

MIL-S-20708/94B(MU)  
4 February 1971  
SUPERSEDING  
MIL-S-20708/94A(MU)  
13 May 1963  
MIL-S-12472(ORD)  
13 February 1953  
In part (see 6.4)

## MILITARY SPECIFICATION

### SYNCHROS, 60 AND 400 Hz, SIZE 23

#### 1. SCOPE

1.1 This specification covers the detail requirements for 115 volt, 60 and 400 Hz, size 23 synchros (see 6.1).

#### 2. APPLICABLE DOCUMENTS

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

#### SPECIFICATIONS

##### Federal

TT-I-558 Ink, Marking Stencil, Opaque, for Nonporous Surfaces (Metals, Glass, etc.)

##### Military

MIL-V-173 Varnish, Moisture-and-fungus resistant (For the Treatment of Communications, Electronic, and Associated Electrical Equipment)  
MIL-S-20708 Synchros, General Specification for

#### STANDARDS

##### Military

MS 17186 Washer, Drive (Synchro)  
MS 17187 Nut, Plain, Hexagon  
MS 35275 Screw, Machine-drilled, Fillister Head, Slotted, Corrosion Resisting Steel, Passivated, UNC-2A  
MS 35333 Washer, Lock, Flat-Internal Tooth

MS 35338	Washer, Lock-spring, Helical, Regular (Medium) Series (in./mm)
MS 51972	Nut, Plain, Hexagon-steel, Corrosion Resisting, 300 Series, Passivated, UNF-2B

(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. REQUIREMENTS

3.1 Qualification.- Synchros furnished under this specification shall be products which are qualified for listing on the applicable qualified products list at the time set for opening of bids (see 4.2 and 6.5).

3.2 Design and construction.- Synchros furnished under this specification shall conform with the design, construction, and physical dimensions specified in Figure 1.

3.2.1 Housings.- Not applicable.

3.2.2 Slip rings.- Not applicable.

3.3 General requirements.- All requirements shall be in accordance with MIL-S-20708 except as otherwise specified herein. In case of conflict between the requirements of MIL-S-20708 and this specification, the requirements of this specification shall govern.

3.3.1 Altitude.- Not applicable.

3.3.2 Vibration.- Synchros shall withstand mechanical vibrations of  $0.10 \pm 0.02$  inch amplitude up to 60 Hz perpendicular and parallel to the shaft axis for a period of 8 hours + 15 minutes without mechanical damage or loosening of parts, and without degradation in performance to the extent specified in MIL-S-20708 following conformance to the vibration requirement.

3.3.3 Shock.- Synchros shall be capable of withstanding shock blows of 100 G in accordance with the low impact shock requirement of MIL-S-20708 where applicable. After testing, there shall be no damage or loosening of parts and synchros shall meet the performance requirements specified in MIL-S-20708 following low impact shock testing.

3.3.4 Ambient temperature.- Synchros shall be capable of storage in ambients ranging from  $-62^{\circ}\text{C}$  to  $100^{\circ}\text{C}$ . Synchros shall be capable of operation in ambient temperatures ranging from  $-55^{\circ}\text{C}$  to  $85^{\circ}\text{C}$ . Synchros shall meet the applicable requirements in Tables I and II herein at the specified ambient temperatures of MIL-S-20708, except the high ambient temperature shall be  $85^{\circ}\text{C}$  in lieu of  $125^{\circ}\text{C}$ . Hereinafter throughout this specification all requirements specified at the high temperature, shall be made at  $85^{\circ}\text{C}$ .

TABLE I. Synchros, Torque System Types

Requirement	Unit	Tolerance	Types							
			TX6 TX6A	TDX6 TDX6A	TR6 TR6A	TX4 TX4A	TDX4 TDX4A	TR4 TR4A		
1/ Frequency	Hz	Nominal	60	60	60	400	400	400	400	
1/ Primary voltage	Volts	Nominal	115	90	115	115	115	115	115	
Primary current	Milliamps	Maximum	231	420	231	1040	1040	1040	1040	
Primary power	Watts	Maximum	6	13.5	6	9.36	9.36	9.36	9.36	
Transformation ratio		± 1%	0.783	1.154	0.783	0.783	0.783	1.154	0.783	
Electrical error	Minutes	Maximum	8	8	8	8	8	8	8	
Torque gradient	oz-in/deg	Minimum	0.12	0.03	0.12	0.12	0.12	0.16	0.12	
Receiver error	Minutes	Maximum			60				60	
Null voltage	Millivolts	Maximum	160		160	100	100		100	
Total Fundamental			60		60	75	75		75	
Friction torque @-55°C	oz./in.	Maximum	0.2	0.2		0.2	0.2	0.2	0.2	
Temperature rise	°C	Maximum	0.5	0.5		0.5	0.5	0.5	0.5	
Impedance	Ohms	Maximum	65	65		65	65	65	65	
Z <sub>ro</sub>		R±15%+		100+j210						
Z <sub>so</sub>		jx±10%		170+j52						
Z <sub>rs</sub>										
Z <sub>ss</sub>										
		Nominal	121+j28.3		121+j28.3	7.3+j6.3	7.3+j6.3	11+j94 9+j10	7.3+j6.3	

1/ See MIL-S-20708, Standard test voltage and frequency.

