

WHA YU INDUSTRIAL CO., LTD. (HEAD OFFICE)

TAI HWA ELECTRONIC CO., LTD.(CHINA)
SHANGHAI HUA YU ELECTRONIC CO., LTD.(CHINA)

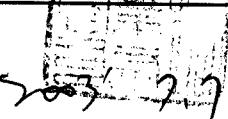
SPECIFICATION FOR APPROVAL

CUSTOMER: 中磊科技股份有限公司

PART NAME: RF Antenna Assembly

PART NO: **REVISION:**

W. Y. P / NO.: C147-510016-A **REV.:** X1

	MANUFACTURER SIGNATURE	CUSTOMER SIGNATURE
APPROVED BY :		
DATE :		

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RF Antenna Cable Assembly

Specification

1. Electrical Properties :

- 1.1 Frequency Range..... 2.4GHz ~ 2.5GHz
- 1.2 Impedance 50Ω Nominal
- 1.3 VSWR 2.0 Max.
- 1.4 Return Loss..... -9.5 dB Maximum
- 1.5 Electrical Wave..... 1/2 λ Helix
- 1.6 Gain..... 3.3 dBi
- 1.7 Admitted Power..... 1W

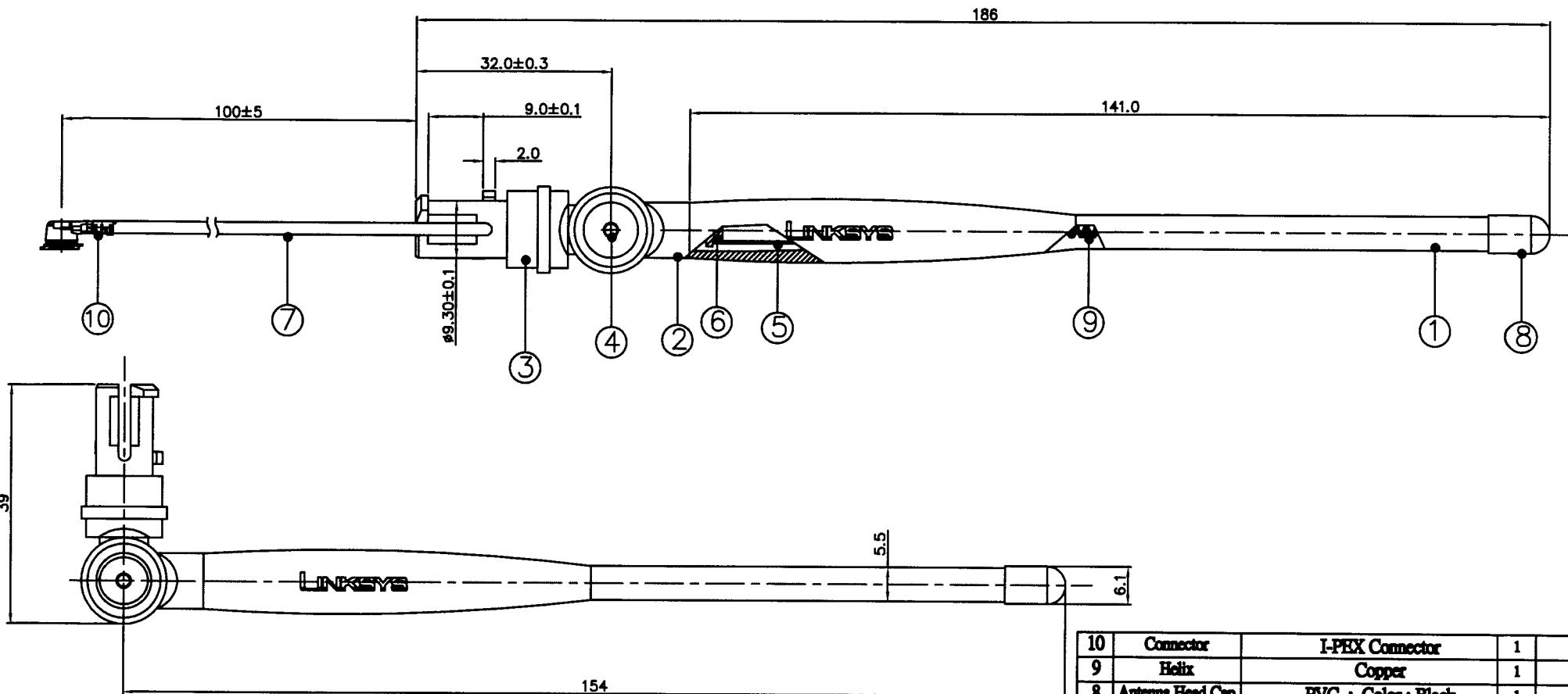
2. Physical Properties :

- 2.1 Cable..... φ 1.13 Coaxial Cable
- 2.2 Antenna Cover..... TPE
- 2.3 Antenna Base..... PC
- 2.4 Operating Temp.-20°C ~ +65°C
- 2.5 Storage Temp.-30°C ~ +75°C
- 2.6 Color Black
- 2.7 Connector..... I-PEX

CG-xx

REV	DATE	DESCRIPTION
X1	07/07-2003	New Issue

186



NO	DESCRIPTION	QTY	REMARK
10	Connector	1	I-PEX Connector
9	Helix	1	Copper
8	Antenna Head Cap	1	PVC ; Color : Black
7	Cable	1	Ø1.13 Cable
6	Insulator	1	ABS Compound ,White
5	Ground Tube	1	Brass ,Ni Plated
4	Rivet	2	Brass ,Cr Plated (Black)
3	Antenna Base	1	PC ; Color : Black
2	Antenna Base	1	PC ; Color : Black
1	Antenna Body	1	TPB ; Color : Black

