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**Cubicle type high voltage power
receiving units**

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Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee, as the result of proposal for revision of Japanese Industrial Standard submitted by Japan Electric Association (JEA)/Japanese Standards Association (JSA) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law applicable to the case of revision by the provision of Article 14. Consequently **JIS C 4620 : 1998** is replaced with this Standard.

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Cubicle type high voltage power receiving units

1 Scope This Japanese Industrial Standard specifies cubicle type high voltage receiving units (hereafter referred to as “cubicles”) not exceeding 4 000 kVA in receiving capacity, intended for use in circuits at nominal voltage 6.6 kV, at a frequency of 50 Hz or 60 Hz with a system short circuit current not exceeding 12.5 kA by a consumer to receive electrical power from electrical utilities.

2 Normative references The following standards contain provisions which, through reference in this Standard, constitute provisions of this Standard. The most recent editions of the standards (including amendments) indicated below shall be applied.

JIS C 0446 *Identification of conductors by colours or numerals*

JIS C 0704 *Insulation test for control gear*

JIS C 1102-1 *Direct acting indicating analogue electrical measuring instruments and their accessories Part 1 : Definitions and general requirements common to all parts*

JIS C 1102-2 *Direct acting indicating analogue electrical measuring instruments and their accessories Part 2 : Special requirements for ammeters and voltmeters*

JIS C 1102-3 *Direct acting indicating analogue electrical measuring instruments and their accessories Part 3 : Special requirements for wattmeters and varmeters*

JIS C 1102-4 *Direct acting indicating analogue electrical measuring instruments and their accessories Part 4 : Special requirements for frequency meters*

JIS C 1102-5 *Direct acting indicating analogue electrical measuring instruments and their accessories Part 5 : Special requirements for phase meters, power factor meters and synchrosopes*

JIS C 1102-6 *Direct acting indicating analogue electrical measuring instruments and their accessories Part 6 : Special requirements for ohmmeters (impedance meters) and conductance meters*

JIS C 1102-7 *Direct acting indicating analogue electrical measuring instruments and their accessories Part 7 : Special requirements for multi-function instruments*

JIS C 1102-8 *Direct acting indicating analogue electrical measuring instruments and their accessories Part 8 : Special requirements for accessories*

JIS C 1102-9 *Direct acting indicating analogue electrical measuring instruments and their accessories Part 9 : Recommended test methods*

JIS C 1731-1 *Instrument transformers for testing purpose and used with general instrument Part 1 : Current transformers*

- JIS C 1731-2 *Instrument transformers for testing purpose and used with general instrument Part 2 : Voltage transformers*
- JIS C 2320 *Electrical insulating oils*
- JIS C 3307 *600 V Polyvinyl chloride insulated wires*
- JIS C 3315 *Rubber insulated lead wires for electric machinery and apparatus*
- JIS C 3316 *Polyvinyl chloride insulated wires for electrical apparatus*
- JIS C 3317 *600 V Grade heat-resistant polyvinyl chloride insulated wires*
- JIS C 3611 *Insulated wires for cubicle type unit substation for 6.6 kV receiving*
- JIS C 3612 *600 V Flame retardant polyethylene insulated wires*
- JIS C 3801-1 *Testing method for insulators—Part 1 : Insulators for overhead line*
- JIS C 3814 *Indoor post insulators*
- JIS C 3851 *Indoor post insulator of organic material*
- JIS C 4304 *6 kV Oil-immersed distribution transformers*
- JIS C 4306 *6 kV Encapsulated-winding distribution transformers*
- JIS C 4510 *Hook bars for disconnecting switch operation*
- JIS C 4601 *Ground relay set for 6.6 kV consumer*
- JIS C 4602 *Overcurrent relays for 6.6 kV receiving*
- JIS C 4603 *AC circuit breakers for 3.3 kV or 6.6 kV*
- JIS C 4604 *High-voltage current-limiting fuses*
- JIS C 4605 *AC load break switches for 3.3 kV or 6.6 kV*
- JIS C 4606 *6.6 kV Disconnectors for indoor use*
- JIS C 4607 *AC load break switches with tripping device for 3.3 kV or 6.6 kV*
- JIS C 4608 *Lightning arresters for 6.6 kV cubicle type unit substation*
- JIS C 4609 *Directional ground relay set for 6.6 kV consumer*
- JIS C 4611 *High-voltage alternating current switch-fuse combinations*
- JIS C 4901 *Low-voltage power capacitors*
- JIS C 4902 *High voltage power capacitors and attached apparatus*
- JIS C 8201-4-1 *Low-voltage switchgear and controlgear—Part 4 : Contactors and motor-starters, Section 1 : Electromechanical contactors and motor-starters*
- JIS C 8314 *Particular requirements for low-voltage cartridge fuses*
- JIS C 8319 *Particular requirements for screw fuses and D-type fuses*
- JIS C 8352 *General requirements for fuses for the protection of low-voltage cables and lines*
- JIS C 8370 *Molded case circuit breakers*
- JIS C 8371 *Residual current operated circuit breakers*
- JIS C 8374 *Residual current sensing and relaying equipment*

