MILITARY SPECIFICATION

TRANSOLVERS, GENERAL SPECIFICATION FOR

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

1. SCOPE

1.1 Scope. This specification covers the general requirements for transolvers. Transolvers are rotating inductive devices similar to synchros and electrical resolvers, types of which can convert a three winding system signal to a two winding system signal; convert a two winding system signal to a three winding system signal; or when used in a servo system with a three winding input signal, a quadrature winding of the two winding output signal can be used for the purpose system monitoring. Either element can be supplied with electrical angular information, and the output element transmits a voltage proportional to the sine and the cosine or sine as applicable of the electrical input angle and the rotor angle with respect to the stator.

1.2 Classification.

1.2.1 Type designation. The type designation shall be in the following form, and as specified (see 3.1 and 6.2):

26	08	T	S	Y	3	40	A
Voltage (1.2.1.1)	Size (1.2.1.2)	Function (1.2.1.3)	Primary element (1.2.1.4)	Primary winding (1.2.1.5)	Secondary winding (1.2.1.6)	Excitation frequency (1.2.1.7)	Modification (1.2.1.8)

1.2.1.1 Voltage. For 115 volts units, this space will be left blank. All other units will be designated with the supply voltage to the primary element.

1.2.1.2 Size. These two digits will designate the maximum diameter in tenths of an inch. If the diameter is not exactly a whole number of tenths, the next higher tenth shall be used.

1.2.1.3 Function. The letter "T" designates transolver.

1.2.1.4 Primary element. The primary element shall be applicably identified as either R for rotor or S for stator.

1.2.1.5 Primary winding. The primary winding shall be indicated as follows:

Y - Three windings, wye connected, three leads.
3 - Two windings, perpendicular to each other, three leads.
4 - Two windings, perpendicular to each other, four leads.

1.2.1.6 Secondary winding.

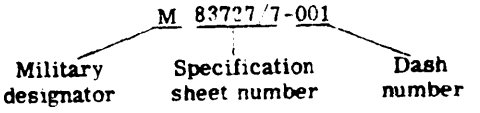
Y - see (1.2.1.5)
3 - see (1.2.1.5)
4 - see (1.2.1.5)

1.2.1.7 Excitation frequency. The rated frequency code shall be in multiples of ten as illustrated below:

Excitation frequency (Hz)	Code
60	6
323	32.3
400	40
800	80

1.2.1.8 Modification. The letter "A" following the frequency digits shall indicate the original or basic issue of a standard transolver type designation. The first modification that affects the external mechanical dimensions or the electrical characteristics of the basic type shall be indicated by succeeding upper case letters "B", "C", "D", etc.

1.2.2 Military part number. The military part number shall consist of the letter "M", the basic number of the specification sheet, and an assigned dash number (see 3.1) as shown in the following:



2. APPLICABLE DOCUMENTS

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

SPECIFICATIONS

FEDERAL

QQ-A-250/4 - Aluminum Alloy, Plate and Sheet, 2024.
QQ-B-613 - Brass, Leaded and Non-leaded; Flat Products, (Plate, Bar, Sheet and Strip).
QQ-B-637 - Brass, Naval: Rod, Wire, Shapes, Forgings, and Flat Products with Finished Edges (Bar, Flat Wire, and Strip).
QQ-S-764 - Steel Bar, Corrosion Resisting, Free Machining.
PPP-B-566 - Boxes, Folding, Paperboard.
PPP-B-636 - Box, Fiberboard.
PPP-B-676 - Boxes, Setup.
PPP-T-60 - Tape: Pressure-Sensitive Adhesive, Waterproof, for Packaging.
PPP-T-76 - Tape, Pressure-Sensitive Adhesive, Paper (for Carton Sealing).

MILITARY

MIL-P-116 - Preservation, Methods of.
MIL-W-583 - Wire, Magnet, Electrical.
MIL-S-6872 - Soldering Process, General Specification for.
MIL-A-8625 - Anodic Coatings for Aluminum and Aluminum Alloys.
MIL-W-16878/4 - Wire, Electrical, Type E, 200° C and 260° C., 600 Volts. (Insulated, High Temperature).
MIL-C-45662 - Calibration System Requirements.

(See Supplement 1 for list of applicable specification sheets.)

STANDARDS

MILITARY

MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes.
MIL-STD-129 - Marking for Shipment and Storage.
MIL-STD-130 - Identification Marking of U.S. Military Property.
MIL-STD-147 - Palletized and Containerized Unit Loads 40" x 48" 4-Way (Partial) Pallet Skids, Runners, or Pallet-Type Base.
MIL-STD-202 - Test Methods for Electronic and Electrical Component Parts.
MIL-STD-461 - Electromagnetic Interference Characteristics Requirements for Equipment.

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

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.

NATIONAL BUREAU OF STANDARDS

Handbook H28 - Screw-Thread Standards for Federal Services.

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

ABMA Standard - ABEC-5

(Application for copies should be addressed to the American Boiler Manufacturer's Association and Affiliated Industries, 1180 Raymond Boulevard, Newark, New Jersey 07102.)

(Technical society and technical association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.)

3. REQUIREMENTS

3.1 Specification sheets. The individual item requirements shall be as specified herein and in accordance with the applicable specification sheet.

3.2 Qualification. Transolvers furnished under this specification shall be products which are qualified for listing on the applicable qualified products list at the time set for the opening of the bids except sole source items and low usage replaceable parts (see 4.4 and 6.5).

3.3 First article. Transolvers furnished under this specification which are sole source items or low usage replaceable parts not intended for new design shall be products which have passed the first article inspection specified in 4.5 (see 6.6).

3.4 Material. The material shall be as specified herein. However, when a definite material is not specified, a material shall be used which will enable the transolvers to meet the performance requirements of this specification. Acceptance or approval of any constituent material shall not be construed as a guaranty of the acceptance of the finished product.

3.4.1 Metals. Metals shall be of corrosion-resistance type or suitably processed to resist corrosion.

3.4.1.1 Aluminum. Aluminum shall conform to QQ-A-250/4.

3.4.1.2 Steel. Steel shall conform to QQ-S-764, class 416.

3.4.1.3 Brass. Brass shall conform to QQ-B-613.

3.4.2 Dissimilar metals. Dissimilar metals shall not be used in intimate contact unless suitably protected against electrolytic corrosion. When it is necessary that any combination of such dissimilar metals be assembled, an interposing material compatible to each shall be used. Dissimilar metals are defined as follows:

Group I	Group II	Group III
Aluminum	Zinc	Copper and its alloys
Aluminum alloys	Cadmium	Nickel and its alloys
Zinc	Steel	Chromium
Cadmium	Lead	Stainless steel
Tin	Tin	Gold
Stainless steel	Stainless steel	Silver
Tin lead (solder)	Tin lead (solder)	Most cathodic

Note:

a. Contact between a member of any one group and another member of the same group shall be considered as similar. Contact between a member of one group and a member of any other group shall be considered as dissimilar, except for zinc, tin, and cadmium, as listed in Groups I and II, and stainless steel as listed in groups I, II, and III.
b. Unless specifically approved by the procuring activity, all other metals shall be considered dissimilar with respect to each other and with respect to any of the materials listed.
c. The above grouping is intended to serve as a guide in selecting materials to be used in electronic equipment, and shall not be construed to waive requirements herein or in the detail specification sheet pertaining to corrosion resistance of components and assemblies. In particular, care shall be exercised in using aluminum alloys against each other or against differing materials.
d. Where reference is made to a metal in a particular group, the reference applies to the metal on the surface of the part; that is, zinc means castings as well as zinc electroplate, zinc hot dip, or zinc metal spray.
e. Different metals in contact, even though similar shall be employed in assemblies in such manner that the smaller part is cathodic or protected and the larger part is anodic or corroded, if any corrosion takes place.
f. Certain qualified standard or approved non-standard parts and attaching hardware have tin or nickel-plate finish. These parts may be mounted on a chassis without additional protection from corrosion.

3.4.2.1 Protection against electrolytic corrosion. Where it is necessary that any combination of dissimilar metals be assembled, the following methods or combination of methods shall be employed for the alleviation of electrolytic corrosion, unless electrical considerations preclude the employment of such methods:

a. Interposition of a material compatible to each to decrease electrolytic potential differences, such as cadmium or zinc plate on steel on contact with aluminum.
b. Interposition of an inert material between the dissimilar metals to act as a mechanical and insulating barrier.
c. Application of organic coatings to the contact faces of each of the dissimilar metals, such as paint coats on steel and aluminum surfaces in contact.
d. Application of corrosion inhibitors to the faces of each of the dissimilar metals, such as zinc-chromate paste on nickel-plated brass screws in contact with aluminum.
e. Design of dissimilar metal or similar metal contacts, in order that the area of the cathodic metal is relatively smaller than the area of the anodic metal, such as screws of stainless steel or nickel-plated brass in contact with aluminum.
f. Limitation of amount of aeration reaching the dissimilar metal faces, such as steel bolts in aluminum with all surfaces of contact sealed with zinc-chromate primer, vinyl films, or equivalent.
g. Any other systems of protection which are designed to alleviate electrolytic corrosion shall be subject to the approval of the procuring activity.

3.4.3 Plastics. Plastics shall be of such composition and workmanship to conform with all aspects of this document.

3.4.4 Fungus and moisture resistant materials. Materials which are not nutrients for fungi and which are moisture resistant shall be used.

3.4.5 Lubricants. All suppliers shall use lubricants consistent with all requirements of the applicable specification sheet in reference to temperature, life, speed, and environmental conditions.

3.4.6 Housing material. Housing material shall conform to QQ S-764, class 416.

3.4.7 Rotor shaft material. Rotor shaft material shall have a Rockwell hardness C20-C32 and shall conform to QQ-S-764, class 416.

3.4.8 Slip rings and brush collectors.

3.4.8.1 Slip rings. Slip rings shall be of gold alloy.

3.4.8.2 Brush collectors. Brush collectors shall be of silver alloy. The best design capability shall be achieved.

3.4.9 Bearings. Ball bearings of the radial thrust type shall be used. Balls, races, retainers, and shields shall be of corrosion resisting steel, and shall conform to ABMA Standard ABEC-5, or better.

3.4.10 Magnet wire. Magnet wire shall conform to MIL-W-583, class 130 or higher.

3.4.11 Terminal lead wire. Terminal lead wire shall conform to MIL-W-16878/4 and shall be a minimum of 18 $^{+1}_{-0}$ inches long.

3.4.12 Restricted material. Flammable or explosive material, material which can produce toxic or suffocating fumes, magnesium or magnesium alloys, and mercury and compounds containing mercury shall not be used.

3.5 Design and construction. Unless otherwise specified (see 6.2), transolvers shall be of the design, construction, and physical dimensions specified (see 3.1).

3.5.1 Protective coatings. All transolvers and transolver parts shall be suitably protected so as to be resistant to destructive deterioration caused by the corrosive conditions experienced in service. Destructive deterioration shall be construed as being any type of corrosion which could in any manner prevent the transolvers from meeting performance requirements of this document during service life. Where cleaning operations on metal parts are not specified in detail, they shall be in accordance with approved government specifications or commercial practices which will not cause any subsequent corrosion. Any procedure which would cause malfunction or unreliability shall not be used. All parts made of aluminum or aluminum alloys shall be anodized in accordance with MIL-A-8625.

3.5.2 Soldering. Soldering shall be in accordance with MIL-S-6872.

3.5.3 Threaded parts. All screw threads used in the construction of transolvers shall be in accordance with the National Bureau of Standards Handbook H-28 - "Screw-Thread Standards for Federal Services." The number of threads and general dimensions shall be those specified for the American National Coarse-Thread series of the American National Fine-Thread series. Threads of the coarse-thread series are preferred, except where definite improvements in design or operating characteristics would be affected by use of fine-thread series.

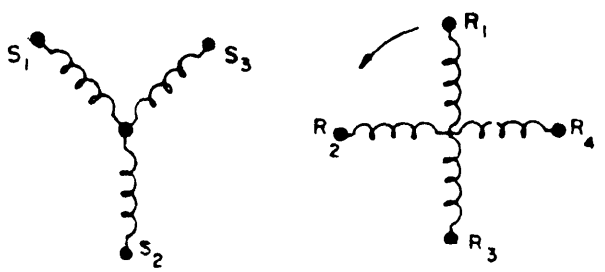
3.5.4 Impregnating and potting compounds. A compound shall not, at any time of application or life of the unit, have any injurious effect upon the insulation or contacting materials. The compound shall not crack or flow under the temperature range referenced in this document.

3.5.5 Cast or molded thermosetting materials. When used for insulation, parts fabricated from cast or molded thermosetting plastic materials shall be impregnated with a suitable material and dried after all machining and punching operations have been completed. Materials having moisture absorption of less than 1.04 percent shall not require impregnation.

3.5.6 Input voltage and frequency. The transolver shall be designed to operate at the input voltage and frequency specified in the applicable specification sheet.

3.5.7 Transolver electrical angle. The electrical angle shall be the angle which satisfies the relative magnitudes and polarities of the secondary voltages of an ideal transolver in accordance with the equations of 3.5.7.1 thru 3.5.7.6, as applicable.

