

ATTACHED TABLES

UPPER LIMITS OF USAGE TEMPERATURES FOR INSULATING MATERIALS USED FOR ELECTRICAL APPLAIANCES AND MATERIALS

- 1 Electrical or Thermal Insulating Materials Used for Electrical Appliances and Materials (Except for Supply Coeds and Like)**
 - 1.1 Scope of Application and the Like**
 - 1.1.1 This Chapter applies to electrical insulating material and to thermal insulating material for cables and cords other than supply cords or the like.
 - 1.1.2 “Electrical insulating materials” means solid or liquid insulating materials with a volume resistivity not less than 1×10^8 ohm-cm at the normal temperature uses as an electrically insulating barrier between live parts and dead metal parts, between live parts and the enclosure (including inside and outside surfaces for enclosures made of thermal insulating material or other insulating material), or between various live parts for the purpose of enabling electrical appliances to continue to perform their function and to prevent electric shock and other hazards.
Of liquid insulating materials, only completely filled types are treated as electrical insulating materials.
 - 1.1.3 “Thermal insulating materials” means insulating materials provided for the purpose of isolating or lighting the heat generated from the electrical appliance or the heat received from elsewhere and to mitigate the changes in appliance performance or their effects on these.
 - 1.1.4 “Upper limits of usage temperatures” of insulating materials used for electrical appliances and materials shall be the upper limits of temperatures permissible during continuous use¹⁾ at the maximum temperature²⁾ to which the insulating materials is subjected under regular stipulated usage conditions³⁾.
 - (1) “Continuous use” shall mean, in principle, 40,000 hours.
 - (2) “Maximum temperature to which the insulating materials is subjected” shall mean the highest temperature to which the insulating material is subjected when the appliance temperature rise has become saturated under regular stipulated usage conditions.
 - (3) “Regular stipulated conditions” shall mean conditions of a normal temperature rise test, carried out at standard ambient temperature, stipulated in the “MITI Ordinance Establishing Technical Requirement for Categories A and B Appliances and Materials.”
 - 1.1.5 Chemical combinations or physical blends of different insulating materials mentioned in the Attached Table or of insulating materials not to in the Attached Table with insulating materials in the Attached Table are not regard as insulating materials stipulated in this Attached Table.
For the time being, the Attached Table does not apply to materials treated with fire retardants or the like and to irradiated plastics exposed to energy rays or the like.
 - 1.1.6 Insulating materials made by physically jointing in one piece by bonding or other methods

different insulating materials mentioned in the Attached Table shall have the lowest of the various upper limits of usage temperature treated as the upper limit of usage temperature of the joined insulating materials. However, when the highest temperature insulating material is by itself of a thickness equal to or greater than that necessary for compliance with the requirements, that higher temperature shall be treated as the upper limit of usage temperature of the jointed insulating material.

- 1.1.7 Appliances or materials with a heat resistance of Class E or over must use insulating materials equal to or greater than that heat resistance class for materials in contact with windings, even when the temperature of those windings does not reach the temperature corresponding to the heat resistance class stipulated for the insulation type in JIS C4003 (1977) "Types of Electrical Appliance Insulation".

1.2 Upper Limits of Usage Temperatures for Insulated Materials

Table DR-1-1 Natural Materials

Type (name of material)	Upper limit of usage temperature ()	
	No. (1)	No. (2)
Bituminous compound for filler	75(105) ¹⁾	105
Paper, cotton, silk, other natural fiber, and wood	90(105) ²⁾	-
Oil modified natural resin		
Asbestos	105	-
Rock wool	400	600
Silica powder	-	600
Mica	500	-
Hard		
Soft	500(600) ³⁾	700
Heat-resistant cement (for tube and bulk use)	650(850) ³⁾	900
	-	350

Remarks: 1) This value shall be applied to heat insulation.

2) This value shall be applied to impregnated varnish.

3) This value shall be applied when mechanical external force is absent. "When mechanical external force is absent" means when insulation is so firmly fixed by any other parts, etc. that it should never directly receive external pressures resulting from rotational, reciprocating and linear motions, among others.