CUSTOMER'S SIGNATURE

XX	±3.0	APPROVED	<i>Smith 1/3</i>
X	±2.0		
X	±1.0	CHECKED	<i>petri 1/3</i>
XX	±0.5		
XXX	±0.1	DRAWING	<i>東京 1/3</i>

CUSTOMER: 中嘉科技股份有限公司

PART NO :

PARTNAME: RF Antenna Cable Assembly (2.4G)

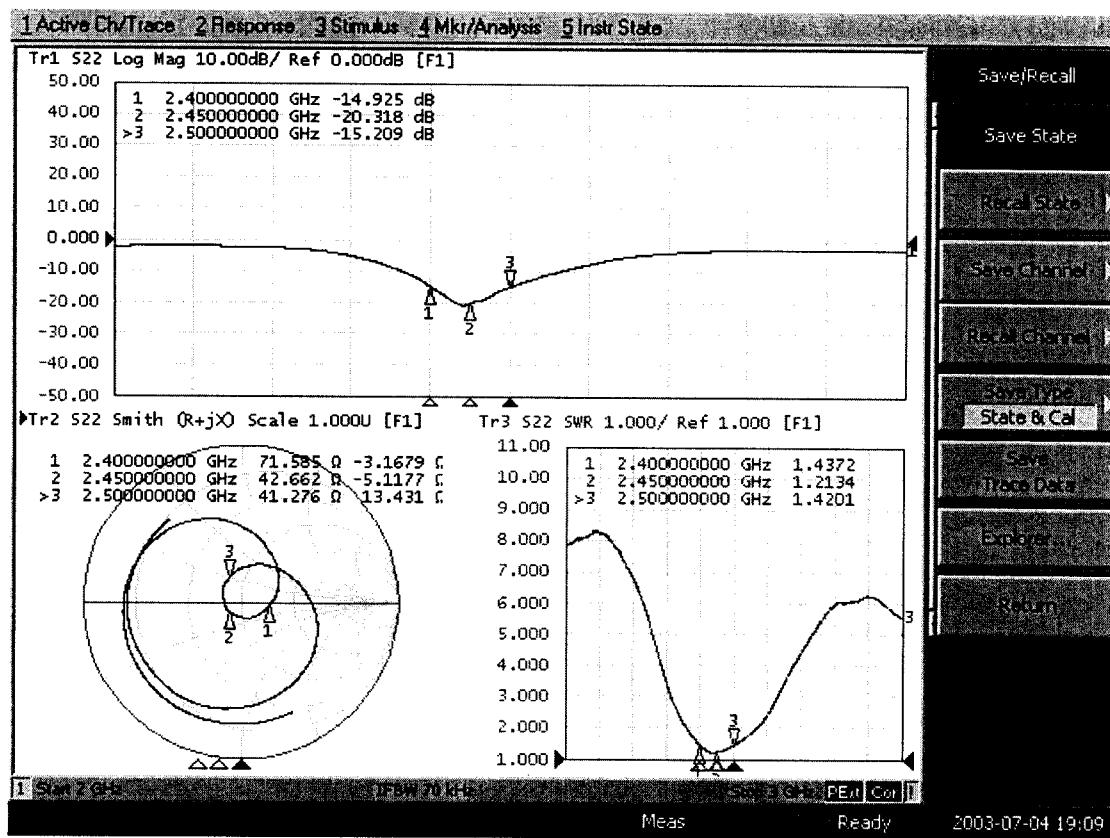
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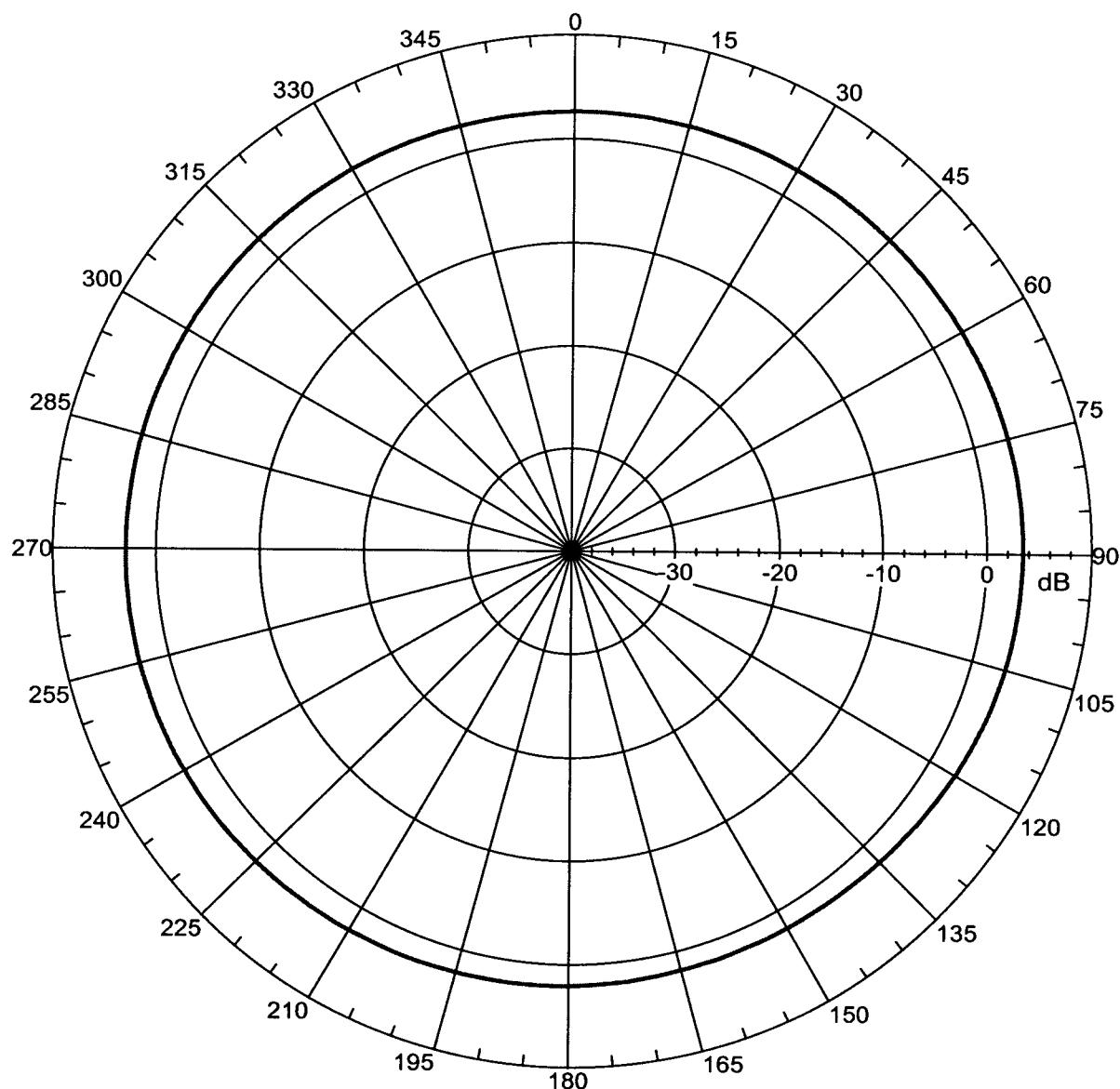
X1 m/m SHEET : 1/1