3.5.7.1 Type SY4: Stator excited; stator wye connected; rotor two perpendicular windings, four wire leads.



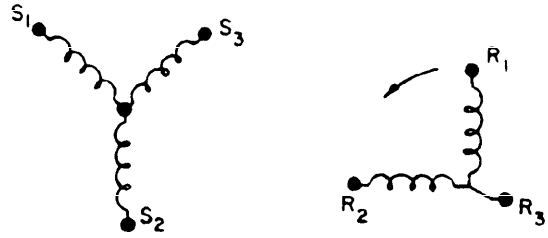
$$ER_{1-3} = N\left[ES_{1-3}\,\mathrm{Cos}(\theta + 120^{\circ}) + ES_{3-2}\,\mathrm{Cos}\,\theta\right]$$

$$ER_{2-4} = N\left[ES_{1-3}\,\mathrm{Sin}(\theta + 120^{\circ}) - ES_{3-2}\,\mathrm{Sin}\,\theta\right]$$

$$\text{and } ES_{1-3} + ES_{3-2} + ES_{2-1} = 0$$

FIGURE 1.

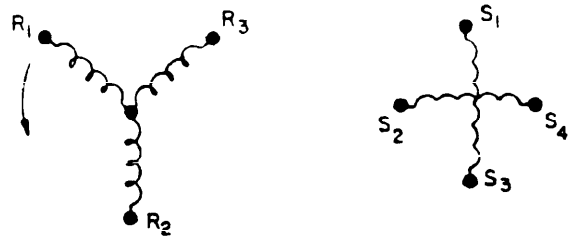
3.5.7.2 Type 13: Stator excited; stator wye connected; rotor two perpendicular windings, three wire leads - common wire.



$$ER_{1-3} = N\left[-ES_{1-3}\ \mathrm{Cos}\ (\theta + 120^\circ) + ES_{3-2}\ \mathrm{Cos}\ \theta\right]$$
$$ER_{2-3} = N\left[ES_{1-3}\ \mathrm{Sin}\ (\theta + 120^\circ) - ES_{3-2}\ \mathrm{Sin}\ \theta\right]$$
$$\text{and } ES_{1-3} + ES_{3-2} + ES_{2-1} = 0$$

FIGURE 2.

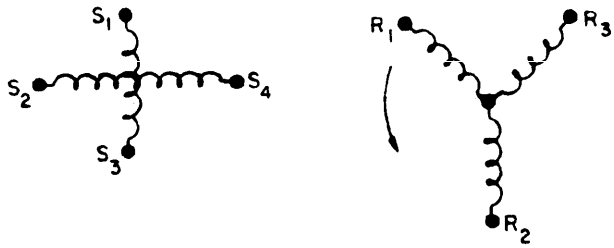
3.5.7.3 Type RY4: Rotor excited; rotor wye connected; stator two perpendicular windings, four wire leads.



$$ES_{1-3} = N\left[-ER_{1-3}\ \mathrm{Cos}\ (\theta + 240^\circ) + ER_{3-2}\ \mathrm{Cos}\ \theta\right]$$
$$ES_{2-4} = N\left[-ER_{1-3}\ \mathrm{Sin}\ (\theta + 240^\circ) + ER_{3-2}\ \mathrm{Sin}\ \theta\right]$$
$$\text{and } ER_{1-3} + ER_{3-2} + ER_{2-1} = 0$$

FIGURE 3.

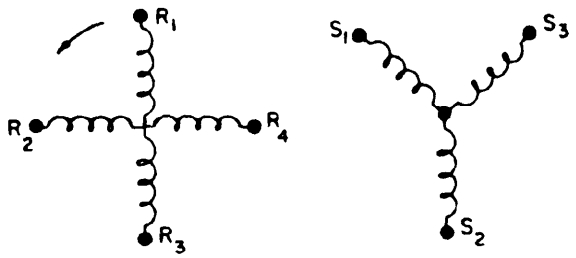
3.5.7.4 Type S4Y: Stator excited; stator two perpendicular windings, four wire leads; rotor wye connected.



$$ER_{1-3} = N\left[-ES_{1-3}\ \mathrm{Sin}\ \theta + ES_{2-4}\ \mathrm{Cos}\ \theta\right]$$
$$ER_{3-2} = N\left[-ES_{1-3}\ \mathrm{Sin}\ (\theta + 240^\circ) + ES_{2-4}\ \mathrm{Cos}\ (\theta + 240^\circ)\right]$$
$$ER_{2-1} = N\left[-ES_{1-3}\ \mathrm{Sin}\ (\theta + 120^\circ) + ES_{2-4}\ \mathrm{Cos}\ (\theta + 120^\circ)\right]$$

FIGURE 4.

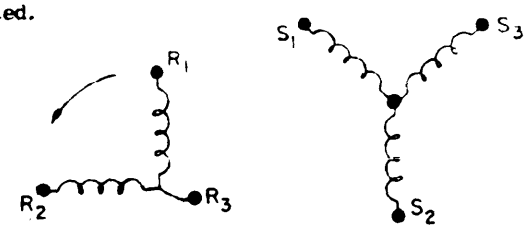
3.5.7.5 Type R4Y: Rotor excited; rotor two perpendicular windings, four wire leads, stator wye connected.



$$E(S_{1-3}) = N\left[E(R_{1-3}) \sin \theta + E(R_{2-4}) \cos \theta\right]$$
$$E(S_{3-2}) = N\left[E(R_{1-3}) \sin (\theta + 120^\circ) + E(R_{2-4}) \cos (\theta + 120^\circ)\right]$$
$$E(S_{2-1}) = N\left[E(R_{1-3}) \sin (\theta + 240^\circ) + E(R_{2-4}) \cos (\theta + 240^\circ)\right]$$

FIGURE 5.

3.5.7.6 Type R3Y: Rotor excited; rotor two perpendicular windings, three wire leads - common wire; stator wye connected.



$$E(S_{1-3}) = N\left[E(R_{1-3}) \sin \theta + E(R_{2-3}) \cos \theta\right]$$
$$E(S_{3-2}) = N\left[E(R_{1-3}) \sin (\theta + 120^\circ) + E(R_{2-3}) \cos (\theta + 120^\circ)\right]$$
$$E(S_{2-1}) = N\left[E(R_{1-3}) \sin (\theta + 240^\circ) + E(R_{2-3}) \cos (\theta + 240^\circ)\right]$$

FIGURE 6.

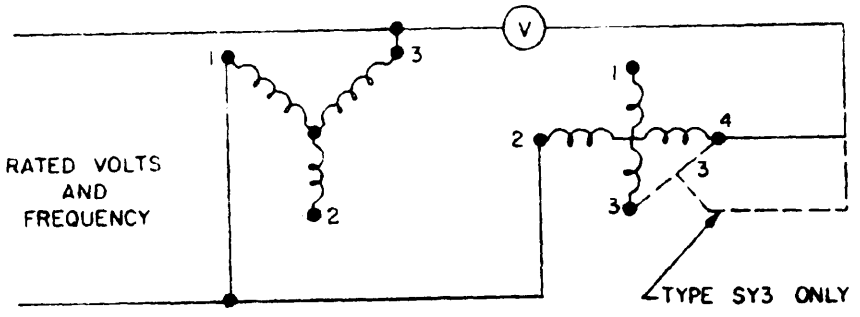
NOTE: Where N is the transformation ratio, R (or S) represents the element, i.e. R_{1-3} indicates the rotor with the instantaneous phasing from terminal 1 to terminal 3. Other voltages are similarly defined.

3.5.8 Transolver zero.

3.5.8.1 Transolver zero for wye connected primary - rotor or stator.

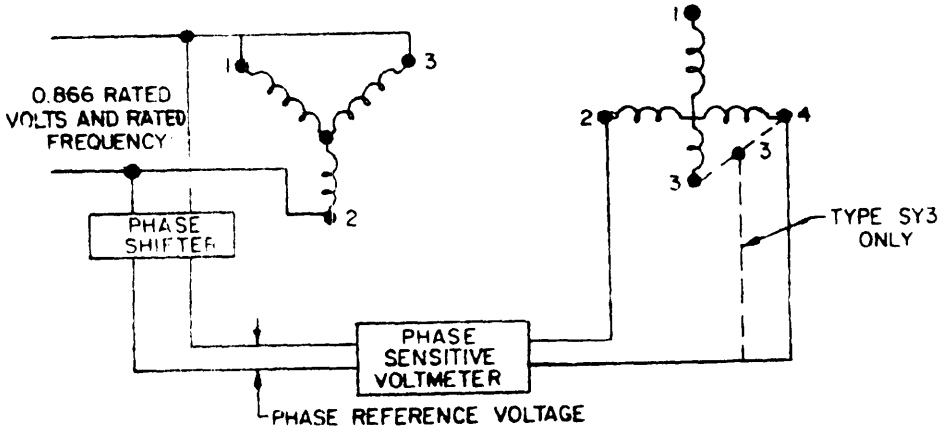
3.5.8.1.1 Types SY3 and SY4. The zero position of a transolver is that position of the rotor with respect to the stator at which minimum voltage is induced in the secondary winding, quadrature winding, Secondary 2-4 1/, when the circuit is energized by applying 0.866 times the rated voltage between $Primary_2$ and the terminal $Primary_1$ which is connected to $Primary_3$. It is so determined that for small deflections of the rotor counterclockwise from transolver zero that the induced voltage in the secondary winding, Secondary 2-4 1/, is approximately in time phase with the primary voltage at terminals Primary 2-1 and Primary 2-3. The minimum voltage position is defined as the point where the secondary voltage of fundamental frequency, that is in time phase with the secondary voltage at maximum coupling, is zero. Figure 7 shows the diagrams for determining the transolver zero position.

1/ For type SY3, secondary circuit is (2-3).



The correct coarse transolver zero position is that one which produces the minimum voltage reading.

FIGURE 7A. Coarse transolver zero for wye connected element - types RY4, SY3, SY4.



With the phase sensitive voltmeter in the in phase position and the shaft positioned as per 7A above, rotate the transolver shaft through the smallest angle that will produce a zero reading on the null meter. That position is the transolver zero position.

FIGURE 7B. Fine transolver zero for wye connected element - types RY4, SY3, SY4.

FIGURE 7. Transolver zero position - wye connected element.

3.5.8.1.2 Type RY4. The zero position of a transolver is that position of the rotor with respect to the stator at which minimum voltage is induced in the secondary winding, quadrature winding, Secondary 2-4, when the circuit is energized by applying 0.886 times the rated voltage between the terminal Primary 1, which is connected to Primary 3 and terminal Primary 2. It is so determined that for small deflections of the rotor counterclockwise from transolver zero that the induced voltage in the secondary winding, Secondary 2-4, is approximately in time phase with the primary voltage between the terminal Primary 1, which is connected to Primary 3, and terminal Primary 2. The minimum voltage position is defined as the point where the secondary voltage of fundamental frequency, that is in time phase with the secondary voltage at maximum coupling, is zero. Figure 7 shows the diagrams for determing the transolver zero position.

3.5.8.2 Transolver zero for two perpendicular windings primary - rotor or stator.

Types S4Y, R3Y, and R4Y.

The zero position of a transolver is that position of the rotor with respect to the stator at which minimum voltage is induced in the secondary winding, Secondary 1-3, and at which the secondary voltages at terminals, Secondary 1-2 and Secondary 3-2 are approximately in time phase with the primary voltage when the transolver is energized by applying 1/5 rated voltage between terminals, Primary 1-3 and with the primary winding, Primary 2-4 [1/] short circuited. The minimum voltage of fundamental frequency, that is in time phase with the secondary voltage at maximum coupling, is zero. Figure 8 shows the diagrams for determining the transolver zero position.

3.5.9 Transolver construction.

3.5.9.1 Wire leads and terminals identification.

3.5.9.1.1 Wire leads. When wire leads are specified, each lead shall be designated every 1/2 inch with the applicable letter and number; e.g., R_1. Each wire lead shall be capable of withstanding a pulling force of 1 pound for size 05 units or 2 pounds for sizes 08 and larger, without insulation damage, breakage of strands or leads pullout when tested in accordance with 4.7.21.1.

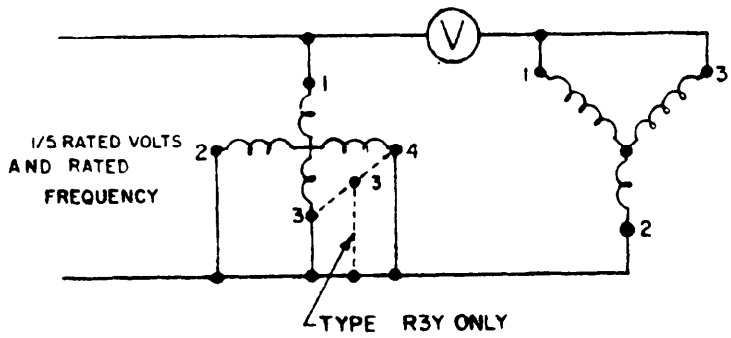
3.5.9.1.2 Terminals (screw or solder type). When terminals are specified, the basic end cap configuration shall provide space for 8 terminals. These terminals shall be identified as R_1, R_2, R_3, and R_4; S_1, S_2, S_3, and S_4. All unused terminal positions shall be closed.