Table DR-1-2 Mica Products

Type (name of material), lining material, adhesive	Upper limit of usage temperature ()	
	No. (1)	No. (2)

Mica splittings and untreated mica paper		
No lining material		
Adhesive based on asphalt; Adhesive based on natural resin or modified natural resin; Adhesive based on ceramic; Adhesive based on oil-modified synthetic resin, alkyd orthophtalate resin, or cross-linked polyester resin	130	150
Adhesive based on silicon-modified synthetic resin, isophtalate alkyd resin, terephtalate alkyd resin, or epoxy resin	155	(180)
Adhesive based on silicon resin	180	-

Inorganic adhesive	450 ¹⁾	700
	450 ²⁾	700
	700 ³⁾	900
Paper		
No adhesive	-	(180)
Adhesive based on asphalt; Adhesive based on natural resin or modified natural resin; Adhesive based on ceramic; Adhesive based on oil-modified synthetic resin; alkyd orthophtalate resin or cross-linked polyester resin	130	-
Polyethylene terephtalate film		
Adhesive based on oil-modified synthetic resin, alkyd orthophtalate resin, or cross-linked polyester resin	130	(150)
Adhesive based on silicon-modified synthetic resin, isophtalate alkyd resin, terephtalate alkyd resin, or epoxy resin	-	(180)
Glass fabric		
Adhesive based on oil-modified synthetic resin, alkyd orthophtalate resin, or cross-linked polyester resin	130	(155)
Adhesive based on silicon-modified synthetic resin, isophtalate alkyd resin, terephtalate alkyd resin, or epoxy resin	155	(180)
Adhesive based on silicon resin		
Polyester nonwoven fabric	180	-
Adhesive based on oil-modified synthetic resin, alkyd orthophtalate resin, or cross-linked polyester resin	130	(150)
Adhesive based on silicon-modified synthetic resin, isophtalate alkyd resin, terephtalate alkyd resin, or epoxy resin	155	(180)
Polyester woven fabric		
Adhesive based on oil-modified synthetic resin, alkyd orthophtalate resin, or cross-linked polyester resin	130	-
Adhesive based on silicon-modified synthetic resin, isophtalate alkyd resin, terephtalate alkyd resin, or epoxy resin	155	(180)
Polyethylene naphthalate film		
Adhesive based on oil-modified synthetic resin, alkyd orthophtalate resin, or cross-linked polyester resin	130	(150)
Adhesive based on silicon-modified synthetic resin, isophtalate alkyd resin, terephtalate alkyd resin, or epoxy resin	155	-
Polyamide imide film		
Adhesive based on silicon-modified synthetic resin, isophtalate alkyd resin, terephtalate alkyd resin, or epoxy resin	155	(180)
Adhesive based on silicon resin		
Aramide paper	180	-
Adhesive based on silicon-modified synthetic resin, isophtalate alkyd resin, terephtalate alkyd resin, or epoxy resin	155	(180)
Adhesive based on silicon resin	180	-

Polyimide film		
Adhesive based on silicon-modified synthetic resin, isophthalate alkyd resin, terephthalate alkyd resin, or epoxy resin	155	(180)
Adhesive based on silicon resin	180	-
Micalex	-	350

Adhesives: 1) Mainly consisting of asphalt.

2) Mainly consisting of natural resins or modified natural resins.

3) Mainly consisting of ceramics.

4) Mainly consisting of oil modified synthetic/orthophthalic acid alkyd/crosslinked polyethylene resins.

5) Mainly consisting of silicon modified synthetic resin/iso, or terephthalic acid alkyd/epoxy resins.

6) Mainly consisting of silicon resins.

7) Inorganic ones.

8) No adhesive.

Notes: 1) With a hard mica-made heating substrate.

2) With a soft mica-made heating substrate.

Remarks: 1) The figures in parenthesis in the No.1 column are applied when mechanical external force is absent.

2) The figures in parenthesis in the No.2 column are applied only when employed as insulating system.

Table DR-1-3 Organic Materials – Thermosetting Resins

Type (name of material), form, filler or base material	Upper limit usage temperature ()	
	No. (1)	No. (2)
Melamine resin		
Laminated material		
Glass fiber	75(100) ¹⁾	(140) ¹⁾
Molding material		
Cellulose	120	140
Inorganic material	140	160
Phenol resin		
Laminated material		
Cotton fabric	115(85) ²⁾	120
Paper	120(70) ³⁾	140(110) ³⁾
Polyamide cloth	75	100
Inorganic material	140	180
Molding material		
Material other than inorganic	140(150) ¹⁾	160
Inorganic material	150(160) ¹⁾	180
Melamine phenol resin		
Molding material		
Specific gravity less than 1.55	130	-
Urea resin		
Molding material		
Cellulose	90	110