- JIS G 3131 *Hot-rolled mild steel plates, sheets and strip*
- JIS G 3141 *Cold-reduced carbon steel sheets and strip*
- JIS G 3555 *Woven wire cloth*
- JIS G 3556 *Industrial woven wire cloth*
- JIS K 6912 *Laminated thermosetting sheets*
- JIS K 6915 *Phenolic molding compounds*
- JIS R 3204 *Wired glass*
- JIS Z 8721 *Colour specification—Specification according to their three attributes*

3 Definitions For the purpose of this Standard the following principal definitions apply:

- a) **cubicle** an assembly of electrical apparatus intended to be used as a high voltage receiving unit that is contained in an enclosure
- b) **(power) receiving compartment** a metal chamber in which a set of receiving apparatus such as voltage and current transformers and a main breaking device are mainly contained
- c) **(power) distribution compartment** a metal chamber in which transformer, high voltage (switch) board, high voltage power capacitor board, series reactor board, low-voltage distribution board, etc. are accommodated
- d) **front and rear maintenance type** a type of cubicle in which external doors for such work as operation of apparatus, maintenance, checking, replacement are provided on both of front and rear faces of the enclosure
- e) **front maintenance type (thin type)** a type of cubicle in which external door(s) for such work as operation of apparatus, maintenance, checking, replacement are provided on front face of the enclosure and which has a depth not exceeding 1 000 mm
- f) **main breaking device** a breaking device used for incoming power of a cubicle capable of breaking the circuit when any overload current, short-circuit current or the like occurs
- g) **circuit-breaker type (CB type)** a type of cubicle in which a circuit breaker (CB) is used as the main breaking device
- h) **power fuse and switch type (PF·S type)** a type of cubicle a set of high voltage current-limiting fuses (PF) (hereafter referred to as “current-limiting fuses”) and a high voltage a.c. load break switch (LBS) are used in combination as the main breaking device
- i) **power-receiving-unit capacity** the total capacity (kVA) of transformers, motors, high voltage outlets, etc. to be used under the receiving voltage

As for a high voltage motor, the rated output (kW) is regarded as the apparatus capacity (kVA), and high voltage power capacitor(s) is (are) not included in the power-receiving-unit capacity.

- j) **draw out(-mounted) circuit breaker or the like** an equipment which can move from its closed position (operating position) to open position (breaking position) where necessary breaking distance is available while the main circuit is alive or vice versa when it is mechanically connected with the enclosure
- k) **installed capacity of high voltage capacitor** the reactive power (kvar) when the series reactor(s) and power capacitor(s) are used in combination under the rated voltage
- l) **main circuit** the conductor parts for transmission of electrical energy to the load installation
- m) **auxiliary circuit** the conductive parts included in the circuits which carry out control, measurement, signaling, adjustment, panel lighting, etc. (other than main circuit)
- n) **grounding circuit** the circuit for protective grounding of enclosure, accommodated equipments, etc. and it means such conductive parts as grounding wire, grounding bus, grounding terminal
- o) **grounding bus (bar)** the conductor which is provided for common grounding of equipment in a cubicle

4 Service conditions

4.1 Standard service conditions Standard service conditions mean the service conditions given below, and cubicles shall be used under these conditions unless otherwise specified.