3.5.9.2 Sleeving. If sleeving is used, a red sleeve shall be used for rotor leads and a black sleeve shall be used for stator leads.

3.5.9.3 Transolver zero marking. A mark shall be scribed on the housing to aline with the scribe mark on the end of the shaft to indicate electrical zero $\pm 10^\circ$.

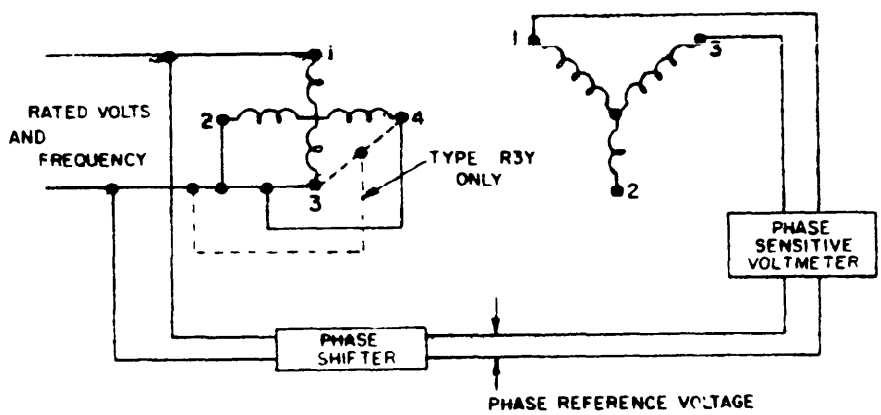
3.5.10 Identification marking. Transolvers shall be identified with marking conforming to figure 9 and MIL-STD-130. Marking shall be applied by acid or electric etching, permanent marking ink, or engraving applied directly to the housing. Serial numbers shall be assigned sequentially under each contract.

[1/] For type R3Y, primary circuit is (2-3).



The correct coarse transolver zero position is that one which produces the minimum voltage reading.

FIGURE 8A. Coarse transolver zero two perpendicular winding element - types S4Y, R3Y, R4Y.

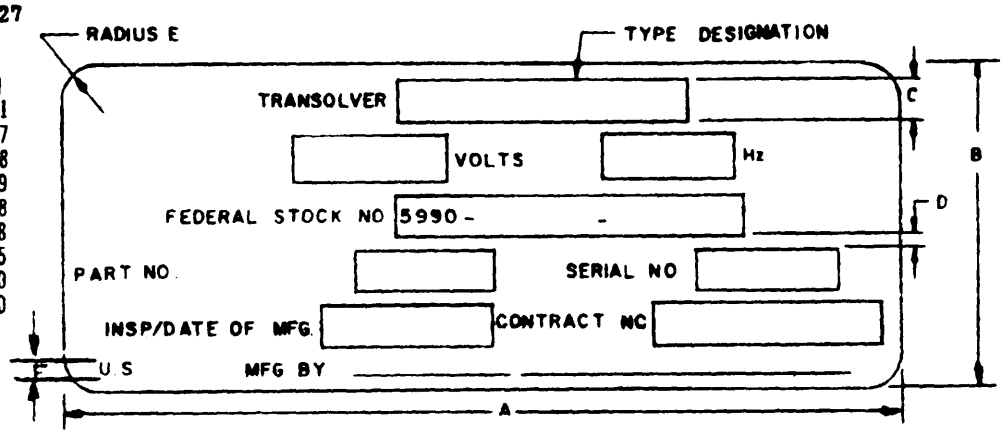


With the phase sensitive voltmeter in the in phase position and the shaft positioned as per 8A above, rotate the transolver shaft through the smallest angle that will produce a zero reading on the null meter. That position is the transolver zero position.

FIGURE 8B. Fine transolver zero - Types S4Y, R3Y, R4Y.

FIGURE 8. Transolver zero position – two perpendicular winding element.

INCHES	MM
.02	.51
.046	1.17
.062	1.58
.09	2.29
.125	3.18
.625	15.88
.750	19.05
1.50	38.10
3.00	76.20



Transolver size	A	B	C	D	E	F
Size 10 and smaller	1.50	.625	.09	.02	.125	.046
Size 11 and larger	3.00	.750	.09	.02	.125	.062

FIGURE 9. Identification marking.

3.6 Temperature rise. When tested in accordance with 4.7.2, the temperature rise of transolvers shall not exceed the value specified in the applicable specification sheet.

3.7 Variation of voltage and frequency. Transolvers shall be capable of operating from power sources subject to plus or minus 10 percent voltage regulation in combination with frequency variation of plus or minus 5 percent, when tested in accordance with 4.7.3, the power drawn from the source shall not exceed that specified in the specification sheet.

3.8 Impedance. The value of impedance shall be as specified in the applicable specification sheet, when tested in accordance with 4.7.4.

3.9 Electromagnetic interference. Transolvers shall not exceed the limits of MIL-STD-461, requirements CEO3 and REO2 of Equipment Class IIB, when tested in accordance with 4.7.5.

3.10 Vibration. The transolver shall be capable of withstanding vibrations at frequencies up to 2,000 Hz at a force of 15G's without damage or loosening of parts. After testing in accordance with 4.7.6, all transolvers shall be tested in accordance with table II.

3.11 Brush contact resistance variation. When tested in accordance with 4.7.7, the variation in brush contact resistance, after the third revolution of the rotor, shall not exceed ±1.5 ohms or ±0.75 percent of the rotor DC resistance, whichever is greater. Additionally, the resistance variation in excess of this requirement shall not be greater than 5 milliseconds in duration.

3.12 Electrical error. When tested in accordance with 4.7.8, the electrical error of the transolver shall not exceed the value specified in the applicable specification sheet.

3.13 Null voltage. When tested in accordance with 4.7.9, the fundamental null voltage and the total null voltage shall not exceed the values specified in the applicable specification sheet.

3.14 Friction torque. When tested in accordance with 4.7.10, the torque required to turn the rotor shall not exceed the values specified in the applicable specification sheet.

3.15 Radial and end play. When tested in accordance with 4.7.11, the radial and end play of the transolver rotor shall not exceed the values specified in the applicable specification sheet.

3.16 Dielectric withstanding voltage. Transolvers shall display no evidence of internal arcing or insulation breakdown when tested in accordance with 4.7.12. The leakage current shall not exceed 1 peak milliampere.

3.17 Insulation resistance. When tested in accordance with 4.7.13, the insulation resistance of the transolver shall be at least 50 megohms at the standard test condition and at -55 degrees C, and at least 10 megohms at 125 degrees C. Upon completion of the dielectric withstanding voltage test, the transolver shall be maintained at the standard test condition for a period of 24 hours after which the resistance shall be at least 25 megohms.

3.18 Shock.

3.18.1 Low impact. All transolvers shall be capable of withstanding shock blows at an acceleration of 50G's of 11 ± 1 millisecond duration without damage, loosening of parts, or degradation of performance characteristics. After testing in accordance with 4.7.14.1, all transolvers shall meet the requirements as shown in table II.

3.18.2 High impact. All transolvers shall be capable of withstanding shock blows of 400, 1,200, and 2,000 foot-pounds without suffering irreparable damage. After testing in accordance with 4.7.14.2, all transolvers shall meet the requirements of table II, with 50 percent or less degradation of specified characteristics accepted.

3.19 Altitude. All transolvers shall be capable of operation from sea level to 100,000 feet in combination with any ambient temperature from -55 degrees C to +125 degrees C. After testing in accordance with 4.7.15, all transolvers shall meet the requirements as shown in table II.

3.20 Endurance. All transolvers shall be energized and subjected to 2,000 hours of continuous operation at 600 rpm without failure or undue wear. After testing in accordance with 4.7.16, all transolvers shall meet the requirements as shown in table II.

3.21 Ambient temperature. All transolvers shall be capable of storage in ambient temperatures ranging from -62 degrees C to +100 degrees C, and shall be capable of operation in ambient temperatures ranging from -55 degrees C to +125 degrees C. After testing in accordance with 4.7.17, all transolvers shall meet the requirements as shown in table II.

3.22 Moisture resistance. All transolvers shall be capable of operation and storage in an atmosphere of high relative humidity. After testing in accordance with 4.7.18, transolvers shall be maintained unenergized, at the standard test condition for a period of 24 hours and shall then meet the requirements as shown in table II.

3.23 Salt atmosphere resistance. When required by the specification sheet, transolvers shall be capable of withstanding atmospheres saturated with salt-laden moisture. After testing in accordance with 4.7.19, transolvers shall be disassembled and visually inspected for evidence of destructive deterioration as specified in 3.5.1.

3.24 Life. All transolvers shall be designed for a minimum life span of 18 months. This span shall include the storage and actual operation time. Degradation for this period shall not exceed the requirements contained herein and in the applicable specification sheet.

3.25 Wire lead and terminal stress.

3.25.1 Wire leads. When wire leads are specified, each lead shall be capable of withstanding a pulling force of 1 pound for size 05 units and 2 pounds for sizes 08 and larger, without insulation damage, breakage of strands or leads pull out when tested in accordance with 4.7.21.1.

3.25.2 Terminals (screw or solder pin type). When terminals are specified, each terminal shall be capable of withstanding a 4.5 pounds-inch torque or a two-pound pulling force without movement or discernable damage when tested in accordance with 4.7.21.2.

3.26 Primary current and power. The values of primary current and energizing power of each winding of the transolver shall be as specified in the applicable specification sheet, and the primary power shall not vary more than 2 percent of the maximum measured value as the rotor is rotated through a complete revolution (see 4.7.22)

3.27 Transformation ratio. When tested in accordance with 4.7.23, the value of the transformation ratio shall be as specified in the applicable specification sheet.

3.28 Phase shift. When tested in accordance with 4.7.24, the value of phase shift shall be as specified in the applicable specification sheet.

3.29 Interaxis error. When tested in accordance with 4.7.25, the interaxis error shall not exceed the value specified in the applicable specification sheet.

3.30 DC resistance. When tested in accordance with 4.7.26, the dc resistance of the rotor and stator windings shall be as specified in the applicable specification sheet.

3.31 Workmanship. The transolvers, including all parts and accessories shall be manufactured and finished in a thoroughly workmanlike manner. Particular attention shall be paid to neatness and thoroughness of soldering, wiring, marking, and plating. All dimensions and tolerances not specified shall be consistent with the best engineering practice. Where dimensions and tolerances affect the interchangeability, operation, or performance of the transolver, they shall be held or limited accordingly. All material shall be sound, of uniform quality and condition, and free from seams, cracks, and other defects which may adversely affect the strength, endurance, or wear of the part. Any material hammered, filed, or treated in any other manner to conceal defects therein shall be subject to immediate rejection.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilize his own facilities or any commercial laboratory acceptable to the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 Test equipment and inspection facilities. The supplier shall establish and maintain a calibration system in accordance with MIL-C-45662.

4.2 Classification of inspections. The inspections specified herein are classified as follows:

(a) Qualification inspection (see 4.4).
(b) First article inspection (see 4.5).
(c) Quality conformance inspection (see 4.6).

4.3 Inspection conditions.

4.3.1 Standard test conditions. Unless otherwise specified herein, all tests and measurements shall be made within the temperature, atmospheric pressure, and relative humidity limits as follows:

Temperature	-	23 degrees ± 5° C.
Pressure	-	650 to 800 MM of Hg.
Humidity	-	No greater than 55 percent relative humidity.

4.3.2 Standard test voltage and frequency. Unless otherwise specified, the test voltage and frequency shall be as specified in table I and shall have a tolerance of ± 1 percent on voltage and frequency, and a total harmonic content of less than 1 percent. The voltage and approximate time phase shall be in accordance with the applicable equations of 3.5.7.

4.3.3 Stabilized operating temperature. The stabilized operating temperature is the temperature condition of a transolver when the dc resistance measurement of the windings, energized in accordance with 4.3.2 and taken at fifteen-minute intervals, does not indicate a change of more than 0.5 percent from the preceding measurement.

4.3.4 Standard test fixture. Unless otherwise specified, each test shall be performed with the transolver mounted on the standard test fixture detailed on figure 10.

4.3.5 Alternative test methods. All tests shall be performed in accordance with the test methods detailed herein. Authorization for the use of alternative test methods must be obtained from the qualifying activity in the case of qualification inspection and from the procuring activity in the case of other inspections.

4.4 Qualification inspection. Qualification inspection shall be performed at a laboratory acceptable to the Government (see 6.5) on sample units produced with equipment and procedures normally used in production.

4.4.1 Sample size. Four transolvers of each type shall be subjected to qualification inspection.

4.4.2 Inspection routine. The sample shall be subjected to the inspection specified in table II in the order shown. After completion of group I tests, the sample shall be divided into the remaining groups shown in table II and subjected to the tests for their particular group.

