

403
408

STANDARD

"Scotch" Brand Magnetic Tape for Instrumentation

Why are "SCOTCH" BRAND Magnetic Tapes 403* and 408* considered the standard of the instrumentation field?

It's all quite logical. *No. 403 and No. 408 were the first magnetic tapes designed specifically for instrumentation work.* They set the standard that other tapes sought to attain.

Quite logically too, 3M made these tapes—the first to meet the critical demands of instrumentation recording and reproducing. 3M had introduced the first practical magnetic audible range tape in 1947. A decade later it would introduce the first video tape. Leadership is a 3M tradition.

So is product improvement. Magnetic tapes 403 and 408 were good products when they were introduced. But continuing research has made them even more sophisticated tapes today.

WHAT MAGNETIC TAPE IS

Magnetic tape is basically a plastic ribbon, coated on one side with iron oxide particles. The plastic ribbon, or base, may be either cellulose acetate or polyester.

Magnetic tapes 403 and 408 both have an identical standard red oxide coating. But 403 has a 1.5 mil cellulose acetate base, and 408 has a 1.5 mil polyester base.

No. 403 is especially suited for recording situations which require moderate speeds, tensions, and pressures. For best performance, 403 should be stored and used in humidity-controlled areas.

No. 408, with its weather-balanced base, offers freedom from physical distortion under severe environmental conditions. Because it is dimensionally stable, 408 is well suited for multi-track operations. It is also an excellent medium for long term storage of recorded data.

Both 403 and 408 offer quality with economy. Both have a record of wide

acceptance in data acquisition and reduction. *In fact, more rolls of 408 have been sold than any other instrumentation tape ever made.*

HOW MAGNETIC TAPE IS MADE

3M's exacting quality control governs each step in the manufacture of these tapes. Highly refined gamma ferric oxide, each particle in the shape of a needle less than 1 micron in length, is mixed in huge ball mills with a vinyl resin binder solution. The resulting dispersion is coated on a web of selected base material.

It is in this critical coating stage that 3M's experience *tells*. Each drop of dispersion must hold exactly the same amount of magnetic material. The coating applied must be physically uniform—only 1/6th the thickness of a human hair—if it is to be magnetically uniform. When you select a "SCOTCH" BRAND magnetic tape, you take advantage of 3M's half-century of specialization in precision coating techniques, and you get the coating uniformity that results from it.

After being coated, and before the coating is dry, the tape is run through a magnetic field which aligns the oxide particles longitudinally, that is, in the direction of normal tape travel. This particle orientation results in increased sensitivity and greater signal-to-noise ratio. The tape is then dried in ovens which cause solvents in the binder to evaporate, leaving the particles permanently bonded in place.

The finished web of tape is wound in jumbo rolls. Slitting machines, observing precise tolerances, then cut the tape into proper widths and wind the tape on individual reels.

DUST-FREE ENVIRONMENT

The tape-making process is carried out in an environment of the utmost cleanliness. 3M's Hutchinson plant, for instance, is located in a small town in the Minnesota countryside to avoid the relatively contaminated air of an industrial city. Within the plant a positive air system insures that air flows outward from the critical coating area, carrying away any dust that might be present. The reason for these elaborate precautions? If dust particles were to get into the tape coating, they could cause imperfections which might result in dropouts—losses of signal in tiny areas of the tape.

SILICONE LUBRICATION

Like all "SCOTCH" BRAND magnetic tapes, 403 and 408 have 3M's exclusive silicone lubrication (U. S. Patent No. 2654681). This dry lubricant lets the tape glide smoothly over sensitive recording heads, with a minimum of friction and wear. Impregnated throughout the coating, the silicone lubricant lasts the life of each tape.

STANDARD SIZES

Popular standard widths of 403 and 408 tapes are $\frac{1}{4}$ ", $\frac{1}{2}$ ", $\frac{3}{4}$ ", and 1". Standard lengths for these tapes (1.5 mil base) are 1250', 2500', and 5000'. Tapes 403 and 408 are supplied on NAB hubs, on NAB reels, on semi-precision reels, and on precision reels.

SPECIAL ORDERS

Widths and lengths of these tapes to meet any specialized requirements can be provided on special order. In addition, Standard oxide is available on various thicknesses of either cellulose acetate or polyester bases. Check with your 3M Representative for details.