- a) For indoor cubicles, the ambient temperature is in the range of -5°C to $+40^{\circ}\text{C}$. Provided that average temperature over a period of 24 h does not exceed $+35^{\circ}\text{C}$.
- b) For outdoor cubicles, the ambient temperature is in the range of -20°C to $+40^{\circ}\text{C}$. Provided that average temperature over a period of 24 h does not exceed $+35^{\circ}\text{C}$.
- c) The altitude does not exceed 1 000 m.

4.2 Special service conditions Special service conditions mean the service conditions corresponding to any one of the conditions stated below; and if cubicles are unavoidably used under such conditions, the conditions shall be agreed between the parties concerned with acceptance.

- a) When the cubicle is used in a place where the conditions are other than those specified in 4.1.
- b) When the cubicle is used in a place where it is subjected to considerable sea breeze.
- c) When the cubicle is used in a place where existence of snow and/or ice is remarkable.
- d) When the cubicle is used in a place where it is always humid.
- e) When the cubicle is used in a place where excessive steam or oil vapour exists.

- f) When the cubicle is used in a place where corrosive gas exists and a place where likely attacked by such gas.
- g) When the cubicle is used in a place where excessive dust exists.
- h) When the cubicle is used in a place where it receives abnormal vibration or shock.
- i) When the cubicle is used under other special conditions.

5 Classification Cubicles are classified as given in table 1.

Table 1 Classification of cubicles

Unit: kVA

Type of main breaking device	Identification of indoor or outdoor	Style due to maintenance work	Power-receiving-unit capacity
Type CB	Indoor service	Front and rear maintenance type	4 000 max.
		Front maintenance type (thin type)	
	Outdoor service	Front and rear maintenance type	
		Front maintenance type (thin type)	
Type PF • S	Indoor service	Front and rear maintenance type	300 max.
		Front maintenance type (thin type)	
	Outdoor service	Front and rear maintenance type	
		Front maintenance type (thin type)	

6 Performances

6.1 Coordination of operation The main breaking device shall sufficiently coordinate with the protective devices of the electric utility's substation so that spread of a fault to the power supply side is prevented.

6.2 Breaking performance The main breaking device shall be such that it has a breaking capacity not less than the short-circuit current at the place where the cubicle is installed (hereafter referred to as "power receiving point short-circuit current"), and that it is capable of protecting ground fault. If the ground fault protection is made by a high voltage a.c. load breaking switch provided on the power supply side of the entry cable to the cubicle, the ground fault relay system is not necessary.

6.3 Operation When the cubicle is subjected to the test in accordance with 10.3.2, various parts of the cubicle shall operate without any trouble.

6.4 Temperature rise

- a) When the temperature rise test is carried out in accordance with 10.3.5, the temperature rises of various parts shall not exceed the appropriate values given in table 2.

- b) The temperature rises of accommodated equipments and materials other than those stated in table 2 shall comply with the appropriate standard values determined in the standards of equipments and materials given in table 6. However, for the temperature rise of transformers is exempted from the above requirements if it does not exceed the specified value by +10 K.

Table 2 Temperature rise limit

Position and component		Temperature rise limit K	Maximum allowable temperature °C
Joint clamped by bolt(s) or the like	Bare copper	50	90
	Tin plating	65	105
	Silver or nickel plating	75	115
Contacts	Bare copper	35	75
	Tin plating	50	90
	Silver or nickel plating	65	105
Terminal connected with external conductor by screws or bolts	Bare copper	50	90
	Silver, nickel or tin plating	65	105

6.5 Dielectric withstand voltages The dielectric withstand voltages shall be as given in table 3, and when a cubicle is subjected to the test in accordance with **10.3.3** no earth fault, flashover, etc. shall appear and no abnormality shall be found on any part of the cubicle.

Table 3 Dielectric withstand voltages

Place where voltage is applied		Power frequency withstand voltage	Lightning impulse withstand voltage
Between phases of high voltage circuits (excluding transformers, arresters, instrument transformers and high voltage power capacitors)		22 kV	60 kV
Between high voltage circuit(s) and low voltage circuit(s), and between high voltage circuit(s) and the earth (excluding arresters and earthed instrument transformers)			
Between low voltage circuit(s) and the earth	Circuit 60 V or less	1 000 V	—
	Circuit over 60 V up to and incl. 250 V	1 500 V	
	Circuit over 250 V up to and incl. 600 V	2 000 V	

6.6 Waterproof Waterproof performance is required of outdoor cubicles and when the cubicle is subjected to the test in accordance with **10.3.4**, the following requirements shall be complied with.

