

Materials by Classification	Requirements
Incombustible Kraft Paper	Incombustible kraft paper shall be vinyl paper using non-plastic vinyl chloride resin, having weight of 500 g. per 1 m ² and conforming to class 2 flame resistance, as specified by JIS A 1322 (Testing method for incombustibility of thin building papers)
Asphalt roofing	Asphalt roofing shall be the product manufactured by the manufacturing process of JIS A6006, having weight of 17 kg. per roll (21m ²) or more.
Asphalt felt	Asphalt felt shall be the product manufactured by the manufacturing process of JIS A6005 (Asphalt felt), having weight of 17 kg. per roll (42m ²) or more.
Adhesive tape	Adhesive tape shall be the product conforming to type 1 of JIS Z1525 (vinyl adhesive tape), having thickness of 0.2 mm or more.
Metal lath	Metal lath shall be the product conforming to plain lath No.1 or rib lath (A) No. 1 conforming to JIS A5505, (metal lath), being anti-corrosion treated.
Diamond-shaped wire fabric	Wire fabric shall conform to JIS G3554 (wire fabric), using the galvanized wire specified by JIS G3532 (iron wire), having 16 - 26 mm mesh and diameter of wire being 0.9mm or more.
Iron wire	Iron wire specified by JIS G3552, having diameter of 0.8 mm or more.
Tack rivet	Tack rivet shall consist of the nail, with length corresponding to the thickness of heat insulating material, studded to the galvanized steel-plate washer, or copper-plated nails for spot-welding purpose, having sufficient strength to hold heat insulating materials

Materials by classification	Requirements
Steel frame	In all cases, steel frame shall be fabricated of galvanized iron sheet, JIS G3302, with standard thickness of 0.4 mm or more. When using light-gauge pre-fabricated shape steel, such steel shall be anti-corrosion treated.
Solder	Solder shall conform to JIS H4341 (solder).
Wooden frame	Wooden frame shall be made of Japanese cedar (SUGI)
Toothed washer and band	Toothed washer and have shall conform to JIS H3201 (brass plate), or JIS G4305 (cold-rolled stainless steel plate), having thickness of 0.2mm or more. Those made of brass plate shall be chrome-plated. Width of hand shall be 20mm for heat insulating material of 150 mm or less in outside diameter and 25 mm for more than 150mm.
Mastic compound	Mastic compound shall be as approved by the Government Inspector.
Joiner and Corner bead	Joiner and bead shall be of metal and approved by the Government Inspector.
Asbestos cement	Asbestos Cement shall be an admixture of 75% of asbestos powder, 22% of Portland Cement and 3% of asbestos piker, by weight.
Adhesive agent	Adhesive agent shall be adequate to adhesion required and approved by the Government Inspector.

7.5.2 Insulation
Thickness

Rock wool may be used instead of glass wool insulation.
The thickness of insulation is as follows:

Nominal diameter	- 25	30-65	80	100-125	150	200-
Rock wool	20	25	30	40	40	50
Glass wool	20	25	25	30	40	40
Snow country	25	30	40	40	50	50

Hot water storage tank and
small boiler.

- 1) Glass wool 50 mm
- 2) Wire lath
- 3) Asbestos cement 20 mm
- 4) Cotton cloth wrap width 40 mm or more
- 5) Galvanized iron sheet 0.3 or
Aluminum sheet 0.6 mm or more.

7.6 Anti-corro-
sion
treatment

Water to be used shall be analyzed and following anti-corrosion material shall be applied.

- A) Magnesium rod shall be installed into the boiler.
- B) For different metal, joint shall be done with non-corrosive joints.
- C) Anti-corrosion chemical shall be added.
- D) shall conform to particular specification.

8. Gas Supply Work

8.1 City Gas Supply

- 8.1.1 General City gas supply work shall conform to the requirement of gas supplier and related local authorities regulation.
- 8.1.2 Piping Material
- A. Gas pipe shall conform to JIS G 3452 (Gas supply carbon steel pipe), galvanized pipe and joint shall conform to JIS B 2301 (threaded cast iron joint).
 - B. Cast iron pipe shall conform to JWWAG 105 (Water supply use centrifugal ductile cast iron pipe) A type, K type, JWWAG 106 A type, K type, JWWAG 109 A type or gas supply authority's standard.
 - C. Lead pipe shall conform to JIS H 4311 (lead pipe) class 3.
 - D. Gas cock and gas valve shall be made of cast iron, bronze or brass and where exposed in view shall be chrome-plated.
 - E. Water trap shall be made of cast iron.
 - F. Meter shall conform to the requirement of gas supplier.
- 8.1.3 Gas Equipment
- A. Gas equipment shall be specified in the drawings and particular specification.
 - B. Gas equipment shall conform to the requirement of gas supplier.
- 8.1.4 Installation
- A. In all case gas pipe shall be used for piping except nominal pipe diameter more than 75 mm and underground piping, cast iron pipe may be used. Lead pipe shall be used for connection of gas meter or small type wall gas boiler.
 - B. Joint for pipe shall be threaded joint conforming JIS B 0203.

