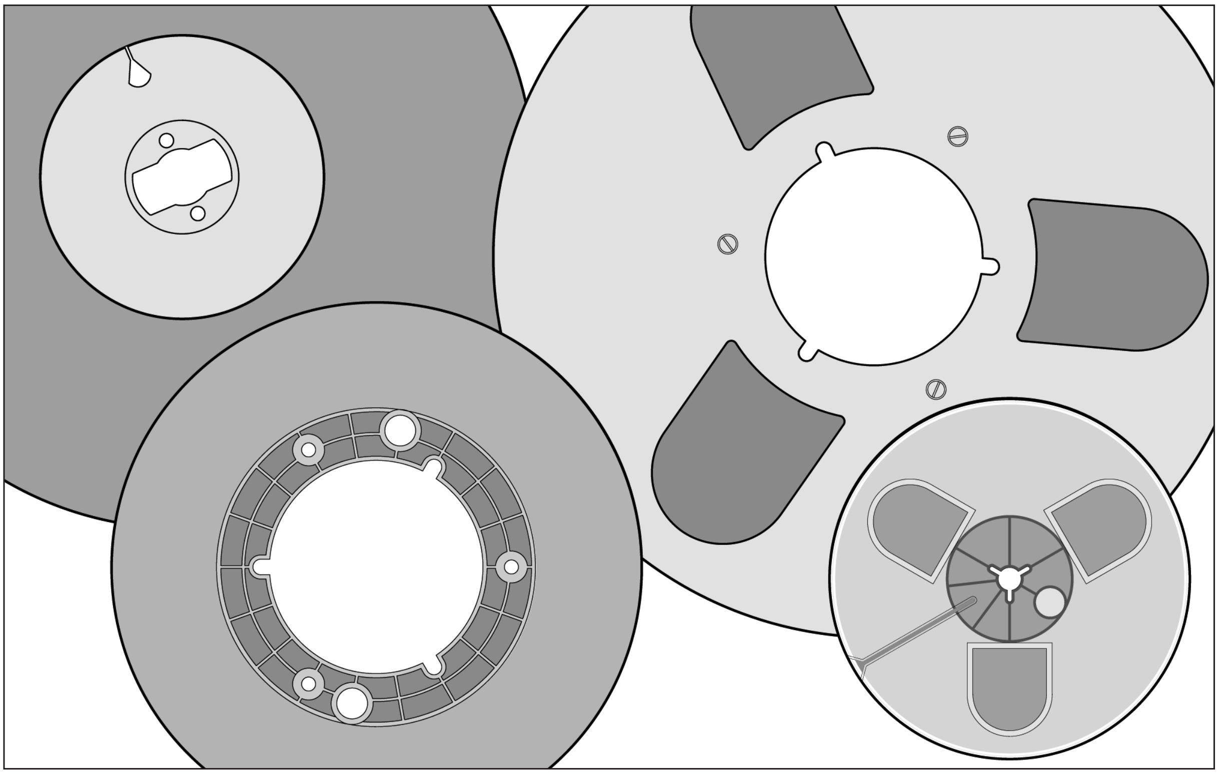
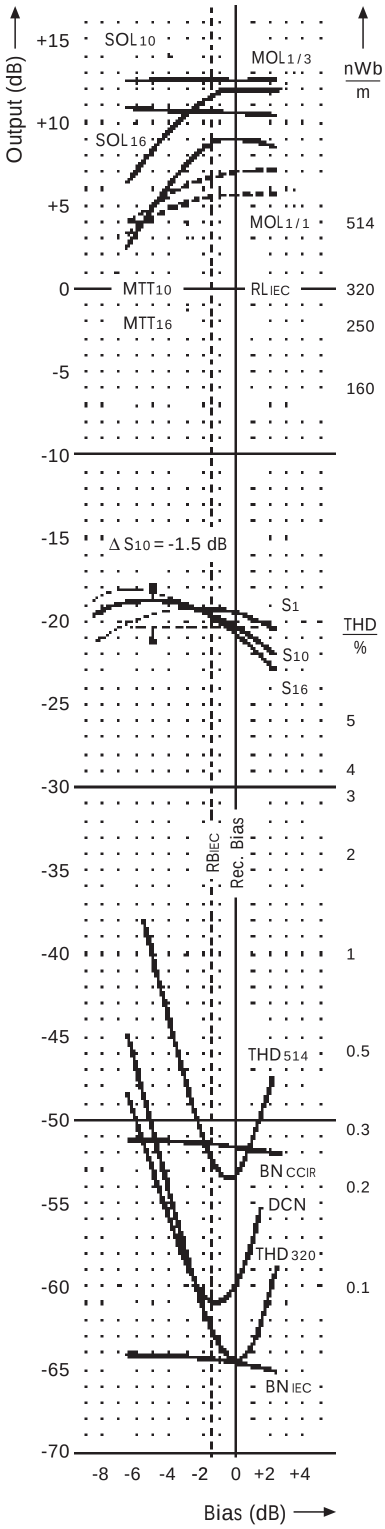
Studio Master 468