- a) No ingress of water which disturbs normal function shall be found inside of the whole cubicle.
- b) No water drops shall be found on the disconnecting switches, circuit breakers, high voltage a.c. load break switches, arresters, instrument transformers, etc. accommodated in the power receiving compartment.

7 Construction

7.1 Construction in general The cubicle shall be constructed by using equipment and materials of good quality so that mounting at site, connection of wires, operation of switching device, maintenance and checking of equipment are carried out safely and easily; and shall comply with the following requirements:

- a) A cubicle is classified into power receiving compartment and power distributing compartment. However, for a cubicle of PF·S type, structure without such classification is allowed.
- b) If there is (are) exposed high voltage live part(s) while the cubicle door is open, it (they) shall be protected so that it (they) will not be easily accessed during daily operation. If insulating protective cover(s) is (are) attached to such exposed part(s), such a case is exempted from the above requirements.
- c) If a high voltage a.c. load break switch to be used as the main breaking device of a cubicle of PF·S type has a exposed high voltage live part(s), a transparent barrier shall be provided in front of the switch and warning of danger shall be marked with red colour thereon. Further, insulating barriers shall be provided between phases and on both side of the said switch.
- d) Insulating protective covers shall be attached to the high voltage terminals of circuit breakers (excluding draw out type), transformers, high voltage power capacitors and series reactors.
- e) Spaces necessary for maintenance and checking shall be provided above, below and on the side of such equipment as transformer that require such work as tap-changing, oil changing, and behind low voltage switchboard.
- f) When high voltage power capacitor set and series reactor set are accommodated in a power receiving compartment, these equipments shall be installed in the lower part of compartment and spaces necessary for maintenance and checking shall be provided above and around these equipments.
- g) Test terminals for current transformers, potential transformers, zero-phase-sequence current transformers, etc. used in high voltage circuits shall be provided at a location inside of enclosure front where the work is easily done. However, the test terminals may be provided on the door of enclosure, for indoor cubicles installed in an exclusive electrical room.
- h) Socket outlet(s) for maintenance and checking shall be provided at a location inside of the front, where the work is easily done.
- i) The power supply side of the main breaking device in a cubicle of PF·S type shall be capable of being earthed easily and surely by means of a short-circuit earthing apparatus or the like.

- j) The hook bar(s) necessary for operating disconnecting switches, high voltage a.c. load break switches, etc. shall be prepared in the power receiving compartment, and such preparation of hook bars shall be indicated on the door front. If the hook bar is not used in the receiving compartment, the bar may be prepared in the distribution compartment.
- k) The illumination light shall be provided at a location where the replacement is done easily and safely, for outdoor cubicle and other cubicles if necessary.
- l) It is preferable to provide a display lamp, buzzer, etc. which alarms such abnormalities as overload failure if necessary.

7.2 Enclosure or the like The enclosure or the like shall comply with the following requirements:

- a) The enclosure shall consist of body (including base), roof, door, wall plate and bottom plate and the materials shall be as stated below. However, for ventilating holes, such other materials as the wire netting and expanded metals specified in **JIS G 3555** or **JIS G 3556** may be used.
 - 1) The steel sheets specified in **JIS G 3131** or **JIS G 3141** shall be used for the body, roof, door and wall plate, and the standard thickness shall be not less than 1.6 mm for indoor cubicles or 2.3 mm for outdoor cubicles. Otherwise mechanical strength at least corresponding to the said respective thickness is required.
 - 2) The steel sheet specified in **JIS G 3131** or **JIS G 3141** shall be used for the bottom plate and the standard thickness shall be not less than 1.6 mm or the bottom plate shall have mechanical strength at least corresponding to the said thickness.
 - 3) If a glass window is provided, the metal wire netted glass of 6.8 mm or more in classification by thickness specified in **JIS R 3204** or glasses at least equivalent thereto in mechanical strength and fireproof performance shall be used.
- b) The enclosure shall be treated deterrent to rusting and then coated with durable paint. If the base is galvanized by hot dipping, such a case is exempted from the above requirement.
- c) The slope of roof of outdoor cubicle shall be not less than 1/30.
- d) The front face of enclosure shall consist of a door capable of being opened and closed, and doors or detachable covers shall be provided on the side faces or rear face to allow checking and taking in and out of the equipments. However, the side faces or rear face through which no checking or taking in and out of equipments is carried out, are exempted from the above requirement.
- e) Doors can be locked, and also fixed in open state.