**These are new designations. No. 403 used to be called No. 109; No. 408 was formerly No. 108.*

403

1.5 MIL BASE

408

1.5 MIL BASE

PHYSICAL PROPERTIES

	Reddish Brown Acetate	Reddish Brown Polyester
Color	Reddish Brown	Reddish Brown
Backing Material	Acetate	Polyester
Thickness in Mils		
Backing	1.42	1.45
Coating	.50	.50
Total	1.92	1.95
Slitting Tolerances—inches	+ .000 - .004	+ .000 - .004
Ultimate Tensile Strength		
1/4" Wide—Room Conditions	5.8#	9#
PSI	14,000	25,000
PSI @ 150°F.	11,000	20,500
Yield Strength		
5% Stretch in 1/4" Width	4.5#	5.4#
Elongation at Break	25%	100%
Coefficient of Friction	0.33	0.33
Residual Elongation	1.5%	0.5%
Toughness		
Tear—grams	3	26
Impact—kg—cms	20	100
Coefficient of Expansion*		
Humidity (units per % RH change)	15 x 10 ⁻⁵	1.1 x 10 ⁻⁵
Temperature (units per °F.)	3 x 10 ⁻⁵	2 x 10 ⁻⁵
Temperature Limits for Safe Use**		
Low	- 40°F.	- 40°F.
High	+140°F.	+140°F.
Wear Ability***	1	1

*These coefficients are unitless and represent the change per % relative humidity or degree Fahrenheit over the following ranges:

Humidity: 20% RH to 80% RH
Temperature: +30°F. to +130°F.

**These tapes will not cup or show layer-to-layer adhesion within the indicated temperature limits for safe use.

***Wear ability of standard instrumentation tape No. 408 is considered as "1." Relative wear ability of each additional tape is expressed as a multiple of this figure.

MAGNETIC PROPERTIES

Intrinsic Coercivity (H _{ci})—oersteds	250	250
Retentivity (B _{rs})—gauss	800	800
Remanence (flux lines/1/4" tape)	0.6	0.6
Output at 1% Distortion—db †		
15 Mil Wave Length	0	0
Sensitivity—db †		
15 Mil Wave Length	0	0
1 Mil Wave Length	0	0
Erasing Field—oersteds	1000	1000
Uniformity at 15 Mil Wave Length		
Within a Roll	± 3%	± 3%
Roll to Roll	± 10%	± 10%
Dropout Count ††		
Errors/1 Roll	1 or less	1 or less

†At optimum bias for each tape. Output and sensitivity are referred to standard instrumentation tape No. 408, which is designated as "0". All other tapes are expressed as gradations from this reference point.

††Measured by recording 200 non-return-to-zero (NRZ) pulses per inch on a 0.035" track. A reduction to less than 50% normal signal amplitude constitutes a signal error. Zero errors are measured by saturating the tape unidirectionally. Each spurious signal greater than 10% of normal signal amplitude constitutes a zero error. Errors per roll based on recording 7 tracks on rolls 1/2" x 2500'.

MIL-T-21029A

MIL-T-21029A

NOTE: These tapes conform to the requirements of specification MIL-T-21029A.

**GENERAL
OFFICES**

900 Bush Avenue
St. Paul 6, Minnesota

**BRANCH
OFFICE
LOCATIONS**

ATLANTA

732 Ashby Street N.W.
Atlanta 18, Georgia

BOSTON

1330 Centre Street
Newton Center 59, Massachusetts

BUFFALO

330 Green Street
All Mail: P.O. Box 2012
Buffalo 5, New York

CHICAGO

6850 South Harlem Avenue
Argo P.O.
Bedford Park, Illinois

CINCINNATI

4825 Para Drive
Cincinnati 37, Ohio

CLEVELAND

12200 Brookpark Road
Cleveland 30, Ohio

DALLAS

2121 Santa Anna Avenue
Dallas 28, Texas

DETROIT

411 Piquette Avenue
Detroit 2, Michigan

GRAND RAPIDS

815 Monroe Avenue
Grand Rapids 4, Michigan

HIGH POINT

2401 Brevard Street
All Mail: P.O. Box 151
High Point, North Carolina

HONOLULU

1410 Kapiolani Boulevard
Honolulu 14, Hawaii

LOS ANGELES

6023 South Garfield Avenue
Los Angeles 22, California

PHILADELPHIA

5698 Rising Sun Avenue
Philadelphia 20, Pennsylvania

RIDGEFIELD (NEW YORK)

700 Grand Avenue
Ridgefield, New Jersey

ST. LOUIS

10725 Baur Boulevard
St. Louis 32, Missouri

ST. PAUL

Benz Building
367 Grove Street
St. Paul 1, Minnesota

SAN FRANCISCO

320 Shaw Road
South San Francisco, California

SEATTLE

3663 1st Avenue South
Seattle 4, Washington

*"SCOTCH" and the plaid design are registered trademarks of 3M Co.,
St. Paul 6, Minnesota*

MINNESOTA MINING AND MANUFACTURING COMPANY
... WHERE RESEARCH IS THE KEY TO TOMORROW

