

AMPEX

MAGNETIC TAPE

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MILITARY SPECIFICATIONS AND HOW THEY APPLY TO MAGNETIC TAPE

Much confusion exists concerning Military and Federal Specification interpretation. They are probably the most quoted and least understood documents throughout the industry. In this issue of "TRENDS" we shall endeavor to outline each MIL SPEC and briefly trace its history leading up to the latest revision. Pertinent performance specifications will be quoted and clarified where necessary. It should be noted that Federal Specifications have been generated to replace the Military Specifications. This was done to broaden the coverage and effect of the document as pointed out in this quote from the introductory paragraph of Federal Specification W-T-0070, 26 April 1963: "It is recommended that Federal agencies use it in procurement and forward recommended changes to the preparing activity at the address shown above."

Generally speaking there are two product areas covered by MIL SPECS that affect the Magnetic Tape industry, one for tape and one for reels. Each will be discussed separately.

TAPE

Initial MIL SPEC	Replaced by	Latest Revision (FED SPEC)
MIL-T-21029A (SHIPS) (Instrumentation)	MIL-T-22756 (SHIPS)	W-T-0070
W-T-0061b (SHIPS) (Audio)		

MIL-T-21029A was a Military Spec written by BuShips to govern instrumentation tapes. This is the specification that created the two familiar categories of "A" and "B" oxide

instrumentation tapes. The primary difference between "A" and "B" oxide tapes is in the frequency response characteristics as pointed out in Table V, Pg. 5, MIL-T-21029A, 4 February 1960.

TABLE V FREQUENCY RESPONSE

Frequency Cycles per second (cps)	Output with respect to 1000 cps output and maximum permissible deviation	
	Type A (db)	Type B (db)
200	0 + 2	0 + 2
5,000	0 + 2	2 + 2
10,000	0 - 3 (No + limit)	2 - 2 (No + limit)

From this table it is evident that "B" oxide instrumentation tape must provide a higher frequency response at shorter wavelengths. It is this characteristic that makes "B" oxide the more desirable tape for critical instrumentation applications.

In order to be approved as either "A" or "B" oxide, the tape must also comply with the entire Mil Spec MIL-T-21029A which covers physical as well as electrical requirements. Following is a brief listing of such requirements:

Physical

- Tensile Strength
- Shock Tensile Strength
- Elongation under stress
- Humidity stability (cupping)
- Layer-to-Layer adhesion
- Anchorage
- Splices
- Dimensional Tolerances
 - Length
 - Width
 - "E" Values

Composition

Magnetic

- Signal-to-noise
- Output
- Sensitivity
- Frequency Response
- Dropouts
- Distortion
- Uniformity
- High-frequency Uniformity

Ease of Erasure
 Frictional Vibration
 Print-through
 Wind
 Workmanship and general inspection

A quality assurance sampling plan is also included to define testing procedures for acceptance inspection as well as packaging and labeling requirements.

W-T-0061B (SHIPS), March 21, 1960, Revision 3, was an interim Federal Spec covering both Audio tape and reels. It was superseded by MIL-T-22756A (SHIPS) which in turn was replaced by FED SPEC W-T-0070. W-T-0061B (SHIPS) and MIL-T-21029A are very similar in content, and they contain basically the same requirements.

MIL-T-22756 (SHIPS) not only updated and replaced MIL-T-21029A (SHIPS) and W-T-0061b, but it broadened the coverage to include the following under one specification:

MIL-T-22756/1A	Cellulose acetate base audio tapes
MIL-T-22756/2A	Polyester base audio tapes
MIL-T-22756/3A	Cellulose Acetate base instrumentation tapes
MIL-T-22756/4A	Polyester base instrumentation tapes
MIL-T-22756/5A	Polyester base high resolution instrumentation tapes

W-T-0070 is a reissue of MIL-T-22756, and contains basically the same specifications, so MIL-T-22756 may be used if W-T-0070 is not available.

REELS AND HUBS

Initial Spec	Replaced by	Latest Revision (FED SPEC)
W-T-0061b (audio reels portion only)	MIL-R-22842A (SHIPS)	W-R-00175

W-T-0061b contained specifications for audio reels in addition to audio tape specifications. That portion pertaining to reels was incorporated into MIL-R-22842A (SHIPS) 15 June 1962, which in turn was replaced by Fed Spec W-R-00175. The general specification MIL-R-22842 is broken down into the following specific sections:

MIL-R-22842/1B	Reels, standard, plastic and fiberglass 5/16 inch center hole
MIL-R-22842/2B	Hubs, standard, fiberglass, and metallic 3-inch center hole
MIL-R-22842/3B	Reels, standard, fiberglass and metallic 3-inch center hole

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MIL-R-22842/4B

Reel, Precision, Aluminum and Magnesium
3-inch center hole

Fed Spec W-R-00175 is a reissue of MIL-R-22842, and if W-R-00175 is not available, MIL-R-22842 may be used until a copy of W-R-00175 is obtained.

It should be remembered that all MIL SPECS (or FED SPECS) set forth the MINIMUM requirements for acceptance under the corresponding specifications. This does not mean that all tapes of different manufacture are equal in performance or reliability by virtue of the fact that they are all qualified under the same MIL SPEC. Certainly many tapes that are commercially available far exceed the minimum requirements set forth in the MIL SPECS. MIL SPECS should not be considered a leveling device that reduces all tapes to the same quality, performance, and reliability level. The MIL SPECS do establish a reference plane about which most manufacturers relate their specific published specifications. The magnetic tape industry does not have a standard, unified set of specifications, and therefore it is extremely difficult to compare a given manufacturer's tape's performance to that of another. The MIL SPECS do enable one to have a performance reference for purposes of comparing or referring to specific tape parameters of different tapes. There are certain, vital areas of performance and quality that the MIL SPECS have not embraced in the past.

A basis for judging useful tape life was incorporated in the new W-T-0070/5 for high resolution tapes. Relative head wear and other areas of performance are not presently contained in the present MIL SPECS. Most manufacturers work closely with users to furnish specific application data. The W-T-0070 specifications are a step ahead over the older W-T-0061b and MIL-T-21029A appear to offer the basis for continual improvement as the state of the art improves.