The locking device for doors of outdoor cubicles shall have sufficient strength and durability so that the doors will not open due to a strong wind or the like while they are being locked.

- f) A hoisting metal necessary for hoisting at transportation and movement shall be prepared.
- g) The plate to be attached to close gaps at wiring entry and exit shall be made of a metal with a thickness not less than 1.6 mm, or a nonflammable or flame retardant material with a thickness not less than 3 mm.
- h) There shall be neither holes nor clearances through which a round bar of 10 mm diameter can be inserted in vent holes (including ventilation holes) as a measure to keep out small animals or the like. The same requirement applies to holes through which cables penetrate the enclosure.
- i) Foundation bolt holes shall be prepared on enclosures for fixing the cubicle to the foundation, and the size and number of holes shall meet the installation conditions.

The design basis shall be agreed between the parties concerned with acceptance.

- j) The protective plate against access to exposed high voltage live part or similar purposes shall be as follows:
 - 1) Conductive plate such as metal plate shall be connected with such earthed metal part as the enclosure by tightening with bolts.
 - 2) Plate of synthetic resin shall have a fire protective property of at least flame retardance.

7.3 Configuration and mounting of equipments to be accommodated

7.3.1 Configuration The circuit configuration given in attached figure 1 is the standard one.

7.3.2 Mounting of equipments to be accommodated The mounting of equipments to be accommodated in a cubicle shall comply with the following requirements:

- a) The equipment shall be mounted in a location at a height at least 100 mm for outdoor cubicle or 50 mm for indoor cubicle above the bottom; and the mounting position of such live parts as terminal, socket outlet, etc. shall have a height of at least 150 mm above the bottom.
- b) The equipments shall be securely fixed to the enclosure, frame, etc.
- c) Instrument window shall be provided so that indicating electrical instruments are easily visible from the outside of cubicle. If indicating electrical instruments are mounted on the door of indoor cubicle, such a case is exempted from the above requirement.
- d) The disconnecting switch shall be so mounted that state of open or closed is easily decided.
- e) When draw out equipment such as draw out circuit breaker is used, it shall be so mounted that state of open circuit is easily decided.

7.3.3 Mounting of utility meters and voltage and current transformers Mounting of utility meters and voltage and current transformers shall comply with the following requirements:

- a) When utility meters are accommodated in an enclosure, a reading window shall be provided at a location so that the measured values are easily visible from the outside.
- b) It is desirable that utility meters are mounted at an approximate level of 800 mm to 1 500 mm above the floor where reading, maintenance, etc. of meters are easy.
- c) Enough space shall be prepared for the mounting of utility meters.
- d) If mounting plate for an utility meter is necessary, the thickness shall be 20 mm or more and the plate shall have a size enough for mounting the utility meter.
- e) The size of reading window shall be such that the width is 120 mm or more and the height is 180 mm or more.
- f) A voltage and current transformer shall be mounted by taking the arrangement shown in attached figure 3 as the reference where the transformer of the dimensions given in attached figure 2 is accommodated so that a space necessary for mounting and replacement works is ensured.
- g) A metal fitting for lifting the voltage and current transformer shall be prepared.
- h) The cubicle shall be so arranged that the checking of secondary terminal box of voltage and current transformer is capable.

7.3.4 Disconnecting switch In a cubicle of CB type, a set of disconnecting switches shall be provided on the supply side of main circuit breaker to ensure safety at maintenance and checking.

7.3.5 Arrester The arrester shall be as follows:

- a) For a set of arresters, the circuit is branched from a point immediately downstream of the disconnecting switch provided on the supply side of main breaking device and a disconnecting switch exclusively used for the arrester shall be provided. However, in a cubicle of PF•S type such a configuration is allowed that the circuit is branched from a point immediately downstream of the load side of main breaking device and the disconnecting switch exclusively used for the arrester is omitted.
- b) In such a case that an arrester set (including arrester elements) is attached to the power supply side of cubicle entrance cable or the cable enters from underground distribution line, the said arrester may be omitted.

