part of the loudspeaker. There shall be no change in the sensitivity and response-frequency characteristic of the loudspeaker after the 50-hour operation.

3.5.2.3.10 Articulation.- The average word articulation score of Dynamic Loudspeaker LS-184A/AIC-10, when tested in a representative operating Intercommunication Set AI/AIC-10A in simulated aircraft noise having any level up to and including 105 db for propeller type noise and 100 db for jet type noise, shall be approximately equal to or better than the average word articulation score of a typical Dynamic Loudspeaker LS-184A/AIC-10 selected from USAF stock when tested with the same system under the same ambient noise conditions. A word articulation score within 4 points of the reference articulation score shall be considered as indicating approximately equal performance.

3.5.2.3.11 Overall Performance.- With a 4-volt (rms) input signal, the acoustic output of the complete assembly over the frequency range of 200 cps to 10000 cps shall be free of buzzes, rattles, and other spurious sounds, and shall have a sound pressure level of approximately 93 db, relative to 0.0002 dyne per square centimeter, measured in a free field at a point on the principal axis 3 feet away from the complete assembly.

3.5.3 Service Conditions.- Dynamic Loudspeaker LS-184A/AIC-10 shall be so designed and constructed that after being subjected to the environmental and mechanical service condition tests specified herein, no part shall crack, warp, deteriorate, or become dimensionally unstable; no fixed part or assembly shall become loose; no moving or movable part or assembly shall become undesirable free or sluggish in operation; and no degradation shall be caused in the performance below that required by this specification.

3.6 Audio Frequency Amplifier AM-492B/AIG-103.6.1 Performance in "Normal" Condition

3.6.1.1 Gain (Normal).- The bridging gain of the amplifier, measured at 1000 cps and below the overload point, shall be 7.5 db plus or minus 1.5 db.

3.6.1.2 Frequency Response (Normal).- The frequency response of the amplifier shall be within the limits specified in table V.

TABLE V

<u>Frequency (cps)</u>	<u>Relative Output in db</u>
300	+2, -2
500	+1, -2
1000	0
2000	+1, -2
4000	+1, -2
5000	+1, -2
6000	+1, -2
10000	+2, -10

3.6.1.3 Distortion (Normal).- The total harmonic distortion present in the output of the amplifier at 400 cps shall not exceed the value indicated in table VI.

TABLE VI

<u>Output in db (re: 1.0 volt)</u>	<u>Maximum Distortion (%)</u>
0	2.0
1	2.0
2	2.0
3	2.5
4	3.0
5	3.5
6	4.0
7	6.0
8	12.0

3.6.1.4 Input-Output Characteristic (Normal).- The input-output characteristic shall be within the limits listed in table VII.

TABLE VII

<u>Signal Input in Volts</u>	<u>Output in DB Relative to 1.0 Volt</u>
2.0	-1.0 to +2.0
2.5	1.0 to 4.0

TABLE VII (Continued)

<u>Signal Input in Volts</u>	<u>Output in DB Relative to 1.0 Volt</u>
3.0	2.8 to 5.8
4.0	5.0 to 8.0
4.5	6.0 to 9.0
5.0	6.6 to 9.6
6.0	7.4 to 10.2
7.0	8.2 to 11.0
8.0	9.5 to 12.5
12.0	12.5 to 15.0

### 3.6.2 Performance in Call Condition

3.6.2.1 Gain (Call).- The bridging gain of the amplifier, measured at 1000 cps and below the overload point, shall be 6.5 db plus or minus 1.5 db.

3.6.2.2 Frequency Response (Call).- The frequency response of the amplifier shall be within the limits specified in table V.

3.6.2.3 Distortion (Call).- The total harmonic distortion present in the output voltage of the amplifier at 400 cps shall not exceed the value indicated in table VIII.

TABLE VIII

<u>Output in db (re: 1.0 volt)</u>	<u>Maximum Distortion (%)</u>
0	2.0
1	2.0
2	2.0
3	2.5
4	3.0
5	3.5
6	4.0
7	6.0
8	12.0

3.6.3 Amplifier Output With ON-OFF Switch in OFF Position.- With the ON-OFF switch in the OFF position and the call circuit of the amplifier unenergized, the output of the amplifier shall not exceed 0.0045 volt when fed with a 4.4 volt 1000-cps signal.

3.6.4 Noise in Output Due to Ripple on DC Line.- The noise output of the amplifier in the normal condition, with 1.5-volt (rms) ripple of 400 cps superimposed on the 27.5-volt dc power line, shall be less than 0.001 volt.

