

MIL-A-22165 (AER)
15 AUGUST 1959

MILITARY SPECIFICATION

AMPLIFIER, COMPASS, SERVO (TYPE MF-1 COMPASS)

This specification has been approved by the
 Bureau of Aeronautics, Department of the Navy.

1. SCOPE

1.1 Scope.- This specification covers design requirements and all performance requirements for procurement of a Compass Servo Amplifier, a component of the MF-1 type compass directional reference system for military aircraft.

1.2 Classification.- Servo Amplifier shall be of the following types:

Type I - With clutched synchro transmitter for azimuth control of the P-1 Autopilot. (MS28100-1)

Type II - With clutched synchro transmitter for azimuth control of the MH-67 Autopilot. (MS28100-2)

2. APPLICABLE DOCUMENTS

2.1 The following specifications, standards, and publications of the issue in effect on date of invitation for bids, form a part of this specification to the extent specified herein:

SPECIFICATIONS

Federal

QQ-N-290	Nickel Plating (Electrodeposited)
QQ-C-320	Chromium Plating (Electrodeposited)
QQ-P-416	Plating, Cadmium (Electrodeposited)

Military

MIL-P-116	Preservation, Method of
MIL-S-4456	Shock, Variable Duration, Method and Apparatus for
MIL-D-70327	Drawings, Engineering and Associated Lists
MIL-E-5272	Environmental Testing, Aeronautical and Associated
	Equipment, General Specification for
MIL-E-5400	Electronic Equipment, Aircraft, General Specification for
MIL-C-5541	Chemical Films for Aluminum and Aluminum Alloys
MIL-I-6181	Interference Limits, Tests and Design Requirements,
	Aircraft Electrical and Electronic Equipment
MIL-S-6872	Soldering Process, General Specification for
MIL-L-6880	Lubrication of Aircraft, General Specification for
MIL-S-7742	Screw Threads, Standard Aeronautical
MIL-P-7936	Parts and Equipment, Aeronautical, Preparation for
	Delivery
MIL-A-8625	Anodic Coating for Aluminum and Aluminum Alloys
MIL-T-19576	Transmitter: Remote Compass, Thin Wing Type ML-1
	(Unstabilized)
MIL-C-21013	Compass Directional Reference System Magnetic Slave,
	Directional Gyro Roll Stabilized, 3°/HR Type MF-1
MIL-T-25193	Transmitter: Remote Compass, Type C-2 (Unstabilized)

MIL-A-22165 (Aer)**STANDARDS**Federal

FED. STD. No. 1 Standard for Laboratory Atmospheric Conditions

Military

MIL-STD-130	Identification Marking for U.S. Military Property
MIL-STD-200	Electron Tubes and Semiconductor Devices, Diode
MIL-STD-701	Transistors
MS26100	Amplifier, Compass, Servo (Type MF-1 Compass)
MS33558	Numerals and Letters, Aircraft Instrument Dial, Standard Form of
MS33506	Metals - Definitions of Dissimilar

PUBLICATIONSAir Force-Navy Aeronautical Specification Bulletin

No. 143 Specifications and Standards, Use of

(When requesting any of the applicable documents, refer to both title and number. Copies of this specification and applicable documents may be obtained upon application of the Commanding Officer, Naval Aviation Supply Depot, 5801 Tabor Avenue, Philadelphia 20, Pennsylvania, Attention: Code GDS.)

3. REQUIREMENTS

3.1 Qualification.- The Servo Amplifier furnished under this specification shall be a product which has been tested and has passed the qualification tests specified herein.

3.2 Selection of Government Documents.- Specifications and standards for necessary commodities and services not specified herein shall be selected in accordance with ANA Bulletin No. 143, except as provided in Sections 3.2.1 Commercial Parts and 3.2.2 Standard Parts.

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

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

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

3.2.2 Standard Parts.- With the exception of Section 3.2.1 Commercial Parts, MS and AN standard parts shall be used where they suit the purpose. They shall be identified on the drawings by their part numbers.

3.3 Materials.- Materials shall conform to applicable specifications and shall be as specified herein. Materials for which there are no applicable specifications, or which are not specifically described herein, shall be of the best quality, of the lightest practicable weight, and suitable for the purpose intended.

3.3.1 Critical Materials.- Noncritical materials shall be used where practicable. Where the use of a critical material is essential to meet specification requirements, the material used shall be the least critical of those which are adequate for the purpose.

3.3.2 Metals.- Metals shall be of the corrosion-resistant type, or shall be suitably protected as specified herein to resist corrosion due to salt spray or atmospheric conditions to which the Servo Amplifier may be subjected when in storage or during normal service life.

3.3.2.1 Dissimilar Metals.- Unless suitably protected against electrolytic corrosion, dissimilar metals as defined in Standard MS33586 shall not be used in intimate contact with each other.

3.3.3 Nonmagnetic Materials.- Nonmagnetic materials shall be used for all parts of the Servo Amplifier, except where magnetic materials are essential.

3.3.4 Fungus-proof Materials.- Materials which are nutrients for fungi shall not be used where it is practicable to avoid them. Where used and not hermetically sealed, they shall be treated with a fungicidal agent acceptable to the procuring activity. However, if they will be used in a hermetically sealed enclosure, fungicidal treatment will not be necessary.

3.3.5 Corrosive Fumes.- The materials used in the Servo Amplifier shall not liberate deleterious fumes.

3.4 Component Parts.- Unless otherwise specified, both Types of the Servo Amplifier shall consist of the following component parts:

- (a) Compass Control Transformer
- (b) A Slaving Amplifier
- (c) A Twenty-four Point (15°) Cam Compensator
- (d) A Slew-Slave Motor-Generator Unit with two Speed Drive
- (e) Azimuth Control Transformer
- (f) An Azimuth Amplifier
- (g) An Azimuth motor generator unit with gear trains
- (h) Power Supply
- (i) Emergency Mode Operation, Thermal Time Delay, Slewing, Autosynch, D.G., and Turn Cutout Relays
- (j) Five Output Synchros as follows:

- (1) Three, four-power 26 volt excited, 400 cycle per second (cps) synchro transmitters
- (2) One, twenty-power 26 volt, 400 cps, synchro transmitter
- (3) (Type I Only) One, nine volt, 400 cps, clutched synchro transmitter
(Type II Only) One, 26 volt, 400 cps, clutched synchro transmitter

3.5 Design and Construction.- The servo amplifier shall be designed to supply aircraft heading to autopilots, flight director systems, and other aircraft equipment requiring heading information. The Servo Amplifier shall contain the components in Section 3.4 Component Parts and the circuitry to receive, amplify, modify, and transmit heading information received from a magnetic and inertial source. The cam compensator shall have visual compensated and uncompensated indicators calibrated in 0.2 degree. The clutched synchro transmitter is for the azimuth control of automatic pilots. The autopilot synchro transmitter shall also be equipped with a spring mechanism to center the synchro to the mechanical position that will provide an electrical zero (E-Z). The spring centering device shall also contain a solenoid retractor. The Servo Amplifier shall be constructed to withstand the normal strains, jars, vibrations, and such other conditions as are incident to shipping, storage, installation, and service.

3.5.1 Maintenance.- The design of the Servo Amplifier shall be such as to accommodate to the greatest possible extent, disassembly, reassembly, and service maintenance by those tools and items of maintenance equipment which are normally available as commercial standards.

3.6 Performance.- The Servo Amplifier shall perform satisfactorily when subjected to the tests specified in Section 4 Quality Assurance Provisions.

3.7 Case.- The outline dimensions of the Servo Amplifier case shall conform to Standard MS28100.

3.7.1 Case Shock Mount.- The Servo Amplifier shall be provided with a rack type vibration mount in accordance with Standard MS28100.

