[Domestic products]

Restrictions of use of cords and flexible cables

Application				Vinyl cord	Vinyl-insulated vinyl flexible cord	Vinyl flexible cable
Electric lighting and electric household appliances (Indoor wiring regulation 3203-1)	Indoor	Lightbulb wire		×	×	×
		Movable electric wire		△	△	△◎
	External walls /Outdoor	Lightbulb wire		×	×	×
		Movable electric wire		×	△▼	△◎
Wiring (Indoor wiring regulation 3202-1)	Indoor	Exposed location		×	×	○
		Concealed location	Inspectable	×	×	○
			Non-inspectable	×	×	×
	External walls /Outdoor	Exposed location		×	×	○
		Concealed location	Inspectable	×	×	○
			Non-inspectable	×	×	×

○: Can be used only at voltages 300V and below ×: Cannot be used ◎: Can be used at voltages exceeding 300V
▼ : Only for use on external covered spaces △ : Only for use in the following conditions

① When used on small appliances that do not use electricity for heat
② When used in heating systems without exposed high-temperature parts and designed to prevent cables from touching these parts (Connection temperature of 80°C and below, outer surface temperature of 100°C and below)
③ In incandescent lamps designed to eliminate any thermal impact on cables

Voltage drop

Allowable voltage drop

(Indoor wiring regulations1310-1)

Cable distance between the secondary terminal of the supply transformer or mounting point of the lead-in wire and the farthest load point	Allowable voltage drop	
	When supplying power from a transformer set up within the area electricity is used	When electricity is supplied by the utility provider at low-voltage
Up to 60m main line	**Up to 3%**	**Up to 2%**
Up to 60m branch circuit	**Up to 2%**	
Up to 120m	**Up to 5%**	**Up to 4%**
Up to 200m	**Up to 6%**	**Up to 5%**
Over 200m	**Up to 7%**	**Up to 6%**

$\cos\theta$	1	0.950	0.900	0.850
$\sin\theta$	0	0.312	0.436	0.527

Formula for calculating voltage drop

$$\Delta V = K \times I \times L \times Z$$

ΔV : Voltage drop(V)
K : Coefficient according to the wiring system
I : Current(A)
L : Cable distance(km)
Z : Impedanc(Ω/km)

Wiring system	K
Single-phase two-wire system	2
Single-phase three-wire system	1
Three-phase three-wire system	$\sqrt{3}$
Three-phase four-wire system	1

①When calculating while taking account for the power factor ($\cos\theta$)

$$Z = R\cos\theta + X\sin\theta$$

②When the power factor ($\cos\theta$) is unknown

$$Z = \sqrt{R^2 + X^2}$$

Here R : Line AC conductor resistance(Ω/km)
X : Line reactance(Ω/km)
$\cos\theta$: Load power factor $\sin\theta$: $\sqrt{1-\cos^2\theta}$

Allowable current during short circuit

Formula for calculating the allowable current during short circuit (simplified formula)

(The Japanese Electric Wire & Cable Makers' Association "Cable catalogue")

Insulator type		T1 (℃)	T2 (℃)	Formula (copper conductor)
Vinyl	(VV、VE)	60	120	$I = 97 \times A/\sqrt{t}$
Polyethylene	(EV、EE)	75	140	$I = 98 \times A/\sqrt{t}$
Cross-linked polyethylene	(CV、CE)	90	230	$I = 134 \times A/\sqrt{t}$
Natural rubber	(RN)	60	150	$I = 116 \times A/\sqrt{t}$
EP rubber	(PN、PV)	80	230	$I = 140 \times A/\sqrt{t}$

T1: Conductor temperature before short circuit
T2: Highest allowable temperature during short circuit
A: Conductor cross-sectional area
t: short circuit duration

(Calculation examples)
In the case of 3.3 kV, 3x150㎟ CK cables with a short circuit duration of t=0.3s
According to the table

$$I = 134 \times 150/\sqrt{0.3} = 37{,}000 \text{ (A)}$$

Namely, based on the cable type alone, conditions for laying wire, which raised issues concerning the continuous allowable electric current or cable's rated voltage and number of core wires, become irrevelant.