WHA YU
INDUSTRIAL CO., LTD.

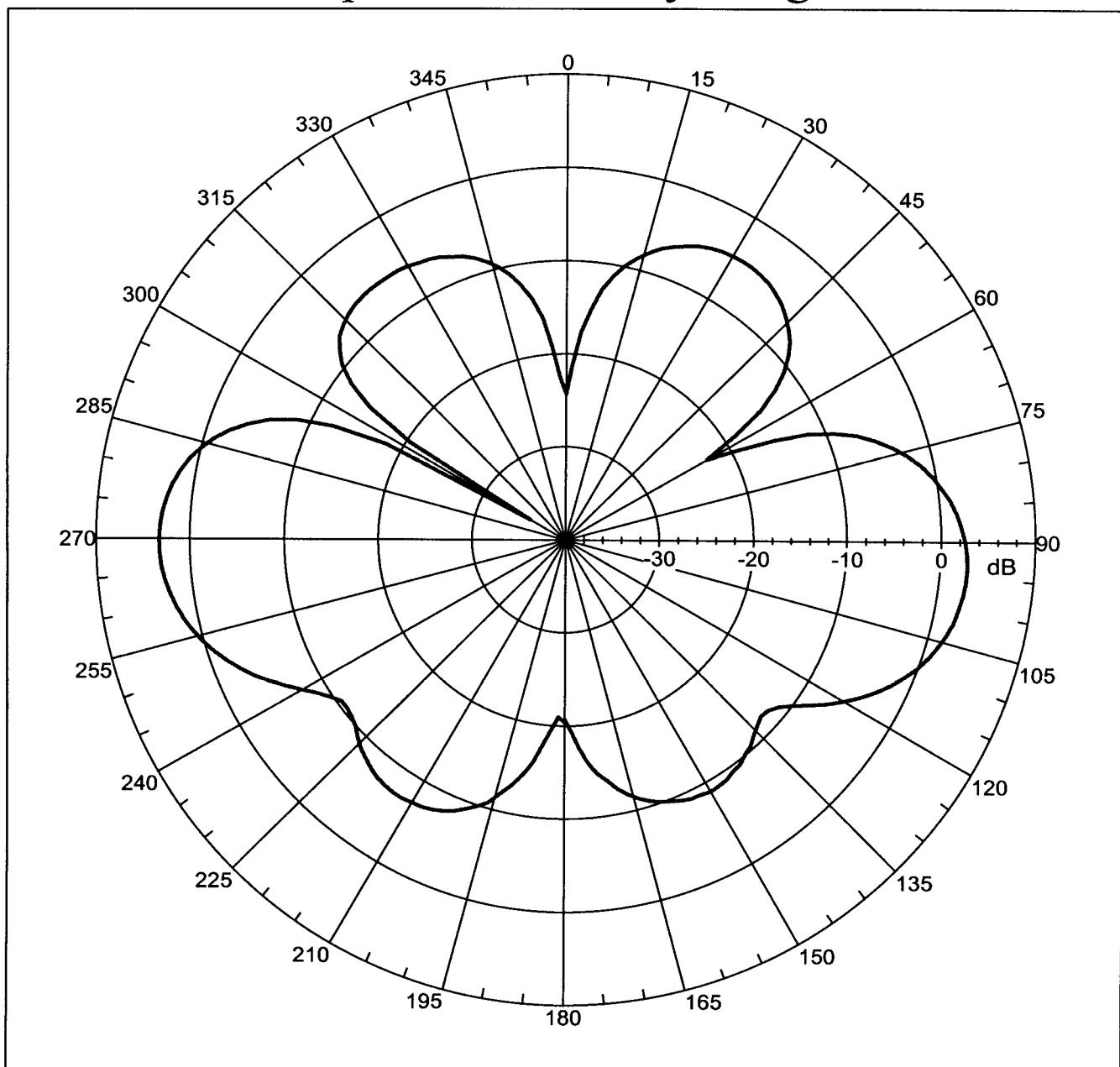
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Far-field amplitude of Linksys 2.4g 3.5dbi h.nsi



Far-field amplitude of Linksys 2.4g 3.5dbi e.nsi



KURABE INDUSTRIAL CO., LTD

SP3830M-X	FEP INSULATED HIGH-FREQUENCY COAXIAL CABLE (FWS 5022)	PAGE	1/4
PRODUCT STANDARD		ISSUED	17-9-2001
		REVISED	

1. SCOPE

This standard covers "FEP insulated High-Frequency coaxial cable".

