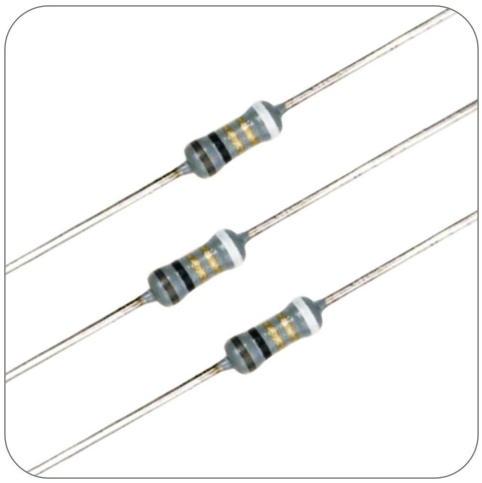
FUSIBLE RESISTOR - NFR25H

FEATURES

- Metal film technology
- Suitable for protection of circuit boards and designs
- Overload protection without risk of fire
- Defined interruption behavior (fusing time)
- Wide range of overload currents
- Flame retardant lacquer
- High stability, reliability and uniformity characteristics
- Various forming styles available
- Various packing and taping configurations
- RoHS compliant



MARKET SEGMENTS AND APPLICATIONS

INDUSTRY SECTOR	APPLICATION SEGMENT	END-USER EQUIPMENT
Industrial	Controls	Power supplies Power system control Central heating controls
Telecom	Data Communication	Line protection resistor Power supplies Modems
Consumer	Sound & Vision	Amplifiers TV VCR

TECHNOLOGY

A homogeneous film of metal alloy is deposited on a high-grade ceramic body. After a helical groove has been cut in the resistive layer, tinned connecting wires of electrolytic copper are welded to the end-caps. The resistors are coated with a gray flame retardant lacquer, which provides electrical, mechanical and climatic protection. The encapsulation is resistant to all cleaning solvents in accordance with MIL-STD-202, method 215 and IEC 60068-2-45.

QUICK REFERENCE DATA

DESCRIPTION	NFR25H ± 5% (E24 series)
	Cu-lead
Resistance range	0.22 Ω - 15 KΩ
Maximum dissipation at T_{amb} = 70 °C	0.5 W
Thermal resistance (R_{th})	150 K/W
Limiting voltage (DC or RMS)	350 V
Rated voltage (1)	$\sqrt{Pn \times R}$
Temperature coefficient: 0.22 Ω ≤ R ≤ 4.7 Ω 4.7 Ω < R < 15 kΩ	 ±200ppm/°C ±100ppm/°C
Climatic category (IEC 60068)	55/155/56
Basic specifications	IEC 60115 - 1 and 60115 - 2
Stability $\Delta R/R_{max}$ after:	
Load	±1% + 0.05 Ω
Climatic tests	±1% + 0.05 Ω
Resistance to soldering heat	±0.25% + 0.05 Ω