Unsaturated polyester resin		
Casting material	120	130
Laminated material		
Inorganic material	140	180
Molding material		
Material other than inorganic	120	170
Inorganic powder	140	180
Glass fiber	155	180
Epoxy resin		
Casting material	120	150
Laminated material		
Material other than inorganic	110(90) ³⁾	120
Inorganic	130(140) ¹⁾	160
Molding material		
Inorganic	130	160
Diallyl phthalate resin		
Laminated material		
Inorganic material	140	180
Molding material		
Material other than inorganic	130	160
Inorganic powder	150	180
Glass fiber	155	180
Xylene resin		
Casting material	140	-
Polyamide imide		
Film	180	-
Silicon resin		
Laminated material		
Inorganic	180(220) ¹⁾	220
Molding material		
Inorganic	180(240) ⁴⁾	220
Polyimide		
Film	210	250
Laminated material	190	-
Polybutadiene		
Casting material	120	130
Molding material		
Inorganic	130	150
Diphenyl oxide		
Laminated material		
Inorganic	180	-
Polyurethane		
Molding material		
Soft		50(85) ⁵⁾
Hard		60(100) ⁵⁾

Notes: 1) Values apply to thermal insulating materials.

2) Values apply to material with a thickness less than 0.8mm.

3) Values apply to material with a thickness less than 0.8mm when treated to retard flame.

4) Values apply to materials used for thermal insulation and to seal outlets of sheathed heating wires.

- 5) Values apply only to materials used to retain heat.
- 6) Temperatures of materials using inorganic material or glass fiber as filler or base material shall be the temperature when a large amount of the inorganic material or glass fiber is mixed in.
- 7) Alkyd resins and dichloropentadiene resins are treated as unsaturated polyester resin.
- 8) "Casting" includes encapsulation, embedding, and potting.

Table DR-1-4 Organic Materials – Thermoplastic Resins

Type (name of material) and reinforcement material	Upper limit of usage temperature ()	
	No. (1)	No. (2)
Methacrylic resin	50	90
Cellulose acetate resin and cellulose acetate butylate resin	50	60
Polystyrene	50(70) ¹⁾	85
Heat polystyrene	-	80
Polyethylene	50	80
Foamed polyethylene compound (for cables and cords)	60	-
Cross-linked foamed polyethylene compound (for cables and cords)	-	105
Polyethylene compound (for cables and cords) ³⁾	75	-
Cross-linked polyethylene	90	120
Cross-linked polyethylene compound (for cables and cords)	90	125
Fluorinated polyethylene compound (for cables and cords)	90	110
Acrylonitrile acrylic rubber styrene and acrylonitrile chlorinated polyethylene styrene resin	55	85
Acrylonitrile styrene resin, acrylonitrile butadiene styrene resin, and acrylonitrile butadiene chlorinated polyethylene resin	55	105
Reinforced with glass fiber	80	105
Polyvinyl chloride resin	60	75
Polyvinyl chloride compound (for cables and cords)	60	75
Heat-resistant polyvinyl chloride resin	75	105
Heat-resistant polyvinyl chloride compound (for cables and cords)	75	105
Cross-linked polyvinyl chloride compound (for cable and cords)	75	105
Polypropylene	105(85) ⁴⁾	110
Reinforced with glass fiber	110	120
Polypropylene compound (for cables and cords)		105
Modified polyphenylene oxide	75	120
Reinforced with glass fiber	100	140
Polyacetal	100	120
Reinforced with glass fiber	120	130
Polyamide (nylon)	90	120
Reinforced with glass fiber	120	130
Polyamide compound (for cables and cords)	90	
Polycarbonate	100	125
Reinforced with glass fiber	120	130
Polyethylene terephthalate	120	125
Reinforced with glass fiber	130	150

Polybutadiene terephthalate	120	125
Reinforced with glass fiber	135	150
Polybutadiene terephthalate compound (for cables and cords)	120	
Heat-resistant polyethylene terephthalate	135	150
Reinforced with film		
Fluorinated polyvinylidene compound (for cables and cords)	150	160
Polychlorotrifluoroethylene (ethylene trifluoride resin)	150	180
Ethylene-tetrafluoroethylene copolymer (for cable and cords)	150	
Tetrafluoroethylene hexafluoropropylene resin and tetrafluoroethylene hexafluoropropylene compound (for cables and cords)	200	
Polytetrafluoroethylene (ethylene tetrafluoride) resin and polytetrafluoroethylene (ethylene tetrafluoride) compound (for cables and cords)	250	
Aramide (aromatic polyamide paper)	220	
Polysulfone	140(150) ²⁾	150
Polyethylene naphthalate	155	
Perfluoroalkoxy compound (for cables and cords)	250	
Polyallylate	120	
Reinforce with glass fiber	130	

Notes: 1) Values apply to capacitor dielectrics.

