THE SOCIALIST REPUBLIC OF THE UNION OF BURMA

REPORT ON TELEPHONE PLANT PLANNING PROJECT

VOLUME II

October 1977

JAPAN INTERNATIONAL COOPERATION AGENCY

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PART III

TECHNICAL SPECIFICATION OF THE INSIDE PLANT AND A LIST OF MATERIALS

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CHAPTER 1 TECHNICAL SPECIFICATION

1.1 Specifications of Installation Work

Installation work of the inside plant shall be performed in conformity with the drawings included in Annex I and Annex II as well as the procedures and instructions to be stated hereunder.

1.1.1 General Description

(1) Transportation of exchange

Exchange which is shipped after a precise adjustment shall be transported with utmost precaution not to cause damages in transit. Since most of transportation service is to be performed by other authorities than the PTC, for precluding dropping and excessive vibration or shock being given to the exchange in transit, full coordination shall be made in advance between parties concerned, and all the personnel and workers involved shall be fully briefed of the procedures to be followed.

a) Procurement of transportation equipment

The following equipment necessary for hoisting, transporting and installing the exchange shall be provided by the specified date.

i) For C2 type automatic exchange

Crane : One unit with a capacity of 40 tons or more; or two units each having a capacity of 20 tons or more.

Trailer truck : With a capacity of 20 tons or more. The length of carrier bed shall be 8m* or more. (The optimum length is 12m or more.)

*The exchange shall be fixed to the carrier bed in the manner illustrated in Fig. III.1.1.1, if the bed measures less than 12m.

ii) For C1 type automatic exchange

Crane : With a capacity of 10 tons or more.

Truck : With a capacity of 5 tons or more.

b) Unloading at the Rangoon port

Crane having a capacity of 40 tons or more is required for unloading C2 type automatic exchange. Therefore, arrangement shall be made with parties concerned for securing a wharf equipped with such cargo-handling equipment at the time of arrival of a ship carrying the exchange.

c) Railroad transportation

For utilization of railroad services for overland transportation of C1 type automatic exchange to the Maymyo District, inform the party concerned of the external dimensions of the exchange so as to be able to take steps for prevention

of possible collision of the exchange with other object. In case where, in consideration of the size of the exchange, a low floor wagon is necessary, arrangement shall be made to secure such a wagon at the time of necessity.

Utmost precaution shall be taken not to expose the exchange to shocks and impacts during transportation. In other words, shocks that may be produced in connecting and disconnecting the freight wagons shall be minimized.

The wagon carrying the exchange shall not be rammed against another wagon.

d) Road transportation

The route of road transportation shall be pre-investigated including investigation of overhead lines.

Those overhead lines that may impede the passage of the truck shall be temporarily taken off or lifted higher. For road transportation, a guide car shall be used for the prevention of traffic accident and possible collishion against the overhead lines.

In carrying C2 type automatic exchange on a 12m or shorter trailer, in particular, attention shall be paid to the following points:

i) The width and height of the trailer, load-bearing capacity of the road, etc. shall be fully investigated in advance for deciding on the transport route, and where an official permission is required for the transportation of a large long object, such permission shall be obtained in advance.

ii) The height of timbers to be placed underneath the container shall be decided taking into consideration the degree of sinking of the timber's bed and rise of the rear wheels as the container is placed on the trailer.

iii) The timbers shall be fixed with bolts so that they cannot be dislocated.

iv) C2 type automatic exchange shall be fastened to the trailer by use of wire ropes and turnbuckles.

v) The running speed of the truck carrying the exchange shall not exceed 30km/h.

(2) Unpacking and inspection

Following arrival of the exchanges at the Rangoon port, the number of packages shall be checked, and further each package shall be checked for possible damage on the outer side of the crate. Any package on the outside of which is found a damage shall be unpacked, and contents shall be inspected for damage, in the presence of a party or parties concerned.

Following completion of the overland transportation, the packages shall be promptly unpacked and inspection shall be performed as to the quantity* of the contents and possible damage.

* Inspection shall also cover the quantity of accessories and other attached materials.

