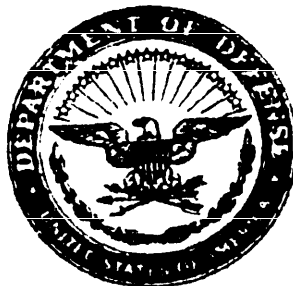


MIL-STD-1451A
16 June 1972
SUPERSEDING
MIL-STD-1451
7 July 1969

MILITARY STANDARD
RESOLVERS, ELECTRICAL, SELECTION OF



FSC 5990

MIL-STD-1451A
16 June 1972

Department of Defense
Washington, D. C. 20301

Resolvers, Electrical, Selection of

MIL-STD-1451A

1. This Military Standard is mandatory for use by all Departments and Agencies of the Department of Defense.
2. Recommended corrections, additions, or deletions should be addressed to Commanding Officer, Frankford Arsenal, ATTN: SMUFA-J4000, Philadelphia, Pa. 19137.

MIL-STD-1451A
16 June 1972

CONTENTS

	<u>Page</u>
Paragraph 1. SCOPE -----	1
1.1 Scope -----	1
1.2 Purpose of standard -----	1
2. REFERENCED DOCUMENTS -----	1
3. DEFINITIONS -----	2
4. GENERAL REQUIREMENTS -----	2
4.1 Selection of electrical resolvers -----	2
4.2 Criteria for inclusion in this standard -----	3
4.3 General listing of standard electrical resolvers to NATO interest -----	3
4.4 Application and use of electrical resolvers -----	4
4.4.1 Guide to primary design parameters -----	4
4.4.2 General guide to applications of electrical resolvers -----	4
4.4.3 Selections and alterations -----	4
4.4.4 Tests and inspections of electrical resolvers -----	5
4.4.5 Unspecified characteristics -----	6
4.4.6 Application functions -----	6
4.5 Request for use of non-standard resolvers -----	6
4.6 New resolver development -----	6
4.7 List of resolvers used in equipments -----	7
4.8 Specification modifications -----	7
5. DETAILED REQUIREMENTS (Not applicable) -----	7
6. NOTES -----	7
6.1 International standardization agreements -----	7
6.2 Relationship of standard resolvers with MIL-R-23417 Qualified Products List (QPL) -----	7
FIGURE	
Figure 1 List of electrical resolvers in equipment -----	8
TABLE	
Table 1 Guide to standard electrical resolver primary design parameters -----	5
Appendix -----	9

MIL-STD-1451A
16 June 1972

CONTENTS		<u>Page</u>
Paragraph 1.	SCOPE -----	1
1.1	Scope -----	1
1.2	Purpose of standard -----	1
2.	REFERENCED DOCUMENTS -----	1
3.	DEFINITIONS -----	2
4.	GENERAL REQUIREMENTS -----	2
4.1	Selection of electrical resolvers -----	2
4.2	Criteria for inclusion in this standard -----	3
4.3	General listing of standard electrical resolvers to NATO interest -----	3
4.4	Application and use of electrical resolvers -----	4
4.4.1	Guide to primary design parameters -----	4
4.4.2	General guide to applications of electrical resolvers -----	4
4.4.3	Selections and alterations -----	4
4.4.4	Tests and inspections of electrical resolvers -----	5
4.4.5	Unspecified characteristics -----	6
4.4.6	Application functions -----	6
4.5	Request for use of non-standard resolvers -----	6
4.6	New resolver development -----	6
4.7	List of resolvers used in equipments -----	7
4.8	Specification modifications -----	7
5.	DETAILED REQUIREMENTS (Not applicable) -----	7
6.	NOTES -----	7
6.1	International standardization agreements -----	7
6.2	Relationship of standard resolvers with MIL-R-23417 Qualified Products List (QPL) -----	7
FIGURE		
Figure 1	List of electrical resolvers in equipment -----	8
TABLE		
Table I	Guide to standard electrical resolver primary design parameters -----	5
Appendix	-----	9

MIL-STD-1451A
16 June 1972

1. SCOPE

1.1 Scope.- This standard establishes requirements for the selection and application of electrical resolvers used in the design and manufacture of military equipment. Complete detailed requirements for electrical resolvers listed in this standard are stated in the applicable MIL-R-23417 specification sheet listed herein.