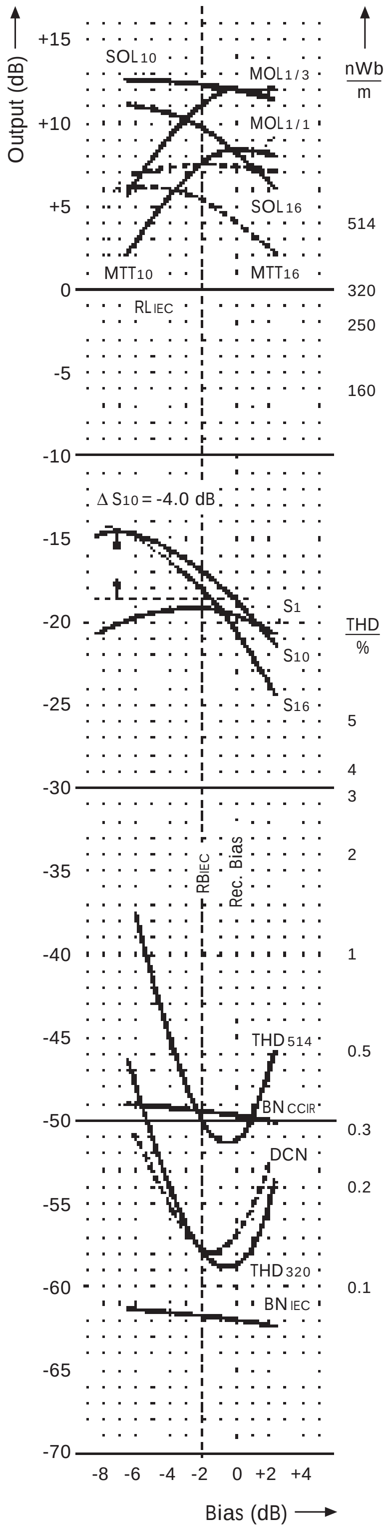


Studio Master tape for use in multitrack operation. Outstanding output level coupled with extremely low noise provides an excellent dynamic range over the entire frequency spectrum. Minimal print-through. Level uniformity up to the highest frequencies.

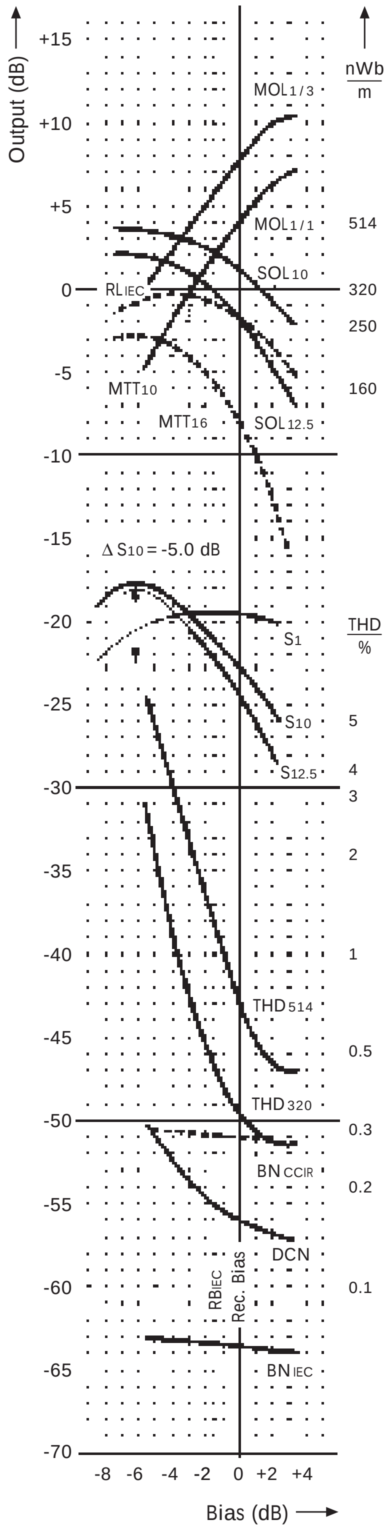
Tape speed 76.2 cm/s
Recording head gap length 7.0 µm
Playback head gap length 3.0 µm
Equalisation 17.5 µs
Reference level 320 nWb/m