(3) Installation

The installation work involves handling of large-size heavy equipment within limited area of space, and consequently utmost caution is essential for the prevention of accidents and troubles. In the event of installing the equipment at a soft ground or a reclaimed area, in particular, iron plate or the like shall be spread for precluding the equipment from capsizing, etc. Objects which may hamper installation work shall be removed, and ground levelling and other necessary preparations shall also be performed.

(4) Preparation of foundation and earthing

The major dimensions and structure of the foundation base for the exchange are given in Annex I.8 and Annex II.9. However, larger dimensions and structures are acceptable in case such arrangement is necessary for provision of sunshine shelter, etc.

Earthing shall be provided before preparing the foundation and specified value of earthing resistance for each earthing application is as follows:

o	For signal (positive feeder of DC power mains)	6 ohms or less
o	For low-tension power arrester	10 ohms or less
o	For exchange arrester *	10 ohms or less
o	For power equipment protection (for earthing the cabinet)	100 ohms or less

* Earthing of the exchange arrester frame at the Mayangon Exchange Office and of the frame itself of the manual exchange room CDF at the Maymyo Exchange Office.

Two units of C1 type automatic exchange are to be installed in parallel. Two units of C2 type automatic exchange are also to be installed in parallel. Each type of necessary earthing shall be provided commonly for each two units.

Branching of earth for connection to the two units shall be made at a level of 600mm or more under the ground. The standard method of earthing is described in Annex I.11 and Annex II.10. In case the standard method cannot satisfy the specified values, other measures, such as connecting of earthing conductors of different types and connecting with the existing earthing device, shall be taken. For connection in such case, 14mm² stripped and twisted copper wire shall be buried at 600mm or more under the ground.

The standard earthing method is as follows:

a) For earthing, metal earth rods (combination of A plus 2B) shall be positioned rectilinearly at 2m intervals. For connection of earth rods, 14mm² 600V insulated wire shall be used.

b) Refer to Annex I.11 and Annex II.10 for methods of burying and connecting the

earth rods. For connecting the lead wire of the earth rod to the connection wire, tear off the connection wire sheath at the connecting point, wind the lead wire there, solder, and cover the joint with self-adhesive tape and then with PVC tape for protection.

c) Number of earth rods

i) Mayangon Exchange

For signal	25 pieces
For low-tension power arrester	12 pieces
For protector (exchange)	12 pieces
For power equipment protection	1 piece/unit

For connection with the existing earthing device, the multi-wire shall be laid from the existing MDF frame to the inlet of the building, via cable plate, and the wire shall be buried under the ground just after coming out of the building through inlet.

ii) Maymyo Exchange

For signal	26 pieces
For low-tension power arrester	15 pieces
For protector (exchange)	15 pieces
For power equipment protection	1 piece/unit

Protector wire shall be connected to the switchboard room CDF, and it shall be laid from the CDF to the lead-in pole via cable rack, and buried at the place where the lead-in pole is installed.

(5) Preparation of the sunshine shelter

The following conditions shall be taken into account in designing the sunshine shelter:

a) Approximately 1,000 mm clearance shall be kept between the roof and the top of the exchange for better circulation of air.

b) The length of the eaves shall be so decided that the entire area of the side panel of the exchange may not be exposed to sunlight during daytime. In putting up a fence as sunshine shelter, space* necessary for performing a job shall be provided.

c) The sunshine shelter shall be so constructed as to have due strength for precluding possible collapse that may result in damage to the exchange.

* Open space of about 2m or more is required behind the air conditioner and in front of the door of the container of storage batteries for C1 type automatic exchange.

(6) MDF work

In principle, the new MDF shall accommodate new cables only. However, some

of the existing subscribers shall be accommodated in the new MDF by new cables, as occasion demands. Jobs involving the installation of new MDF or CDF shall be performed paying attention to the following points:

It shall be confirmed, before installing subscriber jumper, that arrester spring or test spring terminating at the exchange side is cut off by a disconnecting piece. After installation of the subscriber jumper, do not remove the disconnecting piece except when the exchange side of corresponding subscriber is cut off on the old MDF.

In testing a subscriber's line from the newly installed exchange, firstly confirm that the line is not busy on the old MDF, disconnect the line, remove the disconnecting piece on the new MDF, and then perform the test. After completing the test, the line shall be restored to the original condition.