(1) Maximum rated voltage is the limiting voltage

MECHANICAL DATA

AXIAL STYLE

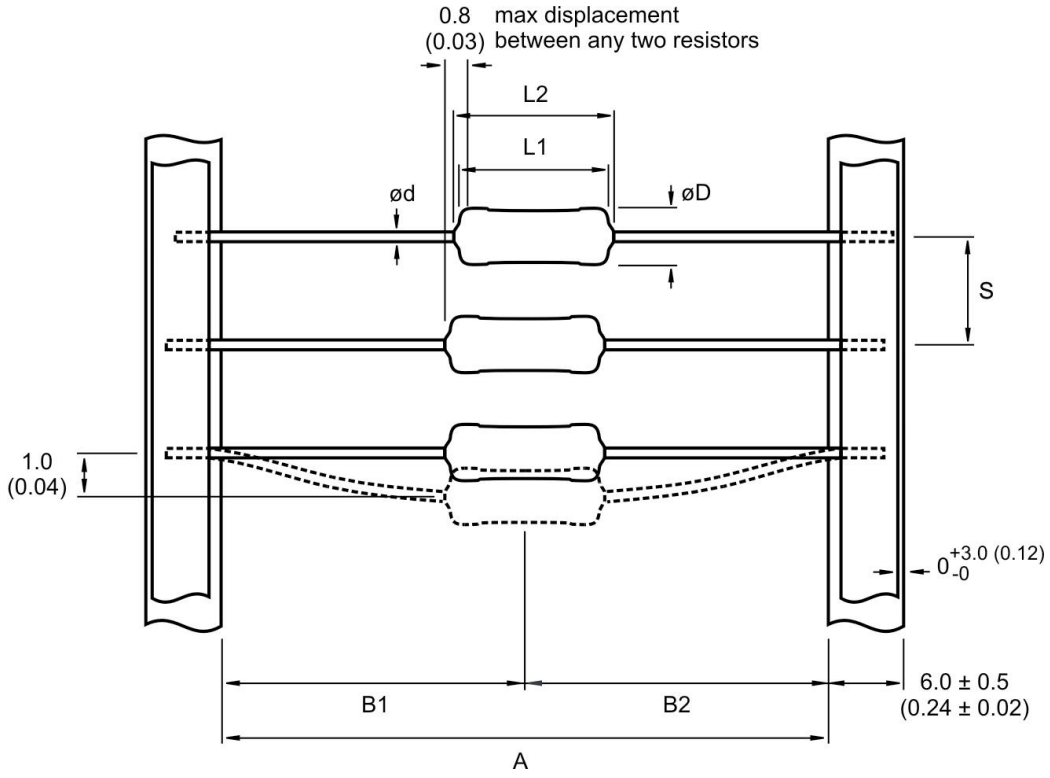


Fig. 1

Table 1. Mechanical data.

PRODUCT	A	L1 max	L2 max	ØD max	|B1 - B2| max	Ød	S	WEIGHT gr/100 pcs
NFR25H	52.0 + 1.5 / - 0.0 (2.05 + 0.06 / - 0.00)	6.5 (0.26)	7.5 (0.30)	2.5 (0.10)	1.2 (0.05)	0.58 ±0.05 (0.023 ±0.002)	5.0 ±0.1 (0.20 ±0.01)	22.0

Dimensions unless specified in mm (inches)

MOUNTING

The resistors are suitable for processing on automatic insertion equipment, cutting and bending machines. A radial taped version economizes space on the PCB. The double kink style offers great advantages for manual insertion improving the mounting stability for the customer. They have a real snap in function to fix the resistor in PCB without weakening the connecting leads.

ELECTRICAL CHARACTERISTICS

DERATING

The power that the resistor can dissipate depends on the operating temperature.

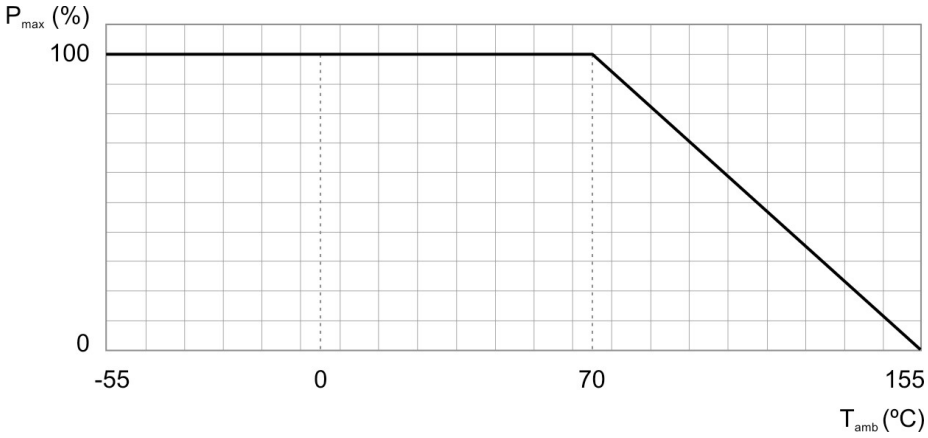


Fig. 2. Maximum dissipation (P_{max}) in percentage of rated power as a function of ambient temperature (T_{amb})

APPLICATION INFORMATION

Hot spot

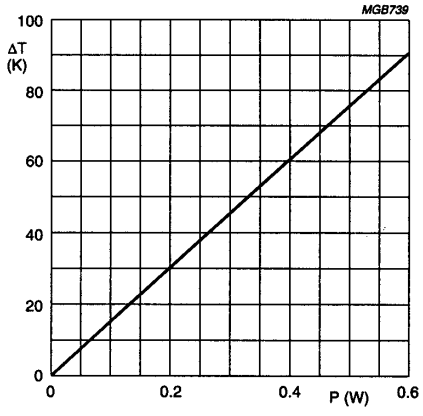


Fig. 3. Hot spot temperature rise (ΔT) as a function of dissipated power.