Tape speed 38.1 cm/s
Recording head gap length 7.0 µm
Playback head gap length 3.0 µm
Equalisation 50 + 3180 µs
Reference level 320 nWb/m



Tape speed 19.05 cm/s
Recording head gap length 7.0 µm
Playback head gap length 3.0 µm
Equalisation 50 + 3180 µs
Reference level 320 nWb/m



Technical Data

Studio Master 468

05/99

1 Measurement conditions

					see Notes
Tape speed		76.2 cm/s 30 ips	38.1 cm/s 15 ips	19.05 cm/s 7.5 ips	
Recording head:	IEC Reference Head	IEC	IEC	IEC	1.1
	Gap length	7.0 µm	7.0 µm	7.0 µm	
	Track width	6.3 mm	6.3 mm	6.3 mm	
Playback head:	IEC Reference Head	IEC	IEC	IEC	1.1
	Gap length	3.0 µm	3.0 µm	3.0 µm	
	Track width	2.575 mm	2.575 mm	2.575 mm	
Playback equalisation		17.5 µs	50 + 3180 µs	50 + 3180 µs	1.2
RL_{IEC}	Reference level (1 kHz)	320 nWb/m	320 nWb/m	320 nWb/m	1.3
	IEC reference tape: batch	MT 82472	MT 82472	A 342 D	
	IEC reference tape bias definition	Min. THD_{320}	Min. THD_{320}	Min. THD_{320}	1.4
RB_{IEC}	IEC reference bias	-1.5 dB	-2.0 dB	-1.5 dB	1.5
Rec. Bias	Recommended bias setting	±0.0 dB	±0.0 dB	±0.0 dB	
ΔS_{10}	**Sensitivity drop for recommended bias setting**	**-1.5 dB**	**-4.0 dB**	**-5.0 dB**	1.6

2 Recording Performance Specifications

The table below presents the main parameters in the recommended bias setting. All figures given represent nominal values.

$MOL_{1/3}$	Maximum output level at 1 kHz, THD = 3 %	+12.0 dB	+12.0 dB	+7.5 dB	2.1
$MOL_{1/1}$	Maximum output level at 1 kHz, THD = 1 %	+9.0 dB	+8.5 dB	+4.5 dB	2.1
SOL_{10}	Saturation output level at 10 kHz	+12.5 dB	+12.0 dB	+1.0 dB	2.2
$SOL_{12.5}$	Saturation output level at 12.5 kHz			-2.0 dB	2.2
SOL_{16}	Saturation output level at 16 kHz	+10.5 dB	+8.5 dB		2.2
MTL_{10}	Twin-Tone output level at 10 kHz	+7.0 dB	+7.5 dB	-2.0 dB	2.3
MTL_{16}	Twin-Tone output level at 16 kHz	+5.5 dB	+4.0 dB	-8.0 dB	2.3
S_1	Relative tape sensitivity at 1 kHz	+0.5 dB	+0.5 dB	+0.5 dB	2.4
S_{10}	Relative tape sensitivity at 10 kHz	+1.5 dB	+1.5 dB	+1.5 dB	2.4
$S_{12.5}$	Relative tape sensitivity at 12.5 kHz			+1.5 dB	2.4
S_{16}	Relative tape sensitivity at 16 kHz	+2.5 dB	+1.5 dB		2.4
THD_{320}	Third harmonic distortion ratio at 320 nWb/m	-64.5 dB	-58.5 dB	-49.5 dB	2.5
THD_{320}	Third harmonic distortion factor at 320 nWb/m	0.06 %	0.12 %	0.34 %	2.5
THD_{514}	Third harmonic distortion ratio at 514 nWb/m	-53.0 dB	-51.0 dB	-43.0 dB	2.5
THD_{514}	Third harmonic distortion factor at 514 nWb/m	0.26 %	0.28 %	0.72 %	2.5
DCN	DC noise, weighted, rel. RL_{IEC}	-60.0 dB	-57.0 dB	-56.0 dB	2.6
BN_{IEC}	Bias noise level (IEC 94; A curve)	-64.5 dB	-62.5 dB	-64.0 dB	2.7
BN_{CCIR}	Bias noise level (CCIR 468-3)	-51.5 dB	-49.5 dB	-51.0 dB	2.7
MOL/BN_{IEC}	Signal to bias noise ratio at 1 kHz	76.5 dB	74.5 dB	71.5 dB	2.8
MOL/BN_{CCIR}	Signal to bias noise ratio at 1 kHz	63.5 dB	61.5 dB	58.5 dB	2.8
P	Print through	60.0 dB	58.0 dB	59.0 dB	2.9