7.3.6 Main breaking device The main breaking device shall comply with the following requirements:

- a) The main breaking device of type CB shall consist of an equipment where the circuit breaker and overcurrent relays are combined or integrated, and the device shall be combined with ground fault relay system as needed, and shall comply with the requirements:

- 1) The control power supply shall be a stable supply so that the said equipment operates surely at such faults as ground fault, short circuit, etc.
 - 2) If the circuit breaker is draw out type, it shall be interlocked with the disconnecting mechanism.
- b) PF·S type shall be an equipment where the high voltage a.c. load break switch and the current-limiting fuses are combined or integrated, and the equipment shall be combined with earth fault relaying device as needed, and shall comply with the following requirements:
- 1) For short circuit in high voltage side, the current limit fuse shall interrupt the current; and for earth fault, the high voltage a.c. load break switch shall have the function to open the circuit automatically.

Enough operation coordination shall be capable of between the current-limiting fuses and the tripping type high voltage a.c. load break switch.
 - 2) The rated make current of high voltage a.c. load break switch shall be not less than the cutoff current of current-limiting fuse corresponding to the short-circuit current at the power receiving point.
 - 3) The fuse of class G specified in **JIS C 4604** shall be used as the current-limiting fuse.
 - 4) The high voltage a.c. load break switch with current-limiting fuse shall have a tripping system by a striker.

7.3.7 Transformer The transformer shall be as follows:

- a) The capacity of one transformer shall be 500 kVA or less.
- b) Transformers shall be so connected that capacities of every phase are balanced as far as possible. Such limit of unbalance is preferred, that the limit of installed unbalance factor does not exceed 30 % calculated by the single-phase transformers. If the difference between the maximum and the minimum in the capacities of transformers connected across lines does not exceed 100 kVA, such a case is exempted from the above requirement.
- c) If a switchgear is provided for a transformer, a circuit breaker, high voltage a.c. load break switch or an equipment at least equivalent thereto in switching performance shall be used. If the transformer capacity is not exceeding 300 kVA, high voltage cutout switches may be used.

When a high voltage a.c. load break switch with current-limiting fuses is used in a three-phase transformer circuit, adoption of tripping system by a striker is preferred.

- d) If necessary for protection of transformer or the like, power fuse, high voltage cutout (with fuse), etc. may be used. In such a case the non-current-limiting fuse shall be so mounted that it is apart from the wiring, equipment, metal plate, etc. by 600 mm or more in the direction of its gas blow-out hole.

7.3.8 High voltage power capacitor and series reactor The high voltage power capacitor and series reactor shall be as follows:

- a) The switchgear for high voltage power capacitor shall be a high voltage load break switch which can make and break the capacitor current or an equipment at least thereto in make-break performance.
- b) A protective device such as current limiting fuses, etc. shall be prepared for the high voltage power capacitor.
- c) The capacity of high voltage power capacitor to be connected with a switchgear shall be 300 kvar or less. However, the capacity shall not exceed 200 kvar for a switchgear which carries out automatic power factor adjustment.
- d) The series reactor shall be equipped with alarm contact so that it is capable of alarming and also of being automatically disconnected at its overheat.
- e) If a low-voltage power capacitor is provided, the high voltage power capacitor may be omitted.

7.3.9 Protective device of low voltage circuit The protective device of low voltage circuit shall be as follows:

- a) In the low voltage main circuit on the secondary side of transformer, a molded case circuit breaker or the like which is capable of breaking the short circuit current flows through its location surely and of protecting the wiring from the overcurrent due to overload, shall be provided.
- b) In a outgoing circuit exceeding 300 V, a ground fault breaking device shall be provided. However, in accident prevention or safety power supply or the like, an alarming device may substitute the said device.
- c) In an auxiliary circuit directly connected with the low voltage main circuit on the secondary side of transformer, a molded case circuit breaker of a rated breaking current not less than 5 kA or the like shall be provided.

7.3.10 Low voltage power capacitor and series reactor The low voltage power capacitor and series reactor shall be as stated below, if they are installed.

- a) Exclusive switchgear shall be prepared for the low voltage power capacitor.
- b) The series reactor shall be equipped with alarm contact so that it is capable of alarming and also of being automatically disconnected at its overheat.