3.6.5 Phasing.- The phasing shall be such that when the instantaneous voltage at terminal A of Connector J701, as shown on Drawing No. 57C12765, is positive with respect to that at terminal B, the instantaneous voltage measured at the output terminal identified with a red dot shall be negative with respect to the other output terminal.

3.6.6 Microphonic Noise.- When subjected to the vibration test specified herein, the microphonic noise output of the amplifier shall not exceed 0.003 volt.

3.6.7 Transformers.- Transformers shall be in accordance with MIL-T-27, grade 1, class A.

3.6.8 Wiring of Amplifier.- The amplifier shall be wired in accordance with Drawing No. 57C12765. The hookup wire shall be AWG No. 22 (642.4 circular mils) in accordance with MIL-M-16878, type B. The outer covering shall be a synthetic textile or glass braid or a polyamide jacket. Color coding shall be like that of the model amplifier.

3.6.9 ON-OFF Switch.- The ON-OFF toggle switch shall be a Type ST-231 switch in accordance with JAN-S-23.

3.6.10 Loudspeaker-Amplifier Connection Terminals.- The terminals shall be dimensioned and located as shown on Drawing No. 54D13185.

3.6.11 Variation in Output.- The output of the amplifier at any particular frequency shall not vary more than plus or minus 1 db from the initial output when the amplifier is subjected to any combination of the environmental conditions of MIL-E-5400. The electrical characteristics of the amplifier, in all other respects, shall be in accordance with the requirements specified herein.

3.7 Explosion.- Dynamic Loudspeaker LS-184A/AIC-10 shall not permit ignition of surrounding explosive vapor when tested as specified herein.

3.8 Wiring.- Dynamic Loudspeaker LS-184A/AIC-10 shall be wired in accordance with Drawing No. 57C12765.

3.9 Life.- Dynamic Loudspeaker LS-184A/AIC-10 shall be capable of normal operation for long periods of time under the varied service conditions of military usage.

3.10 Dimensions.- The outline dimensions of the loudspeaker, amplifier, and housing shall be in accordance with Drawings No. 54D13184, No. 54D13185 and No. 54D13189. Particular attention shall be paid to those dimensions of the loudspeaker and the amplifier which control the fitting of the loudspeaker and the amplifier in the housing to insure interchangeability between component parts procured on the current contract and the

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component parts in Government stock. Those dimensions marked MAX on Drawings No. 54D13184 and No. 54D13185 shall not be exceeded, and efforts shall be made to reduce those dimensions as much as practicable.

3.11 Weight.- The weight of the loudspeaker shall not exceed 1 pound 13-1/2 ounces. The weight of the amplifier shall not exceed 11-1/4 ounces. The weight of the housing shall not exceed 11-1/4 ounces. The weight of the complete assembly shall not exceed 3-1/4 pounds.

3.12 Color and Finishes.- The exterior normally-exposed surface of Dynamic Loudspeaker LS-184A/AIC-10 shall be a black wrinkle finish in accordance with MIL-E-5558.

3.13 Identification of Product.- Dynamic Loudspeaker LS-184A/AIC-10 shall be marked for identification in accordance with MIL-STD-130. The marking shall include the following information:

Dynamic Loudspeaker  
LS-184A/AIC-10  
Order Number \_\_\_\_\_ \* \_\_\_\_\_ (Government order number)  
\*Manufacturer's Name  
\*Data to be inserted by contractor

3.14 Government-Loaned Property.- When provided for in the contract or purchase order, and if available, the following item will be loaned by the Government to the contractor, upon his request, for use as a guide in designing Dynamic Loudspeaker LS-184A/AIC-10:

<u>Item</u>	<u>Item Description</u>	<u>Quantity</u>
1	Dynamic Loudspeaker LS-184A/AIC-10	2

4. QUALITY ASSURANCE PROVISIONS

4.1 Classification of Tests.- The inspection and testing of Dynamic Loudspeaker LS-184A/AIC-10 shall be classified as follows:

- a. Preproduction tests. . . . . See 4.3
- b. Acceptance tests . . . . . See 4.4

4.2 General Test Procedures

4.2.1 Test Conditions.- Unless otherwise specified or indicated, Dynamic Loudspeaker LS-184A/AIC-10 shall be tested under the following conditions:

Temperature - Room ambient, plus 15°C (plus 59°F) to plus 35°C  
(plus 95°F)  
Pressure - Normal atmospheric

Humidity - Room ambient up to 90 percent relative humidity  
 Primary voltage supply - 27.5 volts direct current.  
 High voltage supply - 170 volts direct current.  
 Location - Free acoustic field

4.2.2 Order of Tests. - The order of performing the preproduction or acceptance tests is immaterial except that the salt spray test and the 30g shock test may be performed last. At the end of each test, Dynamic Loudspeaker LS-184A/AIC-10 or the parts subjected to the test shall be thoroughly inspected and checked for any damage, defects, or deterioration which may result from the test.