3 Magnetic Properties

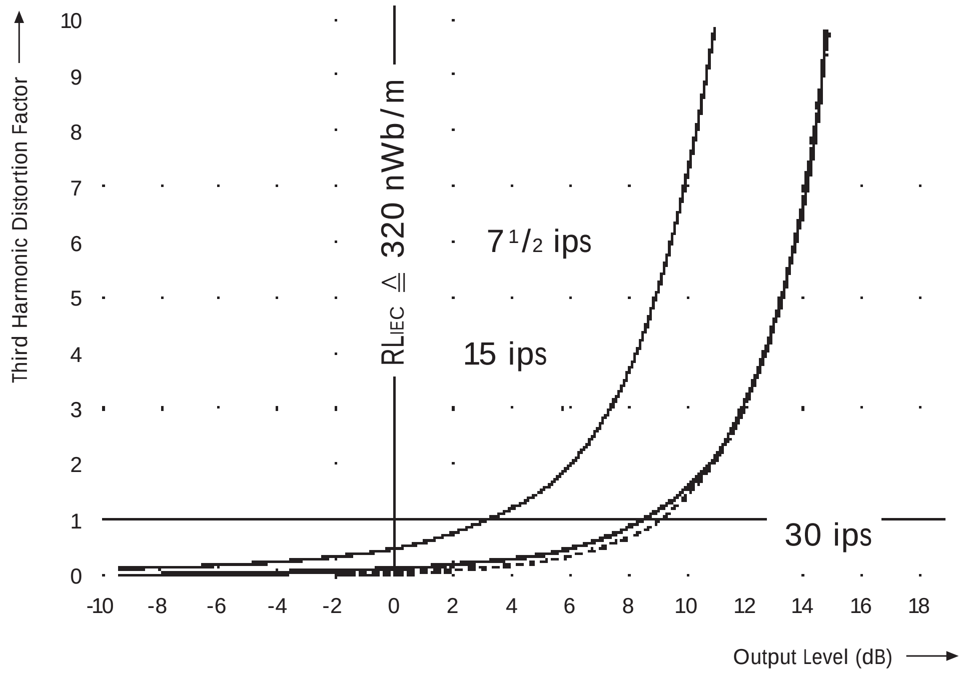
3.0

H_C	Coercivity	30.0 kA/m	380 Oe	3.1
B_{RS}	Retentivity	140 mT	1400 G	3.2
Φ_{RS}	Saturation flux	1990 nWb/m	199 mM/mm	3.3