7.3.11 High voltage outlet When high voltage outgoing is done, the following requirements shall be satisfied:

- a) A set of disconnecting switches and circuit breaker or a high voltage load break switch with a set of current-limiting fuses shall be prepared for outgoing lines. If a draw out circuit breaker is used the disconnecting switches may be omitted.
- b) The outgoing line shall be capable of being protected from the ground fault by means of a ground fault relay set. If the outgoing is done from an indoor cubicle to a place in the same electrical room, such a case is exempted from the above requirement.

- c) In the case of a cubicle of CB type, high voltage motors may be used as the load facility.

7.4 Wiring and connection of equipments

7.4.1 High voltage wiring

Wiring on high voltage side shall be as follows:

- a) The insulated wires specified in **JIS C 3611** (hereafter referred to as “high voltage insulated wires”) shall be used, and the thickness shall be as stated below.
 - 1) The high voltage insulated wire for CB type shall be that with nominal conductor sectional area not less than 38 mm². However, for branch circuit to transformer, instrument transformer, arrester, high voltage power capacitor, etc., high voltage insulated wire with nominal conductor sectional area not less than 14 mm² may be used.
 - 2) The high voltage insulated wire for PF·S type shall be that with nominal conductor sectional area not less than 14 mm².
- b) If the high voltage insulated wire is supported, the support shall comply with the following requirements:
 - 1) The wire shall be fixed by using a support insulator for the joint, and a wire support or a support having at least equivalent insulating performance and mechanical strength for the part not jointed.

In this fixation, each phase wire shall be individually fixed, not three phases bundled together and fixed.
 - 2) In a cubicle of CB type, the wire shall be firmly fixed so as to withstand the electromagnetic force due to short-circuit current at the power receiving point.
 - 3) In a cubicle of PF·S type, the wire shall be firmly fixed so as to withstand the electromagnetic force due to the cutoff current of current-limiting fuse corresponding to the short-circuit current at the power receiving point.
- c) High voltage insulated wires shall be connected to each other at the support by means of a support insulator, or the terminal of the equipment.
- d) The insulation distance at various parts of the wiring shall show a value not less than that specified in table 4.

Table 4 Insulation distance in high voltage circuit

Unit: mm

Position		Minimum insulation distance
High voltage live part ⁽¹⁾	Between parts each other	90
	Between wire and earth (including low voltage circuit)	70
High voltage insulated wire without joint ⁽²⁾	Between parts each other	20
	Between wire and earth (including low voltage circuit)	20
Between high voltage live part and high voltage insulated wire without joint ⁽²⁾		45
Creepage distance from live part at wire end to insulated support		130

Notes (1) When a hook bar is used for operation of single pole disconnecting switch or the like, the space between the said live parts each other and space between the live part and the sides of enclosure shall be at least 120 mm. However, disconnecting switch with insulation barrier is exempted from the above requirement.

(2) The minimum insulation distance means the distance from the outside of the insulated wire covering.

Remarks : The part of a high voltage insulated wire end within 50 mm from the covering is considered as a high voltage live part even if the part is treated by insulating tape.

- e) Main circuit wires and copper ribbons including the wiring at inlet and outlet shall be marked with phase identification.
- f) Power cables shall be used for incoming and outgoing lines and no incoming and outgoing by overhead electric lines are allowed.

7.4.2 Low voltage wiring Wiring on low-voltage side shall be as follows:

- a) For the main circuit, wires or copper ribbons which can withstand the short-circuit current which passes through the circuit.

The insulated wires specified in **JIS C 3307**, **JIS C 3315**, **JIS C 3316**, **JIS C 3317** or **JIS C 3612** (hereafter referred to as "low voltage insulated wires") or wires at least equivalent thereto in performance shall be used.

- b) For an auxiliary circuit the low voltage insulated wire shall be used, the nominal sectional area shall be at least 1.25 mm² and the wire shall be chosen by taking into account the capacity of the circuit. However, when the wire is used in the secondary circuit of transformer with secondary rated current of 5 A, an area of 2 mm² or more is required.

Further, wires of thinner than 1.25 mm² may be used in such a circuit as the circuit not directly connected with the main circuit, electronic control circuit, etc. where protection of the circuit is possible without problem on the capacity, voltage drop, etc.