Solder spot

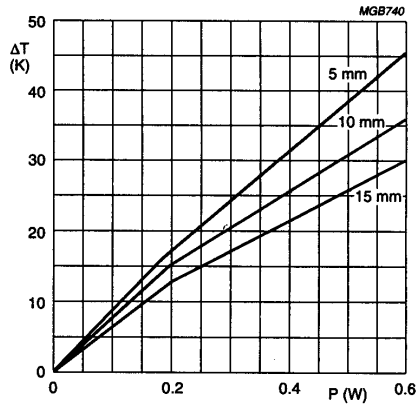


Fig. 4. Temperature rise (ΔT) at the lead (solder spot) as a function of dissipated power at various lead lengths after mounting

Note: The maximum permissible hot spot temperature is 155 °C

FUSING CHARACTERISTIC

The resistors will fuse without the risk of fire and within an indicated range of overload. Fusing means that resistive value of the resistor increases at least 100 times; see Figs. 5 and 6.
The fusing characteristic is measured under constant voltage.
This graph is based on measured data witch may deviate according to the application.

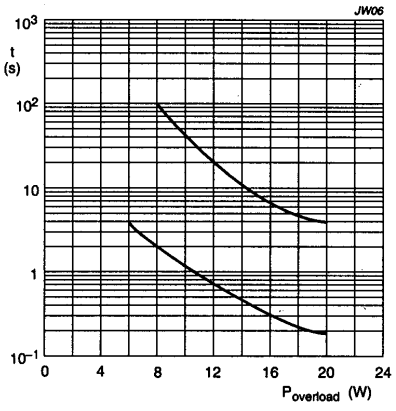


Fig. 5. Fusing characteristic: ≤ 1 Ω

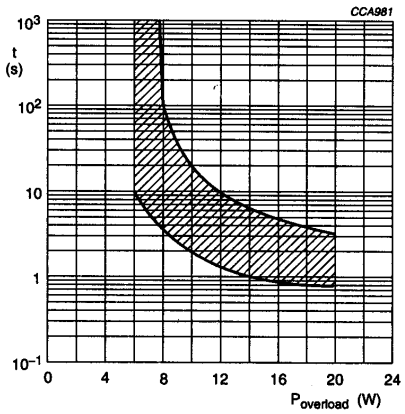


Fig. 6. Fusing characteristic: > 1 Ω

PULSE LOADING CAPABILITIES

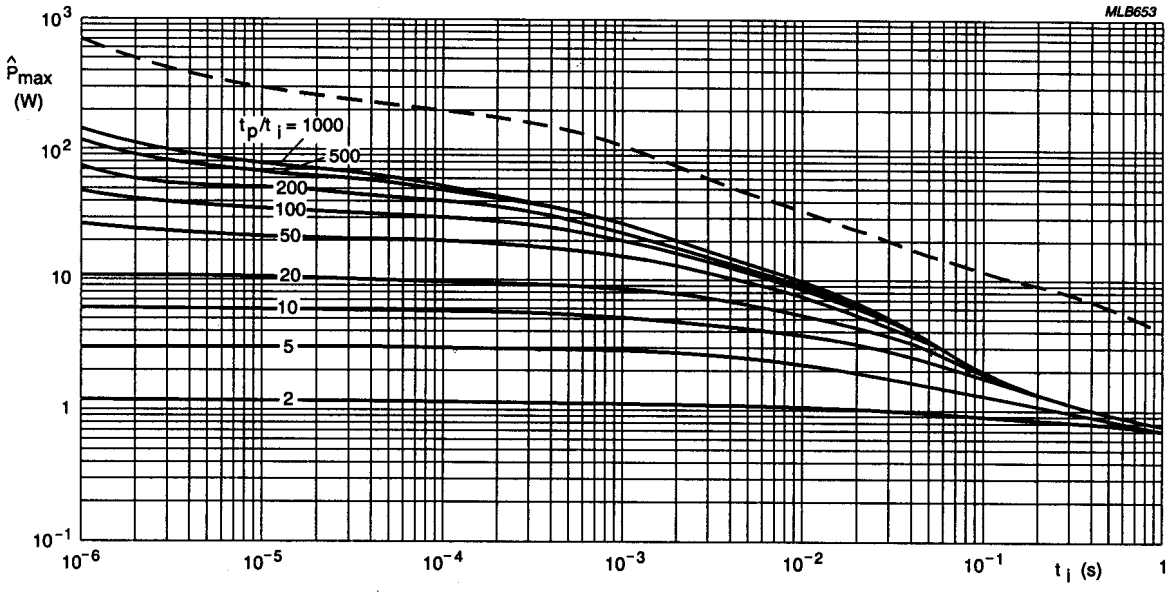


Fig. 7. Pulse on a regular basis, maximum permissible peak pulse power (^P_{max}) as a function of pulse duration (ti)