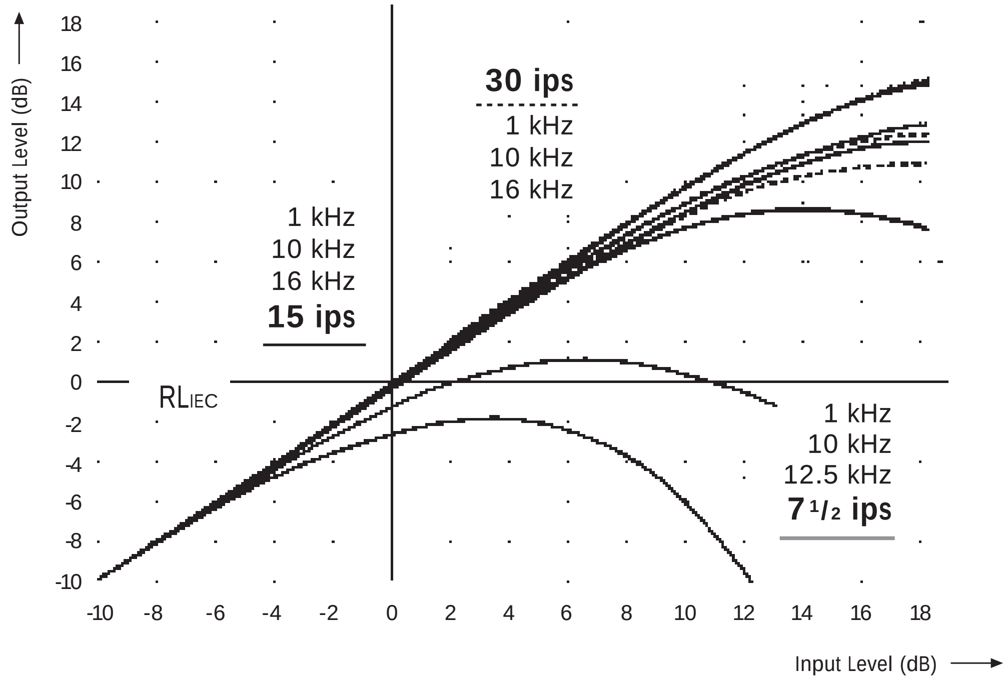
4 Physical Properties

Base material	Polyester		
Tape width	6.3 / 12.7 / 25.4 / 50.8 mm	1/4, 1/2, 1, 2 inch	
Tolerances of tape width	+0/-0.06 mm	+0/-0.0024 inch	
Base thickness	30.0 µm	1.18 mil	4.1
Coating thickness	14.5 µm	0.57 mil	4.1
Total thickness	48.0 µm	1.89 mil	4.1
Matt back	black		
Surface resistance of magnetic coating	$\leq 1.3 \cdot 10^4$ MΩ/□	≤ 13 GΩ/□	4.2
Surface resistance of matt back	≤ 60 kΩ/□		4.2
Coefficient of thermal expansion (ΔL/L)/°C	$2 \cdot 10^{-5}$		4.3
Coefficient of humidity expansion (ΔL/L) % RF	$1 \cdot 10^{-5}$		4.4
Load for elongation of 3 %, F_3	25 N	2.5 kp	4.5
Breaking tensile strength	≥ 60 N	≥ 6.0 kp	4.6
Static tensile strength per 6.3 mm tape width	≥14 N	≥ 1.4 kp	4.7
Dynamic tensile strength per 6.3 mm tape width	≥ 30 N	≥ 3.0 kp	4.7

Output level versus Third Harmonic Distortion Factor at frequency 1 kHz and tape speeds 30 ips (76.2 cm/s), 15 ips (38.1 cm/s) and 7 1/2 ips (19.05 cm/s). See also References 2.1 and 2.5.



Input Level versus Output Level at frequencies 1 kHz, 10 kHz and 16 kHz (12.5 kHz at 7 1/2 ips) and tape speeds 30 ips (76.2 cm/s), 15 ips (38.1 cm/s) and 7 1/2 ips (19.05 cm/s). See also Reference 2.2.



BASF Studio Tapes – A history of Expanding Expertise

Magnetic audio recording is an American invention. Oberlin Smith, a mechanical engineer from Bridgeton, New Jersey, USA, worked out the basics of the process in 1878 and conducted the first experiments. Ten years later, he reported on his findings in the trade magazine "The Electrical World". The first functioning magnetic recording devices, first built in 1898 by the Danish telephone engineer Valdemar Poulsen, used steel wire, steel tapes and even plated steel discs. Steel wire recorders continued to play a minor role in magnetic audio recording into the 1950's, although never achieving very wide acceptance.

Magnetic tape, as we know it today, was invented in Germany. In 1928, the Austrian-born paper specialist Fritz Pfleumer developed the first magnetic tape recorder using 16 mm (2 / 3 inch) paper tape covered with a powdered iron coating. AEG in Berlin, one of the largest European electrical firms of its day, expressed interest in the system. Following initial tests, AEG decided to contact the IG Farben Works in Ludwigshafen (better known as BASF) concerning tape production in autumn of 1932. As early as 1934, this led to the development of a coated tape using cellulose acetate backing and a carbonyl iron pigment as magnetic oxide, to meet AEG's specifications. The "Magnetophon K1" and "Magnetophon Tape Type C" were successfully demonstrated at the 1935 *Große Deutsche Funkausstellung* in Berlin. Since that time, BASF has never stopped producing magnetic tape. It's formula γ-Fe_2O_3, first introduced in 1939, has been continuously enhanced and is still in use in its latest improved version today.