- C. Flange joint and mechanical joint shall conform to section of Water supply work.
- D. All pipe shall be cut square and true to the pipe axis by means of suitable tool without reducing the pipe diameter, and cut end of pipes shall be finish smooth. Prior to making connection, the interior of each pipe shall be checked and all chips, dirt and other foreign matters shall be thoroughly removed.
- E. In all case, piping shall be graded with 1/100 - 1/200 and at the bottom water discharge cock shall be provided.
- F. In all case, piping shall be exposed piping or installed at pipe shaft or trench pit.
Where necessary to embed into concrete slab, pipe shall be wrapped with anti-corrosion vinyl tape.
- G. Where piping is used for pressure air, check valve shall be provided and where piping is used for Oxygen supply, safety device shall be provided.
- H. Piping shall not be installed close from smoke flue or stack.
- I. Where pipings are installed parallel or cross with electrical wiring, gas piping shall be separate 150 mm from those wiring or shall be isolate by wall or other means.
- J. Where piping is installed at underground, necessary care shall be taken not to damage the other piping or wiring.
- K. Supporting metal shall be made of steel and firmly fixed at structure.
- L. Where piping penetrate through the wall, chrome-plated bronze escattheon shall be provided.
- M. Where piping penetrate through the fire wall, those space between pipes and wall shall be filled with non combustibile materials.

SECTION 7 GENERAL SPECIFICATION

Part 6. Electrical Work

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Part 6. Electrical Work

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1. Wiring Work
 - 1.1 Wireway in Metal Conduit Pipings
 - 1.1.1. Wire Wire shall conform to the material stated in general provision and shall be 600 volts Vinyl-insulated wire unless otherwise specified.
 - 1.1.2. Metal Conduit and Accessories Metal Conduit and Accessories shall conform to general provision and shall be as follows;
 - A. Metal Conduit:

Conduit shall be thin-walled steel conduit pipe unless otherwise specified. Thick-walled steel conduit pipe shall be used in accordance with the particular specification and the drawings.
 - B. Accessories
 - 1) Outlet box, switch box and cover plate shall be made by steel plate with thickness of at least 1.6 mm. Exposed type shall be made of cast iron
 - 2) Stud shall be threaded type with outside diameter 20 mm and inside 9 mm.
 - 3) Bushing shall be insulating bushing type.
 - 4) Coupling shall be union coupling.
 - 5) In all case, normal bends shall be used for pipes larger than 31 mm in diameter.
 - 6) Location and type of Boxes shall conform to drawing and particular specification.
 - 1.1.3. Cabinet and Pull box Shop drawings for distribution board, terminal box or pull box shall be submitted to the supervisor prior to commencement of fabrication unless otherwise specified.
 - 1) Cabinet:

Cabinet shall be made of 1.6 mm or thicker steel plate and detail shop drawings shall be approved by the supervisor.
 - 2) Pull box:

Pull box shall be made of 1.6 mm or thicker steel plate and detail shop drawings shall be approved by the supervisor.

1.1.4. Conduit
Installation

Conduit shall be embedded in floor, wall, column or ceiling or exposed in the manner as follows;

A. Embedded Raceway

- 1) Raceway shall be embedded in a manner not to obstruct the structure and strength of building. Cut end of pipe shall be reamed smooth, moisture-proof treated and rust proof paint shall be painted at the threaded part.
- 2) To facilitate a lead-in of electric wire, bending radius of pipe shall be more than six times that of inner diameter. Pull box shall be provided where one section of raceway exceed 30 m or where necessary in view of technical requirement. In all case, number of bents in one section shall not exceed two times.
- 3) Cut end of pipe where not damp or wet place shall be provided terminal-end or end and where damp or wet place, shall be provided with entrance cap.

B. Exposed Raceway

Exposed raceways shall be installed orderly along ceilings or walls. Wherever conduit pipes are to be installed vertically, they shall be installed in pipe chases along wall surface. Metal supports shall be of steel, corresponding to number and configuration of conduit pipe and condition under which they are to be installed. Where conduit pass through the corrosive area, such part shall be painted with anti-corrosive paint. The color of paint shall be directed by the supervisor.

C. Consealed Raceway

Consealed Raceway shall conform to Embedded Raceway and Exposed Raceway.

D. Connection of Conduit

All conduit pipes, conduit pipe and box or pull boxes connected shall be bonded to effect electrical integration. Connection between conduit pipe shall be made using a coupling, screwed in until pipe ends closely butt each other. Where connection between pipe and box or panel board is not to be screwed in, locknuts shall be fitted on both sides of box or panel board case to tighten the connection. Pipe end shall be provided with a bushing.

E. Installation of Boxes

Location and height of Cabinet and Box shall be determined with the consideration of

other facilities and in accordance with the instruction of the supervisor. Inside of box shall be painted by electric isolation paint.

F. Cleaning of Raceway

- 1) Pipes shall be cleaned as directed by the supervisor. Provided that pipes shall be cleaned and checked for continuity immediately after the installation of the Raceway.
- 2) After installation of raceway has been completed, lead wire shall be put through the raceway.

G. Raceway Passing through metal-lath lining wall

Wherever metal conduit pipes pass through metal-lath lining walls (including wire-lath and metal-sheet lining wall) such part of walls shall be provided with pipe sleeve. The pipe sleeve shall extend more than 1 meter beyond each surface of the wall. Pipe end shall be protected with tape.

H. Grounding

Conform to the section of grounding.

1.1.5. Installation of Conductors

- A. In all case, vinyl-covered conductors shall be color-coded in accordance with the type of circuit and system. Color shall be determined with the instruction of the supervisor except grounding shall be green in all case.
- B. Conductors shall be installed into the conduit pipe in the manner not to produce magnetic anbalance.
- C. In all case, conductor shall be installed into conduit after the complete dry of structure. Vertical length of conduit shall not exceed over 20 meters and shall be firmly supported.
- D. Wires to be installed in metal conduit pipe, hard vinyl pipe, flexible conduit pipe and floor duct shall not be joined. In all case, cores shall be jointed using pressure connector and thoroughly connected using a specific tool. Number of turns of insulating tape on vinyl-covered conductor and rubber-sheathed. conductor shall be more than three times for less 8 mm^2 more than five times for $14 \text{ mm}^2 - 50 \text{ mm}^2$ and more than seven times for over 60 mm^2 .