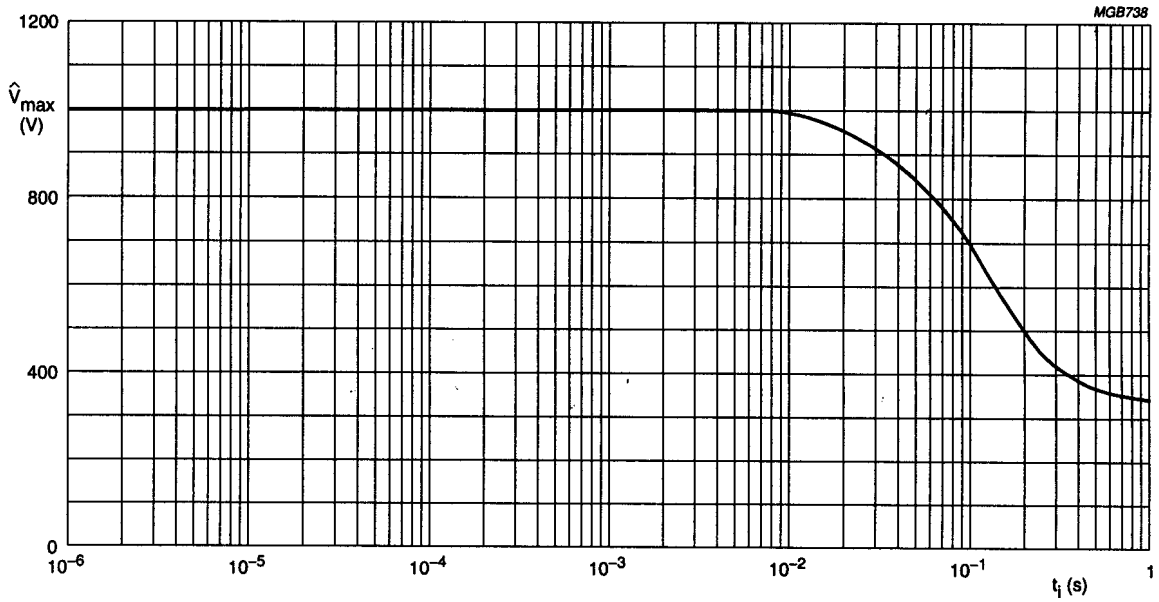


Fig. 8. Pulse on a regular basis, maximum permissible peak pulse voltage (^V_{max}) as a function of pulse duration (ti)

MARKING

The nominal resistance and tolerance are marked on the resistor using four colored bands in accordance with IEC publication 60062 “color code for fixed resistors”. There is a fifth white band in order to indicate the type of resistor. Standard values of nominal resistance are taken from the E24 series for resistors with a tolerance of ±5%. The values of the E24 series are in accordance with IEC publication 60063.

ORDERING INFORMATION

Table 2. Ordering code.

LEAD ∅	TOLERANCE	TAPING	QUANTI TY (pcs)	PACKAGING	ORDERING CODE
0.58 Cu (0.023)	±5%	52.0 (2.05)	5000	AMMOPACK	2322 207 33xxx
				REEL	2322 207 23xxx
			1000	AMMOPACK	2322 207 13xxx

Dimensions unless specified in mm (inches)
Check ”***Formed leads***” specifications to see related part-numbers

The resistors have a 12 digit ordering code starting with 2306 or 2322.
The next 5 digits indicate the resistor type and packaging, see table 2.
The last 3 digits indicate the resistance value:
- The first 2 digits of these last 3 indicate the actual resistance value;
- The last digit indicates the resistance decade in accordance with table 3.

Table 3. Last digit of ordering code.

RESISTANCE DECADE	LAST DIGIT
0.22 Ω - 0.91 Ω	7
1 Ω - 9.1 Ω	8
10 Ω - 91 Ω	9
100 Ω - 910 Ω	1
1 kΩ - 9.1 kΩ	2
10 kΩ - 15 kΩ	3

Example:
NFR25H, 750 Ω, ±5%, ammopack 1000 pcs is **2322 207 13751**.