3.8 Screw Threads.- Screw threads 0.060 inch or larger in diameter shall be in accordance with Specification MIL-S-7742.

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3.9 Electronic Parts.- Electronic parts and the application thereof shall be in accordance with Specification MIL-E-5400. Parts that do not appear on approved lists in accordance with Specification MIL-E-5400 shall not be used unless approved by the procuring activity.

3.9.1 Tube Types.- The choice and application of electron tubes and transistors shall be in accordance with Standards MIL-STD-200 and MIL-STD-701.

3.9.2 Wiring.- The electrical wiring system shall be insulated from the Servo Amplifier case, except that J2003-M pin may be grounded to the case. The external wiring shall be in accordance with the wiring diagram in Specification MIL-C-21013.

3.9.3 External Test Points.- The Servo Amplifier unit shall be provided with the following external test points:

<u>Test</u>	<u>Test Point</u>
(1) Input voltage to the slaving amplifier	B
(2) Output voltages from the slaving amplifier (2 voltages) 180° phase relation	A and C
(3) Input voltage to the azimuth amplifier	D
(4) Output voltage from the azimuth amplifier	E
(5) Regulated dc	F
(6) System ground	GND

3.9.4 Electrical Receptacle.- The electric receptacles used shall be in accordance with Standard MS28100.

3.9.5 Electrical Power Requirements.- The Servo Amplifier shall operate from a 115 volt, 1 phase, 400 cycles per second and 28 volts d-c power supply.

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

3.11 Physical Requirements.-

3.11.1 Weight.- The weight of the Servo Amplifier and shock mount frame shall not exceed 17 pounds.

3.11.2 Finish.- Protective coatings and finishes which will crack, chip, or scale during normal service life or due to extreme of atmospheric conditions shall not be used.

3.11.2.1 Aluminum Alloy Parts.- Where practicable, aluminum alloy parts shall be covered with an anodic film conforming to Specification MIL-A-8625. Aluminum alloys which do not anodize satisfactorily shall be coated with a chemical film in accordance with Specification MIL-C-5541.

3.11.2.2 Iron and Steel Parts.- Where practicable, iron and steel parts shall be cadmium, chromium, or nickel plated in accordance with Specifications QQ-P-416, QQ-C-320, and QQ-N-290, respectively.

3.11.3 Soldering.- Soldering shall be performed in accordance with Specification MIL-S-6872.

3.11.4 Lubrication.- Lubrication shall be accomplished in accordance with Specification MIL-L-6880, except that the selection of the lubricant used shall be approved by the procuring activity.

3.12 Dial Marking.- Dial markings shall be durable to withstand usage encountered in service. The form of the letters and numerals shall conform to Standard MS33558. Numerals shall distinctly indicate the graduation to which each applies. The dial shall be marked as shown in Figure 1. Unless otherwise specified, the finish of the dial shall be durable dull black non-reflecting background with matte white numerals and graduations.

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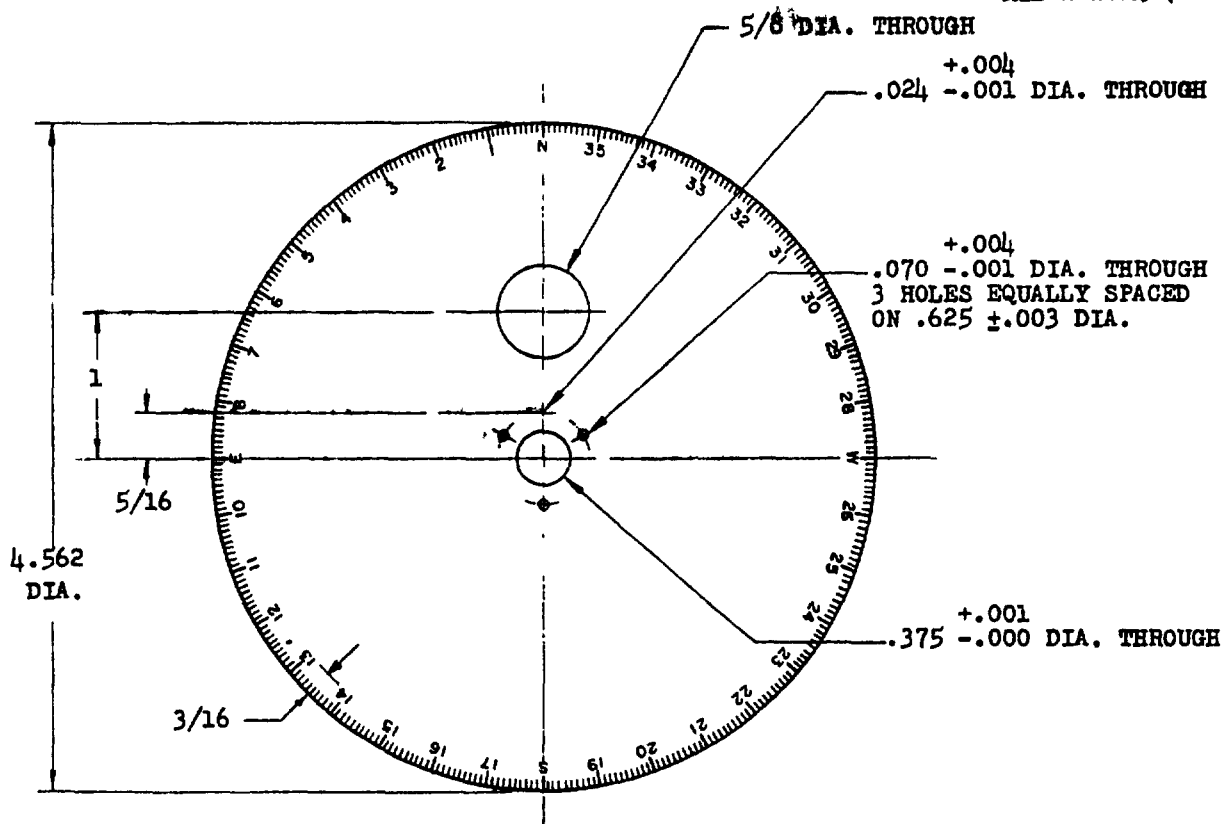


FIGURE 1
DIAL-UNCOMPENSATED

NOTES:

1. ALL NUMERALS AND LETTERS .070 HIGH BY .012 LINE.
2. 10° GRADUATIONS TO BE .094 LONG BY .010 LINE.
3. 1° GRADUATIONS TO BE .062 LONG BY .006 LINE.
4. ACCURACY BETWEEN ANY 2 GRADUATIONS TO BE $\pm 5'$.
5. DIMENSIONS ARE IN INCHES.
6. MATERIAL .032 \pm .002 INCH THICK ALUMINUM ALLOY.
7. PIECE TO BE FLAT WITHIN .002 PER INCH OF RADIUS.

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3.13 Identification of Product.- A nameplate shall be securely attached to the exterior of the Servo Amplifier case, and shall be legibly and durably marked in accordance with Standard MIL-STD-130.

3.14 Receptacles.- The electrical receptacle code markings as specified on Standard MS28100 shall be legibly and permanently applied to the Servo Amplifier case.

3.15 Installation.-

3.15.1 Installation Instructions.- The contractor shall furnish with each Servo Amplifier one printed copy of instructions with illustrations and diagrams, if necessary, covering the installation of the Servo Amplifier. Prior to printing, two copies shall be furnished to the Bureau of Aeronautics for approval. The instructions shall be printed on 8-1/2 by 11 or 11 by 17 inch paper.