TABLE II. Synchronos, Control System Types

Requirement	Unit	Tolerance	Types							
			CX6 CX6A	CDX6 CDX6A	CT6 CT6A	CX4 CX4A	CDX4 CDX4A	CT4 CT4A		
1/ Frequency	Hz	Nominal	60	60	60	400	400	400	400	
1/ Primary voltage	Volts	Nominal	115	90	90	115	90	90	90	
Primary current	Milliamps	Maximum	83	112	22	264	297	297	7.7	
Primary power	Watts	Nominal	1.6	2.2	0.5	2.5	2.8	2.8	0.08	
Transformation ratio		± 1%	0.783	1.154	0.735	0.783	1.154	1.154	0.735	
Electrical error	Minutes	Maximum	8	8	6	8	8	8	6	
Null voltage	Millivolts	Maximum								
Total			100	100	75	100	100	100	60	
Fundamental			75	75	60	75	50	50	30	
Friction torque	oz/in.	Maximum	0.2	0.2	0.2	0.2	0.2	0.2	0.2	
(@-55°C			0.5	0.5	0.5	0.5	0.5	0.5	0.5	
Temperature rise	°C	Maximum	45	45	45	45	45	45	45	
Impedance	Ohms	R±20% jx±15%	256+j1510	211+j757	1200+j3920	50.1+j544	41.4+j311	41.4+j311	1495+j11870	
Zro				471+j127	1412+j389			36+j32.7	675+j741	
Zso										
Zrs										
Zss			285+j55.5				19.3+j16.4			

1/ See MIL-S-20708, Standard test voltage and frequency.

3.3.5 Endurance.- All synchros shall be capable of continuous operation for 1000 + 10 hours without failure or undue wear. After testing, all synchros shall meet the applicable requirements of MIL-S-20708. The high ambient temperature shall be 85°C in lieu of 125°C.

3.4 Performance requirements.- The performance requirements shall be as specified in Tables I and II as applicable.

3.5 Part number identification.- Synchros listed in Tables I and II shall be identified by the following part numbers (see 6.2).

<u>Part No.</u>	<u>Type</u>	<u>Item Name</u>
7674818	23TX4	Synchro, Transmitter
7674819	23TR4	Synchro, Receiver
7674820	23CDX4	Synchro, Differential Transmitter
7674821	23CT4	Synchro, Control Transformer
7676354	23TX6	Synchro, Transmitter
7676355	23TR6	Synchro, Receiver
7676356	23CDX6	Synchro, Differential Transmitter
7676357	23CT6	Synchro, Control Transformer
7676359	23CX6	Synchro, Transmitter
7676360	23TDX6	Synchro, Differential Transmitter
7676906	23CX4	Synchro, Transmitter
7676963	23TDX4	Synchro, Differential Transmitter
8212762	23TX4A	Synchro, Transmitter
8212766	23TR4A	Synchro, Receiver
8212772	23CDX4A	Synchro, Differential Transmitter
8212775	23CT4A	Synchro, Control Transformer
8212778	23TX6A	Synchro, Transmitter
8212781	23TR6A	Synchro, Receiver
8212786	23CDX6A	Synchro, Differential Transmitter
8212789	23CT6A	Synchro, Control Transformer
8212794	23CX6A	Synchro, Transmitter
8212797	23TDX6A	Synchro, Differential Transmitter
8212801	23CX4A	Synchro, Transmitter
8212807	23TDX4A	Synchro, Differential Transmitter

#### 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 in the contract or order, the supplier may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by 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.

4.2 Qualification and quality conformance inspections.- Qualification and quality conformance inspections shall consist of the same test provisions of MIL-S-20708 as applicable and as specified herein.

4.3 Test methods and procedures.

4.3.1 Vibration.- Synchros shall be mounted rigidly to a vibration stand, shaft axis vertical and shaft extension downward, and shall be vibrated simultaneously in the vertical and horizontal directions for 8 hours  $\pm$  15 minutes, at  $0.10 \pm 0.02$  inch amplitude and at a frequency varying linearly from 10 Hz to 60 Hz over a period of one minute. An acceptable test method is as follows: Mount the synchro with the shaft extension downward and shaft axis at  $45^\circ$  to the horizontal and vibrate in the vertical direction with a resultant amplitude yielding  $0.10 \pm 0.02$  inch components parallel and perpendicular to the shaft axis.