NAFTA ORDERING INFORMATION

Table 4. NAFTA ordering code.

LEAD ∅	TOLERANCE	TAPING	QUANTITY (pcs)	PACKAGING	NAFTA ORDERING CODE
0.58 Cu (0.023)	± 5%	52.0 (2.047)	1000	AMMOPACK	5065FMxxxxxJ08AFX (1) 5065FDxxxxxJ08AFX (2)
		52.0 (2.047)	5000	REEL	5065FMxxxxxJ12AFX (1) 5065FDxxxxxJ12AFX (2)
		52.0 (2.047)	5000	AMMOPACK	5065FMxxxxxJ18AFX (1) 5065FDxxxxxJ18AFX (2)

Dimensions unless specified in mm (inches)
(1) Part number for values ≤ 15 Ω
(2) Part number for values > 15 Ω

The ohmic value in the NAFTA ordering code (see table 4) is represented by the “xxxxx” in the middle of the above ordering code. Table 5 gives some examples how to use these 5 digits.

Table 5. Ohmic value examples.

VALUE	5 DIGITS
1 Ω	1R000
10 Ω	10R00
100 Ω	100R0
1 kΩ	1K000
10 kΩ	10K00
100 kΩ	100K0
1 MΩ	1M000

PACKAGING

TAPE IN AMMOPACK

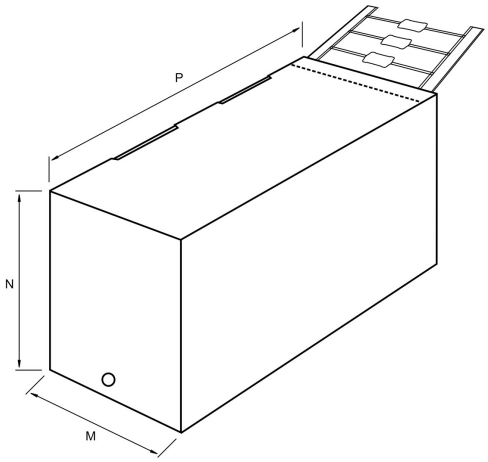


Table 6. Ammopack.

PRODUCT	TAPING	M	N	P	QTUANTIY (pcs)
NFR25H	52.0 + 1.5 / - 0.0 (2.05 + 0.06 / - 0.00)	82 (3.3)	28 (10.1)	262 (10.4)	1000
	52.0 + 1.5 / - 0.0 (2.05 + 0.06 / - 0.00)	78 (3.1)	98 (3.9)	260 (10.3)	5000

Dimensions unless specified in mm (inches)

TAPE ON REEL

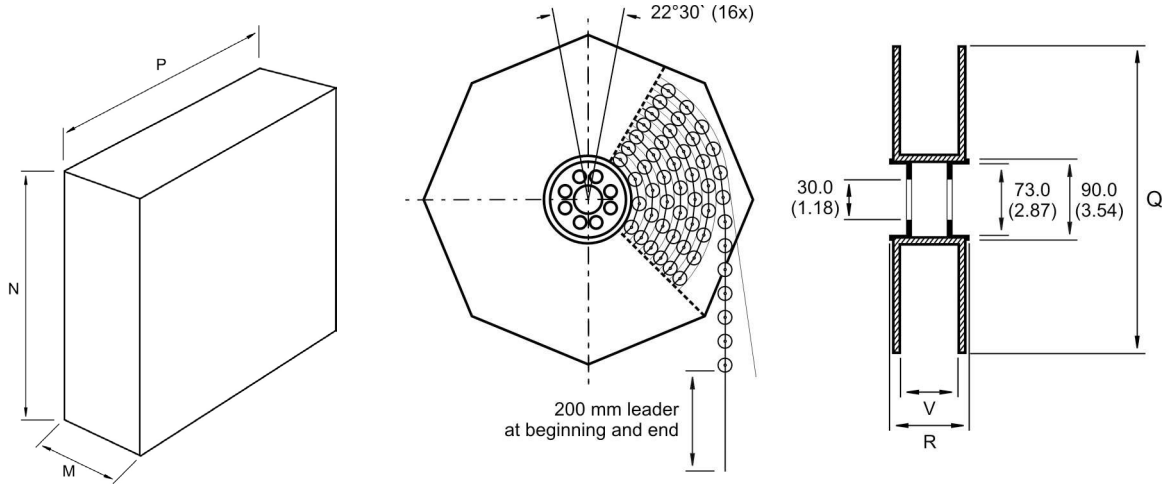


Table 7. Reel.