#### 4.3 Preproduction Tests

4.3.1 Preproduction tests shall be performed by the contractor in accordance with the following:

4.3.2 Preproduction Test Samples. - When specified in the contract, a minimum of 10 each Dynamic Loudspeaker LS-184A/AIC-10 shall be subjected by the contractor to the preproduction tests specified herein.

4.3.2.1 Additional Samples. - When specified in the contract, an additional 5 each Dynamic Loudspeaker LS-184A/AIC-10 shall be submitted to the procuring activity, together with a response-frequency characteristic for each of the 5 samples. The samples shall be accompanied by adequate identifying information including the Government order number involved (File No. in contract), name and address of prime contractor, and name and address of manufacturer. The samples and data will be used by the procuring activity for:

- a. Calibration check of the contractor's test equipment.
- b. Review of the mechanical design.
- c. Performance of any tests which may be deemed necessary by mutual agreement between the procuring activity and the contractor after a review of contractor's test report.
- d. Government reference purposes.

4.3.3 Preproduction Test Program. - Prior to any formal testing of the preproduction samples, the contractor shall submit a draft of his proposed test program to the procuring activity for approval. The draft of the proposed test program shall include:

- a. A list of all tests to be performed and complete procedures for each test, including block or schematic diagrams.
- b. A list of test equipment to be used, identified by manufacturer

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and type number.

- c. Copies of the data record forms to be used in recording the test data.

4.3.4 Preproduction Test Report.- After completion of the preproduction tests by the contractor, three copies of the complete report shall be furnished the procuring activity. The preproduction test report shall be in accordance with MIL-T-9107 and shall include the name and grade of all materials used in Dynamic Loudspeaker LS-184A/AIC-10.

4.3.5 Preproduction Test Routine.- Preproduction samples shall be subjected to the tests listed in table IX in the quantities shown and any other tests deemed necessary by the procuring activity to determine that Dynamic Loudspeaker LS-184A/AIC-10 meets all the requirements of this specification.

TABLE IX

<u>Inspection or Test</u>	<u>Paragraph</u>	<u>Preproduction</u>	<u>Individual</u>	<u>Sampling</u>
A. <u>Mechanical inspection</u>	4.5.1	all	all	all
B. <u>Electrical tests</u>	4.5.2			
1. <u>Loudspeaker:</u>	4.5.2.1			
Voice coil polarity	4.5.2.1.1	all	all	all
Voice coil impedance	4.5.2.1.2	all	all	all
Sensitivity	4.5.2.1.3	all	---	all
Response frequency characteristic	4.5.2.1.4	all	---	all
Acoustic quality	4.5.2.1.5	all	all	all
Ruggedness	4.5.2.1.6	all	---	all
Directional characteristics	4.5.2.1.7	all	---	all

Table IX, continued

<u>Inspection or Test</u>	<u>Paragraph</u>	<u>Preproduction</u>	<u>Individual</u>	<u>Sampling</u>
Linearity	4.5.2.1.8	all	---	---
Distortion- frequency characteristic	4.5.2.1.9	all	---	all
2. <u>AF Amplifier</u> <u>AM-492B/AIC-10:</u>	4.5.2.2			
<u>Performance in</u> <u>normal condition:</u>				
Gain (normal)	4.5.2.2.2	all	all	all
Frequency response (normal)	4.5.2.2.3	all	all	all
Distortion (normal)	4.5.2.2.4.1	all	---	all
Input-output characteristics (normal)	4.5.2.2.5	all	---	all
<u>Performance in</u> <u>call condition:</u>				
Gain (call)	4.5.2.2.2	all	---	all
Frequency re- sponse (call)	4.5.2.2.3	all	---	all
Distortion (call)	4.5.2.2.4.2	all	-all	all
Amplifier output with ON-OFF switch in OFF position	4.5.2.2.6	all	all	all
Noise in output due to ripple on dc line	4.5.2.2.7	all	all	all
Phasing	4.5.2.2.8	all	---	all