1.2 Purpose of standard.

a. To provide military equipment designers and Original Equipment Manufacturers (OEM's) with a list of standard resolvers for military applications.

b. To control and minimize the variety of resolver types used in new equipment design and thereby facilitate effective logistic support of equipment in the field; to maximize economic support of, and to concentrate product improvement effort on the resolver types listed in this standard.

c. To establish means for requesting approval of deviation from the provisions of this standard.

d. To provide criteria pertinent to choice, application, and use of resolvers in military equipment.

e. To identify standard resolver types with respect to pertinent type designation, associated MIL-R-23417 coordinated specification sheet, and the North Atlantic Treaty Organization (NATO) interest.

2. REFERENCED DOCUMENTS

2.1 The issue of the following documents in effect on the date of invitations for bids form a part of this standard to the extent specified herein.

SPECIFICATION

Military

MIL-R-23417	Resolvers, Electrical: General Specification for; and coordinated associated specification sheets
-------------	---

STANDARDIZATION HANDBOOK

Military

MIL-HDEK-218	Applications of Electrical Resolvers
--------------	--------------------------------------

MIL-STD-1451A

16 June 1972

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

3. DEFINITIONS

3.1 The following special terms and definitions are basic to electrical resolvers. Other special terms, abbreviations, and symbols used in this standard are defined in MIL-R-23417 and principally apply to analog servo-equipment systems.

a. Electrical resolver - An electrical resolver is an inductive device analogous to a variable transformer which produces output voltages which vary, in magnitude and polarity, with the sine or cosine of the rotor shaft angular position.

b. Compensated resolver - An electrical resolver containing two windings in addition to the standard four winding configuration to minimize the effects of variations in source and load impedance, temperature, frequency, and energization level.

4. GENERAL REQUIREMENTS

4.1 Selection of electrical resolvers.- The variety of resolver types used in any military equipment shall be the minimum necessary to provide satisfactory performance. This document lists standard resolver types, all of which are intended for new military applications. The selection of resolver types to be incorporated in new equipments shall be confined to those types listed in this standard. In those applications where none of the types listed satisfy the requirements, the procedures of 4.5 and 4.6 shall be employed.

4.1.1 The term "new equipments" includes:

a. Equipments basically new in design with no similar prototypes.

b. Equipments incorporating a similar prototype, but completely redesigned electrically.

4.1.2 The term "new equipments" does not include:

a. Equipments that are merely reorders, without change, of existing equipment.

b. Equipments that are purely physical redesigns of existing equipments.

MIL-STD-1451A
16 June 1972

c. Equipments that are likely to be manufactured in very small quantities, such as laboratory equipment.

d. Equipments in the design stage before the effective date of the adoption of this standard.

4.2 Criteria for inclusion in this standard.

a. The resolver shall be defined in an approved coordinated MIL-R-23417 specification sheet.

b. The resolver type shall be approved by the military departments as the best available type for current application.

c. The resolver type shall have been in production and continued availability shall be reasonably certain.

d. The resolver shall be a four winding (2 rotor, 2 stator) 8 terminal noncompensated type or a compensated type with 2 rotor windings, 2 stator windings, 2 compensating windings and 12 terminals adhering to the design conventions of MIL-R-23417.

3. The resolver technical definition shall be such that all items produced to the definition shall be mechanically and electrically interchangeable for all military applications and therefore warrant assignment of a unique part number.

4.3 General listing of Standard Electrical Resolvers (as per 4.2) and North Atlantic Treaty Organization (NATO) interest.