- E. In all case, pressure terminal shall be used for connection of conductors with the fixture terminal. In the pull box, conductors for the respective circuits shall bear their destined panel board clearly written on plastic name plate in accordance with the instruction of the supervisor.
 - F. Conductor shall not be installed into same raceway with weak current wire way, unless provided rigid partition between two conductors.
- 1.2. P.V.C. Conduit Work
- 1.2.1. Wire Wire shall conform to general provision and in all case shall be 600 volts vinyl sheathed wire unless otherwise specified.
 - 1.2.2. Vinyl Pipes and Accessories
 - A. Pipes shall be hard vinyl pipes and where embedded in the concrete, pipes thickness shall be not less than 2.0 mm.
 - B. In all case, boxes shall be hard vinyl makes and where fixed at stud, boxes shall have back plate. Other matters not provided in this section shall conform to metal conduit work.
 - 1.2.3. Cabinet and Pull Box Conform to 1.1.3. Where pipe is connected, boxes shall have connector and thickness shall be not less than 5 mm.
 - 1.2.4. Installation of Conduit
 - A. Installation shall conform to metal conduit installation and as follows;
 - 1) Bending or butt-joint fabrication of pipes shall use specific heating equipment or shall be heated in other approved method. Heated temperature during fabrication shall be within a 120° C. Care shall be taken not to over heat the pipe. Expansion couplings shall be used at approximately every 10 meters to correspond the outdoor temperature. Saddles shall be fixed at every 1.5 meters intervals or less.
 - 2) Raceways to be grounded shall have bare copper put through or installed along the raceway and both ends perfectly and electrically connected.
 - B. Hard vinyl pipes shall be carefully connected in the manner to correspond with outdoor temperature.
 - 1) In all case, coupling shall be used for connection of pipes and for connection by means of expansion coupling, one end of the coupling shall be coated with

adhesive, then closely inserted in the pipe, and the other end inserted loose without use of adhesive.

- 2) In case specified in the drawing or particular specification, insert type or loose type joint may be used.
- 3) In all case, for connection between pipe and hard vinyl box where embedded or concealed, in the ceiling, connector or combination of connector and coupling shall be used.
- 4) For connection between pipe and hard vinyl box where exposed, hubbed hard vinyl box exposed type shall be used and connection shall be insert type.
- 5) Grounding for Cabinet and Pull box shall conform to the section of grounding.

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| 1.2.5. | Installation
of Conductor | Wiring shall conform to the section of metal conduit pipe. |
| 1.3 | Metal Sheathed
Raceway | |
| 1.3.1. | Wire | Wire shall conform to general provision and in all case shall be 600 volts vinyl-sheathed wire unless otherwise specified. |
| 1.3.2. | Metal Sheath
and Accessories | Metal sheath and accessories shall be approved by the supervisor. |
| 1.3.3. | Installation | For raceways to be passing through the structure shall be installed in a manner not to adversely effect the construction and strength of the building and as directed by the supervisor. |
| 1.4 | Raceways in
Flexible Con-
duit Pipes | |
| 1.4.1. | Wire | Wire shall conform to general provision and in all case, shall be 600 volts vinyl-sheathed wire unless otherwise specified. |
| 1.4.2. | Flexible Con-
duit and
Accessories | Unless otherwise specified, flexible conduit shall be class 2 flexible conduit and Accessories shall conform to general provision. |

- 1.4.3. Installation
- A. Conduit pipe shall be firmly fixed to structural member with saddle. Connection between flexible conduit pipe and box or other metal puupe shall with proper connector.
 - B. Both ends of pipe shall be connected with 2.0 mm bare soft copper ground wire.
 - C. Pipe end shall be provided with bushing, connector or the like to protect conductor covering from damage.
- 1.4.4. Installation of Conductor
- Installation of Conductor shall conform to the section of metal conduit.
- 1.5. Metal Ducts
Wire Ways
- 1.5.1. Wire
- Wire shall conform to general provision and in all case, shall be 600 volts vinyl-sheathed wire unless othersise specified.
- 1.5.2. Metal Ducts a
and Accessories series
- Metal ducts shall be fabricated of steel plate of 1.6 mm thick or more and fitted with conductor supporting hardware. Duct shall be of construction easy for installation and inspection of inside, and shop drawings shall be submitted to the supervisor for approval prior to commencesent of fabrication.
- 1.5.3. Installation of Ducts
- A. Ducts shall be supported at every 3-meter intervals or less and firmly secured to structural member using proper inserts, or bolts.
 - B. Ducts shall be constructed so as not to permit entry of moisture, dust, etc..
 - C. Connection between ducts or ducts and metal conduit shall be closely butted and rigidly made mechanically using bolts, etc., and electrically jointed using bare copper wire. Other matter not provided in this section shall conform to the metal conduit section.
- 1.5.4. Wire way in Ducts
- Wire way in Ducts shall comform to the section of metal conduit otherwise as follows;
- A. In any case, conductors shall have no joints in duct, however, that if for any reason, conductors must be branched, prior approval by the supervisor, shall be needed.
 - B. In case wire has to be pulled out from duct, such work shall conform to the section of metal conduit work.
 - C. Unless rigid partition is provided to isolate conductor and weak-current carrying

conductor and/or such conductor are installed in a box or duct grounded by the Special Class 3 Method.