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Table IX, continued

<u>Inspection or Test</u>	<u>Paragraph</u>	<u>Preproduction</u>	<u>Individual</u>	<u>Sampling</u>
Microphone noise	4.5.2.2.9	all	---	all
3. <u>Complete Assembly:</u>	4.5.2.3			
Stray magnetic field	4.5.2.3.1	all	---	---
Radio interference	4.5.2.3.2	all	---	---
Articulation	4.5.2.3.3	2	---	---
Overall performance	4.5.2.3.4	all	all	all
C. Service-condition tests, complete assembly:	4.5.3			
Loudspeaker lead wire flexibility	4.5.3.1	2	---	---
Lead wire clamp efficiency	4.5.3.2	all	---	all
Disengagement force of loudspeaker lead connector	4.5.3.3	all	all	all
Loudspeaker lead connector life test	4.5.3.4	2 pair	---	---
Extreme operating temperature	4.5.3.5	2	---	all
Temperature cycling	4.5.3.6	2	---	all
Pressure cycling	4.5.3.7	2	---	---

Table IX, continued

<u>Inspection or Test</u>	<u>Paragraph</u>	<u>Preproduction</u>	<u>Individual</u>	<u>Sampling</u>
Humidity	4.5.3.8	2	---	3 out of every 1000
Vibration	4.5.3.9	2	---	3 out of every 1000
Shock	4.5.3.10	2	---	---
Fungus	4.5.3.11	2	---	---
Salt spray	4.5.3.12	2	---	1 out of every 1000
Explosive decomposition	4.5.3.13	2	---	---
Gun blast	4.5.3.14	2	---	---
Explosion proof	4.5.3.15	2	---	---

4.4 Acceptance Tests.-- Acceptance tests shall consist of.

- a. Individual tests
- b. Sampling tests

4.4.1 Individual Tests.-- Each Dynamic Loudspeaker LS-184A/AIC-10 shall be subjected to the individual tests listed in table IX. In addition, each Dynamic Loudspeaker LS-184A/AIC-10 shall be subjected to any other tests agreed by the procuring activity and the contractor to determine compliance with the requirements of this specification.

4.4.2 Sampling Tests.-- Unless otherwise specified, one Dynamic Loudspeaker LS-184A/AIC-10 shall be selected at random from each number of 100 or fraction thereof on the order, which have passed individual tests. The selected Dynamic Loudspeaker LS-184A/AIC-10 and its component parts shall be subjected to all the sampling tests listed in table IX, and to any other tests deemed necessary by mutual agreement of the procuring activity and the contractor to determine conformance to the requirements of this specification.

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

#### 4.5 Test Procedures

4.5.1 Mechanical Inspection.- Dynamic Loudspeaker LS-184A/AIC-10 and its component parts shall be thoroughly inspected and their dimensions measured to determine conformance to the requirements of this specification with respect to materials, workmanship, mechanical detail, and finishes prior to and during assembly. Particular attention shall be paid to the width and concentricity of air gap, cleanliness of air gap, clearance and concentricity of voice coil in the air gap, terminal and tubing of loudspeaker lead wire, polarity marking of connector terminals and terminal board, freedom from loose particles, voice coil lead dress, soldering operations, cementing operation, fit of loudspeaker and amplifier in the housing, and fit of loudspeaker lead connector to amplifier pin terminals.

4.5.2 Electrical Tests.- The test circuit used shall be in accordance with Drawing No. 53E13920. The loudspeaker shall be mounted in the housing with the amplifier during all performance tests. In conducting tests for the complete assembly, the loudspeaker shall be connected to the amplifier.

##### 4.5.2.1 Loudspeaker

4.5.2.1.1 Voice Coil Polarity.- A direct current potential of 1.5 to 6 volts shall be applied to the voice coil terminals with the positive terminal connected to the red terminal of the voice coil. The direction of motion of the loudspeaker cone shall be observed.

4.5.2.1.2 Voice Coil Impedance.- The impedance of the voice coil shall be determined over the frequency range of 200 cps to 7000 cps with the loudspeaker mounted in the housing with the amplifier. Impedance measurements shall be made with a constant signal input of 2.65 volts. In individual tests, the voice coil impedance shall be measured at the frequency above fundamental resonance which gives the lowest impedance.

4.5.2.1.3 Sensitivity.- Sensitivity measurements shall be made with a constant signal input of 2.65 volts in a free field at a point on the principal axis 3 feet away from the loudspeaker. In individual tests, sensitivity measurements shall be made for the frequency bands of 320-500 cps, 500-800 cps, 800-1250 cps, 1250-2000 cps, 2000-3200 cps, 3200-5000 cps, and 5000-6000 cps; the sensitivity measurements for the 320-1250 cps, 1250-6000 cps, and 320-6000 cps bands may be omitted. The average sensitivity for each frequency band may be obtained by measuring the area between the response-frequency characteristic and any reference line provided that this line was established from a basic reference level of 0.0002 dyne per square centimeter.