With the introduction of AC biasing in 1940, magnetic tape recording technology had advanced (in its German home, at least) to become the highest quality recording medium available. As of 1941, the film manufacturer Agfa Wolfen also began to show great interest in magnetic audio recording since magnetic tape recording promised superior sound quality for the first German color movies. When the tape factory in Ludwigshafen was destroyed in 1943, tests in Wolfen were so far advanced that Agfa was able to become the second German magnetic tape manufacturer. During the post-war years, production was transferred, at least in part, to Leverkusen and Munich where a constantly growing assortment of magnetic tapes were developed and made. In 1991, Agfa's magnetic tape production joined BASF to form BASF Magnetics GmbH. This provided an excellent opportunity to combine the very best tape types and the most advanced dispersion and coating technologies from both companies. BASF Magnetics GmbH thus inherited superior quality products and processes from each of the two development lines.

Today, BASF Magnetics is one of the world's leading magnetic media manufacturers. Parallel to audio and video pancakes, which form the broadest segment of the product line, a highly developed, thoroughly tested and proven range of analogue and digital studio tapes is offered. Decades of experience, continuous and on-going development as well as close interaction with customers results in reliable, high-quality products that meet and surpass even the most demanding professional requirements.

To produce analogue magnetic tape requires an enormous sense of responsibility, both to the recording artist and the purchasing public. The logical choice of the right tape means that several quality parameters must be carefully considered simultaneously. The "noiseless" interaction of the electro-acoustic and mechanical properties of a tape and the often overlooked requirement for decade-long archivability are the ultimate factors in determining tape quality. Here, BASF Magnetics has an advantage of more than 60 years of practical experience leading to a fully developed and mature product line with finely balanced characteristics and outstanding reliability.

German broadcasters have traditionally produced programming using tape wound only on hubs alone, meaning without the protective flanges of closed NAB-type reels. This means that LGR 50 and PER 528 broadcast tapes must meet stringent requirements in daily operations, especially where winding properties are concerned, something both tapes accomplish easily. The knowledge gained in this area has also benefited the winding characteristics of studio tapes. The strict regulations concerning tape print-through set down by European broadcasters are fulfilled by BASF Magnetics by limiting magnetic pigment use to only those oxides with high print-through attenuation. Simultaneously, these provide high output levels across the entire frequency bandwidth. BASF tapes can trace their excellent reputation to this remarkable combination of superior electro-acoustic and mechanical quality.

Notes

The data in this publication are based on test methods of IEC Publication 94, Part 5. In as far as any test method is not part of this publication, DIN methods have been used.

1.1 Measurement method according to IEC 94, using the IEC standard reference heads. Recording heads with a gap length of 7 µm are recommended.

1.2 Playback equalization on the tape testing equipment is adjusted to provide a flat frequency response of the output voltage when compared with the frequency response section of the appropriate IEC calibration tape (time constants t_1 = 17.5 µs at tape speed 76.2 cm/s, t_1 and t_2 = 50 + 3180 µs at tape speeds 38.1 cm/s and 19.05 cm/s).

1.3 RL_{IEC} (Reference Level): The reference level 320 nWb/m corresponds with the reference level section of the IEC calibration tape used.

1.4 IEC reference bias definition: Using the relevant IEC calibration tape and the standard reference heads, the bias current providing the maximum third harmonic distortion ratio at the reference level (signal frequency 1 kHz) is the reference bias setting.

1.5 RB_{IEC} (IEC reference bias): This data represents the reference bias ratio of the tape under test and the relevant IEC reference tape at 76.2 cm/s, 38.1 cm/s and 19.05 cm/s respectively.

1.6 ΔS_{10} (Sensitivity drop for recommended bias setting): Operationally, the recommended bias is set with an input signal of 10 kHz at -20 dB. Based on the sensitivity curve S_{10} peak, the bias is increased until the playback level is reduced by the given value ΔS_{10} (see curve).

2.1 $MOL_{1/3}$, $MOL_{1/1}$ (maximum output level): Output level at 1 kHz relative to reference level RL_{IEC}, with a third harmonic distortion ratio of 3 % (1 %) or THD = -30.5 dB (-40.0 dB) (Point 2.5).