4.4.3 Failures. Failure of any transolver in any test shall be cause for refusal to grant qualification approval.

4.4.4 Retention of qualification. In order to retain qualification, qualification inspection shall be conducted every 24 months, or as directed by the qualifying activity.

TABLE I. Standard test energising connections.

Type	Primary			Voltage in approx. time phase secondary winding	Secondary terminals
	Volts at rated freq.	Terminals	Shorted terminals		
SY4	.866E	S_1S_3-S_2	---	R_1-R_3	R_2-R_4
SY3	.866E	S_1S_3-S_2	---	R_1-R_3	R_2-R_3
RY4	.866E	R_1R_3-R_2	---	S_1 S_3	S_2-S_4
S4Y	E	S_1-S_3	S_2-S_4	R_1-R_2 and R_3-R_2	R_1-R_3
R4Y	E	R_1-R_3	R_2-R_4	S_1-S_2 and S_3-S_2	S_1-S_3
R3Y	E	R_1-R_3	R_2-R_3	S_1-S_2 and S_3-S_2	S_1-S_3

TABLE II. Qualification inspection.

Examination or test	Requirement paragraph	Method paragraph
Group I - all of sample		
Visual and mechanical examination	3.1, 3.4 to 3.5.3 incl, 3.5.9, 3.5.10 and 3.31	4.7.1
Temperature rise	3.6	4.7.2
Variation of voltage and frequency	3.7	4.7.3
Impedance	3.8	4.7.4
Electromagnetic interference	3.9	4.7.5
Vibration	3.10	4.7.6
Brush contact resistance	3.11	4.7.7
Electrical error	3.12	4.7.8
Null voltage	3.13	4.7.9
Friction torque	3.14	4.7.10
Radial and end play	3.15	4.7.11
Dielectric withstanding voltage	3.16	4.7.12
Insulation resistance	3.17	4.7.13
Shock, low impact	3.18.1	4.7.14.1
Brush contact resistance	3.11	4.7.7
Electrical error	3.12	4.7.8
Null voltage	3.13	4.7.9
Friction torque	3.14	4.7.10
Radial and end play	3.15	4.7.11
Dielectric withstanding voltage	3.16	4.7.12
Insulation resistance	3.17	4.7.13
Group II - 1/2 of sample		
Altitude	3.19	4.7.15
Brush contact resistance	3.11	4.7.7
Insulation resistance	3.17	4.7.13
Temperature rise	3.6	4.7.2
Endurance	3.20	4.7.16
Brush contact resistance	3.11	4.7.7
Electrical error	3.12	4.7.8
Null voltage	3.13	4.7.9
Friction torque	3.14	4.7.10
Radial and end play	3.15	4.7.11
Dielectric withstanding voltage	3.16	4.7.12
Insulation resistance	3.17	4.7.13
Shock, high impact	3.18.2	4.7.14.2
Brush contact resistance	3.11	4.7.7
Electrical error	3.12	4.7.8
Null voltage	3.13	4.7.9
Friction torque	3.14	4.7.10
Radial and end play	3.15	4.7.11
Dielectric withstanding voltage	3.16	4.7.12
Insulation resistance	3.17	4.7.13

TABLE II. Qualification inspection. -Continued

Examination or test	Requirement paragraph	Method paragraph
Group III - remaining 1/2 of sample		
Ambient low temperature	3.21	4.7.17.1
Brush contact resistance	3.11	4.7.7
Electrical error	3.12	4.7.8
Null voltage	3.13	4.7.9
Friction torque	3.14	4.7.10
Radial and end play	3.15	4.7.11
Dielectric withstanding voltage	3.16	4.7.12
Insulation resistance	3.17	4.7.13
Ambient high temperature	3.21	4.7.17.2
Brush contact resistance	3.11	4.7.7
Electrical error	3.12	4.7.8
Null voltage	3.13	4.7.9
Friction torque	3.14	4.7.10
Radial and end play	3.15	4.7.11
Dielectric withstanding voltage	3.16	4.7.12
Insulation resistance	3.17	4.7.13
Moisture resistance	3.22	4.7.18
Brush contact resistance	3.11	4.7.7
Electrical error	3.12	4.7.8
Null voltage	3.13	4.7.9
Friction torque	3.14	4.7.10
Radial and end play	3.15	4.7.11
Dielectric withstanding voltage	3.16	4.7.12
Insulation resistance	3.17	4.7.13
Shock, high impact	3.18.2	4.7.14.2
Brush contact resistance	3.11	4.7.7
Electrical error	3.12	4.7.8
Null voltage	3.13	4.7.9
Friction torque	3.14	4.7.10
Radial and end play	3.15	4.7.11
Dielectric withstanding voltage	3.16	4.7.12
Insulation resistance	3.17	4.7.13

4.5 First article inspection. First article inspection shall be performed by the supplier, after award of contract and prior to production, at a location acceptable to the Government. First article inspection shall be performed on sample units which have been produced with equipment and procedures normally used in production. First article approval is valid only on the contract or purchase order under which it is granted, unless extended by the Government to other contracts or purchase orders.

4.5.1 Sample size. Four transolvers shall be subjected to first article inspection.

4.5.2 Inspection routine. The sample shall be subjected to the inspections specified in table II, in the order shown. After completion of group I tests, the sample shall be divided into the remaining groups shown in table II, and subjected to the tests for their particular group.

4.6 Quality conformance inspection.

4.6.1 Inspection of product for delivery. Inspection of product for delivery shall consist of group A inspection.

4.6.1.1 Inspection lot. An inspection lot shall consist of all transolvers of the same type designation produced under essentially the same conditions, and offered for inspection at one time.

4.6.1.2 Group A inspection. Group A inspection shall consist of the examinations and tests specified in table III, in the order shown.

4.6.1.2.1 Sampling plan. Statistical sampling and inspection shall be in accordance with MIL-STD-105 for general inspection level II. The acceptable quality level shall be 1 percent defective for all tests combined.

4.6.1.2.2 Rejected lots. If an inspection lot is rejected, the supplier may withdraw the lot, rework it to correct the defects, or screen out the defective units, as applicable, and reinspect. Such lots shall be separate from new lots, and shall be clearly identified as reinspected lot. Rejected lots shall be inspected using tightened inspection.

TABLE III. Group A inspection.

Examination or test	Requirement paragraph	Method paragraph
Visual and mechanical inspection	3.1, 3.4 to 3.5.3 incl, 3.5.9, 3.5.10 and 3.31	4.7.1
Transolver zero marking	3.5.9.3	4.7.27
Terminal and wire lead stress	3.25	4.7.21
Primary current and power	3.26	4.7.22
Brush contact resistance	3.11	4.7.7
Electrical error	3.12	4.7.8
Null voltage	3.13	4.7.9
Transformation ratio	3.27	4.7.23
Phase shift	3.28	4.7.24
Interaxis error	3.29	4.7.25
DC resistances, windings	3.30	4.7.26
Friction torque	3.14	4.7.10
Radial and end play	3.15	4.7.11
Dielectric withstanding voltage	3.16	4.7.12
Insulation resistance	3.17	4.7.13

4.6.1.2.3 Disposition of sample units. Sample units which have been subjected to group A inspection shall not be delivered on the contract or purchase order.

4.6.1.2.4 Noncompliance. If a sample fails to pass group A inspection, the supplier shall take corrective action on the materials or processes. Acceptance of the product shall be discontinued until corrective action, acceptable to the Government, has been taken. After the corrective action has been taken, group A inspection shall be repeated on additional sample units (all inspection, or the inspection which the original sample failed, at the option of the Government). Final acceptance shall be withheld until the group A reinspection has shown that the corrective action was successful. In the event of failure after reinspection, information concerning the failure and corrective action taken shall be furnished to the contracting officer.

4.6.2 Inspection of preparation for delivery. Sample packages and packs and the inspection of the preservation, packaging, packing and marking for shipment and storage shall be in accordance with the requirements of section 5 and the documents specified therein.

4.7 Methods of examination and test.

4.7.1 Visual and mechanical examination. Transolvers shall be examined to verify that the materials, design, construction, physical dimensions, marking and workmanship are in accordance with the applicable requirements (see 3.1, 3.4 to 3.5.3 inclusive, 3.5.9, 3.5.10, and 3.31).

4.7.2 Temperature rise test. The transolver shall be mounted in the standard test fixture (see figure 10), and placed in a suitable enclosure to prevent stray air currents. After remaining deenergized and "soaking" in the ambient temperature for at least four hours, the resistance of the winding to be tested shall be determined. The transolver shall then be energized in accordance with 4.3.2. After reaching the stabilized operating temperature in accordance with 4.3.3, the temperature rise shall be determined by use of the following equation:

$$\text{Temperature rise } °C = T_h - T_c = \frac{R_h - R_c}{R_c} (234.5 + T_c)$$

where: T_h - temperature (°C) at finalized operating point

T_c - temperature (°C) at ambient temperature

R_h - resistance (ohms) of test winding at operating temperature

R_c - resistance (ohms) of test winding at ambient temperature

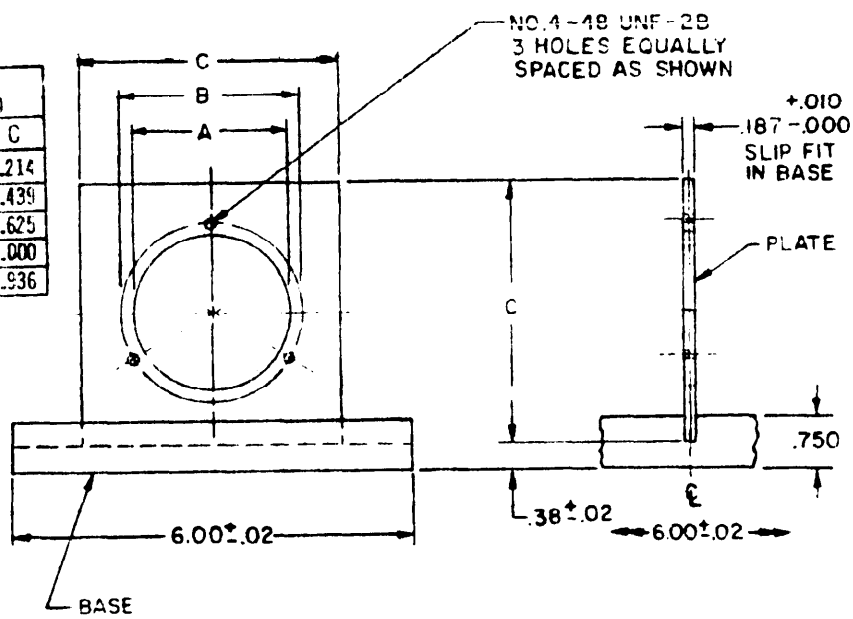
234.5 - constant for copper wire

Any method of measuring the resistance of the winding while the unit is in operation at operating temperature is permissible.

4.7.3 Variation of voltage and frequency. The transolver shall be mounted in the test stand of figure 10, energized and stabilized according to 4.3.2 and 4.3.3. The voltage shall then be adjusted plus 10 percent of 4.3.2 and the frequency adjusted to minus 5 percent of 4.3.2 (see 3.7).

Size	Dimensions +.010 -.000		
	A	B	C
05	.376	.725	2.214
08	.501	1.020	2.439
10	.813	1.187	2.625
13	1.001	1.375	3.000
15	1.313	1.688	3.936

INCHES	MM	INCHES	MM
.010	.25	1.187	30.15
.020	.51	1.313	33.35
.187	4.75	1.375	34.93
.376	9.55	1.688	42.88
.38	9.65	2.214	56.24
.501	12.73	2.439	61.95
.725	18.42	2.625	66.68
.750	19.05	3.000	76.20
.813	20.65	3.936	99.97
1.001	25.43	6.00	152.40
1.020	25.91		



NOTES:
1. Dimensions are in inches.
2. Material: Plate, aluminum alloy, spec QQ-A-250/4.
   Base, thermally insulating.
3. Finish: Plate, anodize per MIL-A-8625, type II, class 2 black.
4. Metric equivalents (to the nearest .01 mm) are given for general information only and are based upon 1 inch = 25.4 mm.

FIGURE 10. Test stand for transolvers.

4.7.4 Impedance. Impedance shall be measured with the transolver energized and stabilized (see 4.3.2 and 4.3.3) at standard test conditions (see 4.3.1), and mounted in the standard test fixture as shown on figure 10. Measurement shall be made by the wattmeter, ammeter, voltmeter method, or the parallel tuned circuit method, using instruments of sufficient accuracy, sensitivity and resolution. Impedance shall be determined at transolver zero, except as noted (see figure 11).

4.7.4.1

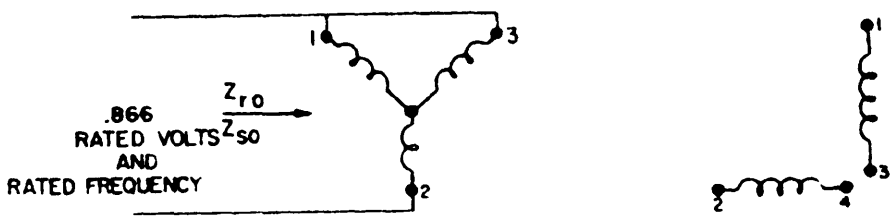


FIGURE 11A.