3.15.2 Envelope.- An envelope furnished by the contractor containing installation instructions (and mounting screws if required) shall be packaged with the following information:

"IMPORTANT
THIS ENVELOPE CONTAINS INSTRUCTIONS AND MOUNTING SCREWS"

3.16 Workmanship.- The Servo Amplifier, including all parts and accessories, shall be constructed and finished to produce an instrument free from all defects which would affect proper functioning in service. Particular attention shall be given to neatness and thoroughness of soldering, wiring, impregnation of coils, marking of parts and assemblies, welding and brazing, painting, riveting, machine-screw assemblies, and freedom of parts from burrs and sharp edges.

4. QUALITY ASSURANCE PROVISIONS

4.1 Unless otherwise specified herein, the supplier is responsible for the performance of all inspection requirements prior to submission for Government inspection and acceptance. Except as otherwise specified, the supplier may utilize his own facilities or any commercial laboratory acceptable to the Government. Inspection records of the examinations and tests shall be kept complete and available to the Government as specified in the contract or order.

4.2 Classification of Tests.- The inspection and testing of the Servo Amplifier shall be classified as follows:

- (a) Qualification Tests.- Qualification tests are those tests performed on Servo Amplifiers submitted for qualification as a satisfactory product.
- (b) Acceptance Tests.- Acceptance tests are those tests performed on Servo Amplifiers manufactured and submitted for acceptance under contract.

4.3 Qualification Tests.- The qualification tests of the Servo Amplifier shall consist of all tests of this specification. The tests shall be conducted in the following sequence:

- Individual Tests
- Sampling Test
- Radio Noise Interference
- High Temperature Exposure
- Low Temperature Exposure
- High Temperature-Altitude
- Low Temperature-Altitude
- Vibration
- Impact Shock
- Life
- Fungus Resistance
- Humidity
- Salt Spray

4.3.1 Qualification Test Samples.- The qualification test samples shall consist of two Servo Amplifiers of each manufacturer's part number submitted as sample for qualification testing. After obtaining authorization for submittal from the Bureau of

Aeronautics, the samples shall be forwarded to the testing laboratory designated in letter of authorization. Each sample shall be plainly identified by a securely attached durable tag marked with the following information (see Section 6.3 Qualification):

Sample for qualification test
 Submitted by (name)(date) for qualification tests in accordance with the requirements of Specification MIL- under authorization
 (reference letter authorizing test)
 Compass, Servo Amplifier (Type MF-1 Compass)
 MS28100
 Manufacturer's Part No.
 Name of Manufacturer

4.4 Acceptance Tests.- The acceptance tests of the Servo Amplifier shall consist of the individual tests and the sampling tests of this specification.

4.4.1 Individual Tests.- The individual tests of the Servo Amplifier shall consist of the following tests conducted on each Servo Amplifier:

Inspection
 Continuity
 Dielectric Strength
 Insulation Resistance
 Voltage Measurements
 Directional Gyro Mode
 Emergency Mode
 Slaved Mode
 Manual Synchronization (Course Setting)
 Turn Cutout Relay

4.4.2 Sampling Tests.- The sampling tests of the Servo Amplifier shall consist of the following tests conducted on each sampling test sample:

System Servo Amplifier Tests
 High Temperature Operation
 Low Temperature Operation

4.4.2.1 Sampling Test Instructions.- Samples shall consist of two Servo Amplifiers selected at random by the inspector, from each lot of 100 or less, which have passed the individual tests. A lot shall consist of identical Servo Amplifiers with the same manufacturer's part number, manufactured under substantially the same conditions, and submitted at substantially the same time. Servo Amplifiers which have been subjected to the sampling tests shall not be delivered on contract until they have been rebuilt and resubmitted to all individual tests.

4.5 Rejection and Retest.- Servo Amplifiers which have been rejected as a result of the acceptance tests may be reworked to correct the defects, or replaced, and resubmitted for acceptance. Failure of samples representing lots shall be cause for rejection of the lot represented. Before resubmitting, full particulars concerning previous rejection and the action taken to correct the defects found in the original shall be furnished the inspector. Units or lots rejected after retest shall not be resubmitted without specific approval of the procuring activity.

4.6 Test Conditions.-

4.6.1 Atmospheric Conditions.- Unless otherwise specified, all tests required by this specification shall be made in accordance with the requirements of Federal Standard No. 1.

4.6.2 Attitude.- Unless otherwise specified, the units under investigation shall be tested in their normal operating positions,

4.6.3 Test Equipment.- Any test or metering equipment shall not load or affect the unit under test. The tolerances indicated are acceptable limits of performance and are not to be confused with meter accuracies.

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4.6.4 Gyro Simulator.- The Azimuth Transmitter contained in the MF-1 Roll Stabilized Directional Gyro may be simulated by connecting the Gyro Simulator at the indicated terminals.

<u>Gyro Simulator</u>	<u>Terminals</u>
Rotor	H and W of J2005
Stator	J, K, and L of J2005

4.6.4.1 The Gyro Simulator Synchro shall have the following characteristics:

- (a) Controlled, High Accuracy Synchro
- (b) 0.4 watts, 1.7 va
- (c) 26 v, 400 cps

4.6.4.2 The synchro shall be mounted in a setting which indicates the direction of rotation for increasing heading and the direction of rotation for decreasing heading. The Gyro Simulator shall be calibrated in 0.1 of a degree. The Gyro Simulator Synchro shall be connected to give the following results:

- (a) Turn the rotor until the voltage between terminals J and K is at a minimum.
- (b) The voltage between K and L will decrease before increasing when the rotor is turned in a direction for increased heading.

4.6.5 Compass Transmitter Simulator.- A Compass Transmitter Simulator shall be a C-2 Remote Compass Transmitter, Specification MIL-T-25193, a ML-1 Remote Compass Transmitter, Specification MIL-T-19576, or an equivalent remote compass transmitter simulator and connected to J2001 A, B, C, D, E and one simulator output terminals A, B, C, D, E respectively.

4.6.6 Controller Simulator.- The MF-1 Compass Controller shall be simulated by the circuitry of Figure 2.

4.6.7 Servo Repeater Synchro.- Whenever a Servo Repeater Synchro is specified, it shall be a 26v servo repeater with an indicating dial calibrated to 0.1 of a degree.

4.6.8 Loads.-

4.6.8.1 The latitude correction potentiometer of control panel MF-1 Compass Controller or equivalent, shall be simulated by connecting the following impedance at the indicated terminals.

<u>Ohms</u>	<u>Connection</u>
1788.6 /0°	A and B of J2002

4.6.8.2 In place of the excitation winding of the Compass Transmitter Simulator, the following impedance shall be connected at the indicated terminals only to take measurements of Section 4.7.5.1 Excitation Voltage.

<u>Ohms</u>	<u>Connection</u>
577 /60°	E and D of J2001

4.6.8.3 In place of the rotor winding of the compass transmitter in the MF-1 Directional Gyro, the following impedance shall be connected at the indicated terminals only to take measurements of Section 4.7.5.1 Excitation Voltage.