4.5.2.1.4 Response-Frequency Characteristic.- The response-frequency characteristic of the loudspeaker shall be measured as a continuous function of frequency over the range of 200 cps to 7000 cps in a free field at a point on the principal axis 3 feet away from the loudspeaker. Response measurements shall be made with a constant signal input of 2.65 volts. In performing individual tests it is not necessary that the response-frequency characteristic of the loudspeaker be obtained in a manner that will provide a permanent record. For preproduction and sampling tests, the response-frequency characteristic shall be recorded and plotted on semilogarithmic coordinate paper with response in db on the linear ordinate scale and frequency in cps on the logarithmic abscissa scale. The length of a 10-to-1 frequency interval on the abscissa scale shall equal the length of 30 db on the ordinate scale.

4.5.2.1.5 Acoustic Quality Test.- A discrete constant voltage having an rms value of 3.0 volts and a frequency between 200 cps and 1000 cps shall be applied to the input terminals of the loudspeaker. The acoustic output of the loudspeaker shall be checked for any buzzes, rattles, or other spurious sounds.

4.5.2.1.6 Ruggeiness.- The loudspeaker shall be operated at 400 cps for 50 hours with a signal input of 4.5 volts. The operation may be continuous or in 8-hour intervals. The sensitivity, response-frequency characteristic, and distortion-frequency characteristic of the loudspeaker shall be measured before and after the test.

4.5.2.1.7 Directional Characteristics.- The off-axis sound pressure shall be measured in a free field at a point 3 feet away from the loudspeaker at angles of 15 degrees and 30 degrees with respect to the principal axis. The vertices of the angles shall be the intersection point of the loudspeaker principal axis and the plane containing the mounting surface of the loudspeaker.

4.5.2.1.8 Linearity.- The acoustic output of the loudspeaker in db relative to 0.0002 dyne per square centimeter shall be measured by using a warble signal, having a frequency range from 750 cps to 1250 cps and a rate of sweep of 5-1/2 times per second. Input voltages shall be as follows: 0.112, 0.200, 0.355, 0.632, 1.12, 2.00, 3.55, 6.32 volts. The acoustic output shall be plotted as a linear function of the input voltage.

4.5.2.1.9 Distortion-Frequency Characteristic.- The harmonic distortion in the acoustic output of the loudspeaker at a certain frequency of the

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fundamental shall be determined by the following formula:

$$\sqrt{P_2^2 + P_3^2 + \dots + P_n^2}$$

RMS distortion (in percent) = 100

$$\sqrt{P_1^2 + P_2^2 + P_3^2 + \dots + P_n^2}$$

where  $P_1$  is the pressure amplitude of the fundamental, and  $P_2, P_3, P_4, \dots$  are the pressure amplitudes of the harmonic components in the output, or by using a total distortion analyzer.

#### 4.5.2.2 AF Amplifier AN-492B/AIC-10

4.5.2.2.1 General Test Conditions. - Test circuit connections shall be in accordance with Drawing No. 53E13920. Unless otherwise specified, a 150-ohm resistor shall be connected across the input terminals of the amplifier, and an 8-ohm resistor shall be connected across the output terminals of the amplifier. In making performance measurements with the amplifier in the normal condition, the ON-OFF switch of the LS-184A/AIC-10 shall be in the ON position, and Switch S-3201 of the test circuit shall be open. In making performance measurements in the call condition, the ON-OFF switch of the LS-184A/AIC-10 shall be in the OFF position, and Switch S-3201 of the test circuit shall be closed.

4.5.2.2.2 Gain. - Bridging gain shall be determined by the following relationship.

$$\text{Gain} = 10 \log_{10} \frac{\text{Power delivered by amplifier to 8-ohm load resistor}}{\text{Power input to 150-ohm resistor across amplifier input terminals.}}$$

4.5.2.2.3 Frequency Response. - Measurements shall be made with a constant signal input of 2 volts. In individual tests, measurements shall be made at 300, 1000, and 6000 cps.

#### 4.5.2.2.4 Distortion

4.5.2.2.4.1 Distortion (Normal). - Measurements shall be made under the conditions indicated herein. In individual tests, distortion shall be checked at an output voltage of 2.5 volts. (This may be done by viewing an oscilloscope, resorting to the use of a distortion analyzer only in questionable cases.)