Switching for starting service by the new exchange is performed by removing all the disconnecting pieces of the new MDF at a time after cutting all lines on the old MDF off.

(7) Test of terminal equipment

In installing telephone sets in premises and performing call test, the conditions of the terminal equipment covering items listed in the following are measured, by use of the test equipment so as to obtain necessary data.

a) Value of resistance of DC loop up to the terminal excluding telephone sets (L1 and L2 be shortcircuited in rosette.)

b) Value of resistance of DC loop including telephone sets (off hook status).

c) Whether or not pad is inserted in position.

d) Dial speed and make/break ratio.

Along with the above measurement, insulation and electrostatic capacity between both lines and between each line and earth shall be measured to confirm that the values measured are satisfactory.

Through call test, verification of subscriber's number and inspection of line conditions shall be conducted. All the subscribers shall be tested at least twice before commencement of the services.

(8) Work in switching equipment room

Precaution shall be taken for the prevention of ingress of dust into the switching room for the purpose of running the automatic exchange in a good operating condition. Personnel entering the room shall change their shoes to indoor footwear, and such indoor footwear shall be provided in the exchange rooms (including the switchboard room of the Maymyo Exchange Office). Further, caution shall be taken not to leave the doors open.

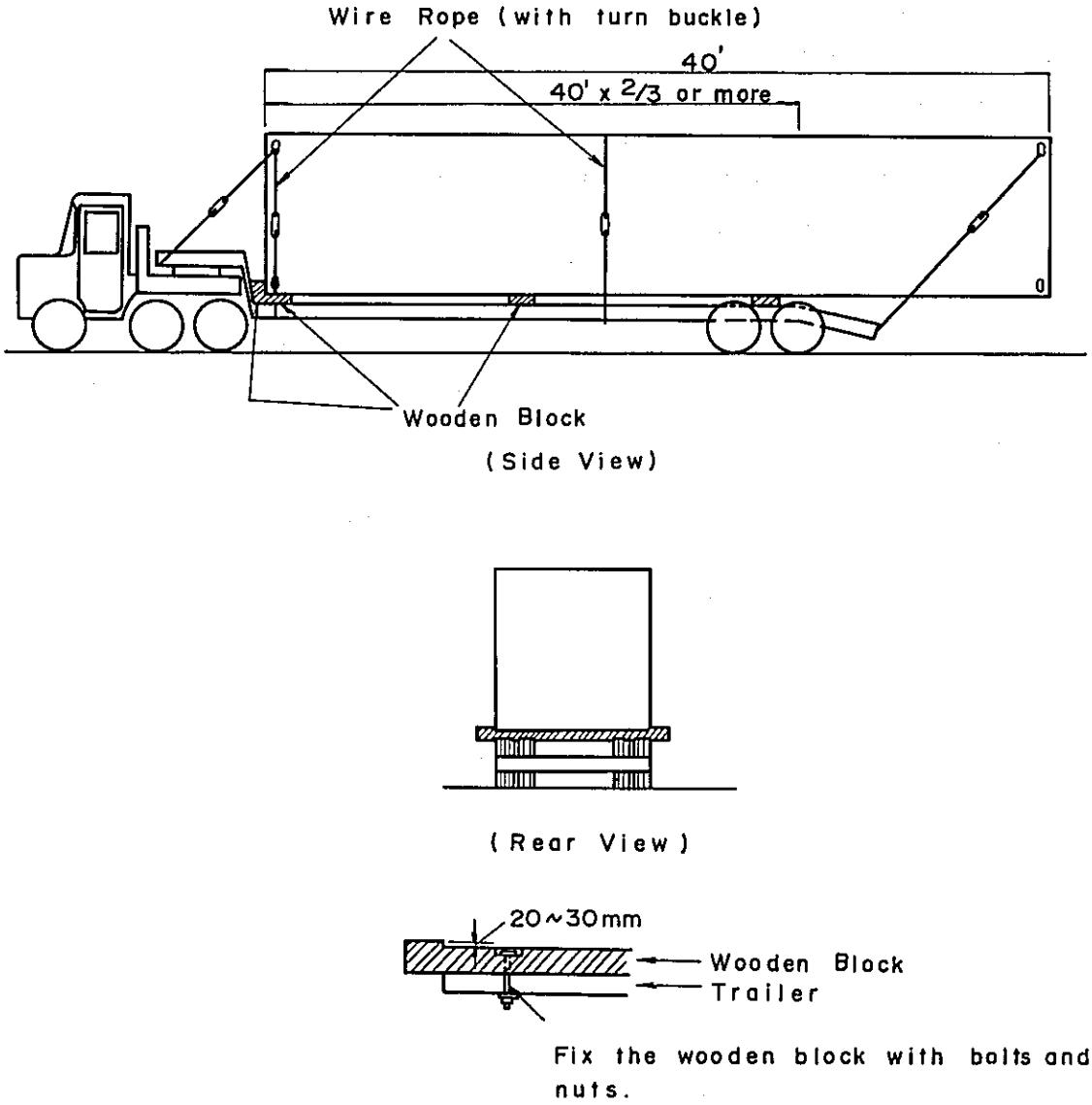


Fig. III 1.1.1 Fixing of C2 Type Automatic Exchange on the Trailer

1.1.2 Mayangon Exchange Office

(1) Installation work

After installing C2 type automatic exchange on the foundation and before performing connection test of the exchange, the following works shall be executed, in accordance with the installation manual which is to be provided together with the exchange.

a) Installation of accessories and storage battery

On the exchange, air conditioner mount, ventilation fan hood and low-voltage arrester for power line shall be installed. Further, storage battery shall be placed on the battery shelves and necessary connection shall be made using the connecting bars.

b) Power reception

Power line shall be led in and necessary connection shall be made.

c) Initial charge

Electrolyte shall be filled into the battery and a rectifier shall be set for initial charging, and then initial charge shall be carried out.

d) Jumper on distribution frame

Junction line and subscriber line shall be connected to the exchange equipment.

(2) Installation test