<u>Ohms</u>	<u>Connection</u>
100 /0°	H and W of J2005

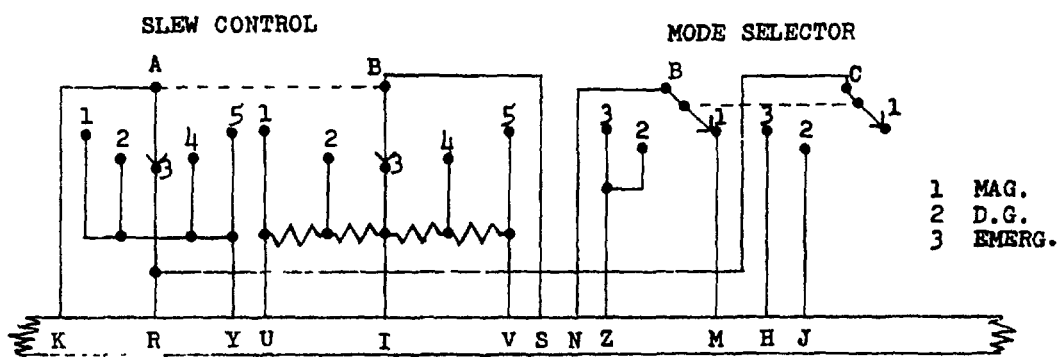


FIGURE 2
CONTROLLER SIMULATOR

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4.6.8.4 In place of the Corr. Ind., the following impedance shall be connected at the indicated terminals:

<u>Ohms</u>	<u>Connection</u>
75	E and F of J2002

4.6.9 Standard Power Source.- A standard power source shall be capable of supplying the following power:

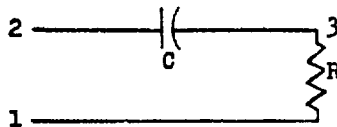
4.6.9.1 115 volts +3 volts ac at 500 ma with a total harmonic distortion of less than five percent and for specification purposes designated AB phase (B-Hi and A-Lo); capable of delivering two amperes, and connected as follows:

<u>Phase</u>	<u>Connection</u>
B - Hi	D of J2003
A - Lo	E of J2003

4.6.9.2 27.5 volts dc capable of delivering one ampere and connected as follows:

<u>Polarity</u>	<u>Connection</u>
Plus	H of J2003
Ground	J of J2003

4.6.9.3 Phase Reference.- The phase reference shall be A phase to B phase. A voltage specified as being "from pin X to pin Y" shall be measured using pin X as reference, or ground terminal. The direction of leading phase angle can be established by the use of the following circuit. In this circuit, the voltage from pin 1 to pin 3, V_{1-3} , leads the voltage from pin 1 to pin 2, V_{1-2} . A positive angle shall be a leading angle.



4.7 Test Methods.-

4.7.1 Inspection.- Each Servo Amplifier shall be examined to determine conformance with the applicable drawings and with all the requirements of this specification not covered by tests.

4.7.2 Continuity.- With the equipment de-energized and no system connections to the Servo Amplifier, the resistance of the circuits shall be as follows:

<u>Pin Designation</u>	<u>Resistance (Ohms)</u>
J2004-18 to J2004-17	0.5 \pm 0.25
J2004-18 to J2004-16	0.5 \pm 0.25
J2004-19 to J2004-20	0.6 \pm 0.3
J2004-8 to J2004-6	4 \pm 1
J2004-8 to J2004-7	4 \pm 1
J2004-9 to J2004-10	10 \pm 2
J2004-13 to J2004-11	4 \pm 1
J2004-13 to J2004-12	4 \pm 1
J2004-14 to J2004-15	10 \pm 2
J2004-3 to J2004-2	4 \pm 2
J2004-3 to J2004-1	4 \pm 1
J2004-4 to J2004-5	10 \pm 2
J2004-24 to J2004-25 (Type I Only)	300 to 500
J2004-28 to J2004-27 (Type I Only)	350 \pm 70
J2004-26 to J2004-27 (Type I Only)	350 \pm 70
J2004-29 to J2004-30 (Type II Only)	4.5 \pm 1
J2004-30 to J2004-31 (Type II Only)	4.5 \pm 1
J2004-32 to J2004-33 (Type II Only)	18.8 \pm 4
J2004-34 to J2004-35 (Type II Only)	338 \pm 70
J2004-36 to J2004-35 (Type II Only)	309 \pm 70

<u>Pin Designation</u>	<u>Resistance (Ohms)</u>
J2001-C to J2001-B	14 ±3
J2001-B to J2001-A	14 ±3
J2002-b to case	continuous
J2002-F to J2002-E	4500 ±900
J2002-M to J2002-B	∞
J2002-N to J2002-B	400 ±100
J2002-A to J2016	continuous
J2005-V to J2002-C	continuous
J2005-M to J2002-D	continuous
J2005-D to J2005-E	∞
J2005-N to J2005-F	continuous
J2005-A to J2003-A	continuous
J2005-C to J2003-C	continuous
J2005-B to J2003-B	continuous
J2005-H to J2003-F	continuous
J2005-K to J2005-J	23 ±4
J2005-J to J2005-L	23 ±4
J2005-P to J2003-J	continuous
J2005-P to J2002-Z	continuous
J2005-P to J2002-L	continuous
J2005-P to J2002-B	continuous
J2005-P to J2017	continuous
J2005-R to J2003-H	continuous
J2005-R to J2002-a	∞
J2005-R to J2002-K	continuous
J2005-E to J2005-F	∞

4.7.3 Dielectric Strength.- A potential of 250 volts rms ac at commercial frequency shall be applied between isolated pins listed below, and between pins and the case for a period of 5 seconds. There shall be no breakdown of insulation or any other permanent damage to the instrument as a result of this test.

<u>Pin Designation</u>		<u>Pin Designation</u>	
<u>From</u>	<u>To</u>	<u>From</u>	<u>To</u>
J2004-18	case	J2005-B	case
J2004-8	case	J2005-L	case
J2004-13	case	J2001-A	case
J2004-3	case	J2004-18	J2004-20
J2004-27 (Type I Only)	case	J2004-8	J2004-10
J2004-35 (Type II Only)	case	J2004-13	J2004-15
J2004-10	case	J2004-3	J2004-5
J2004-15	case	J2004-24 (Type I Only)	J2004-21
J2004-5	case	J2004-27 (Type I Only)	J2004-25
J2005-M	case	J2004-32 (Type II Only)	J2004-29
J2005-N	case	J2004-35 (Type II Only)	J2004-33
J2005-A	case	J2004-20	case
J2005-C	case	J2004-25 (Type I Only)	case
		J2004-33 (Type II Only)	case

4.7.4 Insulation Resistance.- The insulation resistance between each terminal of the connectors and case and between isolated circuits, as listed in Section 4.7.3 Dielectric Strength, shall not be less than 50 megohms with 250 volts dc applied for a period of 5 seconds.

4.7.5 Voltage Measurements.- Connect power supply and loads described in Sections 4.6.8 Loads, 4.6.9.1 Standard Power Source, and 4.6.9.2 Standard Power Source.

4.7.5.1 Excitation Voltages.- Measure the a-c voltages and their corresponding phase angles at each of the following pins. The voltages and phase angles shall be as specified below:

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<u>Pin Designation</u>	<u>RMS Voltage</u>	<u>Phase</u>
J2005-B to J2005-W	26.0 \pm 2.6	0° \pm 5°
J2001-E to J2001-D	22.1 \pm 2.2	305° \pm 5°
J2002-L to J2002-U	3 \pm .3	0° \pm 5°
J2002-L to J2002-V	3 \pm .3	180° \pm 5°

4.7.5.2 Latitude Correction Voltage.-

4.7.5.2.1 Set R2060 to an extreme ccw position. The voltage from J2002-B to J2002-A shall be 8.9 \pm .5 volts dc.

4.7.5.2.2 Set R2060 to an extreme clockwise position. The voltage from J2002-A to J2002-B shall be 11.5 \pm .6 volts dc.

4.7.5.3 Latitude Correction Voltage Regulation.- Adjust the voltage from J2002-A to J2002-B to approximately 9.0 volts dc. Raise the 115 volts 400 cps supply to 120 volts and then lower this voltage to 110 volts. The 9.0 volts dc from J2002-A to J2002-B shall not change.

4.7.6 Directional Gyro Mode.- Remove loads described in Sections 4.6.8.2 Loads and 4.6.8.3 Loads.

4.7.6.1 Connections.- Connect the Servo Amplifier as shown in Figure 3. There shall be Zero Degrees Correction on the Cam Compensator. Compensated and Uncompensated Dial readings shall be the same.

4.7.6.2 Directional Checks.-

- (a) Set Gyro Simulator to zero degrees.
- (b) Set mode selector switch on Compass Controller to D.G. Mode.
- (c) Rotate the Gyro Simulator in an increasing direction.