4.5.2.2.4.2 Distortion (Gain).-- Measurements shall be made under the conditions indicated herein. In individual tests, distortion shall be checked at an output voltage of 2.5 volts. (This may be done by viewing an oscilloscope, resorting to the use of a distortion analyzer only in questionable cases.)

4.5.2.2.5 Input-Output Characteristics.-- Measurements shall be made under the conditions indicated herein.

4.5.2.2.6 Amplifier Output with ON-OFF Switch in OFF Position.-- This measurement shall be made under the conditions indicated herein.

4.5.2.2.7 Noise in Output Due to Ripple on DC Line.-- This measurement shall be made under the conditions indicated herein.

4.5.2.2.8 Phasing.-- Phasing shall be checked under the conditions indicated herein.

4.5.2.2.9 Microphonic Noise.-- This measurement shall be made under the conditions indicated herein.

#### 4.5.2.3 Complete Assembly

4.5.2.3.1 Stray Magnetic Field Test.-- The stray magnetic field of the complete assembly shall be determined as follows, by using a Keuffel and Esser type No. 5600 compass or its approved equivalent. The magnet structure of the complete assembly shall be placed with the geometric center of the magnet structure 18 inches from the pivot point of the compass needle and on the perpendicular bisector of the needle in the plane of rotation of the needle. The magnetic structure of the complete assembly shall be oriented in all directions and the maximum deflection of the compass observed. This test shall be made in a location substantially free from stray magnetic disturbances.

4.5.2.3.2 Word Articulation Tests.-- The word articulation tests shall be conducted in accordance with Office of Scientific Research and Development Report No. 3802. A minimum of two talkers and five listeners shall be used for each test, and each test shall include a sufficient number of words to assure that the resulting scores are statistically significant. The listener shall face the loudspeaker with each ear at a distance of between 27 inches and 30 inches from the mounting surface of the loudspeaker. The listener's ears shall be located in the plane of the base of a cone. The center line of the cone shall coincide with the principal axis of the loudspeaker, and the apex angle of the cone shall be approximately 20 degrees with the apex of the cone at the intersection point of the loudspeaker principal axis and the plane containing the mounting surface of the loudspeaker. Word articulation tests will be performed by the procuring activity on two representative Dynamic Loudspeaker LS-184A/AIC-10 selected from the ten preproduction

samples submitted to the Government by the contractor. It is not mandatory that word articulation tests be performed by the contractor.

**4.5.2.3.3 Overall Performance Test.**- With Dynamic Loudspeaker LS-184A/AIC-10 connected as shown on Drawing No. 53B13920, and with a 4-volt (rms) input signal, the acoustic output of the complete assembly shall be listened to for buzzes, rattles, or other spurious sounds over the frequency range of 200 cps to 10000 cps. The approximate acoustic output over this frequency range shall be measured in a free field at a point on the principal axis 3 feet away from the complete assembly.

**4.5.3 Service-Condition Tests, Complete Assembly**

**4.5.3.1 Loudspeaker Lead Wire Flexibility Test.**- The loudspeaker lead wires inclosed in the insulating tubing shall be aged in a test chamber having an internal temperature of plus 85°C (plus 185°F) for a period of 7 days, at the conclusion of which, the lead wires, tubing, and a 1/4-inch diameter test mandrel shall be immediately placed in another test chamber wherein a temperature of minus 55°C (minus 67°F) is maintained and shall be kept therein for 2 hours. Before being removed from the minus 55°C test chamber, the tubing with the lead wires inclosed shall be wrapped five times around the mandrel which is also at minus 55°C, and then unwrapped. The wires and tubing shall be examined for any evidence of damage to the insulation, such as splits or ruptures, and other mechanical impairment.

**4.5.3.2 Lead Wire Clamp Efficiency.**- A pull of 5 pounds shall be applied to the loudspeaker lead wires in the direction of the clamp axis for at least 20 seconds.

**4.5.3.3 Disengagement Force of Loudspeaker Connector.**- This measurement shall be made under the conditions indicated herein.

**4.5.3.4 Connector Life Test.**- This test shall be performed under the conditions indicated herein.

**4.5.3.5 Extreme Operating Temperature Test.**- The complete assembly shall be placed within a test chamber wherein a temperature of plus 71°C (plus 160°F) is maintained. The complete assembly shall be exposed to this temperature for a period of 3 hours, at the conclusion of which, it shall be immediately transferred to a chamber having an internal temperature of minus 55°C (minus 67°F) and it shall be exposed to this temperature for a period of 3 hours. The complete assembly shall be placed in the test chamber with the face of the loudspeaker exposed and shall be operated at 400 cps with a signal input of 2.65 volts to the amplifier throughout the test. The complete assembly shall be inspected for evidence of mechanical impairment after the test. The impedance,

sensitivity, and response-frequency characteristic of the loudspeaker and the gain and distortion of the amplifier shall be measured before the test, during the test, and within 1 hour after the test.