- D. Total sum of sectional area of conductors to be contained in duct shall be 20 % or less of the inner sectional area of duct, or 50 % or less for the control circuit conductors.

1.6. Bus Ducts

- 1.6.1. Bus Ducts and Accessories Ducts and accessories shall conform to J.I.S. and shop drawings shall be submitted to the supervisor for approval prior to commencement of fabrication.
- 1.6.2. Installation of Ducts
- A. Location of ducts shall be determined with the consideration of other facilities and installed in accordance with the instruction of the supervisor.
- B. Each parts shall be fabricated after measuring the place to be installed and Duct shall be supported at every 3 meters intervals or less and firmly secured to structural member using proper inserts, bolts, etc., Where the vibration will be expected, the manner of installation shall be directed by the supervisor.
- C. Duct shall be constructed so as not to permit entry of moisture dust, etc. and shall be straight as long as possible. Where ducts are installed passing through floor or wall, such part shall not have any duct joint.
- D. Connection between ducts or duct and panel board shall be closely butted and rigidly made mechanically using bolts, etc., and electrically jointed using bare copper wire. Grounding of bus ducts shall be performed as specified in the section of "Grounding".
- E. The matter not provided in this section shall conform to the section of Metal Conduit.

1.7. Wire way in Floor Duct

- 1.7.1. Wire Wire shall conform to general provision and in all case, shall be 600 volts vinyl-sheathed wire unless otherwise specified.
- 1.7.2. Floor Duct and Accessories Floor duct and Accessories shall conform to general provision.

- 1.7.3. Installation of Floor Duct
- A. Duct end shall be reamed smooth, and connection between ducts shall be made using duct coupling. Connection between conduit pipe and duct shall be made using junction box, end connector or end elbow. Duct end shall be closed with an duct end.
 - B. Where duct is placed direct on the floor, duct shall be supported with the level adjust supported and be installed level and linearly.
 - C. Insert shall be fitted with stud or flush-mounted cap, and installed in a manner not to project above floor surface. Insert marker shall be provided at the nearest insert from the junction box.
 - D. Insert shall be fitted with surface-mounted cap, high-tension outlet or low-tension outlet as shown in the drawings or the particular specification.
 - E. Connection between ducts, duct and junction box or conduit pipe and junction box shall be mechanically made to form a firm butt-joint and shall be integrated electrically made to
 - F. The matter not specified in this section shall conform to section of Metal conduit work.
- 1.7.4. Wiring
- Wiring shall conform to metal conduit work.
- 1.8. Cable Work
- 1.8.1. Cable
- A. Cable for high-tension voltage shall conform to general provision and shall be vinyl-isolated cable or chloroprene-isolated cable. Sheath shall be chloroprene-sheath unless otherwise specified.
 - B. Cable for weak current circuit shall conform to J.C.S.
- 1.8.2. Installation of Cable
- A. Installation
 - 1) Non-metallic covered cable shall be installed along structural members and shall not be embedded into floor, ceiling, wall, or column, or shall be contained in a steel conduit pipe.
 - 2) Should cable be subject to external damage, it shall be protected in steel conduit pipe. Otherwise, cable shall be securely fixed to structural members using saddles or staples and without damage to the cable covering.

- 3) Cable shall not be straddled beams and if for any reason cables must be installed beams and if for any reason cables must be installed straddling beam, cable shall be laid and secured on a wooden board bridging the beam or secured on messenger wire line as directed by the supervisor.
 - 4) Where cable laid under ground, cable shall be contained in steel conduit pipe, clay pipe or vitrified pipes, and curved radius larger than 6 times of cable diameter in low-tension and 10 times in high-tension.
- B. In so far as practicable, cables shall not be curved, and if for any reason curvature must be provided, cable shall be curved to a radius larger than 10 times the cable diameter for high-tension use and 5 times for low-tension use.
 - C. Connection or branching of cables shall be made within cabinet or box.
 - D. Where the cables passing through the structural members, it shall be protected by steel conduit.
 - E. The matter not provided in this section, shall conform to the metal Conduit Work.
- 1.9. Wire way
Installed in
Train of In-
sulators
- 1.9.1. Wire Wire shall conform to the general provision and in all case, shall be 600 volts vinyl-sheathed wire unless otherwise specified.
 - 1.9.2. Bind Bind shall be vinyl bind. Where specified in the drawings or wet place, copper bind wire shall be used. Wire shall be 0.9 mm for small insulator and 0.9 mm for medium and large insulators.
 - 1.9.3. Conduit and Accessories Conduit and accessories shall conform to general provision.
 - 1.9.4. Porcelain Iso-
lator and
Porcelain tube Porcelain isolator and porcelain tube shall conform to J.I.S. or shall be directed by the supervisor.
 - 1.9.5. Cabinet and
Pull box Cabinet and pull box shall conform to the section 1.1.3. and 1.2.3.