The Servo Repeater Synchro dial pointer shall move in an increasing direction.

4.7.6.3 Repeat Section 4.7.6.2 Directional Checks, except rotate the Gyro Simulator in a decreasing direction. The Servo Repeater Synchro dial pointer shall move in a decreasing direction.

4.7.6.4 Scale Error.-

- (a) Set the Gyro Simulator to zero degrees.
- (b) Adjust the Gyro Simulator every 30 degrees noting the position of the Servo Repeater Synchro dial pointers after each setting of the Gyro Simulator.

(1) The Servo Amplifier contains four data transmitters. For each setting of the Gyro Simulator, note the Servo Repeater Synchro position for all data transmitters. The maximum spread of each transmitter shall not exceed 1.5 degrees, exclusive of the Servo Repeater spread.

4.7.6.5 Response.-

(a) Rotate the Gyro Simulator through an angle in excess of 360 degrees first clockwise and then counter-clockwise at a rate not less than 7 revolutions per minute. The Servo Repeater Synchro shall rotate through 360 degrees in 9 seconds or less.

4.7.6.6 Stability.-

(a) Rotate the Gyro Simulator rapidly through an angle of approximately 45 degrees. The indicator shall move smoothly without noticeable jumping or overshooting. There shall be no hunting or oscillation when the simulator is stationary or moving.

4.7.6.7 Clutched Synchro.-

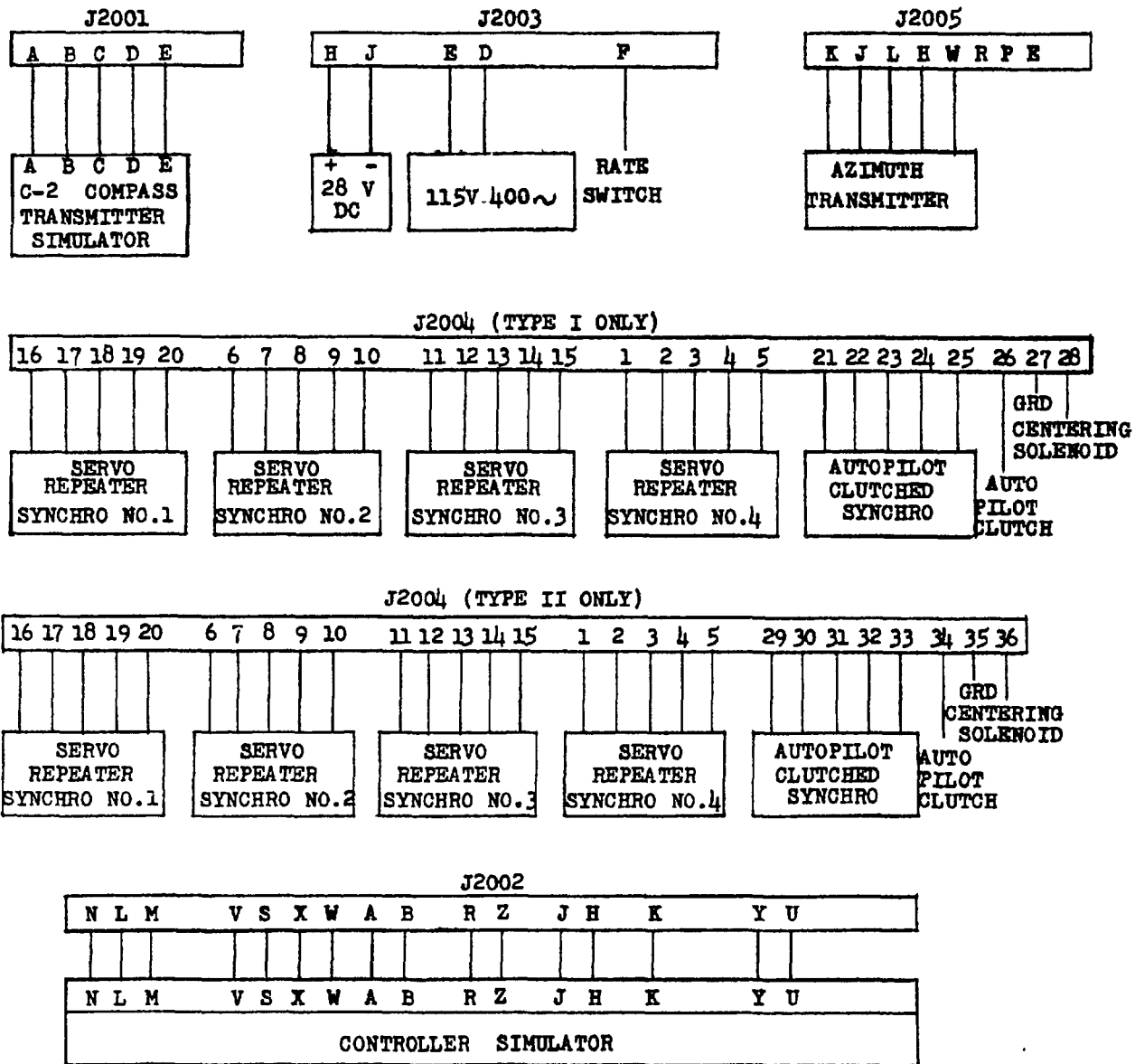


FIGURE 3
CONNECTIONS, SERVO AMPLIFIER

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4.7.6.7.1 Null.- The following test shall be performed at 15 degree intervals for a total of 180 degrees.

4.7.6.7.1.1 (Type I Only).-

(a) Connect 9 volts BA phase from J2004-25 to J2004-24. With the subject unit in any position, the null voltage from J2004-21 to J2004-22 shall be less than 10 mv.

(b) Connect 27.5 volts dc from J2004-27 to J2004-28. The null voltage from J2004-21 to J2004-22 shall be less than 15 mv.

(c) Connect 27.5 volts dc from J2004-27 to J2004-26 three (3) times. The null voltage from J2004-21 to J2004-22 shall be less than 25 mv.

4.7.6.7.1.2 (Type II Only).-

(a) Connect 26 volts BA phase from J2004-33 to J2004-32. With the subject unit in any position, the null voltage from J2004-31 to J2004-30 shall be less than 40 mv.

(b) Connect 27.5 volts dc from J2004-35 to J2004-36. The null voltage from J2004-31 to J2004-30 shall be less than 55 mv.

(c) Connect 27.5 volts dc from J2004-35 to J2004-34 three (3) times. The null voltage from J2004-31 to J2004-30 shall be less than 150 millivolts.

4.7.6.7.2 Sensitivity, Phase and Limits.-4.7.6.7.2.1 (Type I Only).-

(a) Adjust the Gyro Simulator 20 degrees from null in an increasing direction. The voltage from J2004-21 to J2004-22 shall be 0.660 ± 0.066 at a phase of 7 ± 2 degrees. The quadrature shall not exceed 17 mv.

(b) Adjust the Gyro Simulator in an increasing direction until the voltage from J2004-21 to J2004-22 remains constant. The displacement from null shall not exceed 40 degrees.

4.7.6.7.2.2 (Type II Only).-

(a) Adjust the Gyro Simulator 30 degrees from null in an increasing direction. The voltage from J2004-31 to J2004-30 shall be 5.9 ± 0.5 volts at a phase of 20 ± 3 degrees.

(b) Adjust the Gyro Simulator in an increasing direction until the voltage from J2004-31 to J2004-30 remains constant. The displacement from null shall be between 30 and 40 degrees.

4.7.6.7.3 Repeat Section 4.7.6.7.2 Sensitivity, Phase and Limits, except:

4.7.6.7.3.1 (Type I Only).-

(a) Adjust the Gyro Simulator 20 degrees from null in a decreasing direction. The voltage from J2004-21 to J2004-22 shall be 0.660 ± 0.066 volts at a phase of -173 ± 2 degrees.