**4.5.3.6 Temperature Cycling Test.**- The complete assembly shall be placed in the test chamber with the face of the loudspeaker exposed. The complete assembly shall be exposed to a temperature of plus 85°C (plus 185°F) for 1 hour, placed in room temperature for 15 minutes, then exposed to a temperature of minus 65°C (minus 85°F) for 1 hour, and again placed in room temperature for 15 minutes. The complete assembly shall be subjected to ten such temperature cycles. The complete assembly shall be inspected for evidence of mechanical impairment after the test. The impedance, sensitivity, and response-frequency characteristic of the loudspeaker and the gain and distortion of the amplifier shall be measured before the test, immediately after the plus 85°C exposure and minus 65°C exposure during the last cycle, and 1 hour after completion of the test.

**4.5.3.7 Pressure Cycling Test.**- The complete assembly shall be placed in the test chamber with the face of the loudspeaker exposed and the absolute internal pressure of the chamber reduced to 3.44 inches of mercury (corresponding to an altitude of 50,000 feet above sea level) and allowed to remain at the reduced pressure for 5 minutes. The pressure shall be increased again to that prevailing at ground level and the complete assembly be allowed to remain at atmospheric pressure for 5 minutes. The rate of change of pressure shall correspond to approximately 50,000 feet per minute. The complete assembly shall be subjected to three such pressure cycles and shall be operated at 400 cps with a signal input of 2.65 volts to the amplifier throughout the test. The complete assembly shall be inspected for evidence of mechanical impairment after the test. The impedance, sensitivity, and response-frequency characteristic of the loudspeaker and the gain and distortion of the amplifier shall be measured at ground level before the test, and immediately after the test.

**4.5.3.8 Humidity Test.**- The complete assembly shall be subjected to a 10-day humidity test in accordance with procedure I of MIL-E-5272. The complete assembly shall be placed in the humidity chamber with the face of the loudspeaker exposed. The complete assembly shall be inspected for evidence of mechanical impairment after the test. The impedance, sensitivity, and response-frequency characteristic of the loudspeaker and the gain and distortion of the amplifier shall be measured before the test, within 1 hour after the test, and 24 hours after the test.

**4.5.3.9 Vibration Test.**- The complete assembly shall be subjected to the vibration test in accordance with procedure XI of MIL-E-5272. The amplifier and the loudspeaker shall be turned on but no signal shall

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be applied. The voltage across the loudspeaker shall be read during vibration. The maximum voltage measured during the test shall be taken as the microphonic noise output of the amplifier. In addition, the impedance, sensitivity, and response-frequency characteristic of the loudspeaker and the gain and distortion of the amplifier shall be measured before the test and within 1 hour after completion of the test. The complete assembly shall be inspected for evidence of mechanical impairment after the test. The loudspeaker lead connector shall not shift from the initially engaged position with the amplifier pin terminals as a result of the vibration test.

**4.5.3.10 Shock Tests**

**4.5.3.10.1 15g Shock Test.**- The complete assembly shall be mounted securely to the shock testing machine and subjected to five shocks of 15g, each having a time duration of 11 milliseconds plus or minus 1 millisecond, in each of the following directions:

- a. Each of two directions parallel to the length dimension.
- b. Each of two directions parallel to the width dimension.
- c. Each of two directions parallel to the height dimension.

The impedance, sensitivity, and response-frequency characteristic of the loudspeaker and the gain and distortion of the amplifier shall be measured before the test, and within 1 hour after completion of the test. The complete assembly shall be inspected for evidence of mechanical impairment after the test. The loudspeaker lead connector shall not shift from the initially engaged position with the amplifier pin terminals as a result of the 15g shock test.

**4.5.3.10.2 30g Shock Test.**- The complete assembly shall be securely fastened to the shock testing machine and subjected to a shock of 30g applied for the duration of 11 milliseconds plus or minus 1 millisecond in each of the following directions:

- a. Each of two directions parallel to the height dimension.
- b. Each of two directions parallel to the width dimension.
- c. Each of two directions parallel to the length dimension.

The complete assembly shall be examined after the test.