	Type Designation	MIL-R-23417 Specification Sheet Numbers	MIL-R-23417 Part Numbers	NATO Status ^{1/}
1.	08R0N4B	34A	M23417/34-01 thru -06	-01
2.	08R3N4B	35A	M23417/35-01 thru -06	-01
3.	08R21W4B	37A	M23417/37-01 thru -03	-01
4.	11R23W4A	3	M23417/3 -01 thru -06	-01
5.	11R2N4B	31A	M23417/31-01 thru -06	-01
6.	11R1N4B	32A	M23417/32-01 thru -06	-01
7.	11R21N4B	33A	M23417/33-01, -07 thru -11	-01
8.	15R2N4A	4	M23417/4 -01 thru -07	-01
9.	15R8N4A	5	M23417/5 -01 thru -07	-01
10.	15R11W4A	26	M23417/26-01 thru -07	-01
11.	15R26W4A	27	M23417/27-01 thru -07	-01
12.	15R28N4A	9	M23417/9 -01 thru -07	-01
13.	15R28W4A	12	M23417/12-01 thru -07	-01
14.	23R32W4A	17	M23417/17-01	-01
15.	23R58N4A	19	M23417/19-01	-01
16.	23R58W4A	20	M23417/20-01	-01

^{1/} NATO status: Resolver part numbers corresponding to existing NATO preferred types (sec 6.1)

MIL-STD-1451A

16 June 1972

4.4 Application and use of electrical resolvers.

4.4.1 Guide to primary design parameters.- A guide for selection of standard resolvers listed in 4.3 based on primary performance criteria is included in Table 1. A further aid in design selection of standard resolvers is the following illustrated breakdown of MIL-R-23417 type designation for a resolver type 23R58W4A:

<u>23</u>	<u>R</u>	<u>58</u>	<u>W</u>	<u>4</u>	<u>A</u>
Size	Function	Input Winding Impedance	Compensation	Energization Frequency	Modification

Size - The first two digits designate the maximum diameter in tenths of an inch. The next higher tenth is used when the diameter is not exactly a whole number of tenths.

Function - The letter "R" designates resolver.

Input winding impedance - Indicates the nominal input winding impedance in hundreds of ohms. If the impedance is not exactly a whole number of hundreds, the next higher number is used.

Compensation - Compensation is indicated as follows:

W = Winding compensated

N = Not compensated

Energization frequency - Code "4" indicates 400 Hz.

Modification - The letter "A" indicates the original or basic issue of a standard resolver type designation. The first modification that affects the external mechanical dimension or the electrical characteristics of the basic type shall be indicated by "B" and so on.

4.4.2 General guide to applications of electrical resolvers.- MIL-HDBK 218 should be used as a general guide for applications of electrical resolvers.

4.4.3 Selections and alterations.- Military equipments shall be designed to meet equipment performance requirements when employing resolvers whose values of characteristics and dimensions are within the specified tolerances of MIL-R-23417 and associated coordinated specification sheets. Alterations of the resolvers selected are not permitted.

TABLE I

Guide to Standard Electrical Resolver Primary Design Parameters

Type	Spec. Sheet No.	*Eng. Wind.	*T.R. (nom.)	Angular Accuracy			System or Op. Range (Volts)	*P.S. (°)
				*E.E. ± (min.)	*F.E. ± (%)	*I.E. ± (min.)		
08R6N4B	34A	R	0.454	3			26	11
08R3N4B	35A	S	1.000	3			26(11.8) ^{1/}	9.7
08R21W4B	37A	S	0.970		0.1	5	0.5-15	15
11R23W4A	3	S	0.980		0.1	3	0.5-26	7.5
11R2N4B	31A	R	0.454	3			26	7
11R1N4B	32A	S	1.000	3			26(11.8) ^{1/}	5
11R21N4B	33A	S	1.902	3			26(11.8) ^{1/}	5.2
15R2N4A	4	R	0.453	3			0.5-26	7
15R8N4A	5	S	0.955		0.1	5	0.5-30	3.5
15R11W4A	26	S	0.980		0.1	5	5-26	8.5
15R26W4A	27	S	0.980		0.1	5	5-26	8.5
15R28N4A	9	S	0.980		0.1	5	0.5-26	3.5
15R28W4A	12	S	0.980		0.1	3	0.5-26	6
23R32W4A	17	S	0.980		0.05	3	1-130	1.9
23R58N4A	19	S	0.975		0.05	3	1-100	1.2
23R58W4A	20	S	0.298		0.05	3	1-100	1.9