(b) Adjust the Gyro Simulator in a decreasing direction until the voltage from J2004-21 to J2004-22 remains constant. The displacement from null shall not exceed 40 degrees.

4.7.6.7.3.2 (Type II Only).-

(a) Adjust the Gyro Simulator 30 degrees from null in a decreasing direction. The voltage from J2004-31 to J2004-30 shall be 5.9 ± 0.5 volts at a phase of -200 ± 3 degrees.

(b) Adjust the Gyro Simulator in a decreasing direction until the voltage from J2004-31 to J2004-30 remains constant. The displacement from null shall be between 30 and 40 degrees.

4.7.6.7.4 Centering Lever Retracting Mechanism.-

4.7.6.7.4.1 (Type I Only).-

(a) Adjust the Gyro Simulator in an increasing direction from null until the voltage from J2004-21 to J2004-22 is 600 millivolts. The voltage from J2004-21 to J2004-22 shall not change by more than 20 millivolts when:

(1) The voltage from J2004-27 to J2004-26 and J2004-27 to J2004-28 is reduced to 22 volts.

(2) The subject unit is set on end.

4.7.6.7.4.2 (Type II Only).-

(a) Adjust the Gyro Simulator in an increasing direction from null until the voltage from J2004-31 to J2004-30 is 600 millivolts. The voltage from J2004-31 to J2004-30 shall not change by more than 50 millivolts when:

(1) The voltage from J2004-35 to J2004-34 and J2004-35 to J2004-36 is reduced to 22 volts.

(2) The subject unit is set on end.

4.7.6.7.5 Repeat Section 4.7.6.7.4 Centering Lever Retracting Mechanism, except:

4.7.6.7.5.1 (Type I Only).-

(a) Adjust the Gyro Simulator in a decreasing direction from null until the voltage from J2004-21 to J2004-22 is 600 millivolts.

4.7.6.7.5.2 (Type II Only).-

(a) Adjust the Gyro Simulator in a decreasing direction from null until the voltage from J2004-31 to J2004-30 is 600 millivolts.

4.7.6.7.6 Center Lever Release.-4.7.6.7.6.1 (Type I Only).-

(a) Adjust the Gyro Simulator 25 degrees from null in an increasing direction.

(b) Disconnect 22 volts dc from J2004-26. The voltage from J2004-21 to J2004-22 shall not change by more than 10 millivolts.

(c) Disconnect 22 volts dc from J2004-28. The voltage from J2004-21 to J2004-22 shall not change by more than 10 millivolts.

4.7.6.7.6.2 (Type II Only).-

(a) Adjust the Gyro Simulator 25 degrees from null in an increasing direction.

(b) Disconnect 22 volts dc from J2004-34. The voltage from J2004-31 to J2004-30 shall not change by more than 60 millivolts.

(c) Disconnect 22 volts dc from J2004-36. The voltage from J2004-31 to J2004-30 shall not be greater than 40 millivolts.

4.7.6.7.7 Repeat Section 4.7.6.7.6 Center Lever Release, except:

4.7.6.7.7.1 (Type I Only).-

(a) Adjust the Gyro Simulator 25 degrees from null in a decreasing direction.

4.7.6.7.7.2 (Type II Only).-

(a) Adjust the Gyro Simulator 25 degrees from null in a decreasing direction.

4.7.7 Emergency Mode.-4.7.7.1 Connections.-

(a) Set mode selector on Compass Controller to Emergency Mode.

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4.7.7.2 Direction Checks.-

(a) Rotate Compass Transmitter Simulator in an increasing direction. The Servo Repeater Synchro dial pointer shall move in an increasing direction.

4.7.7.3

(a) Repeat 4.7.7.2, except rotate the Compass Transmitter Simulator in a decreasing direction. The Servo Repeater Synchro dial pointer shall move in a decreasing direction.

(b) Rotate Gyro Simulator clockwise and counter-clockwise. The Servo Repeater Synchro dial pointer shall not move.

4.7.7.4 Scale Error.-

(a) Set the Compass Transmitter Simulator to zero degrees.

(b) Adjust the Compass Transmitter Simulator every 30 degrees noting the positions of the Servo Repeater Synchro dial pointers after each setting of the Compass Transmitter Simulator. The maximum spread shall not exceed 2 degrees exclusive of the Servo Repeater spread.

4.7.7.5 Response.-

(a) Set Compass Transmitter or Compass Transmitter Simulator at North (0 degrees).

(b) Displace repeater 180° with Slew control, with system in D.G. mode.

(c) Switch to Emergency and system should rotate from 180 degrees to zero degrees in less than 10 seconds.

4.7.7.6 Stability.-

(a) Rotate the Compass Transmitter Simulator rapidly through an angle of approximately 45 degrees. The indicator shall move smoothly without noticeable jumping or overshooting. There shall be no hunting or oscillating when the simulator is stationary or moving.

4.7.8 Slaved Mode.-

4.7.8.1 Direction and Slaving Rate.-

(a) Set Compass Transmitter Simulator at zero degrees.

(b) Set Gyro Simulator at zero degrees.

(c) Set mode selector on Compass Controller to Magnetic Mode. The Servo Repeater Synchro dial pointer shall move to zero degrees.

(d) Rotate the Compass Transmitter 20 degrees in an increasing direction. The Servo Repeater Synchro dial pointer shall move 10 degrees in an increasing direction in five to ten minutes.

(e) Rotate the Compass Transmitter Simulator 20 degrees in a decreasing heading from zero. The Servo Repeater Synchro dial pointer shall move 10 degrees in a decreasing direction in five to ten minutes.

4.7.8.2 Synchro Indicator.-

4.7.8.2.1 Automatic Synchronization.-

(a) Set the Compass Transmitter Simulator to zero degrees.

(b) Set mode selector on Compass Controller to D.G. Mode.

(c) Set mode selector on Compass Controller to Magnetic Mode. The Servo Repeater Synchro dial pointer shall move to zero degrees $\pm 3/4$ of a degree.

(d) Set Compass Transmitter Simulator to 180 degrees.

(e) Repeat (b) and (c). Servo Repeater Synchro dial pointer shall turn 180 degrees in 10 seconds.

4.7.8.3 Scale Error.-

(a) Set the Compass Transmitter Simulator to zero degrees.

(b) Repeat 4.7.8.2.1 (b) and (c) (i.e. synchronize unit).

(c) Adjust the Compass Transmitter Simulator to every 30 degree setting (starting at zero degrees) and repeat 4.7.8.2.1 (b) and (c) (i.e. synchronize unit).

(d) Note the position of the Servo Repeater Synchro dial pointer after unit is synchronized. The maximum scale error shall not exceed 2 degrees at any point.

4.7.8.4 Correspondence Indicator Polarity Check.- Allow system to synchronize out by setting to Emergency Mode. Revert to Mag Mode and displace Compass Transmitter 30 degrees in a clockwise direction. Observe a positive d-c voltage polarity from pin F of J2002 to pin E of J2002.

4.7.9 Manual Synchronization (Course Setting).-

4.7.9.1 Fast Synchronization.-

(a) Turn the slow control on Controller Simulator clockwise to second detent. The Servo Repeater Synchro dial pointer shall turn clockwise through 5.6 \pm 1.4 revolutions in one (1) minute.

(b) Repeat (a) except turn the Controller Simulator dial knob counter-clockwise. The Servo Repeater Synchro dial pointer shall turn counter-clockwise through 5.6 \pm 1.4 revolutions in one (1) minute.

4.7.9.2 Slow Course Set.-

(a) Turn slow control on the Controller Simulator of Figure 2 clockwise to the first detent. The Servo Repeater Synchro dial pointer shall turn clockwise through 180 degrees \pm 50 degrees in one (1) minute.