4.3.2 Shock.- The low impact shock test of MIL-S-20708 shall apply except that the shock blow and its application shall be in accordance with Method 202 of MIL-STD-202.

4.3.3 Ambient temperatures.- The ambient temperature tests of MIL-S-20708 shall apply except that all synchros covered herein shall be subjected to a high temperature test of  $85^\circ\text{C}$  in lieu of  $125^\circ\text{C}$ .

4.3.4 Endurance.- The endurance test of MIL-S-20708 shall apply except that the total time of test shall be  $1000 \pm 10$  hours and the time of test at  $23 \pm 5^\circ\text{C}$  shall be  $840 \pm 4$  hours.

5. PREPARATION FOR DELIVERY

5.1 Preparation for delivery shall be in accordance with MIL-S-20708.

6. NOTES

6.1 Intended use.- Synchros covered by this specification (see 1.1) are intended only for maintenance support of in-service materiel. For synchros applicable to new materiel design see MIL-STD-710.

6.2 Ordering data.- MIL-S-20708 ordering data coverage shall apply except the synchro part number identification shall be in accordance with 3.5 herein.

6.3 Internal synchro design.- Figure 1 and Section 3 herein constitute the necessary Government requirements for supplying synchros covered by this specification. Details of internal design are optional. US Army Munitions Command detail drawings formerly used in procurement of these synchros are no longer required.

6.4 Supersession data.

6.4.1 MIL-S-12472.- All size 23 synchros formerly listed in MIL-S-12472(MU) will be procured by this specification.

6.4.2 Cancelled MS Part Numbers.- Part numbers listed on cancelled MS's are superseded by part numbers in this specification as follows:

<u>MS Part Number</u>	<u>MIL-S-20708/94 Part Number</u>
MS51082-1	8212762
MS51082-3	8212766
MS51083-1	8212772
MS51082-4	8212775
MS51080-1	8212778
MS51080-3	8212781
MS51081-1	8212786
MS51080-4	8212789
MS51080-2	8212794
MS51081-2	8212797
MS51082-2	8212801
MS51083-2	8212807

6.5 Qualification.- With respect to products requiring qualification, awards will be made only for products which are at the time set for opening of bids, qualified for inclusion in the applicable Qualified Products List whether or not such products have actually been so listed by that date. The attention of the 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. The activity responsible for the Qualified Products List is Commanding Officer, Frankford Arsenal, ATTN: SMUFA-T1000, Philadelphia, Penna. 19137 and information pertaining to qualification of products may be obtained from that activity.