- 1.9.6. Wiring
- A. Wire shall be installed along structural members and clearance shall be 25 mm or more from those members.
 - B. Support intervals and distance shall conform to the code and shall be directed by the supervisor.
 - C. Joints shall conform to metal conduit work.
 - D. Whenever conductor passes through structural member, such part shall be provided with porcelain tube and the both ends of porcelain tube being extended more than two times the tube diameter beyond the outside surface of structural member and properly secured with porcelain fasteners. Where conductor passes through a fire wall, such a part of conductor shall be provided with a steel pipe sleeve and sleeve shall be extend more than 500 mm beyond each surface of the wall and clearance between pipe sleeve and fire wall shall be filled with cement mortar. Pipe end shall be stuffed with fire resistance material. Where conductor passes through a structural part lined with metal lath, wire lath or metal sheet, such part of each conductor shall be isolated from lath or metal sheet.
 - E. Other matters not specified in this section shall conform to the metal conduit work.
- 1.10. Aerial
Distribution
Line
- 1.10.1. Wire Wire shall conform to general provision and shall be vinyl-isolated hard copper cable and shall be specified in the drawings or particular specification.
- 1.10.2. Bind In all case, bind wire shall be semi hard-drawn copper wire having a diameter of 1.6 mm for aerial wires not larger than 5 mm^2 in diameter and 2.0 mm for aerial wires more than 30 mm^2 .
- 1.10.3. Pole
- A. Wooden pole shall be as much as streight and shall be preserved.
 - B. Concrete pole shall conform to J.I.S. and shall be centrifugal R.C. pole.
 - C. Steel fabricated pole shall conform to drawings and particular specification.
- 1.10.4 Under-bracing
Logs For the wood poles, pressure-preserved wooden bracing shall be used and for concrete pole and steel pole, concrete bracing shall be used. Detail shall be specified in the drawings.

- 1.10.5. Crossarms
- A. In all case, wood crossarm shall be provided for wood pole and steel crossarm shall be provided for concrete pole or steel pole.
 - B. Materials shall be approved by the supervisor.
- 1.10.6. Insulators
- Insulators shall conform to J.I.S. and depending on wiring conditions, pin insulators, branched insulators, anchor insulators or other appropriate insulators shall be used.
- 1.10.7. Guys or Pole Braces
- 2.6 mm diameter twisted galvanized steel wires shall be used for guy and three guys shall provided for each pole. Wood braces shall be same quality as pole. Guys used in aerial high-tension lines shall be provided with ball insulators.
- 1.10.8. Transformer and Cutout Switch
- Transformer and Cutout switch shall conform to J.I.S. and J.E.C. and detail shall conform to the drawings and particular specification.
- 1.10.9. Installation
- A. Pole
 - 1) Detail locations of poles shall be as directed by the supervisor.
 - 2) Minimum pole-setting depth in the ground shall be 1/6 of the entire pole length for poles not exceeding 15 m in length, and shall be 2.5 m for poles exceeding 15 m in length. Minimum earth covering over bracing shall be 30 cm.
 - B. Installation of Crossarms

Steel or wooden crossarms shall be installed on the pole on the side opposite to the tension acting on conductors, and shall be firmly secured in place by galvanized steel bolts of sufficient diameter or other suitable fasteners. On each pole, topmost crossarm shall be installed 250 mm below the pole top. Unless otherwise specified or indicated, vertical spacing between crossarm shall be 750 mm apart, provided that wire crossarms belonging to the same high-tension wireway or high-tension and low-tension are to be mounted and shall be 400 mm apart, provided where crossarm belonging to the low-tension wireway. The minimum vertical spacing between such crossway shall be 300 mm apart.
 - C. Installation of insulators

Insulators shall be firmly secured to crossarm by bolts or screws. Minimum spacing between insulators shall be 400 mm apart for high-tension lines and 300 mm for low-tension lines.

D. Guys or Pole Braces

- 1) Positions, setting angles and other details required in installing guys or pole braces shall be as directed by the supervisor. In all case, guys or pole braces shall be secured to poles at least an elevation 200 mm below high-tension line and 100 mm below low-tension line.
- 2) Guys shall be firmly secured to poles using guy thimbles for wooden pole use and guy bands for concrete pole use. Bottom of guys shall be provided with guy rods.
- 3) Earth covering over guy anchors and bracings shall conform to pole setting depth.

E. Wiring and branch

- 1) All wires shall have identical sag so as not apply any unbalanced tension on crossarms or other supports, and shall be installed with proper equipment.
- 2) Wiring height, clearance between wires and structures, and other wiring details shall be as directed by the supervisor.
- 3) Any branch from the line shall be made at the support position.

F. Transformers and switches

- 1) Transformers shall be mounted on racks provided at 4.5 m from ground or higher elevation on pole by assembling steel crossarms, angle steel sections and armties.
- 2) Oil cutout switches shall be hanged at the place where easy to maintenance from the crossarms using hangers or bolts.
- 3) Primary cutout switches or porcelain type cutout switches shall be mounted at the place where easy to change the fuse.

G. Pole steps shall be provided alternately on opposite sides of each pole at intervals of 45 cm, starting from a point 1.8 m above the ground level. Poles shall be provided with cap (except for concrete pole) and name plate indicating date of erection, pole number, pole dimensions and other necessary information.

H. Grounding for transeformer shall conform to the section of Grounding.

1.10.10.Aerial Wiring

A. Cable shall conform to general provision.

- B. Suspension Wireways shall be standard galvanized twisted steel wires having the sectional area of more than 22 mm².
- C. Cable or wire shall be suspended with aerial wire linearly stretched on which hanger shall be fixed at every 500 mm intervals or less.
- D. Bending radius of cable, connection, terminal treatment shall conform to cable work.
- E. Grounding shall conform to the section of Grounding.

1.11. Underground
Distribution Line

1.11.1. Cable Cable shall conform to the general provision.

1.11.2. Protection Material of protection shall conform to general provision and concrete trough, thick steel conduit, P.V.C. conduit and R.C. pipe shall be used.