(b) Repeat (a) except turn the slow control of Figure 2 counter-clockwise. The Servo Repeater Synchro dial pointer shall turn counter-clockwise through 180 degrees \pm 50 degrees in one (1) minute.

4.7.10 Turn Cutout Relay.- Turn cutout relay K2007 shall be energized with 27.5 volts dc at terminals J and F of J2003. Circuit continuity shall be established from terminal D of J2005 to terminal E of J2005. When the Compass Controller is set to Emergency Mode there shall be no continuity from terminal D of J2005 to terminal E of J2005.

4.7.11 System Compass Servo Amplifier Tests.- The Servo Amplifier shall be subjected to system individual tests in accordance with Specification MIL-C-21013.

4.7.12 Radio Noise Interference.- The electrical system of the Servo Amplifier shall be tested for conducted and radiated radio noise interference in accordance with Specification MIL-I-6181.

4.7.13 High Temperature Operation.- (This test may be conducted with the Section 4.7.15 High Exposure Test at the discretion of the testing agency.) The Servo Amplifier shall be tested in accordance with Procedure II of Specification MIL-E-5272, except that the exposure period shall be 4 hours. During the last 15 minutes of the 4 hour period, power shall be applied to the Servo Amplifier. At the end of the 4 hour period and with the temperature maintained at 71°C (160°F), the Servo Amplifier shall be subjected to and meet the requirements of Section 4.7.6.4 Scale Error. The Servo Amplifier shall then be returned to standard conditions and allowed to stabilize for a period of 4 hours after which it shall be operated and meet the requirements of Section 4.7.6.4 Scale Error. There shall be no damage which would adversely affect subsequent operation.

4.7.14 Low Temperature Operation.- (This test may be combined with the Section 4.7.16 Low Temperature Exposure Test at the discretion of the testing agency.) The Servo Amplifier shall be tested in accordance with Procedure I of Specification MIL-E-5272. The exposure period shall be 4 hours. During the last 15 minutes of the 4 hour period, power shall be applied to the Servo Amplifier. At the end of the 4 hour period and with the temperature maintained at -54°C (-65°F), the Servo Amplifier shall be subjected to and meet the requirements of the following sections: 4.7.6.4 Scale Error, 4.7.6.5 Response, 4.7.6.6 Stability, 4.7.6.7.1 Null, 4.7.6.7.2 Sensitivity, Phase and Limits, 4.7.6.7.3 Sensitivity, Phase and Limits, 4.7.8.1 Direction and Slaving Rate, 4.7.8.2 Synchro Indicator, 4.7.9 Manual Synchronization (Course

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Setting), and 4.7.10 Turn Cutout Relay. The Servo Amplifier shall then be returned to standard conditions and allowed to stabilize for a period of 4 hours after which it shall be operated and shall meet the requirements of Section 4.7.6.4 Scale Error. There shall be no damage which would adversely affect subsequent operation.

4.7.15 High Temperature Exposure.- The Servo Amplifier shall be placed within the test chamber. Internal temperature of the chamber shall be raised to $93^{\circ} \pm 2^{\circ}\text{C}$ ($200^{\circ} \pm 3.6^{\circ}\text{F}$). The Servo Amplifier shall be exposed to this temperature for a period of 24 hours. The temperature of the chamber shall then be lowered to 71°C (160°F) and the Servo Amplifier shall be tested in accordance with Procedure II of Specification MIL-E-5272, except that the exposure period shall be 4 hours. During the last 15 minutes of the 4 hour period, power shall be applied to the Servo Amplifier. At the end of the 4 hour period and with the temperature maintained at 71°C (160°F), the Servo Amplifier shall be subjected to and meet the requirements of Section 4.7.6.4 Scale Error. The Servo Amplifier shall then be returned to standard conditions and allowed to stabilize for a period of 4 hours after which it shall be operated and meet the requirements of Section 4.7.6.4 Scale Error. There shall be no damage which would adversely affect subsequent performance.

4.7.16 Low Temperature Exposure.- The Servo Amplifier shall be tested in accordance with Procedure II of Specification MIL-E-5272, except that the exposure periods shall be 24 hours at -62°C (-80°F) and 4 hours at -54°C (-65°F). During the last 15 minutes of the 4 hour period, power shall be applied to the Servo Amplifier. At the end of the 4 hour period and with the temperature maintained at -54°C (-65°F), the Servo Amplifier shall be subjected to and meet the requirements of the following sections: 4.7.6.4 Scale Error, 4.7.6.5 Response, 4.7.6.6 Stability, 4.7.6.7.1 Null, 4.7.6.7.2 Sensitivity, Phase and Limits, 4.7.6.7.3 Sensitivity, Phase and Limits, 4.7.8.1 Direction and Slaving Rate, 4.7.8.2 Synchro Indicator, 4.7.9 Manual Synchronization (Course Setting), and 4.7.10 Turn Cutout Relay. The Servo Amplifier shall then be returned to standard conditions and allowed to stabilize for a period of 4 hours after which it shall be operated and meet the requirements of Section 4.7.6.4 Scale Error. There shall be no damage which would adversely affect subsequent performance.

4.7.17 High Temperature - Altitude.- (This test may be run concurrently with the High Temperature Exposure Test.) The Servo Amplifier, properly connected with no power applied, shall be tested in accordance with Procedure VI of Specification MIL-E-5272, except that the temperature of the chamber shall be raised to 71°C (160°F), the pressure of the chamber shall be reduced to 3.4 inches of mercury (50,000 feet), and the duration of the exposure period shall be 4 hours. During the last 15 minutes of the 4 hour period, power shall be applied to the Servo Amplifier. At the end of the 4 hour period and with the temperature and pressure maintained as specified, the Servo Amplifier shall be subjected to and meet the requirements specified in Section 4.7.6.4 Scale Error.

4.7.18 Low Temperature - Altitude.- (This test may be run concurrently with the Low Temperature Exposure Test.) The Servo Amplifier, properly connected with no power applied, shall be tested in accordance with Procedure VI of Specification MIL-E-5272, except that the chamber shall be reduced to 8.9 inches of mercury (30,000 feet) and the duration of the exposure period shall be 4 hours. During the last 15 minutes of the 4 hour period, power shall be applied to the Servo Amplifier. At the end of the 4 hour period and with the temperature and pressure maintained as specified, the Servo Amplifier shall be subjected to and meet the requirements specified in Section 4.7.6.4 Scale Error.

4.7.19 Vibration.- The Servo Amplifier shall be tested in accordance with Paragraphs 4.7.12, 4.7.12.1, and 4.7.12.2 of Procedure XII of Specification MIL-E-5272. The high temperature portion of the vibration tests shall be conducted at 71°C (160°F). The Servo Amplifier shall be functioning in accordance with the requirements of this detail specification during the entire test period. Upon completion of the vibration period, the Servo Amplifier shall be examined for failures and tested in accordance with Sections 4.7.5 Voltage Measurements, 4.7.6 Directional Gyro Mode, 4.7.7 Emergency Mode, 4.7.8 Slaved Mode, 4.7.9 Manual Synchronization (Course Setting), and 4.7.10 Turn Cutout Relay.

4.7.20 Impact Shock.- The Servo Amplifier, when operating in accordance with Section 4.7.8 Slaved Mode, shall not suffer damage or subsequently fail to meet the operational performance requirements when subjected to peak impact shocks of 10 plus or minus 1.0g with each shock impulse having a maximum time duration of 12 milliseconds. Six shock impulses shall be applied in a vertical direction relative to the normal up right position of the unit. The test equipment shall be a sand box and drop rig, or equivalent, in accordance with Specification MIL-S-4456. Upon completion of the test, the Servo Amplifier shall operate in accordance with the requirements of Sections 4.7.6.4 Scale Error, 4.7.6.5 Response, and 4.7.6.6 Stability. Inspection of the Servo Amplifier shall reveal no mechanical damage or function weakness.