2. CONSTRUCTION

Construction and dimensions of the cable are shown in Figure.1 and Table 1.

3. PERFORMANCE

Performance of the finished cable is shown in Table 2. The test methods are in accordance with applicable test methods described in JIS C 3005.

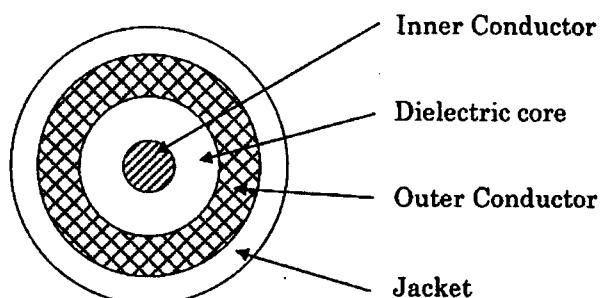


Figure 1.

NOTE :	MADE BY	<i>M. Ohba</i>
	APPROVALS	<i>T. Nagasawa</i>

KURABE INDUSTRIAL CO., LTD

PRODUCT STANDARD	FEP INSULATED HIGH-FREQUENCY COAXIAL CABLE (FWS 5022)	PAGE	2/4
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		REVISED	

Table 1. Construction

Item		Unit	Specified Value
Inner Conductor	Material	—	Silver coated annealed copper wire
	Stranding	No./mm	7/0.08
	Dia.(approx.)		0.24
Dielectric Core	Material	—	FEP
	Thick.(nom.)	mm	0.22
	Dia.	mm	0.68±0.05
Outer Conductor	Color	—	Natural
	Material	—	Silver coated annealed copper wire
	Type	—	Braid (16/4/0.05)
Jacket	Dia.(approx)	mm	0.93
	Material	—	FEP
	Thick.(nom.)	mm	0.10
Jacket	Dia.	mm	1.13 +0.10/-0.06
	Color	—	Standard colors are white,black,blue,brown, and gray.

Table 2. Performance

Item	Unit	Specified Value	Note
Appearance	—	Faultless in visible	—
Inner conductor resistance	Ω/km	Max.597	at 20°C
Insulation resistance	MΩ·km	Min.1500	at 20°C
Dielectric strength	—	Dielectric core: No breakdown at AC1.5kV for 0.15sec.	Spark test
		Jacket: No breakdown at AC1.5kV for 0.15sec.	Spark test
		No breakdown at AC500V for 1min.	Outer conductor to inner conductor
Heat resistance for solder	—	Shrink or expansion of dielectric core are not more than 0.5mm	※
Capacitance	pF/m	nom. 98	at 1kHz
Characteristic impedance	Ω	50±2	TDR method
Attenuation (nom.)	dB/m	2.0	1.0GHz
		2.9	2.0GHz
		3.6	3.0GHz
		4.2	4.0GHz
		4.7	5.0GHz
		5.2	6.0GHz

※ After immersion of dielectric core, 10mm into soldering pot which is 230°C for 5 seconds, shrinkage or expansion of the dielectric core must not exceed 0.5mm.

NOTE :	MADE BY	<i>M. Ohba</i>
	APPROVALS	<i>J. Kawasawa</i>

KURABE INDUSTRIAL CO., LTD

SP3830M-X	FEP INSULATED HIGH-FREQUENCY COAXIAL CABLE (FWS 5022)	PAGE	3/4
PRODUCT STANDARD		ISSUED	17-9-2001
		REVISED	

4. INSPECTION

An inspection is took place in accordance with applicable test methods. The cable has to pass the specifications described Table 1 and Table 2.

5. TEST METHOD

The test methods are in accordance with applicable test methods described in JIS C 3005 (Test methods for rubber or plastic insulated wires and cables).

6. TEMPERATURE RATING

150 °C

7. VOLATGE LATING

250 V

8. MARKING ON TAG

Each reel of finished cable is tagged to indicate following information:

- (1) Designation of the cable,
- (2) Conductor size,
- (3) Length,
- (4) Date of manufacture or LOT No.,
- (5) Specification No., and
- (6) Manufacture's name.

9. PACKAGE

The finished cables are cut into a shipping length of 200 meters, reeled to paper bobbin and packed securely to prevent injuries during transportation. Odd length of the finished wires should be accepted for shipping according to the condition of mutual agreement.

In the case no agreement is found, the condition stated in quotation shall prevail.

10. APPLICATION NOTES

- 10-1. For use other than the use mutually agreed, compatibility should be carefully confirmed in each practical use by user.
- 10-2. It is recommended to make a trial run for each practical application.

NOTE :	MADE BY	<i>M. Ohba</i>
	APPROVALS	<i>T. Kanazawa</i>

KURABE INDUSTRIAL CO., LTD

SP3830M-X	FEP INSULATED HIGH-FREQUENCY COAXIAL CABLE (FWS 5022)	PAGE	4/4
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		REVISED	

10-3. In case a design for use of cable is changed, please contact our sales department, if necessary. Do not use under extreme mechanical stress such as hard bending, tightening, and twisting. The use under extreme mechanical stress may cause not only shortening the life span of cable but also troubles such as decline of dielectric strength.

10-4. Handling precautions

- ① Do not hurt the insulation and sheath of the cable by making holes and scratches. And avoid any sharp edge when wiring so as not to injure cables.
- ② Avoid unnecessary excessive force to cable, such as pulling, twisting, bending or tightening.

10-5. Storage precautions

Avoid continuous exposure to sunlight.