*Code:

R = Rotor

S = Stator

T.R. = Transformation Ratio, output voltage/input voltage

E.E. = Electrical Error

F.E. = Function Error

I.E. = Interaxis Error

P.S. = Phase Shift of output voltage referred to input voltage

Eng. Wind = Energization Winding

^{1/} Operational input voltage = 11.8V.
System voltage = 26V.

NOTE: For complete requirements - see applicable military specification sheet.

4.4.4 Tests and inspections of electrical resolvers. - Tests and inspections of resolvers from suppliers, in addition to those normally required for production acceptance tests, shall be performed only upon approval of the Government contracting agency; except as required to obtain information pertinent to equipment design. Requests for approval submitted to the Government contracting agency, shall describe the purpose and intent of the proposed tests and inspections, and a detailed outline of the procedure. Supporting data that indicate a significant upgrading of equipment reliability as a result of the proposed tests, shall accompany the request. The proposed test or tests may be performed only upon receipt of approval of the Government contracting agency. When tests tend to degrade

MIL-STD-1451A

16 June 1972

performance or useful life, resolvers to which such tests are applied shall not be subsequently installed on deliverable equipment unless approved by the Government contracting agency.

4.4.5 Unspecified characteristics.- Acceptable equipment performance shall not be a function of those resolver characteristics which are not delineated in applicable military specifications, unless approval is obtained from the Government contracting agency. Requests for approval will contain information indicating an assurance that:

a. Specified equipment performance does not preclude usage of the particular resolver type listed in this standard.

b. Specified equipment performance is maintained when using standard resolvers that are chosen at random from acceptable lots supplied by various suppliers.

4.4.6 Application functions.- Resolvers incorporated into equipment shall be assigned functions consistent with applicable specification sheet performance characteristics. It is the responsibility of the equipment designer to determine the proper operating points and realistic safety factors to assure satisfactory and reliable performance of the equipment with anticipated variations of supply voltage, and load variation due to temperature rise and accumulated manufacturing tolerances of the equipment.

4.5 Request for use of non-standard resolvers.- In the event that a resolver type not included in this standard is required for a particular application, request for approval to use the resolver with supporting data (copy to the preparing activity Frankford Arsenal) shall be transmitted to the Government contracting agency. Copy of action by the contracting agency should be forwarded to Frankford Arsenal (SMUFA-J4000). Request for approval shall be in accordance with technical data requirements (see Appendix).

4.6 New resolver development.- In the event that resolver requirements of newly developed equipment cannot be accommodated by an existing resolver type, and development of a new resolver type is contemplated, the following information shall be submitted to the Government contracting agency with a copy to the preparing activity (Frankford Arsenal). Request for approval shall be in accordance with technical data requirements (see Appendix).

MIL-STD-1451A
16 June 1972

4.7 List of resolvers used in equipments.- Unless otherwise specified by the Government procuring activity, (see Appendix) the equipment prime contractor shall furnish a list of resolvers to the Government procuring activity under the following circumstances:

a. When resolvers are tentatively selected for newly developed equipments.

b. When the tentative resolver list is revised during the life of the contract.

c. When the final resolver list is determined, the final list shall be submitted not less than 60 days before the start of equipment production. A suggested format is shown in Figure 1.

4.8 Specification modifications.- The Government contracting agency will upon request, consider tests and inspections of resolvers in addition to those normally required to determine acceptance.