2) Values apply to thermal insulating materials.

3) Also includes tapes and tubes.

4) Values apply to materials with a thickness less than 0.8mm.

5) Temperatures when the material is reinforced with glass fiber shall be the temperature when a large amount of the glass fiber is mixed in.

Table DR-1-5 Inorganic Materials

Type (name of material)	Upper limited of usage temperature ()	
	No. (1)	No. (2)
Glass		
Glass fiber (only alkaline free)	300	500
Lead glass	380	400
Borosilicate glass	490	
Quartz glass	800	1,100
Crystallized		1,000
Ceramic	800(1,000) ¹⁾	1,300
Magnesium oxide		1,000(1,100) ²⁾
Silica board		1,000

Note: 1) Values apply to electric heating elements and like.

2) Values apply to fillers for sheathed heaters and like.

Table DR-1-6 Rubber Compounds

Type (name of material)	Upper limit of temperature ()	
	No. (1)	No. (2)
Natural rubber, polyurethane rubber, ebonite	60	85
Styrene butadiene rubber	75	85
Nitrile rubber	75	90
Chloroprene rubber	75	90
Butyl rubber	80	125
Ethylene propylene rubber	90	110
Chlorosulfonated polyethylene rubber	90	110
Chlorinated polyethylene rubber		105
Silicone rubber	180(200) ¹⁾	260
Fluororubber		230

Notes: 1) Values apply to thermal insulating materials and materials used to seal outlets of sheathed heating wires.

2) "Fluororubber" includes material for casting.

3) "Ethylene propylene rubber" includes ethylene propylene diene rubber (EPDM)

Table DR-1-7 Sleeves, Crosses, Tubes (fibrous), and Like

Type (name of material) and impregnant or coating material	Upper limit of usage temperature ()	
	No. (1)	No. (2)
Rayon, cellulose acetate, vinylon Tackifier, oil varnish	105	
Paper, cotton fabric, silk fabric, polyamide, polyester fabric, polyester nonwoven fabric Oil varnish	105	120
Polyester fabric, polyester nonwoven fabric Alkyd resin varnish	120	
Glass fabric Alkyd resin varnish	130	
Paper Iso or terephthalate alkyd resin varnish, epoxy resin varnish, alkyd resin varnish	105	155
Polyester fabric, polyester nonwoven fabric Iso or terephthalate alkyd resin varnish, epoxy resin varnish, alkyd resin varnish	120	155
Glass fabric, aramide paper, asbestos paper Iso or terephthalate alkyd resin varnish, epoxy resin varnish	155	
Silicon resin varnish	180	
Silicon rubber	180	250
Vulcanized fiber	105	110
Heat-resistance fiber	120	130

2 Electrical or Thermal Insulating Material Used for Supply Cords and the Like

2.1 Scope of Application

This Chapter applies to insulating materials used for supply cords and the like employed for electrical appliances and materials.

2.2 Upper Limit of Usage Temperatures for Insulating Materials

The provisions of paragraphs 1.1.3, 1.1.4 and 1.1.6 also apply to this Chapter.

Table DR-2-1 Upper Limit of Usage Temperature

Type (name of material)	No. (1)
Natural rubber, polyurethane rubber, polyvinyl chloride	60
Chloroprene rubber, styrene butadiene rubber, heat-resistant polyvinyl chloride, polyethylene.	75
Butyl rubber, ethylene propylene rubber	80
Chlorosulfonated polyethylene rubber, cross-linked polyethylene	90
Silicone rubber	
Tetrafluoroethylene resin	90(180)
Chlorinated polyethylene rubber	90(200)
	-

Notes: 1) Values in parentheses apply to supply cords which are protected by surface metal raceways, metal conduits, or the like outside appliances which are fixed at nonaccessible locations.

2) Ethylene propylene rubber includes ethylene propylene diene compounds (EPDM)