**4.5.3.11 Fungus Resistance Test.**- The complete assembly shall be subjected to a 28-day fungus resistance test in accordance with MIL-E-5272. The complete assembly shall be placed in the test chamber with the face of the loudspeaker exposed. The impedance, sensitivity, and response-frequency characteristic of the loudspeaker and the gain and distortion of the amplifier shall be measured before the test, within 1 hour after the test, and 24 hours after the test. The complete

assembly shall be inspected for evidence of mechanical impairment after the test. There shall be no evidence of fungus growth on the complete assembly at the end of the fungus-resistance test.

4.5.3.12 Salt Spray Test.- The complete assembly shall be subjected to a 50-hour salt spray test in accordance with MIL-E-5272. The complete assembly shall be placed in the test chamber with the face of the loudspeaker exposed. The complete assembly shall be inspected for evidence of mechanical impairment after the test. The impedance, sensitivity, and response-frequency characteristic of the loudspeaker and the gain and distortion of the amplifier shall be measured before the test, within 1 hour after the test and 24 hours after the test.

4.5.3.13 Explosive Decompression Test.- The complete assembly shall be subjected to 10 consecutive explosive decompressions from an altitude of 8,000 feet to an altitude of 35,000 feet (corresponding to pressures of 22.2 inches of mercury to 7.04 inches of mercury). Each complete decompression or change of pressure shall take place in not more than 0.1 second. The complete assembly shall be placed in the test chamber with the face of the loudspeaker exposed. The complete assembly shall be inspected for evidence of mechanical impairment after the test. The impedance, sensitivity, and response-frequency characteristic of the loudspeaker and the gain and distortion of the amplifier shall be measured before the test and after completion of the test.

4.5.3.14 Gun Blast Test.- The complete assembly shall be mounted on the carriage of the U. S. Navy simulated gun blast equipment. The front edge of the complete assembly shall be positioned in the test plane, and its axis shall be coincident with that of the explosion chamber. The complete assembly shall be subjected to 30 rounds of blast at a peak pressure of 1-1/2 pounds per square inch, which shall be reached in a time interval not greater than 0.001 second. The complete assembly shall be inspected for evidence of mechanical impairment after the test. The impedance, sensitivity, and response-frequency characteristic of the loudspeaker and the gain and distortion of the amplifier shall be measured before the test and after completion of the test.

4.5.3.15 Explosion Proof Tests.- Dynamic Loudspeaker LS-184A/AIC-10 shall be subjected to explosion proof tests, procedure I of MIL-E-5272. The complete assembly shall be turned on, allowed to remain in the ON position for 2 minutes, and then turned off. This operation cycle shall be performed 10 times.

## 5. PREPARATION FOR DELIVERY

5.1 General.- The preservation, packaging, packing, and marking for shipment shall be in accordance with MIL-P-17555.

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5.2 Shipment Marking.-- The shipment marking nomenclature shall be Dynamic Loudspeaker LS-184A/AIC-10.

6. NOTES

6.1 Use.-- Dynamic Loudspeaker LS-184A/AIC-10 is intended to be used as part of Interoommunication Set AN/AIC-10A at low altitudes to permit stand-by listening on long missions in military aircraft.

6.2 Ordering Data.-- Invitations for bids, contracts and purchase orders should state the conditions for the following:

6.2.1 Preproduction Tests.-- It is expected that the contract or purchase order will specify that a minimum of ten each Dynamic Loudspeaker LS-184A/AIC-10 will be required as preproduction samples to be subjected to the preproduction tests by the contractor to determine compliance with the requirements of this specification, and that five each Dynamic Loudspeaker LS-184A/AIC-10 will be required as preproduction samples to be submitted to the procuring activity.

6.3 Bid Samples.-- A sample Dynamic Loudspeaker LS-184A/AIC-10 will be on display at Wright-Patterson Air Force Base, Ohio, for the convenience of bidders.

6.4 Definition of Terms:

- a. Complete Assembly: The Dynamic Loudspeaker LS-184A/AIC-10 including all component parts.
- b. Loudspeaker: The acoustic transducer component of the complete assembly.
- c. Amplifier: The AF Amplifier AM-492B/AIC-10 component of the complete assembly.
- d. Housing: The case used to enclose the loudspeaker and amplifier.
- e. Loudspeaker Lead Wires: The connecting wires between the terminals on the loudspeaker terminal board and the socket connector or connections.
- f. Voice Coil Lead: The wire connecting the voice coil to the terminal board of the loudspeaker.

NOTICE: When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any

other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may be in any way related thereto.

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