5. DETAIL REQUIREMENTS. Not applicable.

6. NOTES

6.1 International standardization agreements. Certain provisions of this standard are the subject of international standardization agreement (NATO NEPR No. 56). When revision or cancellation of this standard is proposed which will affect or violate the international agreement concerned, the preparing activity will take appropriate reconciliation action through international standardization channels including departmental standardization offices, if required.

6.2 Relationship of standard resolvers with MIL-R-23417 Qualified Products List (QPL).- Future revisions of this standard will include electrical resolver types which have met the QPL requirements of MIL-R-23417 and associated specification sheets. Frankford Arsenal (SMUFA-J4000) is the responsible military activity for maintaining the QPL for electrical resolvers covered by MIL-R-23417.

Custodians:
Army - MU
Navy - AS
Air Force - 11

Preparing activity:
Army - MU
Project No. 5090-0289

Review activities:
Army - EL, MI
Navy - OS, AS, SH, EC
Air Force - 17, 80
DSA - ES

User activities:
Army - ME, AV, AT
Navy - MC
Air Force - 14, 19

MIL-STD-1451A
16 June 1972

LIST OF ELECTRICAL RESOLVERS IN EQUIPMENT

TO:

Procuring Activity

Use of Resolver Types not in MIL-STD-1451A must be approved by the Government Contracting Agency			1. Date	
2. Equip. Description		3. Equip. Model Nomenclature		4. From (Submitting Act.)
5. Date of Contract	6. Contract No.	7. Qty of Equip. on Contract	8. From (Name of Contractor)	
9. Equipment Status (Check as appropriate)				
Proposed Design Preliminary Model Tentative		Developmental Model Preproduction Model Firm		Production Equip. Modification
10. Cognizant Government Engineering Agency		11. Cognizant Government Procurement Agency		12. Government Project Engr.
				13. Phone (Proj. Engr.)
EQUIPMENT UNIT	RESOLVER TYPE	QUANTITY PER UNIT	RESOLVER FUNCTION	

Note: Copy to Commanding Officer, Frankford Arsenal, SMUFA-J4000

Figure 1.

MIL-STD-1451A
16 June 1972

APPENDIX

10. Scope. - This appendix covers contract data requirements cited in this military standard.

10.1 Contract data requirements. - Items of deliverable data required by this standard are cited in the following paragraphs:

<u>Paragraph</u>	<u>Data requirement</u>	<u>Applicable DID</u>
4.5	Non-Std Resolvers	DI-E-1116
4.6	New Resolver Dev.	DI-E-1116
4.7	List of Resolvers	See Figure 1 herein

Such data shall be delivered if applicable in accordance with DI-E-1116, Standardization - Component Selection and Control (Data Item Description /DD Form 1664) when specified on DD Form 1423 (Contract Data Requirements List) and incorporated into the applicable contract.

10/20/2012

INSTRUCTIONS: In a continuing effort to make our standardization documents better, the DoD provides this form for use in submitting comments and suggestions for improvements. All users of military standardization documents are invited to provide suggestions. This form may be detached, folded along the lines indicated, taped along the loose edge (*DO NOT STAPLE*), and mailed. In block 6, be as specific as possible about particular problem areas such as wording which required interpretation, was too rigid, restrictive, loose, ambiguous, or was incompatible, and give proposed wording changes which would alleviate the problems. Enter in block 6 any remarks not related to a specific paragraph of the document. If block 7 is filled out, an acknowledgement will be mailed to you within 30 days to let you know that your comments were received and are being considered.

NOTE: This form may not be used to request copies of documents, nor to request waivers, deviations, or clarification of specification requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

(Fold along this line)

(Fold along this line)

DEPARTMENT OF THE ARMY



NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE \$300

BUSINESS REPLY MAIL
FIRST CLASS PERMIT NO. 12082 WASHINGTON D. C.
POSTAGE WILL BE PAID BY THE DEPARTMENT OF THE ARMY

Commander
US Army Armament Research and Development Command
ATTN: DRDAR-TST-S
Dover, NJ 07801