4.7.4.2

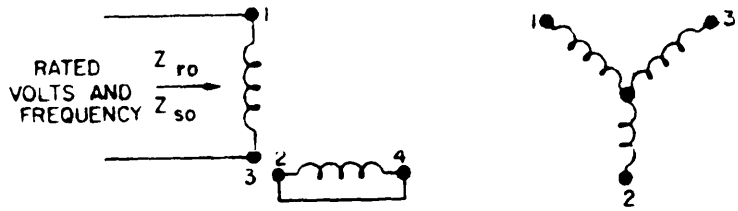


FIGURE 11B.

4.7.4.3

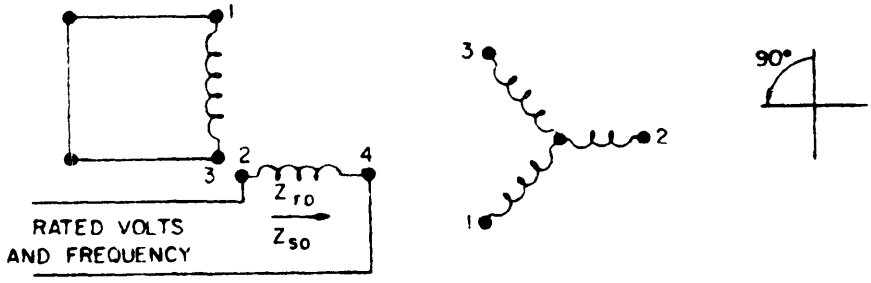


FIGURE 11C.

4.7.4.4

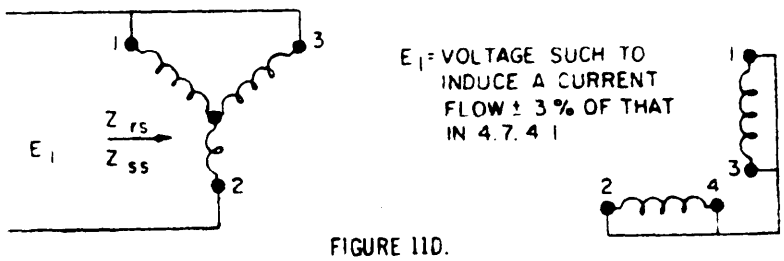
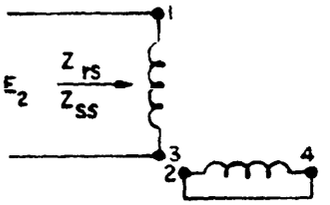
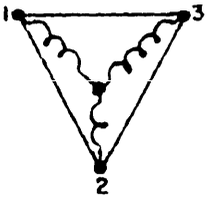


FIGURE 11D.

FIGURE 11. Impedance.

4.7.4.5

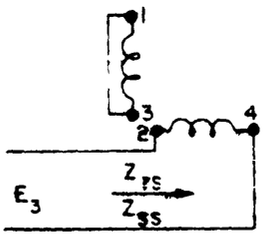


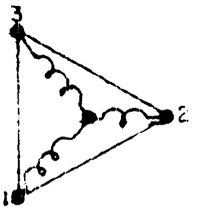


E_2 = Voltage such to induce a current flow ±3% of that in 4.7.4.2.

FIGURE 11E.

4.7.4.6





E_3 = Voltage such to induce current ±3% of that in 4.7.4.3.

FIGURE 11F.

FIGURE 11. Impedance - continued.

4.7.5 Electromagnetic interference. Electromagnetic interference shall be measured under the following conditions:

4.7.5.1 Primary winding. All primary winding shall be energized in accordance with 4.3.2.

4.7.5.2 Secondary winding. The secondary winding shall be connected across an impedance 5 times that of the output open circuit impedance.

4.7.5.3 Rotor rpm. The rotor shall be rotated at 300 rpm.

4.7.6 Vibration. The transolver shall be mounted on a test fixture and energized in accordance with 4.3.2. The transolver shall have an aluminum disc 3/16 inch thick, and the same approximate diameter as the transolver mounted on the shaft to simulate actual installation. With the shaft free to rotate, the unit shall then be tested under the following conditions:

4.7.6.1 Amplitude. The unit will be subjected to a single harmonic motion having an amplitude of either 0.06 inch double amplitude or 15G, whichever is less. The tolerance on vibration amplitude shall be 10 percent.

4.7.6.2 Frequency range. The vibration frequency shall be varied logarithmically between 10 to 2,000 Hz.

4.7.6.3 Sweep time and duration. The entire range and return to 10 Hz shall be traversed in 20 minutes. This cycle shall be performed in two mutually perpendicular planes, one of which shall be that of the machine longitudinal axis for a period of four hours in each plane.

4.7.7 Brush contact resistance variation. The variation in brush contact resistance shall be measured between R_1-R_3 and R_2-R_4 for types SY4 and R Y4; R_1-R_3 and R_2-R_3 for types SY3 and R3Y; and R_1-R_2, R_2-R_3 and R_1-R_3 for types S4Y and RY4. The rotor shall be rotated at 1 rpm while a dc current of 10±1 milliampere is passed through the rotor coils. The variation in brush contact resistance shall be permanently recorded using an instrument with a response time of five milliseconds or better. Compliance with 3.11 shall be determined during the fourth revolution of the rotor.

4.7.8 Electrical error. Transolvers shall be tested for electrical error by one of the proportional voltage methods described herein. The tests shall be conducted at standard condition, except that for qualification tests per table E, the tests shall be conducted at -55 degrees ±2°C. standard condition, and +125 degrees ±2°C. The electrical error shall be measured and recorded for at least every five degrees of rotor rotation through a complete 360 degrees.

4.7.8.1 Proportional voltage nulling method. The transolver shall be mounted in an angular test stand which can position the rotor within ±15 seconds of arc. Rated voltage and frequency shall be applied to the terminals of the two perpendicular winding elements. The error at any given rotor position is defined as the mechanical rotor position minus the electrical position. The electrical position of the transolver is obtained from the following equations and is positive when the transolver rotor is turned in the positive direction.

The electrical angle, α, of the transolver is related to the equivalent bridge position by the following equations:

(a) $\alpha = \emptyset + (N + 3M)\,60°$

(b) $R = 1/2 - 1/2\sqrt{3}\,\cot(\emptyset + 60°)$

$$R = \frac{\text{one of smaller secondary voltage}}{\text{largest secondary voltage}}$$

where: M = 0 when ES_{1-3} is in time phase with ER_{2-1}

M = 1 when ES_{1-3} is 180 degrees out of phase with ER_{2-1}

N is determined from the following table.

TABLE IV.

Value of N	Terminals of largest secondary voltage	Terminals of smallest secondary voltage
0	S_2-S_1	S_1-S_3
1	S_1-S_3	S_3-S_2
2	S_3-S_2	S_2-S_1

(c) The relationship between R and Ø is shown in table IV-A.

TABLE IV-A

Ø - Degrees	R (Ratio)	Ø - Degrees	R (Ratio)	Ø - Degrees	R (Ratio)
0	.00000	20	.34730	40	.65270
5	.09617	25	.42423	45	.73205
10	.18479	30	.50000	50	.81521
15	.26795	35	.57577	55	.90383
				60	1.00000

The transolver shall be connected into the test circuit as shown on figures 12A and 12B. Two noninductive 10,000 ohm resistors and a noninductive voltage divider of 10,000 ohms shall be connected in delta across the 'wye' connected terminals. The resistance values of the fixed resistors and the total resistance of the voltage divider shall be equal within 0.01 percent. The values of the ratios of resistance between either end of the divider and any tap to the total resistance of the divider shall equal the theoretical values within 0.005 percent. The phase shift of the divider shall be less than 10 minutes of arc. The voltage divider shall be connected across the secondary terminals giving the highest voltage, and the resistors shall be connected across the terminals giving the smallest voltage. The variable tap on the voltage divider shall be connected to the common terminals of the two fixed resistors through a phase sensitive nullmeter capable of indicating a 0.2 minute displacement of the transolver under test from the null position. The phase sensitive nullmeter shall be capable of discrimination against a value of quadrature of 0.2 percent of the maximum output voltage of the transolver under test and against a value of total harmonic content of 1 percent of the maximum output voltage of the transolver under test, such that the combined quadrature and harmonic voltages produce a meter indication less than that produced by a 0.2 minute displacement of the rotor from null position. The error at any given rotor position is the mechanical rotor angle minus the electrical angle.

4.7.8.2 Proportional voltage gradient method. The transolver shall be mounted as specified in 4.7.8.1. The equivalent bridge position is defined in 4.7.8.1. The calibrated phase-sensitive amplifier shown on figures 12C and 12D shall have the same electrical characteristics as those specified for the phase-sensitive nullmeter referenced in 4.7.8.1. In addition, the amplifier shall be calibrated to provide an electrical signal output that is a direct function of the electrical error. Electrical error shall be indicated directly on an indicator or recorder. The resolution of the indicating or recording device shall be such as to allow the determination of the electrical error to at least 30 seconds of arc without interpolation. The output of the voltage gradient compensating network shall have an equal voltage gradient at all positions of the delta bridge. The voltage gradient is defined as:

$$VG = \frac{\text{electrical output of the compensating network}}{\text{rotor displacement from the equivalent bridge position}} = \frac{\text{Volts}}{\text{Degrees}}$$

The electrical error at a given rotor position is defined as the electrical angle minus the rotor position.

4.7.8.3 Wye connected winding. The test circuit for electrical error testing of transolvers with wye connected secondary winding is shown on figures 12A and 12C.

4.7.8.4 Two perpendicular windings. The test circuit for electrical error testing of transolvers with two perpendicular windings in the secondary circuit is shown on figures 12B and 12D. The Zss nominal value of the energizing synchro-transmitter shall be no greater than 3 percent of the nominal Zso or Zro value of the transolver under test.

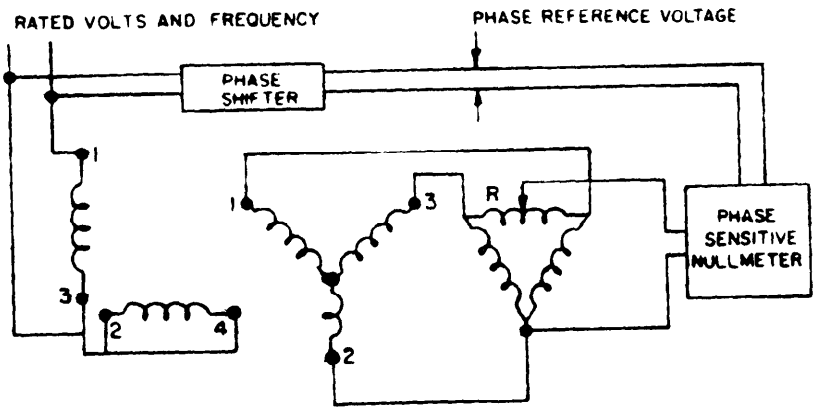


FIGURE 12A. Proportional voltage nulling method test circuit - wye connected.

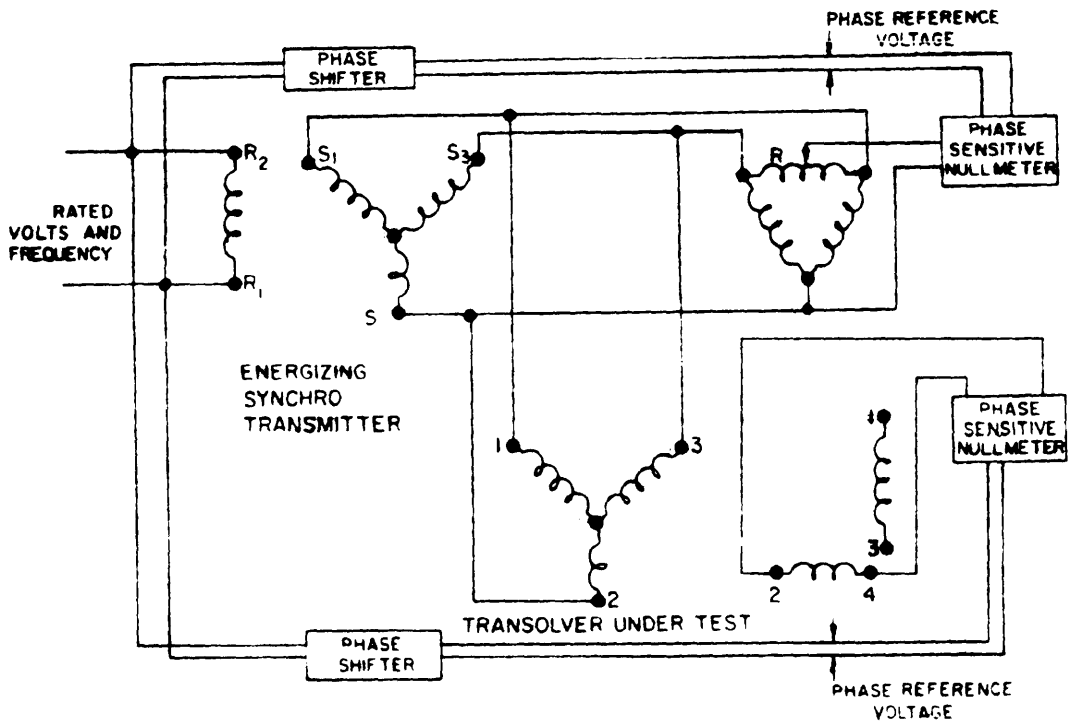


FIGURE 12B. Proportional voltage nulling method test circuit - two perpendicular windings.