1.11.3. Cable Instal-
lation

A. Direct-burying method

- 1) Except C.D. cable, cable shall be laid in troughs. Minimum depth of earth covering the trough shall be 400 mm, provided that in such areas as may be subject to vehicular pressure or other heavy pressure, such depth shall be 1.2 m minimum.
- 2) Concrete trough shall be laid on the compacted bottom close to each other and filled with river sand, then the trench shall be back filled in accordance with the instruction by the supervisor.
- 3) Markers indicating the curved positions of cable runs and cable splices shall be provided at suitable places directed by the supervisor. Other matter not provided here shall conform to the section 1.8. cable work.

B. Duct Method

- 1) Cable shall be laid in tick metal conduit pipe, hard vinyl conduit pipe or centrifugal reinforced concrete pipe. Depth of earth covering the pipes shall be directed by the supervisor and shall withstand the pressure from vehicular or other heavy pressure.
- 2) Manhole and handhole shall be concrete made, capable of withstanding vehicular or other heavy pressure and shall be so designed as to prevent entry of water. Underground boxes shall be so constructed that water accumulate therein may be drained.

- 3) Metallic supports for cables and connections shall be firmly secured to manhole or handhole.
- 4) Other matter not provided here shall conform to the section 1.8. Cable work.

2. Grounding

2.1. Grounding

- 2.1.1. Classification and Ground Resistance Value
- Classification of grounding work shall conform to the Engineering Standard of Electric Equipment, and classification and ground resistance value is as follows;

CLASS	GROUND RESISTANCE VALUE
Class 1 Method	10 ohms or less
Class 2 Method	150/ I_1 ohms or less Where I_1 is single line short-circuit current. However, I_1 value or required resistance value shall be determined as agreed upon between electricity supplier.
Class 3 Method	100 ohms or less
Special Class 3 Method	10 ohms or less

2.1.2. Electrical Work to be Grounded

A. Class 1 Method

The following electrical works shall be grounded by class 1 method:

- 1) Steel bases and external metal boxes of over 600 volts high-tension or extra high-tension equipment or fixtures.
- 2) Metal conduit pipe accommodating the high-tension and extra high-tension circuitry cables, metal junction boxes, or secondary circuitry of extra high-tension instrument transformer.

- 4) External box of the discharge lamp ballast or metallic part of the discharge lighting fixture of which secondary short-circuit current of the discharge lamp transformer, or of which working current of high-tension lighting circuit, exceeding 1 ampere.

B. Class 2 Method

The following electrical works shall be grounded by Class 2 Method;

- 1) Neutral point or one terminal of the low-tension side of transformer connecting high-tension circuitry with low-tension circuitry not in excess of 300 volts.
- 2) Neutral point (10 ohms or less in ground resistance) on the low-tension side of the transformer connecting high-tension circuitry with low-tension circuitry not in excess of 300 volts.

C. Class 3 Method

The following works shall be grounded by Class 3 Method;

- 1) Steel bases and external metal boxes of low-tension equipment or fixtures not in excess of 300 volts. In case if equipment or fixtures voltage to ground is less than 150 volts and to be installed in dry place, this provision may be omitted.
- 2) Low-tension wireways not in excess of 300 volts. Metal conduit, flexible conduit, metal duct, bus duct, floor duct, metallic fittings and parts, or metal pull boxes except following cases.
 - a) Metal conduit less than 4 meters long, metallic parts of cable protector metallic sheath of cable to be installed in dry place.
 - b) Metal conduit less than 8 m, metallic parts of cable protector, metallic sheath of cable to be installed where inaccessible to man or in dry place, all subject to A.C. voltage to ground less than 150 volts.
- 3) Metal conduit to be installed in damp or wet place.
- 4) Secondary circuitry of low-tension (over 300 volts) or high-tension instrument transformer.
- 5) External metal boxes of discharge lamp transformer accommodating over 1,000 volts for circuitry.
- 6) External boxes of discharge lamp ballasts and metallic parts of discharge lamp fixtures except in case A.C. voltage to ground less than 150 volts and installed in dry place, this provision may be omitted.

D. Special Class 3 Method

The following electrical works shall be grounded by Special Class 3 Method;

- 1) Steel bases and external metal boxes of Machinery equipment with power circuitry over 300 volts but not exceed 600 volts.
- 2) Low-tension wireways over 300 volts but not excess of 600 volts installed in metal conduit, hard vinyl conduit, flexible conduit, metal duct, connection metal boxes, and metallic sheath of cable, except that where any of the above-mentioned items if installed in a manner inaccessible to man, it shall be grounded by Class 3 Method with the prior approval of the supervisor.
- 3) Metal pull boxes installed in plastic conduit pipe used not in excess of 600 volts internal wiring.
- 4) Metallic part of steel conduit, hard vinyl conduit, flexible conduit, metallic sheath of cables provided with rigid partition to accommodate interior low-tension and weak current carrying wireways, except if weak current wireway used
- 5) Pull boxes, duct, etc., provided with rigid partition to accommodate interior low-tension and weak current carrying wireways.
- 6) Metallic part of cable protector, metal junction box accommodating over 300 volts interior wire provided where accessible to man.
- 7) External boxes of the discharge lamp ballast or metallic part of the discharge lighting fixture of which secondary short-circuit current of the discharge lamp transformer, or of which working current of high-tension lighting circuit, exceeding 1 ampere with low-tension circuit in excess of 300 volts.

2.1.3. Ground Electrodes

Ground electrodes shall be copper plate, copper pipe, or copper wiremesh. Detail shall conform to drawings and particular specification.

- 1) Copper plate: Thickness shall be more than 1.5 mm
- 2) Copper pipe : Diameter more than 40 mm, thickness; 1.6 mm
- 3) Copper mesh : Wire shall be more than 2.6 mm ϕ
- 4) Jointed rod : Joint ground rod shall be copper covered more than 1 mm thickness.