Custodian:  
Army - MU

Preparing activity:  
Army - MU

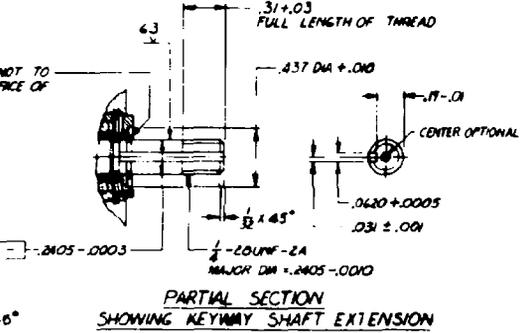
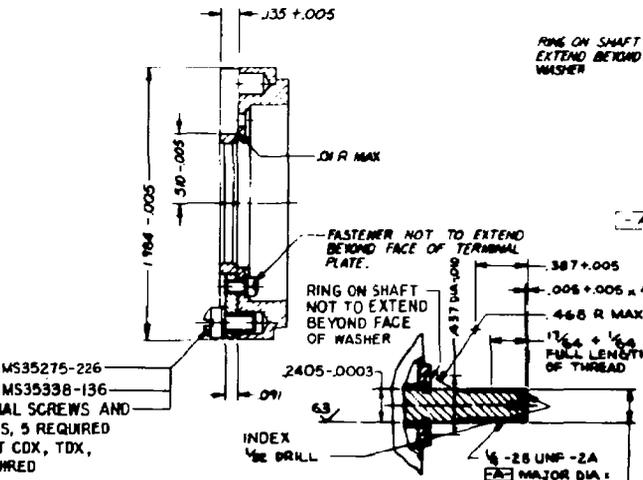
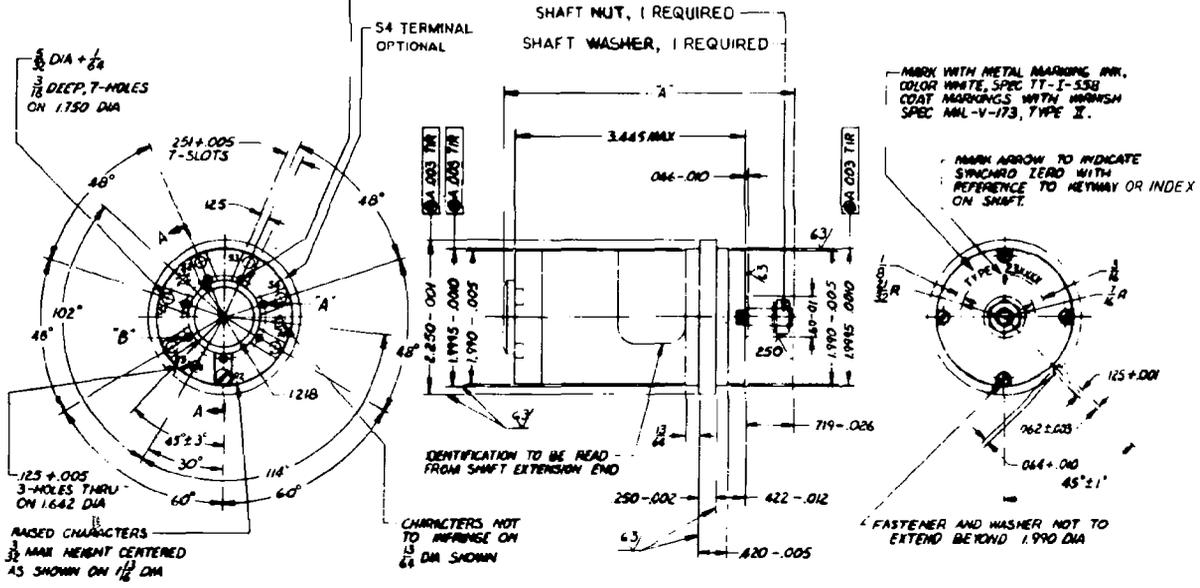
Review activities:  
Army - EL, MI, ME

Project No. 5990-A051

User activities:  
Army - AT, WC

SYNCHRO TYPE	DIM "A"	SHAFT NUT	SHAFT WASHER	SHAFT EXTEN
TR4, TR4, CX4, CT4, TR6, TX6, CX6, CT6	4.294 MAX	MS51972-1	MS35333-74	KEYWAY
TR4A, TX4A, CX4A, CT4A, TR6A, TX6A, CX6A, CT6A		MS17187-3	MS17186-B	SPLINE
TDX4, CDX4, TDX6, CDX6	4.544 MAX	MS51972-1	MS35333-74	KEYWAY
TDX4A, CDX4A, TDX6A, CDX6A,		MS17187-3	MS17186-B	SPLINE

.098 DIA + .005 5-HOLES THRU HOLES MARKED 'A' & 'B' DRILL TO DEPTH OF DRILL POINT, DO NOT BREAK THRU. HOLE MARKED 'B' DRILL THRU FOR DIFFERENTIALS ONLY.



- NOTES -
- 1- END PLAY SHALL NOT EXCEED .003, SHAFT HORIZONTAL, UPON REVERSAL OF A 1 LB. LOAD.
  - 2- RADIAL PLAY SHALL NOT EXCEED .001 UPON REVERSAL OF A 1/2 LB. LOAD.
  - 3- BRUSH PRESSURE SHALL BE ADJUSTED TO PERMIT ATTAINMENT OF PERFORMANCE REQUIREMENTS.
  - 4- DIMENSIONS ARE IN INCHES.
  - 5- TOLERANCES, WHEN NOT SPECIFIED, ARE ±.005 ON DECIMALS, ±1/64 ON FRACTIONS, AND ±0°30' ON ANGLES.
  - 6- THE DESIGN OF THIS UNIT SHALL PROVIDE FOR THE TERMINAL BLOCK TO REMAIN FIRED WHEN TERMINAL SCREWS AND TERMINAL LUGS ARE REMOVED.
  - 7- BREAK ALL SHARP EDGES .010 X 45°.

PARTIAL SECTION A-A SHOWING TERMINAL BOARD

PARTIAL SECTION SHOWING KEYWAY SHAFT EXTENSION

SPLINE DATA  
22 TOOTH INVOLUTE SPLINE  
BASED ON NOMINAL .250 SHAFT  
WITH REDUCED ADDENDUM  
96 DIAMETRAL PITCH .2405-.0002  
OD .250±.0010 P/B .205 MAX  
BASE DIA, 20° PRESSURE ANGLE

PARTIAL SECTION SHOWING SPLINE SHAFT EXTENSION

FIGURE 1. SYNCHROS, 60 AND 400 Hz SIZE 23