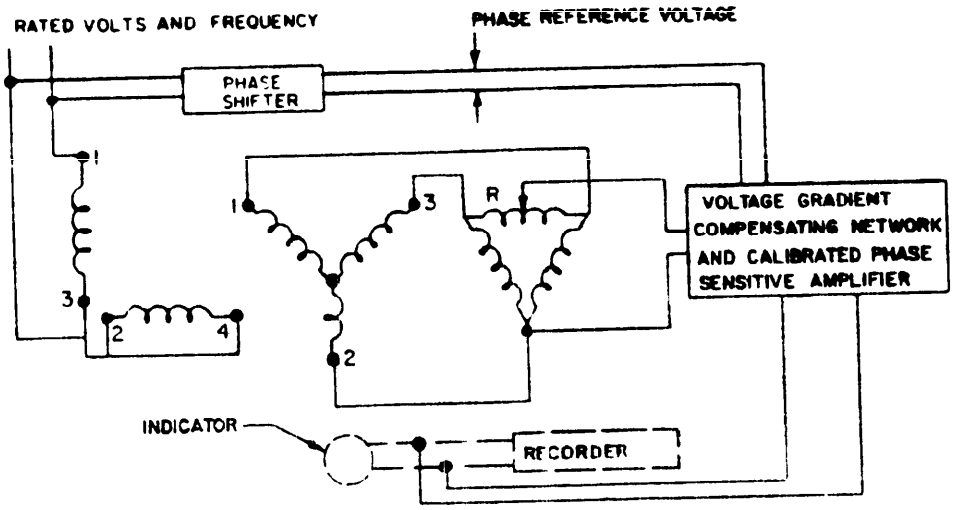


FIGURE 12C. Proportional voltage gradient method - test circuit - wye connected.

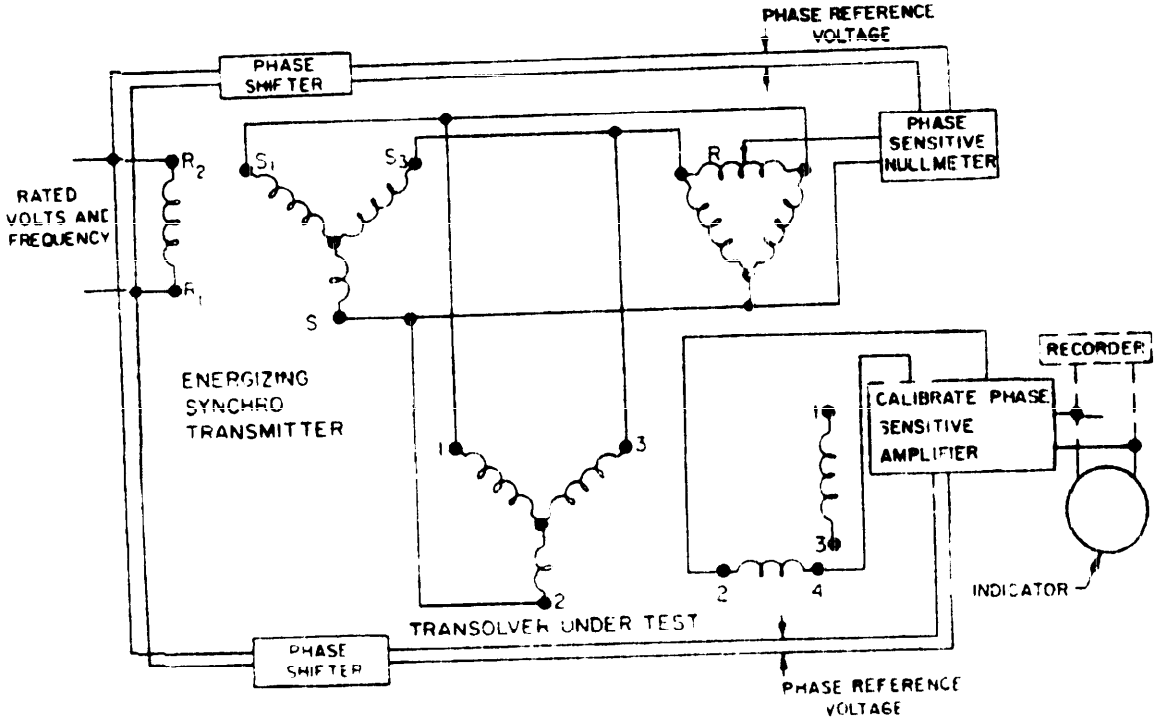


FIGURE 12D. Proportional voltage gradient method - test circuit - two perpendicular windings.

4.7.9 Null voltage. Fundamental and total null voltages shall be measured across the terminals indicated, and at the electrical angles indicated in table IV when the transolver is energized according to 4.3.2 across one of the applicable pairs of primary terminals. Null voltages shall be measured at the specified test voltage by using the method of 4.7.9.1. The voltage measuring instruments used shall indicate the value of the voltage in terms of the rms value of an equivalent sine wave and shall have a minimum input impedance equal to that of a 500,000 ohm resistor shunted by a 30 pf capacitor.

4.7.9.1 Phase-sensitive voltmeter method. Turn the transolver rotor until the inphase component of the null voltage is zero as indicated on a phase sensitive voltmeter. Read the quadrature voltage. This voltage is the fundamental component of the null voltage. Without changing the rotor position, measure the total null voltage with a vacuum tube voltmeter (see figure 13).

4.7.10 Friction torque. With the applicable weights per figure 14, fastened into one of the .062 diameter holes of the appropriate dial per figure 15, and the dial and weight assembly mounted rigidly on the transolver shaft per figure 16, the unenergized transolver stator housing shall be rotated at 4-6 rpm with the shaft horizontal. At least three revolutions in each direction shall be made. The transolver shall fail the test if the dial turns one complete revolution. For qualification, this test shall also be conducted at -55 degrees C and + 125 degrees C.

4.7.11 Radial and end play.

4.7.11.1 Radial play. The transolver stator shall be firmly mounted with the shaft horizontal. A dial indicator shall be rigidly mounted in a position to measure rotor shaft movement perpendicular to the rotor shaft axis in a horizontal plane. The measurement shall be made such that the activating button will contact the shaft within 1/8 inch of bearing face. A horizontal force sufficient to take up all play shall be applied within 1/4 inch of the end of the shaft and perpendicular to its axis. After noting the dial reading, reverse the applied force and note the new dial reading. The difference between the two readings shall not exceed the allowable radial play specified in the applicable specification sheet.

4.7.11.2 End play. The transolver stator (housing) shall be firmly mounted with the shaft horizontal. A dial indicator shall be rigidly mounted in a position to measure rotor shaft movement along the axis of the shaft. An axial force, sufficient to take up all play shall be applied to the end of the shaft. After noting the reading, reverse the applied load and note the dial indicator reading. The difference between the two readings shall not exceed the allowable end play specified in the applicable specification sheet.

4.7.12 Dielectric withstanding voltage. The test shall conform to method 301 of MIL-STD-202 and 3.16. Voltages as specified in table V shall be applied from each winding to the housing and to every other winding. The voltage shall be raised slowly to the specified value and held at that value for one minute, then reduced slowly. The peak voltage of the supply throughout this test shall not exceed 1.5 times the applicable voltage specified in table V.

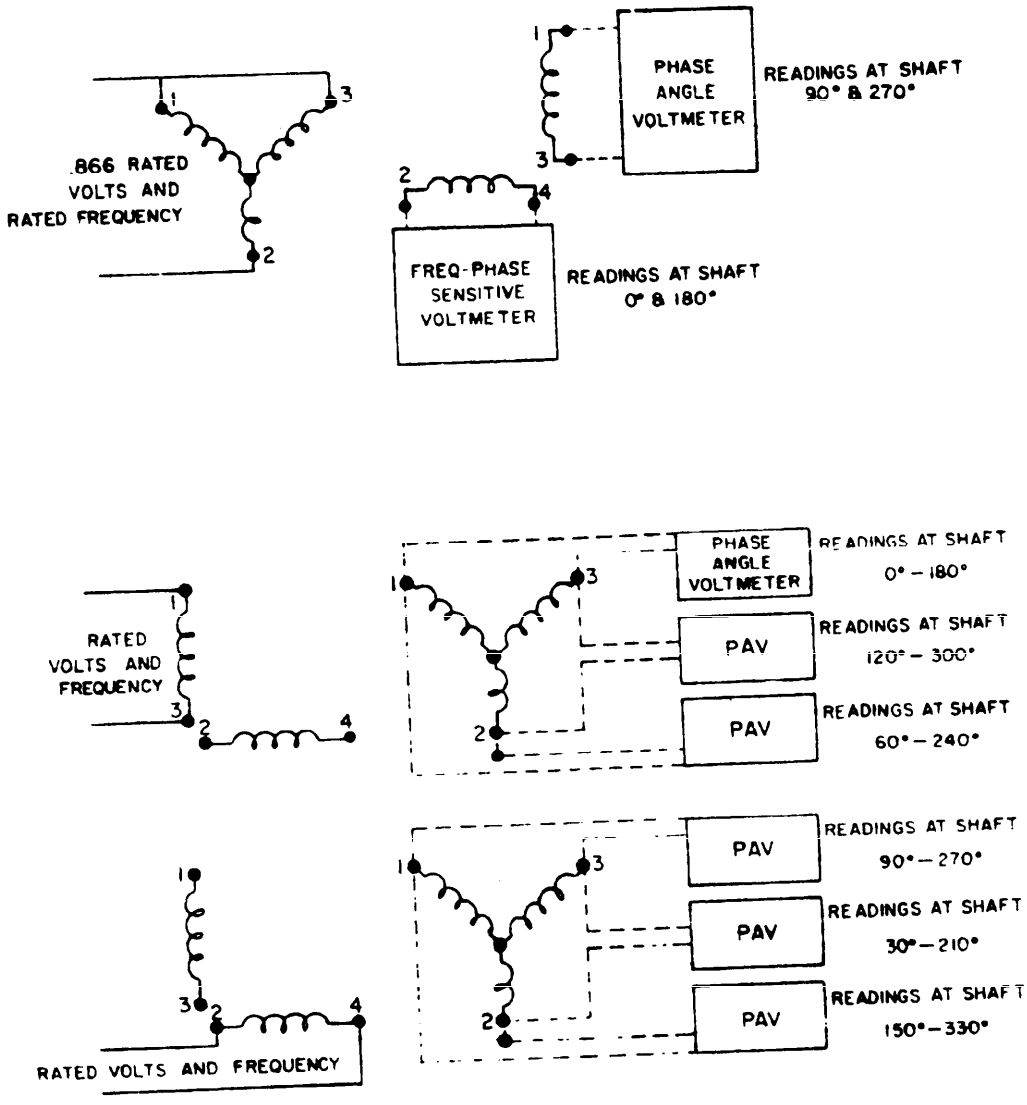
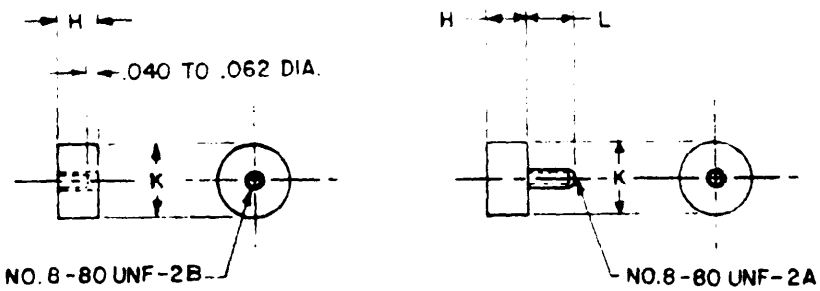


FIGURE 13. Phase sensitive null voltage.