NOTE :	MADE BY	<i>M. Ohba</i>
	APPROVALS	<i>T. Kanzawa</i>

Arnitel

polyether esters

polyetherester

esters de polyether

天線桿套材質特性表

Units Einheiten Unites	EM400	EM460	EL550	EL630	EL740	PL380
	1.12	1.16	1.20	1.23	1.27	1.18
°C	195	185	202	212	221	197
μm/m.k	220	160	180	140	110	150
°C	\	\	110	115	120	\
°C	130	150	180	200	200	145
°C	\	50	85	115	150	\
%	0.30	0.30	0.20	0.20	0.15	0.40
%	0.75	0.70	0.55	0.60	0.90	7.0
*	HB	HB	HB	HB	HB	HB
Mpa	55	110	220	375	900	60
Mpa	4.0	7.1	13.2	20.2	26.9	3.5
Mpa	5.4	9.0	15.7	23	22.6	5.2
Mpa	8.4	11.4	16.6	22.0	26.3	8.5
Mpa	17	21	32	40	45	16
%	700	800	600	600	360	450
kJ/m ²	NB	NB	NB	NB	NB	NB
kJ/m ²	NB	NB	NB	NB	200	NB
kJ/m ²	NB	NB	NB	NB	9	NB
kJ/m ²	NB	NB	20	4	4	NB
	38	45	55	63	74	38
MV/m	\	\	\	\	\	\
Ω.cm	5×10^{14}	10^{14}	10^{14}	10^{14}	10^{12}	10^{12}
Ω	$>10^{13}$	$>10^{14}$	$>10^{14}$	$>10^{14}$	$>10^{10}$	$>10^{13}$
\	4.1	\	\	3.8	\	4.7
\	4.0	4.4	4.0	3.4	3.3	4.4
$\times 10^{14}$	10	\	\	3.8	\	310
$\times 10^{14}$	170	350	400	350	300	350
\	800	800	600	600	600	800
\	600	600	600	800	800	600

Arnitel

2.2 Product coding

The structure of the Arnitel productcodes is illustrated with the following example:

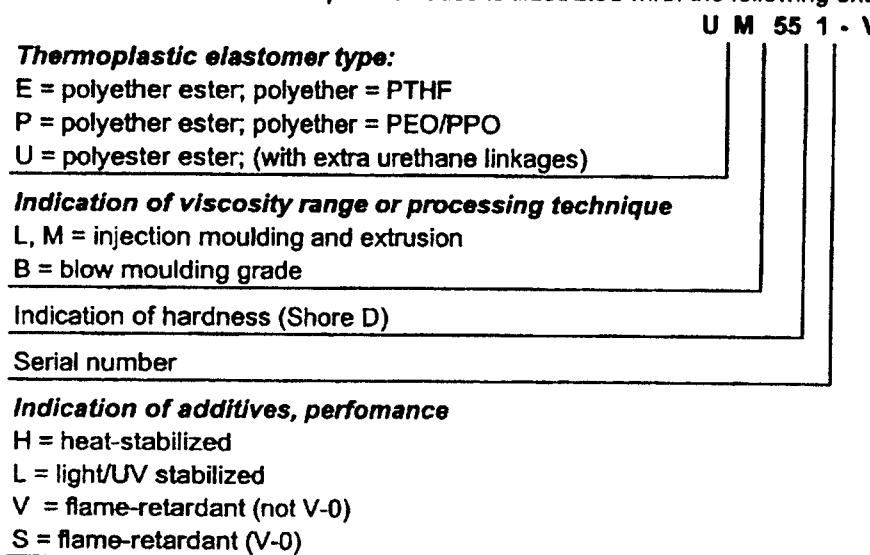


Figure 2.2: Arnitel product coding

2.3 Product portfolio

The Arnitel productrange is available with a hardness from 38 to 74 Shore D. The general Arnitel grades are shown in table 2.2. In order to enhance the flexibility of the portfolio a set of masterbatches (a.o. for heat, UV, etc) are on offer (refer to § 2.4).

Because of the development of these masterbatches heat stabilised Arnitel P is suggested for application areas where thermo-oxidative stability is an issue. For applications where colour and UV stability is required, the Arnitel E range is advised.

Shore D

	38	40	46	55	63	74
Arnitel E		EM400	EM460	EL550	EL630	EL740
				EM550	EM630	EM740
Arnitel P	PL380		PL460	PL580		
				PM581		
Arnitel U				UM551	UM622	
				UM551-V		
				UM552		
				UM552-V		

Table 2.2: Arnitel productrange for general purpose

Besides these multi-purpose grades, specialty grades can be offered for specific purposes and/or application areas. These grades are not intended for regular sales and are therefore restricted. Permission from marketing is needed before sampling is initiated.

	Arnitel E	Arnitel P	Arnitel U
Automotive			
• CVJ boots	EB460		
	EB463		
	EB464		
• Boyplugs		PL380-M0	
Extrusion			
• Roofing foil	EM402-L		

Table 2.3: Examples of specialty grades

Armitel® EL630/EM630

2.8.31 General:

Armitel is the brand name of a series polyester based thermoplastic elastomers. These polymers combine excellent processability with good elastomeric properties between -40 and 200°C. Armitel EL630 and EM630 are excellent materials for injection moulding and extrusion applications respectively. The chemical structure of Armitel EL630/EM630 is shown below.

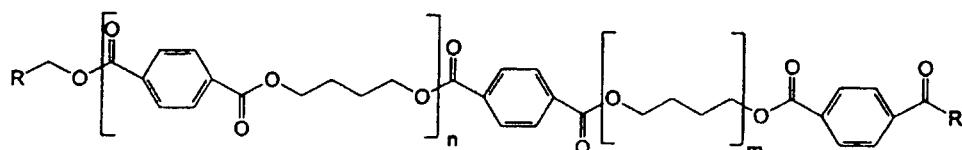


Figure 2.9: Chemical structure of Armitel EL630/EM630.