2.2 SOL_{10}, $SOL_{12.5}$, SOL_{16} (saturation output level): Output level at 10 kHz, 12.5 kHz or 16 kHz respectively, at which saturation occurs, relative to reference level RL_{IEC}.

2.3 MTL_{10}, MTL_{16} (maximum twin tone level): Playback level using a twin tone signal (10,000/10,040 Hz or 16,000 /16,040 Hz respectively) relative to reference level RL_{IEC}, characterised by a side band distortion of 4.7 % (IEC 94, part 5). At this level the annoyance of distortions is comparable to a third harmonic distortion of 3 % at low frequencies ($MOL_{1/3}$). As opposed to the saturation method of measurement, the MTL curves show the actually usable output of the tape.

2.4 S_1, S_{10}, $S_{12.5}$, S_{16} (Sensitivity): The sensitivity curves were recorded using a constant current with no equalisation. The magnetic tape's 1 kHz input signal is approximately 20 dB below the reference level RL_{IEC}. In accordance with IEC publication 94 the values for relative tape sensitivity refer to those of the relevant reference tape (batch MT 82472 or A 342 D resp.) at its own reference bias. – The distance between the sensitivity curves S_1 and S_{10}, $S_{12.5}$, or S_{16} resp. reflects the recording equalisation necessary to achieve a flat frequency response.

2.5 THD_{320}, THD_{514} (Third harmonic distortion ratio): The diagram shows the third harmonic distortion ratio and the third harmonic distortion factor (of a 1 kHz signal) at a constant magnetisation of 320 nWb/m or 514 nWb/m.

2.6 DCN (DC noise): According to IEC 94 a direct current is recorded which is equal to the RMS value of the signal current that is required to produce IEC reference level RL_{IEC}. Using reference bias RB_{IEC}, measurement of DC noise level is made using an RMS meter and a weighting filter network according to IEC 94, part 5, appendix 4.

2.7 BN_{IEC}, BN_{CCIR} (Bias Noise Level): The bias noise level is measured after operational erasure and HF biasing have been applied and compared to the reference level RL_{IEC}. BN_{IEC} is measured after weighting with an A filter in accordance with IEC 651. BN_{CCIR} is given as a quasi peak reading following filter weighting in accordance with CCIR 468-3 (as in IEC 94, part 5, point 3.4).

2.8 MOL/BN_{IEC}, MOL/BN_{CCIR} (Dynamic): The signal to bias noise ratio MOL/BN_{IEC} results from the addition of the maximum output level at 1 kHz $MOL_{1/3}$ and the bias noise level BN_{IEC}. In the same manner, MOL/BN_{CCIR} is the result of adding $MOL_{1/3}$ at 1 kHz and BN_{CCIR}.

2.9 P (Print-through): Print-through is the ratio of a reference level recording to the highest signal level transfered to the next tape layer over 24 hours when stored at 20 °C.

3.0 The measurements are made by means of a magnetic field having a strength of 100 kA/m (equal to 1,250 Oe).

3.1 H_C (Coercivity): The coercitive field strength is the magnetic field strength that saturated magnetic material exerts in a magnetically neutral situation.

3.2 B_{RS} (Retentivity): The remanent saturation flux is the remaining tape flux after the magnetic material has been subjected to saturation magnetisation.

3.3 Φ_{RS} (Residual Saturation Flux): The remanent saturation flux per meter track width is the remanent saturation multiplied by the coating cross-section of a one meter wide track.

4.1 Thicknesses: Values given are mean averages.

4.2 Surface resistance: According to IEC 94, part 4, the magnetic tape's side to be measured is placed over two measuring devices separated by the width of the tape. The resistance of the measured segment is given in megohms.

4.3 The coefficient of thermal expansion measures the tape's expansion when the temperature increases by 1 °C.

4.4 The coefficient of humidity expansion measures the tape's expansion when the relative humidity increases by 1 %.

4.5 Yield strength (F_3, 3 %): According to IEC 735, the force necessary to produce 3 % elongation is evaluated using a sample test length of 200 mm and an elongation rate of 100 mm/min.

4.6 Breaking tensile strength is the force to get the breaking point of a tape sample, according to IEC 735.

4.7 Static and dynamic tensile strength are measured according to DIN 45 481.

All data given in the specification are subject to change without prior notice due to technical progress.

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