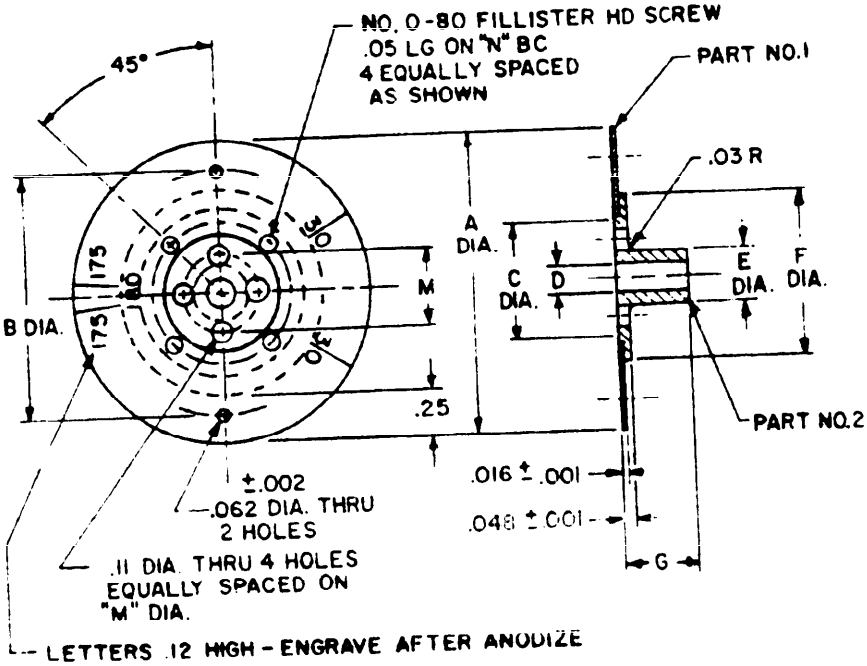
PART NO. 3 PART NO. 4

INCHES	MM	INCHES	MM
.02	.51	.141	3.58
.033	.84	.150	3.81
.040	1.02	.166	4.22
.05	1.27	.171	4.34
.062	1.57	.236	5.99
.07	1.78	.250	6.35
.078	1.98	.262	6.65
.083	2.11	.267	6.78
.10	2.54	.300	7.62
.117	2.97	.346	8.79
.125	3.18	.600	15.24

Transolver size	Maximum torque	Dimensions (inches) of mounted dial weights			Weight ±3%	Mounting radius
	(oz-in)	H	K	L	oz	in
05	.02	.062	.262	.078	.033	.600
08	.07	.125	.346	.141	.117	.600
10, 11	.05	.150	.267	.171	.083	.600
15	.10	.236	.300	.250	.166	.600

NOTES:
1. Material: Brass, naval spec QQ-B-637, composition 4.
2. Tolerance is ±.005 (.13 mm).
3. Metric equivalents (to the nearest .01 mm) are given for general information only and are based upon 1 inch = 25.4 mm.

FIGURE 14. Weights for friction torque tests.



INCHES	MM
.0004	.01
.001	.03
.002	.05
.0050	.13
.016	.41
.03	.76
.048	1.22
.05	1.27
.062	1.57
.11	2.79
.12	3.05
.1250	3.18
.1875	4.76
.250	6.35
.300	7.62
.375	9.53
.5625	14.29
.687	17.45
.8125	20.64
1.200	30.48
1.50	38.10

Size of transolver	Dial dimensions								
	A	B ±.002	C +.0004 −.0000	D +.0050 −.0000	E ±.001	F ±.0050	G +.005 −.000	M *	N
05, 08, 10	1.50	1.200	.5625	.1250	.250	.8125	.300	.375	.687
11, 15	1.50	1.200	.5625	.1875	.250	.3125	.300	.375	.687

*For mounting with standard drive washer.

NOTES:
1. Dimensions are in inches.
2. Unless otherwise specified, tolerances are ±.005 (.13 mm) on three place decimals, ±.02 (.51 mm) on two place decimals, and ±1° on angles.
3. Metric equivalents (to the nearest .01 mm) are given for general information only and are based upon 1 inch = 25.4 mm.
4. Remove all burrs, break sharp edges.
5. Finish: Anodize per spec MIL-A-8625, type II, class 2 black.
6. Material: Aluminum alloy, spec QQ-A-250/4.

FIGURE 15. Dial for friction torque.

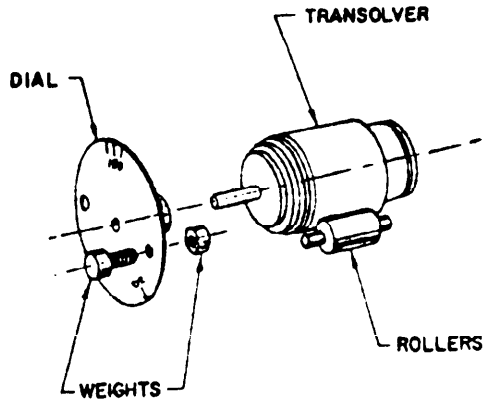


FIGURE 16. Friction torque tests.

TABLE V.

Transolver operating volts - rms	Dielectric withstanding voltage test voltage-rms (60 Hz)		Subsequent tests by manufacturer or authorized Government Agency (60 Hz)	
	(a) Windings to housing (b) Primary to secondary	Separate windings in close contact	(a) Windings to housing (b) Primary to secondary	Separate windings in close contact
0-50	250^{+0}_{-8}	250^{+0}_{-8}	200^{+0}_{-6}	200^{+0}_{-6}
51-100	500^{+0}_{-15}	250^{+0}_{-8}	400^{+0}_{-12}	200^{+0}_{-6}
101-200	900^{+0}_{-30}	250^{+0}_{-8}	720^{+0}_{-20}	200^{+0}_{-6}

4.7.13 Insulation resistance test. Immediately after passing the dielectric withstanding voltage test, insulation resistance between each winding and the housing and to every other winding shall be measured in accordance with method 302 of MIL-STD-202, the applicable dc voltage specified in table VI, and in accordance with 3.17.

TABLE VI.

Transolver operating volts - rms	Insulation resistance test voltage (dc)	
	(a) Winding to housing and (b) Primary to secondary	Separate windings in close contact
0-50	100 condition A	100
51-200	500 condition B	100

4.7.14 Shock.

4.7.14.1 Low impact. All transolvers shall be subjected to 20 impacts of an acceleration of 50G's of 11 ±1 millisecond duration. The shock pulse may be produced by any method capable of producing a pulse approximating a half sine wave with less than 10 percent of the peak pulse distortion at any point of the pulse. The transolver shall be securely mounted to a rigid test fixture. During the test, the transolver shall have the disc mounted on the shaft. The unit shall be energized in accordance with 4.3.2 so that all sets of brushes are energized and the shaft free to rotate. The transolver shall be subjected to five blows in each direction along two mutually perpendicular axes (total 20 blows).

4.7.14.2 High impact. Each transolver shall be subjected to a high impact shock test. The unit shall be mounted in a test apparatus in accordance with method 207, figure 207-4, MIL-STD-202 with the disc mounted on the shaft. The unit shall be energized in accordance with 4.3.2 and subjected to three blows each in the vertical and horizontal plane of 400, 1,200 and 2,000 foot-pounds respectively (for a total of six blows).

NOTE: Tests conducted on the unit after high impact will tolerate a 50 percent degradation in specified characteristics.

4.7.15 Altitude.

4.7.15.1 Low temperature. The transolver shall be mounted on a suitable test fixture and placed in a test chamber unenergized. The temperature of the test chamber shall be reduced to and maintained at -55 degrees C. After the unit has remained in the test chamber for four hours, the pressure of the chamber shall be reduced to 0.315" HG (equivalent to 100,000 ft altitude), at which time the unit shall pass the brush contact resistance test (4.7.7) and the insulation resistance test (4.7.13).

4.7.15.2 High temperature. At the conclusion of the tests in 4.7.15.1, the temperature of the test chamber shall be increased to and maintained at 125 degrees C. The pressure of the chamber shall be equalized to standard atmospheric pressure during the temperature change. After the unit has remained in the test chamber for four hours, the pressure shall again be reduced to 0.315" HG at which time the unit shall pass the brush contact resistance test, the insulation resistance test, and the operating temperature of the windings shall be determined in accordance with 4.7.2. The temperature rise shall not exceed the requirements of 3.6.

4.7.16 Endurance. The endurance test for transolvers shall consist of 2,000 hours at 600 rpm while energized in accordance with 4.3.2. The rotors may be turned mechanically by any means which will not transmit an axial load to the rotor shaft. The time schedule shall be as follows:

Test time hours	Temperature °C	Shaft position
120	-25	Horizontal
48	+125	Up
48	+125	45° Up
48	+125	45° Down
48	+125	Down
840	+25	Horizontal - CW rotation
848	+25	Horizontal - CCW rotation

4.7.17 Ambient temperature. All transolvers covered by this specification shall be capable of withstanding ambient storage temperatures with a range of -62 C to +100 C while standing in a non-energized condition for 24 hours.

4.7.17.1 Low temperature. The unit shall be mounted on a test fixture and placed in a test chamber. The temperature shall be lowered and maintained at -62 C for 24 hours. The temperature shall then be raised to -54 C, and the unit energized and tested in accordance with the specified tests of table II.

4.7.17.2 High temperature. At the conclusion of the tests of 4.7.17.1, the unit shall be de-energized, and the test chamber temperature increased to and maintained at 125 degrees C for 24 hours. The unit shall then be energized and tested in accordance with the specified tests of table II.

4.7.18 Moisture resistance. The transolvers shall be subjected to the moisture resistance test of method 106, MIL-STD-202. One unit shall be energized in accordance with 4.3.2. The other unit will not be energized. At the conclusion of the test, the units shall be tested in accordance with table II.

4.7.19 Salt atmosphere resistance. Transolvers shall be tested in accordance with method 101, test condition B, MIL-STD-202. The salt-solution concentration for this test shall be 5 percent. Transolvers shall be placed in the test chamber with the rotors horizontal and supported in a manner that provides line contact on material impervious to the effects of salt moisture and permits maximum circulation of the atmosphere about the transolver. After completion of the test, the transolver shall meet the visual requirements of 3.23.

4.7.20 Life. The manufacturer shall submit to the qualifying or procuring activity evidence that transolvers supplied will meet the requirements of 3.24. This evidence shall be in the form of a certificate to the qualifying activity on each type qualification requested; and a written guarantee to the procuring activity on each awarded contract. Failure of any procured transolver to meet the requirements of 3.24 shall be replaced by the manufacturer at no cost to the Government.

4.7.21 Wire lead and terminal stress.

4.7.21.1 Wire lead. Each wire shall be tested by having the specified weight (see 3.25.1) attached to the extreme end. The weight shall be applied pulling straight away from the transolver, then the lead bent 90° at the point of exit from the housing and while in this attitude, the transolver rotated 360° counterclockwise. Any indication of the lead pulling loose, wire strands breaking, or a permanent deformation of the insulation shall be cause for rejection.

4.7.21.2 Terminals (screw or solder-pin type).

4.7.21.2.1 Terminal (screw type). The terminal stress shall be tested using a 4.5 pound-inch torque in accordance with method 211, test condition E, MIL-STD-202.

4.7.21.2.2 Terminal (solder-pin type). The terminal stress shall be tested using a 2 pound force in accordance with method 211, test condition A, MIL-STD-202.

4.7.22 Primary current and power test. Each primary winding shall be energized under the conditions of table I. The secondary windings shall be open. The primary current and power shall be measured in accordance with 3.26.

4.7.23 Transformation ratio.

4.7.23.1 115 volt units - type -Y- . The transformation ratio of 115 volt transolvers shall be obtained by applying 78.0 volts ±1 percent across terminals S_2 (or R_2) and S_1 (or R_1) which is connected to S_3 (or R_3). The rotor shall be turned until ER_{1-3} (or ES_{1-3}) is a maximum.

4.7.23.2 26 volt units - type -Y- . The transformation ratio of 26 volt transolvers shall be obtained by applying 10.2 volts ±1 percent across terminals S_2 (or R_2) and S_1 (or R_1) which is connected to S_3 (or R_3). The rotor shall be turned until ER_{1-3} or ES_{1-3} is a maximum.

4.7.23.3 115 volt units - type --4. The transformation ratio of 115 volt transolvers shall be obtained by applying 115 volts ±1 percent between terminals R_1 (or S_1) and R_3 (or S_3) which is connected to terminals R_2 (or S_2) and R_4 (or S_4), and turning the rotor until ES_{1-3} (or ER_{1-3}) is a maximum.

4.7.23.4 26 volt units -type -- 4. The transformation ratio of 26 volt units shall be obtained by applying 26 volts ±1 percent between terminals R_1 (or S_1) and R_3 (or S_3) which is connected to terminals R_2 (or S_2) and R_4 (or S_4), and turning the rotor until ES_{1-3} (or ER_{1-3}) is a maximum.

4.7.24 Phase shift. With the transolver mounted, energized, stabilized, and rotor positioned as in 4.7.23 above, the phase shift shall be measured using a device which indicates or compares the phase shift to an accuracy of ±15 minutes and does not alter the open circuit voltages by more than 0.1 percent.

4.7.25 Interaxis error. The transolver shall be mounted in a test standard capable of positioning the transolver rotor to any given angle within ±15 seconds of arc. The primary winding shall be energized in accordance with 4.3.2 and 4.3.3. The rotor shall be positioned to the angles indicated on figure 17. At each position the rotor shall be adjusted to the nearest null.