Another way of writing the structure of Armitels is shown below in Figure 2.



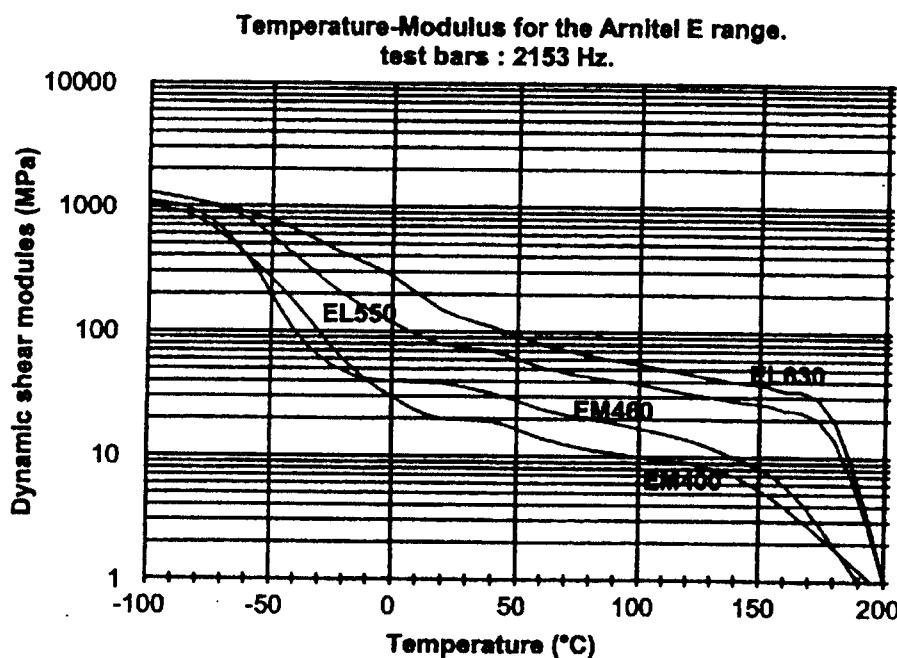
Figure 2.10: Simplified structure of Armitel EL630/EM630.

Armitel EL630/EM630 is TOSCA registered (including DSL-Canada) under CAS 37282-12-5

2.8.32 Thermal properties:

• Modulus-temperature behaviour:

The materials have a glass transition at circa -40°C and a typical melting point at 213°C. The modulus-temperature behaviour is shown in graph 2.76, for comparison, accompanied by other Armitel E types.



Graph 2.76: Modulus-temperature behaviour of Armitel EL630/EM630.

Armitel® EL630/EM630

Although information on performance at higher temperatures may be extracted from the above shown graph, a Vicat or HDT are shown in table 2.29.

analysis	SI unit	typical data	test method
Vicat A	(°C)	200	ISO 306/A
Vicat B	(°C)	125	ISO 306/B
HDT-B	(°C)	115	ISO 75-1

Table 2.29: Vicat and HDT data on Armitel® EL630 and EM630

Armitel EL630 and EM630 have a melting point of 213°C as found in the second heating curve of a DSC. The polymer will crystallize at 155°C using a 20°C/min cooling rate.

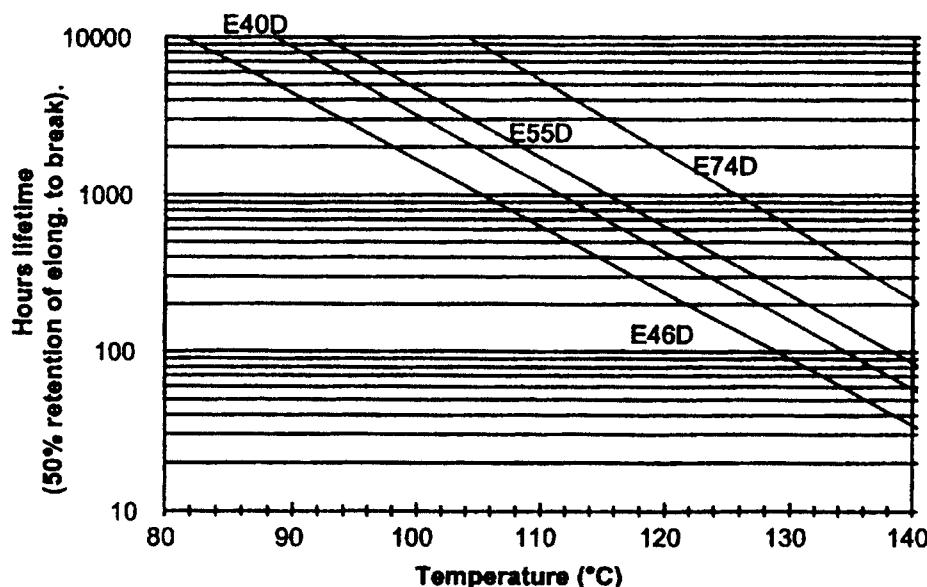
The thermal expansion coefficient of Armitel EL630/EM630 and is $140 \times 10^{-4} \mu\text{m/m.K}$.

- **Heat aging:**

Armitel EL630/EM630 shows an optimum between heat resistance and colour stability. Heat aging for EL630/EM630 is under test at this moment, however the data will be between EL550 and EL740. Arrhenius curves of thermo-oxidative heat aging are shown in graph 2.77. Criterium chosen is retention of 50% original elongation at break.

Heat aging of Armitel E40D, 46D, 55D and 74D.

Natural products, Arrhenius plot.



Graph 2.77: Heat stability for Armitel E-range.

Heat ageing can be improved using a stabilisation masterbatch, however for heat stabilisation the P-range is preferred for its excellence in performance. These data can be found in the Armitel properties summary or an Armitel P datasheet.