2.1.4. Ground Conductor

Ground conductor shall conform to general and where ground conductor joined direct to the rod shall be bare copper cable except below 700 mm from ground surface shall be 600 volts vinyl covered wire shall be used as conductor. Size of conductor shall conform to drawing and particular specification.

- 2.1.5. Installation of Ground Rod
- A. Ground rod shall be installed damp but not corrosive place deeper than 700 mm from ground surface.
 - B. Ground electrodes or Ground conductor shall be isolated more than 1 m from other ground electrodes or ground conductor and shall be isolated more than 2 m from Lightning Arrester.
- 2.1.6. Installation of Ground Conductor
- A. Any breaker shall not be installed in conductor and conductor to ground rod shall be electrically connected.
 - B. Ground conductor shall have the section of its length from ground electrode to a height 2.5 m above the ground surface accommodated in a rigid-non-conductive pipe, except that this provision shall not be applied if ground conductor is installed where in accessible to man. Metal conduit in which ground conductor for lightning arrester is to be installed shall be of non-magnetic type.
- 2.1.7. Joint Ground
- In so far as combined ground resistance value is 3 ohms or less, a joint ground combining more than two methods may be employed in accordance with drawings, except this provision shall not be applied to lightning arrester.
- 2.1.8. Grounding to Water pipe
- Underground metal pipe maintaining an electric resistance value of less than 3 ohms between the ground may be used as a ground electrode as instructed by the supervisor and with the written consent of the utility agency.
- 2.1.9. Ground Marker
- A. Wherever ground electrodes are buried, ground marker shall be provided.
 - B. Marker shall have buried location of ground electrode, depth, date, class of ground and ground resistance value clearly indicated.
- 2.1.10. Test
- Ground resistance value shall be measured in the presence of the supervisor and written report shall be submitted after the completion of inspection by the supervisor.
3. Power Distribution
- 3.1. Lighting System

- 3.1.1. Genral Lighting fixtures, distribution board, wiring equipment, and its installation, wiring method shall be as specified hereinafter on the drawings and particular specification.
- 3.1.2. Lighting Fixture Unless otherwise specified, shop drawings for fixture shall be provided and approved by the supervisor. In all case, fixture shall conform to the requirement of J.I.S. or equivalent standard.
- 3.1.3. Distribution Board Distribution board shall be as follows unless otherwise specified and shop drawing shall be approved by the supervisor.
- 1) Distribution boards shall be made of steel with thickness of 1.6 mm or more.
 - 2) Front panel shall be made of steel with thickness of 2.3 mm or more or more than 1.2 mm for folded plate and shall be easy shape for maintenance use.
 - 3) Inner frame shall be steel with thickness of 1.2 mm or more and enough gurter space shall be provided.
 - 4) Base plate shall be marble, asbestos or steel plate. Thickness shall conform to the drawings.
 - 5) Main feader wire shall be 600 volts vinyl-covered wire or copper strips and front part shall be covered with non-flamable board with card-holder.
 - 6) Circuit breaker and fuse shall conform to the general provision and capacity, number, etc. shall conform to the drawings and particular specification.
 - 7) Distribution boards shall have an insulation and durable colored-finish. Shape, dimensions, instruments and apparatus of panel boards shall be as shown on the drawings.
- 3.1.4. Wire Distri- A. Fittings shall conform to the general provision and detail shall conform to the
bution Fittings drawings and particualr specification.
- B. Followings shall be standard for fittings unless otherwise specified.
- 1) Height of switch.....1.25 m from floor to center of switch.
 - 2) Location of switch.....150 mm from door frame.
 - 3) Wall type receptacle.....100 mm above base.
150 mm above counter.

- 3.1.5. Installation of Lighting Fixtures and Distribution Board
- A. Lighting fixture:
Installation of lighting fixtures shall be performed in accordance with weights and places of lighting fixtures. They shall be suspended and reinforced as instructed by the supervisor. For heavy lighting fixtures or those required special installation method, installation drawings shall be prepared and submitted as the case may require. In all case, lighting fixtures shall be securely installed using bolts or inserts, and when necessary, provided with means to prevent lighting fixtures from being swung using wood screws, etc. Where lighting fixtures are to be installed on ceiling joist, proper reinforcement shall be provided.
- B. Distribution board:
Distribution board shall be installed firmly and in level where necessary to reinforce, such core shall be considered.
- C. Distribution fittings:
Distribution fittings shall firmly installed into the box with screws or other means with level.
- 3.1.6. Wiring
Wiring shall conform to the wiring of other section of this specification.
- 3.1.7. Grounding
Grounding work shall conform to section of Grounding work.
- 3.1.8. Test
After completion of the work, isolation test shall be carried out. Resistance valve is as follows;
- 1) Less than 150 V.....0.1 M Ω or more.
 - 2) More than 150 V.....0.2 "
 - 3) More than 300 V.....0.4 "
- 3.2. Neon-sign Board
Installtion and wiring of neon-sign board shall conform to the drawings and particular specification.
- 3.3. Sterilize Lamp
Installation and wiring of sterilize lamp or ozon produce equipment shall conform to the drawings and specification.