PRODUCT	TAPING	M	N	P	Q	V	R	QTY pcs
NFR25H	52.0 + 1.5 / - 0.0 (2.05 + 0.06 / - 0.00)	92 (3.7)	311 (12.3)	311 (12.3)	305 (12.01)	75 (3.0)	86 (3.4)	5000

Dimensions unless specified in mm (inches)

TESTS AND REQUIREMENTS

Essentially all tests are carried out in accordance to the schedule of IEC publications 60115 - 1, category 55/155/56 (rated temperature range -55 to +155 °C; damp heat, long term, 56 days and along the lines of IEC publications 60068-2); “Recommended basic climatic and mechanical robustness testing procedure for electronic components” and under standard atmosphere conditions according to IEC 60068-1 subclause 5.3, unless otherwise specified.
In some instances deviations from IEC applications were necessary for our method specified.

Table 8. Test and requirements.

IEC 60115-1 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
4.6.1.1	-	Insulation resistance	500 V (DC) during 1 minute; V-block method	$R_{ins\ min}$ 10^4 MΩ

IEC 60115-1 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
4.7	-	Voltage proof on insulation	700 (RMS) during 1 minute; V-block method	No breakdown or flashover
4.8	-	Temperature coefficient	Between - 55 °C and + 155 °C 0.22 Ω ≤ R ≤ 4.7 Ω 4.7 Ω< R ≤ 15 kΩ	± 200 ppm/°C ± 100 ppm/°C
4.12	-	Noise	IEC publication 60195	< 0.1 µV/V
4.16	21(U)	Robustness of terminations:		No damage $\Delta R/R_{max}$ ±0.25% + 0.05 Ω
4.16.2	21(Ua1)	Tensile all samples	Load 10 N; 10 s	
4.16.3	21(Ub)	Bending half number of samples	Load 5 N; 4 x 90°	
4.16.4	21(Uc)	Torsion other half number of samples	3 x 360° in opposite directions	
4.17	20(Ta)	Solderability (after aging)	16 h 155 °C; leads immersed in flux 600, leads immersed 2 mm for 2 ±0.5 s in a solder bath at 235 ±5 °C	Good tinning (≥ 95% covered); no damage
4.18	20(Tb)	Resistance to soldering heat	Thermal shock: 3 s; 350 ºC; 6 mm from body	$\Delta R/R_{max}$ ± 0.25% + 0.05 Ω
4.19	14(Na)	Rapid change of temperature	30 minutes at – 55 °C and 30 minutes at + 155 °C; 5 cycles	No visual damage $\Delta R/R_{max}$ ± 0.25% + 0.05 Ω
4.22	6(Fc)	Vibration	Frequency 10 to 500 Hz; displacement 1.5 mm or acceleration 10 g; three directions; total 6 h (3 x 2 h)	No damage $\Delta R/R_{max}$ ± 0.25% + 0.05 Ω
4.23		Climatic sequence:		$R_{ins\ min}$ 10^3 MΩ $\Delta R/R_{max}$ ± 1% + 0.05 Ω
4.23.2	2(Ba)	Dry heat	16 h, + 155 °C	
4.23.3	30(Db)	Damp heat (accelerated) 1st cycle	24 h, 25 °C to 55 °C, 90% to 100% R.H.	
4.23.4	1(Aa)	Cold	2 h, - 55 °C	
4.23.6	30(Db)	Damp heat (accelerated) remaining cycles	5 days; 25 °C to 55 °C; 90 to 98% R.H.	

IEC 60115-1 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
4.24	3(Ca)	Damp heat (steady state)	56 days; 40 ºC; 90 to 95% R.H.; loaded with 0.01 Pn	$R_{ins\ min}$ 10^3 MΩ $\Delta R/R_{max}$ ± 1% + 0.05 Ω
4.25.1	-	Endurance (at 70 °C)	1000 h; loaded with Pn or V_{max}; 1.5 h ON and 0.5 h OFF.	$\Delta R/R_{max}$.: ± 1% + 0.05 Ω
4.26	-	Accidental overload	Overload of 5, 10, 16, 25, 40, 63 and 100 times the rated power, but the applied voltage shall not exceed four times the limiting voltage.	Non-flammable
4.29	45(Xa)	Component solvent resistance	Isopropyl alcohol followed by brushing in accordance with MIL STD 202	No visual damage
See 2nd amendment to IEC 60115-1		Pulse load		See Figs. 7 and 8