2.8.33 Processing and Handling:

Armitel EL630/EM630 is a polyester with a density of 1.12 g/cm³ according ISO 1183.

Due to the polyester nature of these materials it is of major importance to store the material dry prior to processing. Materials packaged in sealed packaging should have a moisture content lower than 500 ppm. The polymer will contain 0.12% moisture in 50% RH and 0.58% water after saturation in water. Both numbers are in equilibrium.

If samples have become wet during storage a drying step of 24 hours 120°C (or 6 hours 140°C) prior to use will prevent degradation of the material during processing combined with an eventual loss of properties. The air or nitrogen will have to have a dew point of at least -30°C.

Armitel® EL630/EM630

• **Processing:**

Armitel EL630/EM630 shows a single melting point at 195°C in DSC. Processing conditions are shown in the table below.

polymer	zone 1	zone 2	zone 3	additional	melt	mold
EL630	225	230	235	235	225-235	20-50
EM630	225	230	235	235	235	50

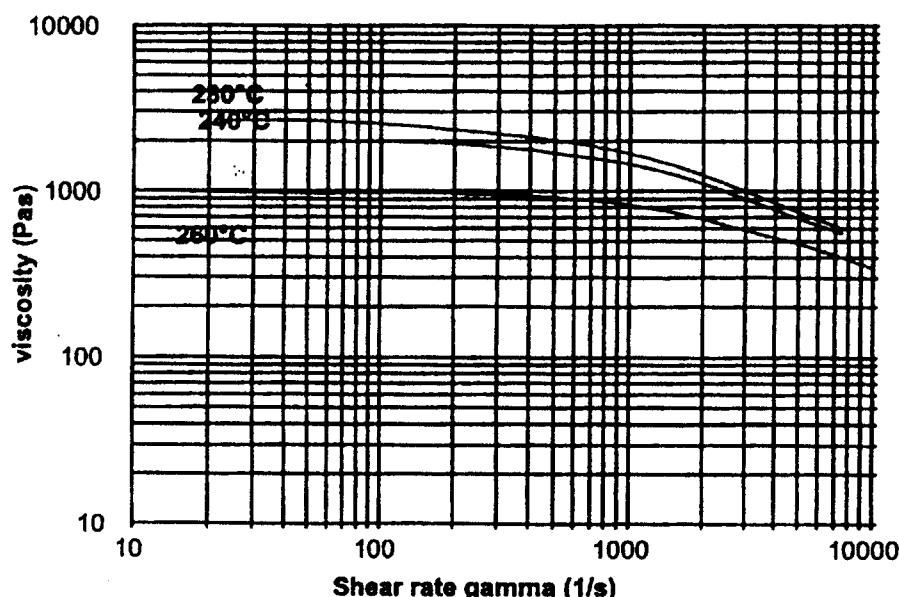
All temperatures are in °C.

Table 2.30: Processing conditions for Armitel EL630 and Armitel EM630.

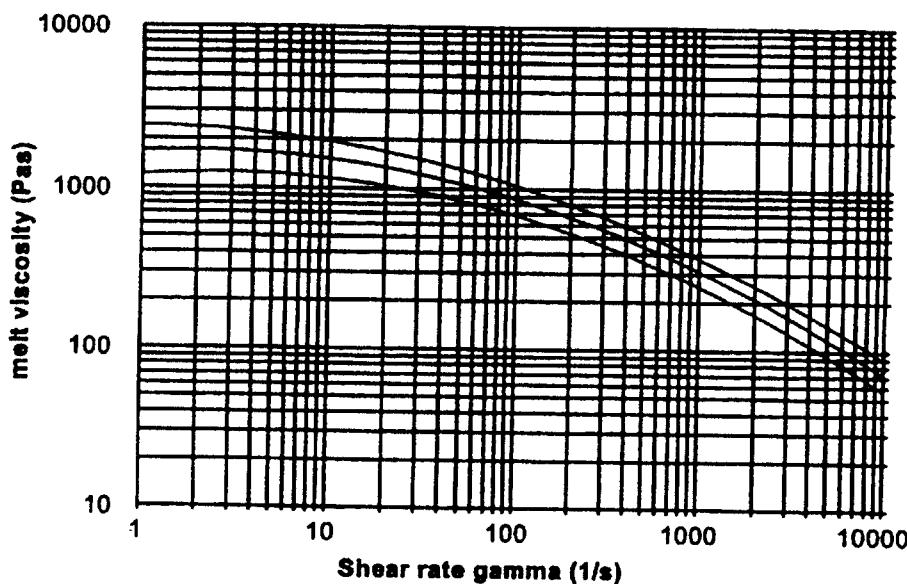
• **Rheology:**

The temperature depending melt viscosity of Armitel EL630/EM630 are shown below in graph 2.80 and 2.81 respectively.

**Shear rate dependent of the melt viscosity of Armitel EL630.
Effect of melt temperature.**



Capillary melt viscosity of Armitel EM630.
240, 250 and 260°C.



Graph 2.80 and 2.81: Temperature dependancy of the melt viscosity for Armitel EL630 and EM630.

The MFI values are shown in table 2.31.

		EL630	EM630	
MFI 230°C	g/10 min		7	ISO 1133
MFI 240°C	g/10 min	30		ISO 1133

Table 2.31: MFI for Armitel EL630/EM630.

- Use of regrind:

Armitel can readily be recycled. If the MFI of the regrind is up or down to four points higher, 20% can be recycled. A difference of 2 MFI points allows up to 50% of regrind. Obviously the regrind should be dried properly before use.

2.8.34 Mechanical properties:

If Armitel EL630 or Armitel EM630 are processed properly the materials will have mechanical properties as shown in table 2.32.