4.7.21 Life.- The Servo Amplifier shall be operated for a period of 1000 hours under the test condition specified in TABLE I.

TABLE I

<u>Conditions</u>	<u>Test Condition</u>	<u>Time</u>
1.	As described in Sections 4.7.6.4 Scale Error, 4.7.6.5 Response, 4.7.6.6 Stability, 4.7.8.1 Direction and Slaving Rate, 4.7.8.2 Synchro Indicator, and 4.7.8.3 Scale Error.	600
2.	The Servo Amplifier shall be subjected to a vibration of 0.002 to 0.005 inch amplitude and a frequency of 1500 to 2000 vibrations per minute. During this vibration, the following test shall be performed in accordance with Sections 4.7.6.4 Scale Error, 4.7.6.5 Response, 4.7.6.6 Stability, 4.7.8.1 Direction and Slaving Rate, 4.7.8.2 Synchro Indicator, and 4.7.8.3 Scale Error.	300
3.	Tests conducted in accordance with this specification as specified by the Inspector.	100

Nothing aforementioned shall be construed to indicate that Conditions 1, 2, and 3 may not be distributed in any manner through life test and that the total time under each condition has to be performed consecutively or without interruption. During this testing period, the Servo Amplifier shall comply with the requirements of Sections 4.7.6.4 Scale Error, 4.7.6.5 Response, and 4.7.6.6 Stability at intervals of not more than fifty hours with the component operating under Conditions 1 and 2, prescribed in TABLE I. Upon completion of 1000 hours of testing operation, the Servo Amplifier, without adjustments during the foregoing period, shall conform to the requirements of Sections 4.7.5 Voltage Measurements, 4.7.6 Directional Gyro Mode, 4.7.7 Emergency Mode, 4.7.8 Slaved Mode, 4.7.9 Manual Synchronization (Course Setting), and 4.7.10 Turn Cutout Relay.

4.7.22 Fungus Resistance.- The Servo Amplifier shall be tested in accordance with Procedure I of Specification MIL-E-5272, except that the test period shall be 14 days. At the conclusion of this test, visual inspection shall be made of the Servo Amplifier to determine whether any growth of fungus has occurred. At the option of the qualifying agency, tests of the component parts of the item may be accepted in lieu of tests of the assembled instrument.

4.7.23 Humidity.- The Servo Amplifier shall be tested in accordance with Procedure I of Specification MIL-E-5272, except that the total time of testing shall be 120 hours (5 cycles). At the conclusion of the 120 hour period, the equipment shall be returned to standard conditions. Moisture shall be removed by drying by air blast. The Servo Amplifier shall then be operated within one hour and shall meet the requirements of Sections 4.7.6.4 Scale Error, 4.7.6.5 Response, and 4.7.6.6 Stability. Examination for deterioration shall be made between 24 and 48 hours after completion of the humidity exposure. There shall be no evidence of corrosion or other deterioration which will affect the subsequent operation of the Servo Amplifier.

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4.7.24 Salt Spray.- The Servo Amplifier, with external connections made to simulate installed conditions, shall be tested in accordance with Procedure I of Specification MIL-E-5272, except that the test period shall be 50 hours. At the end of the 50 hour period, the Servo Amplifier shall be subjected to and meet the requirements specified in Sections 4.7.6.4 Scale Error, 4.7.6.5 Response, and 4.7.6.6 Stability. There shall be no evidence of corrosion or other deterioration which will affect subsequent operation of the Servo Amplifier.

5. PREPARATION FOR DELIVERY

5.1 Packaging.-

5.1.1 Level A.- The Servo Amplifier shall be packaged in accordance with Specification MIL-P-7936. The method of preservation shall be in accordance with Specification MIL-P-116, Method IID, using metal reusable containers.

5.1.2 Level C.- When this level is required, packaging shall be in accordance with standard commercial practice.

5.2 Packing.-

5.2.1 Levels A and B.- The Servo Amplifier shall be packed in accordance with Specification MIL-P-7936. The level or levels required shall be as specified in the invitation for bid or contract.

5.2.2 Level C.- The Servo Amplifier shall be packed to insure that the shipment arrives in a satisfactory condition at destination. The shipment shall conform to the applicable carriers rules and regulations in effect at the time of shipment.

5.3 Marking.- The interior and exterior containers shall be marked as specified in Specification MIL-P-7936.

5.3.1 Precautionary Marking.- The following precautionary marking shall appear on two opposite sides of each interior package and shipping container whenever practicable depending on the size of the carton:

FRAGILE
DELICATE INSTRUMENTS
HANDLE WITH CARE

6. NOTES

6.1 Intended Use.- The Servo Amplifier covered by this specification is a component of the MF-1 Compass, Directional Reference System which is intended for use in fighter, attack, patrol, transport, and cargo type aircraft whose range of operation will be world-wide, including polar regions, as well as all aircraft requiring medium precision heading reference stabilization. This system will provide directional information to remote indicators, electronic equipment, radar equipment, navigational equipment, and furnish directional control for autopilots, bomb directors, automatic approach equipment, and other auxiliary systems requiring directional reference intelligence. The main features of this new system are its precise directional accuracy, compactness, lightweight, reliability, flexibility of application, ease of installation and maintenance, compensation for magnetic deviation, correction for apparent gyro drift, and compass indication stability independent of latitude, as well as permitting the aircraft swing procedure to be accomplished rapidly and accurately.

6.2 Ordering Data.- Requisitions, contracts, and orders should state the MS part number of the Servo Amplifier desired, the quantity, and whether overseas packing is to be furnished.

6.3 Qualification.- With respect to products requiring qualification, awards will be made only for such products as have, prior to the bid opening date, been tested and approved for inclusion in the applicable Qualified Products List whether or not such products have actually been so listed by that date.

6.3.1 The attention of suppliers is called to this requirement and manufacturers are urged to arrange to have the products, that they propose to offer to the Federal Government, tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. Information pertaining to qualification of products covered by this specification may be obtained from the Bureau of Aeronautics, Department of the Navy, Washington 25, D.C., the qualifying agency.

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 in any way be related thereto.

SPECIFICATION ANALYSIS SHEET		Form Approved Budget Bureau No. 119-R004	
INSTRUCTIONS			
This sheet is to be filled out by personnel either Government or contractor, involved in the use of the specification in procurement of products for ultimate use by the Department of Defense. This sheet is provided for obtaining information on the use of this specification which will insure that suitable products can be procured with a minimum amount of delay and at the least cost. Comments and the return of this form will be appreciated. Fold on lines on reverse side, staple in corner, and send to preparing activity (as indicated on reverse hereof).			
SPECIFICATION			
ORGANIZATION (of submitter)		CITY AND STATE	
CONTRACT NO	QUANTITY OF ITEM PROCURED	DOLLAR AMOUNT	
MATERIAL PROCURED UNDER A			
<input type="checkbox"/> DIRECT GOVERNMENT CONTRACT		<input type="checkbox"/> SUBCONTRACT	
1. HAS ANY PART OF THE SPECIFICATION CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE? A. GIVE PARAGRAPH NUMBER AND WORDING.			
B. RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES.			
2. COMMENTS ON ANY SPECIFICATION REQUIREMENT CONSIDERED TOO RIGID			
3. IS THE SPECIFICATION RESTRICTIVE? <input type="checkbox"/> YES <input type="checkbox"/> NO IF "YES", IN WHAT WAY?			
4. REMARKS (Attach any pertinent data which may be of use in improving this specification. If there are additional papers, attach to form and place both in an envelope addressed to preparing activity)			
SUBMITTED BY (Printed or typed name and activity)		DATE	

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