- 3.4. Power Circuit
- 3.4.1. General Installation of power circuit distribution boards, control panel pull boxes shall conform to the drawings and particular specification.
- 3.4.2. Distribution Board Control Panel and Pull Box
- A. Distribution boards and pull boxes shall conform to section 1.1.3. and 3.1.3.
 - B. Control panel
 - 1) External box shall conform to distribution board.
 - 2) Shop drawings shall be provided and approved by the supervisor.
- 3.4.3. Wiring Wiring shall conform to the section of wiring.
- 3.4.4. Grounding Grounding shall conform to the section of grounding.
- 3.4.5. Test Testing shall conform to the section of lighting.
- 3.4.6. Accessories Accessories shall conform to the drawings and particular specification.
- 3.5. Fan This work shall conform to the drawings and particular specification.
- 3.6. Heater "
- 3.7. Medical Equipment "
- 3.8. Substation System
- 3.8.1. General Panel boards, transformers and other equipment shall be laid out and installed in accordance with the drawings and particular specification.
- 3.8.2. Work in Common
- A. Prior to the execution of the work, the contractor shall comply with the applicable laws and regulations, and make all the procedures required by the Governmental Authorities concerned, and Electrical suppliers.
 - B. Necessary fee and expense to Electrical Authorities to take the power for substation shall not be included in this contract.

- C. Prior to commencement of the work, detail drawing showing equipment layout and other necessary shop drawing shall be approved by the supervisor.
- D. Installation of watt-hour meter for incoming power shall not be included in this contract.

3.8.3. Equipment

Equipment and components to be used under this section shall conform to the technical specifications, the drawings, J.I.S., J.E.C. and J.E.M. requirements.

A. Panel Boards

Prior to the fabrication of panel boards, shop drawings shall be submitted to the supervisor for approval.

- 1) Panel boards shall be of good quality, perfectly insulated, free from any flaw or other defect.
- 2) Panel boards shall be made of steel plate and shall have an insulating and durable colored finish. Shape dimensions, instruments and apparatus of panel boards shall be as shown on the drawings.

B. Transformer

Transformer shall be askarel and oil-insulated type unless otherwise specified.

- C. Voltage regulator shall conform to the drawings and particular specification.
- D. Condenser shall conform to the drawings and particular specification.
- E. Primary over current protector shall conform to the particular specification.
- F. Lightning arrester shall conform to the drawings and particular specification.
- G. Ground relay shall conform to the drawings and particular specification.
- H. Storage batteries shall conform to the drawings and particular specification.

3.8.4. Assembly of Frame

Frame shall consist of non-galvanized gas pipes (32 A) and shape steel sections as shown on the drawings and shall be firmly secured to the floor or other surface at each end by means of suitable fasteners. Prior to assembly, frames shall be painted with rust proof paint. After assembly, frames shall be painted in such color as directed by the supervisor.

- 3.8.5. Installation of Equipment Equipment shall be installed as indicated in the drawings.
4. Equipment Following equipment work shall conform to the drawings and particular specification.
1. Electrical Clock System
 2. Signal Work
 3. Speaker Work
 4. T.V. Antenna
 5. Indication System
 6. Interphone System
 7. Fire Alarm System
 8. Telephone System
 9. Automobile Control
5. Lightning Arrester
- 5.1.1. General A lightning rod or conductor shall be provided on top of the building, chimney or tower, and connected and grounded to the ground electrode by means of a lightning conductor in accordance with the drawings and particular specification.
- 5.1.2. Lightning Rod Lightning rod shall be made of copper, having a tip diameter of 12 mm and length of 250 mm or longer. Detail shall conform to the drawing and particular specification.
- 5.1.3. Rod Support Rod support shall be of brass tube, at least 3 mm thick, 38 mm in outer diameter and detail shall conform to the drawing and particular specification.
- 5.1.4. Conductor Conductor shall conform to requirements of J.I.S. and shall be of stranded copper wire or copper flat bar. Detail shall conform to the drawing and particular specification.
- 5.1.5. Metal Fixtures and Protective Pipe Metal fixtures used for fixing the rod support shall be galvanized iron and protective pipe shall be non-magnetic material.
- 5.1.6. Ground Electrode Ground electrode used shall be of copper plate of 1.5 mm x 900 mm x 900 mm or larger, or other material with equivalent ground resistance. Type and quantity shall conform to the drawings and particular specification.

- 5.1.7. Ground Resistance Ground resistance value of each down conductor shall be less than 10 ohms.
- 5.1.8. Installation Installation shall be as follows;
- A. Ground electrode shall be buried vertically below the ground water level and top of ground electrode shall be deeper than 750 mm from top of constant water level. Ground electrode shall be buried at least 2 meters away from other ground electrodes or structures with the attendance of the supervisor.
 - B. Rod support and fixtures shall be rigidly installed in a manner to resist wind pressure and provide water tightness.
 - C. In all case, not less than 2 conductors shall be provided unless otherwise specified in the drawing and particular specification.
 - D. Conductor shall be isolated 1 meter or more from power line or gas pipe.
 - E. Conductor shall be secured at the part of 2.5 meters above ground and upto 0.3 meter underground with the non-magnetic pipe or brass pipe. In case brass pipe is used, both ends of pipe shall be connected by copper cable having a sectional area of 14 mm² or larger.
 - F. Test terminal shall be provided where directed by the supervisor for measurement of ground resistance. Test terminal shall be of brass and terminal box shall be non-magnetic.
 - G. Conductor and ground electrode shall be firmly secured.
 - H. Flat copper cable installed at the top of building shall be tightened firmly with brass bolt.
 - I. Where section area of structural steel member is not less than 300 mm², lightning rod and conductor may be omitted in accordance with the drawing and particular specification.
 - J. Any other matters not specified in this section shall conform to the direction of the supervisor.
- 5.1.9. Ground Marker Conform to the section 2.1.9.
- 5.1.10. Test
- A. Conform to the section 2.1.10.
 - B. Necessary inspection by related Authorities shall be performed.