Mechanical property	SI Unit	typical data*		test method
		EL630	EM630	
Hardness	Shore D	63	63	ISO 868
Tensile modulus (1 mm/min)	MPa	330	330	ISO 527
Tensile strength (50 mm/min)	MPa	30	30	ISO 527
Strain at break	%	350	350	ISO 527
Tensile stress at 5% strain	Mpa	11.5	11.5	
Tensile stress at 10% strain	Mpa	15.9	15.9	
Tensile stress at 50% strain	Mpa	17.3	17.3	
Tear strength Graves	KN/m	145	145	DIN53515
Izod notched 23°C (73°F)	KJ/m ²	NB	NB	ISO 180/1A
Izod notched -30°C (-22°F)	KJ/m ²	4	4	ISO 180/1A
Charpy notched 23°C (73°F)	KJ/m ²	NB	NB	ISO 179/1eA
Charpy notched -30°C (-22°F)	KJ/m ²	12	12	ISO 179/1eA

Data for dry natural materials.

* NB: No Break

Table 2.32: mechanical properties of Armitel® EL630.

Arnitel® EL630/EM630

• **Abrasion:**

Arnitels show good abrasion resistance in both Taber and DIN 53516 abrasion tests. Data are shown in the Arnitel general property overview (also included in the EPIC)

2.8.35 Flame retardancy:

Arnitel EL630 and EM630 show in an ISO1210/A flammability test a burning rate leading to a classification FH-1. Flame retardancy can be improved using a halogenated or halogen free FR masterbatch.

2.8.36 Electrical properties:

Arnitel EL630/EM630 can be used for cable jacketing applications. If the material is in permanent contact with copper a copper stabilisation package should be added. If the copper wires are coated with a tin layer, no stabilisation is necessary. The electrical properties are shown in table 33.

Electrical property	SI Unit	typical data*		test method
		EL630	EM630	
Dielectric strength	kV/mm	22	22	IEC 243-1
Relative permittivity (ϵ_r) at 1 kHz	-	4.4	4.4	IEC 250
Dissipation factor ($\tan \delta$) at 1kHz	-	0.019	0.019	IEC 250
Comparative tracking index	-	600	600	IEC 112
Volume resistivity	$10^{14} \Omega \cdot \text{cm}$	1	1	IEC 93
Surface resistivity	$10^{14} \Omega$	1	1	IEC 93

Table 2.33: Typical electrical properties of Arnitel® EL630 and EM630.

2.8.37 Chemical resistance:

Arnitel EL630 and EM630 are sensitive to strong bases and strong acids, especially at elevated temperatures. In some halogenated hydrocarbons (like tetrachloroethane), the materials (partially) dissolves. For a full review on chemical resistance of Arnitel EL630 and EM630 request the chemical resistance brochure.

• **Hydrolysis**

Like all polyesters Arnitel are sensitive to moisture, however Arnitels are more stable to water then e.g. PET and PBT. graph 2.84 shows the hydrolytic stability of Arnitel EL630 at 100°C and in steam (120°C). For improved hydrolysis stability, using a polycarbodilimide containing masterbatch like Stabaxol® in an option. To maintain all other properties use a masterbatch based on polyester. Data on the Stabaxol stabilised grade are shown in graph 2.85.

Product Information



CALIBRE 700 series

Ignition Resistant Resins

These CALIBRE* resins are formulated and produced to supply both clarity and enhanced ignition resistance. They do so while maintaining excellent physical properties and processability. Grades are available with additives for improved mould release and/or UV stabilisation.

CALIBRE 700: No mould release, no UV stabilisation. CALIBRE 701: Only mould release. CALIBRE 702: Only UV stabilisation. CALIBRE 703: Mould release and UV stabilisation.

Applications

- Industrial switches
- Circuit breakers
- Plugs, sockets and switches
- Street lights
- Safety lights
- Reflectors

Properties	Test method	Value	Value
Products, Units		700-10	700-15
Physical			
Melt Flow Rate (300°C, 1.2kg), g/10 min.	ISO 1133	10	15
Density, kg/m ³	ISO 1183	1200	1200
Mould Shrinkage, %	ASTM D-955	0.5-0.7	0.5-0.7
Optical			
Light Transmittance, %	ASTM D1003	84-88	84-88
Thermal			
HDT 0.45 MPa, annealed, °C	ISO 75	144	142
HDT 1.82 MPa, annealed, °C	ISO 75	140	139
HDT 1.82 MPa, unannealed, °C	ISO 75	123	122
Vicat Softening Point (B/50), °C	ISO 306B	149	147
Mechanical			
Tensile Strength at Yield, MPa	ISO 527	60	60
Tensile Strength at Rupture, MPa	ISO 527	66	66
Elongation at Yield, %	ISO 527	6	6
Elongation at Rupture, %	ISO 527	120	120
Tensile Modulus, MPa	ISO 527	2300	2300
Flexural Strength, MPa	ISO 178	100	100
Flexural Modulus, MPa	ISO 178	2400	2400
Izod Notched (23°C), J/m	ISO 180	900	850
Izod Unnotched (23°C), J/m	ISO 180	no break	no break
Charpy Notched (23°C), kJ/m ²	ISO 179	30	20
Flammability Rating⁽¹⁾			
1.6 mm	UL-94	V2	V2
3.2 mm	UL-94	V0	V0
Electrical			
GWT 2.0 mm, 5 sec., °C	IEC 695-2-1	960	960
Ball Indentation Temperature, °C	IEC 598-1 ⁽²⁾	> 125	> 125
Comp. Tracking Index (2.0 mm), V	IEC 112	250	250

(1) These numerical flame spread ratings are small scale test values and are not intended to reflect hazards presented by these or any other materials under actual fire conditions.

(2) Ball Indentation Temperature is described in IEC 598-1.