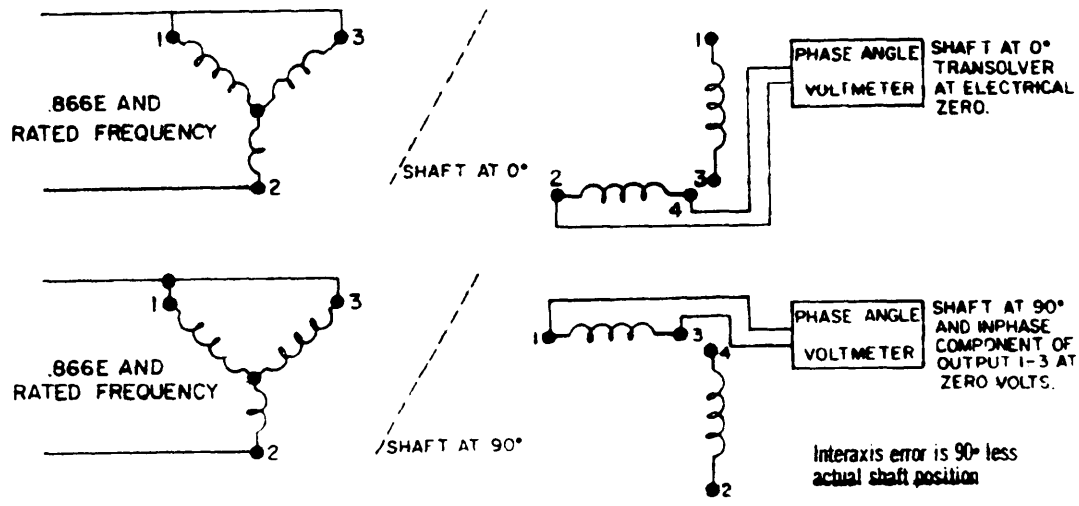


FIGURE 17. Interaxis error test.

4.7.26 DC resistance. The dc resistance of the rotor and stator windings shall be measured with a calibrated wheatstone bridge and meet the requirements of 3.30.

4.7.27 Transolver zero marking. Connect as shown on figure 7b or 8b. The rotor is turned until a minimum reading is obtained on the voltmeter. The relative position of the arrow stamped on the housing to the index on the shaft shall be determined and shall conform to 3.5.9.3.

5. PREPARATION FOR DELIVERY

5.1 Preservation and packaging. Preservation and packaging shall be level A or C, as specified (see 6.2).

5.1.1 Level A.

5.1.1.1 Cleaning. Transolvers shall be cleaned in accordance with MIL-P-116, process C-1.

5.1.1.2 Drying. Transolvers shall be dried in accordance with MIL-P-116.

5.1.1.3 Preservative application. None required.

5.1.1.4 Unit packaging. Transolvers shall be individually packaged in accordance with MIL-P-116, submethod IIc insuring compliance with the general requirements paragraph under methods of preservation (unit protection) and the physical protection requirements paragraph therein. To preclude damage, cushioning and blocking shall be designed to prevent external forces from being applied to the shaft. Each barrier enclosed transolver shall be placed in a supplementary container conforming to PPP-B-566, PPP-B-676 or PPP-B-636.

5.1.1.5 Intermediate packaging. Not required.

5.1.2 Level C. Cleaned and dried transolvers shall be individually packaged in a manner that will afford adequate protection against corrosion, deterioration and physical damage during shipment from supply source to the first receiving activity.

5.2 Packing. Packing shall be level A, B or C, as specified (see 6.2).

5.2.1 Level A. The packaged transolvers shall be packed in fiberboard containers conforming to PPP-B-636, class weather resistant, style optional, special requirements. In lieu of the closure and waterproofing requirements in the appendix of PPP-B-636, closure and waterproofing shall be accomplished by sealing all seams, corners and manufacturer's joints with tape, two inches minimum width, conforming to PPP-T-60, class 1 or PPP-T-76. Banding (reinforcement requirements) shall be applied in accordance with the appendix to PPP-B-636 using nonmetallic or tape banding only.

5.2.2 Level B. The packaged transolvers shall be packed in fiberboard containers conforming to PPP-B-636, class domestic, style optional, special requirements. Closures shall be in accordance with the appendix thereto. For Army procurement, fiberboard containers shall be class weather-resistant as specified in level A.

5.2.3 Level C. The packaged transolvers shall be packed in shipping containers in a manner that will afford adequate protection against damage during direct shipment from the supply source to the first receiving activity. These packs shall conform to the applicable carrier rules and regulations.

5.2.4 Unitized loads. Unitized loads, commensurate with the level of packing specified in the contract or order, shall be used whenever total quantities for shipment to one destination equal 40 cubic feet or more. Quantities less than 40 cubic feet need not be unitized. Unitized loads shall be uniform in size and quantities to the greatest extent practicable.

5.2.4.1 Level A. Transolvers, packed as specified in 5.2.1, shall be placed on pallets in conformance with MIL-STD-147, load type I, with a fiberboard cap (storage aid 4) positioned over the load.

5.2.4.2 Level B. Transolvers, packed as specified in 5.2.2, shall be palletized as specified in 5.2.4.1 except that the fiberboard caps shall be class domestic. For Army procurement, caps shall be weather resistant as specified in level A.

5.2.4.3 Level C. Transolvers, packed as specified in 5.2.3, shall be unitized with pallets and caps of the type, size and kind commonly used for the purpose and shall conform to the applicable carrier rules and regulations.

5.3 Marking. In addition to any special marking required by the contract or order, each unit package, supplementary and exterior container and unitized load shall be marked in accordance with MIL-STD-129.

5.4 General.

5.4.1 Exterior containers. Exterior containers (see 5.2.1, 5.2.2, and 5.2.3) shall be of a minimum tare and cube consistent with the protection required and shall contain equal quantities of identical stock numbered items to the greatest extent practicable.

5.4.2 Navy procurements. For Navy procurements, the use of polystyrene loose fill material (such as strips, strands and beads) is prohibited for packaging and packing applications.

6. NOTES

6.1 Intended use. Transolvers covered by this specification are intended for use in military systems for fire control, radar, navigation, missiles, and instrumentation requiring the accurate transmission and reception of electromechanical signals concerning the angular position of one or more rotor shafts.

6.2 Ordering data. Procurement documents should specify the following:

(a) Title, number, and date of this specification.
(b) Title, number, and date of the applicable specification sheet, the complete type designation, and the military part number (see 1.2.1, 1.2.2, and 3.1).
(c) Whether first article inspection is requested, and if so, the location.
(d) Levels of preservation, packaging, packing, and applicable marking required (see section 5).

6.3 Indirect shipments. The preservation, packaging, packing, and marking requirements specified in section 5 herein apply only to direct purchases by or direct shipment to the Government and are not intended to apply to contracts or orders between the supplier and prime contractor.

6.4 Definitions. For the purpose of this specification, the following definitions apply:

6.4.1 Direction of rotation. Clockwise or counterclockwise rotation is determined when facing the shaft extension end of the transolver. Standard positive direction is counterclockwise.

6.4.2 Electrical angle. The electrical angle is the transmitted electrical signal representing a definite mechanical rotor position.

6.4.3 Electrical degree. Electrical degree is the time required for an alternating current to complete 1/360 of one cycle.

6.4.4 Electrical error. Electrical error is the deviation from the theoretical voltages expressed in the transolver equations and the actual electrical voltages generated at any given rotor position, expressed in minutes of arc.

6.4.5 End play. End play is the total shaft movement along the shaft axis due to reversal of axial force with the housing held stationary.

6.4.6 Impedance. Impedance is a total opposition of alternating current flow, comprised of three components, resistance (R), inductance (L), and capacitance (C).

6.4.6.1 Rotor open-circuit impedance.

Z_{ro} - The impedance of the rotor with the stator terminals open.

6.4.6.2 Stator open-circuit impedance.

Z_{so} - The impedance of the stator with the rotor terminals open.

6.4.6.3 Rotor short-circuit impedance.

Z_{rs} - The impedance of the rotor with the stator terminals shorted.

6.4.6.4 Stator short-circuit impedance.

Z_{ss} - The impedance of the stator with the rotor terminals shorted.

6.4.7 In phase component. In phase component is the voltage signal that has the same phase angle as the reference voltage.

6.4.8 Interaxis error. Interaxis error is the angular deviation of the null positions for all rotor-stator winding combinations from space quadrature.

6.4.9 In time phase. In time phase exists when a voltage or a current at any point in time is at the condition as the applied reference voltage or current.

6.4.10 Null voltage. Null voltage is the actual voltage induced in the secondary circuit at a position at which the theoretical secondary voltage is zero. This voltage consists of two components; a quadrature component at the excitation frequency, and a component which is made up of harmonics of the excitation frequency.

6.4.10.1 Fundamental null. Fundamental null is residual voltage having the same frequency as the excitation. This voltage is always in time phase quadrature with the output voltage at maximum coupling.

6.4.10.2 Total null. The total null is a composite average effect of the harmonic voltages added to the fundamental nulls.

6.4.11 Phase. Phase is the mode of variation of the amplitude of an alternating voltage with respect to time measured in electrical degrees. For transolvers, this wave approximates a sine wave.

6.4.12 Phase reference voltage. The phase reference voltage is the time phase fundamental component of the secondary voltage at the first position of maximum coupling when the transolver rotor is turned in the positive direction from transolver zero.

6.4.13 Phase shift. The phase shift of a transolver is the angle by which the secondary time phase leads the primary time phase at the position of maximum coupling.

6.4.14 Phase time. Phase time is time measured in electrical degrees; zero degrees occurs at the instant the voltage changes from negative to positive.

6.4.15 Rated voltage. Rated voltage is the nominal line voltage to the primary element.

6.4.16 Radial play. Radial play of a transolver rotor is the shaft displacement perpendicular to the shaft axis due to the reversal of a force applied perpendicular to the shaft axis.

6.4.17 Rotor angular displacement. The rotor position of any transolver is an angular mechanical rotor displacement from the transolver zero position, measured in a counterclockwise direction, at which the transolver output voltages exactly correspond to the output voltages of any ideal transolver set at any specific rotor position.

6.4.18 Signal voltage. The electrical signal voltage is the voltage generated in the secondary winding by the incoming primary voltage as modified by the mechanical angular position of the rotor.

6.4.19 Temperature rise. Temperature rise is the increase of the internal temperature of a transolver above the ambient temperature due to the dissipation of the energizing power.

6.4.20 Time phase. The time phase in a transolver system is the phase of the voltage with respect to the energizing voltage of the transolver system. The time phase is measured in electrical degrees.

6.4.21 Transformation ratio. The transformation ratio of a transolver is the ratio of the no-load maximum fundamental secondary voltage to the fundamental supply voltage applied to the primary.

6.4.22 Complex transformation ratio. The complex transformation ratio is the transformation ratio including the phase shift.

6.4.23 Transolver. A transolver is a unit which consists of a three winding Wye connected element and a two winding, quadrature element. Either element can be the rotor or the stator.

6.4.24 Transolver zero. Transolver zero is the position of the transolver shaft for which the electrical angle is zero.

6.4.25 Windings.

6.4.25.1 Primary. The primary winding is the winding which receives energizing power (signal) from either the supply line or from another transolver.

6.4.25.2 Secondary. A secondary winding is a winding which transmits an electrical signal as an output when the primary winding is energized, as modified by the mechanical angular position.

6.4.25.3 Quadrature. A quadrature winding is a winding displaced 90 degrees relative to some other winding.

6.4.26 Units. Unless otherwise specified, units of measurement are as follows:

Angles	- degrees, minutes, seconds
Potential	- volts rms
Impedance	- ohms
Current	- amps rms
Temperature	- degrees centigrade
Time phase	- degrees
Torque	- ounce-inches

6.5 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. 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 to products covered by this specification may be obtained from Headquarters Air Force Logistics Command, SGMES, Wright-Patterson AFB, Ohio 45433.

6.6 First article inspection. Information pertaining to first article inspection of products covered by this specification should be obtained from the procuring activity for the specific contracts involved.

6.7 Interchangeability. All transolvers having the same nomenclature shall be mechanically and electrically interchangeable for all military applications.

Custodians:
Army - MU
Navy - AS
Air Force - 85

Review activities:
Army - EL, MI, MU, AT, AV
Navy - SH, AS
Air Force - 11, 85
DSA - ES

User activities:
Army - ME
Navy - CG, MC
Air Force - 17

Preparing activity:
Air Force - 85

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SPECIFICATION ANALYSIS SHEET

Form Approved
Budget Bureau No. 22-R255

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. Comments and suggestions submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or serve to amend contractual requirements.

SPECIFICATION

ORGANIZATION

CITY AND STATE

CONTRACT NUMBER

MATERIAL PROCURED UNDER A

☐ DIRECT GOVERNMENT CONTRACT ☐ SUBCONTRACT

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

A. GIVE PARAGRAPH NUMBER AND WORDING.

B. RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES

2. COMMENTS ON ANY SPECIFICATION REQUIREMENT CONSIDERED TOO RIGID

3. IS THE SPECIFICATION RESTRICTIVE?

☐ YES ☐ NO *(If "yes", in what way?)*

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

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

DATE

DD FORM 1 JAN 66 1426

REPLACES EDITION OF 1 OCT 64 WHICH MAY BE USED.