Installation test shall consist of unit equipment test, connection test, overall test and artificial call test. The artificial call test shall be executed for one C2 type automatic exchange by 32 telephone sets, i.e., 10 sets for intra-office calls, 6 sets for outgoing calls to another unit, 6 sets for outgoing calls to other exchanges and 10 sets for incoming calls from another unit. This test shall be continued for 30 minutes. As soon as a ringing or busy tone can be heard, the connection shall be cut off, and the next connection test shall be started. Artificial call test shall be conducted until a favourable stability with one or less fault per 1,000 calls is attained, and further this test shall be performed once a day until commencing the service, even after such stability has been obtained.

In accommodating test telephones, they shall be allocated evenly to the respective frames, and their accommodation positions shall be changed test by test.

(3) Shifting of subscriber and junction lines

The existing ARF-101 exchange will be still in service at the time of installing C2 type automatic exchange at Mayangon. Subscribers to be shifted shall be temporarily dualterminated on the MDF at the time. Therefore, shifting shall be performed with full caution not to disturb the normal services. Similar precaution is necessary also in shifting junction lines. During the test, connection test shall be

conducted by making busy several circuits at the existing ARF-101 exchange side.

(4) Modification for interworking with World Bank Project network

Since the C2 type automatic exchange is to be put in operation as part of the existing telephone exchange network, some modifications are necessary in signalling system and numbering plan for the new exchanges which interwork with the new telephone network of the World Bank Project when it is completed. Steps necessary for such modifications shall be taken by PTC in accordance with the instructions attached to the drawings to be supplied together with C2 type automatic exchange.

In the event that decision is made for the World Bank Project network to employ Toll Ticketing, equipment necessary for the ANI (automatic number identification for calling subscriber) facility shall be separately procured by PTC.

1.1.3 Maymyo Exchange Office

(1) C1 type automatic exchange

a) Installation test

Installation test shall consist of unit equipment test, connection test and artificial call test. For the artificial call test, 14 telephone sets and two trunk circuits of trunk switchboard shall be used, and the test shall be continued for 30 minutes. Intra-office connection and "109" connection shall be made.

As soon as a ringing or busy tone can be heard, the connection shall be cut off, and the next connection test shall be started. This test shall be performed, after completing unit equipment test, during the period of various different tests. It shall be continued until a favourable stability with one or less fault per 1,000 register calls has been attained. Further, it shall be performed once a day until commencing the services, even after the above-mentioned stability has been attained.

In accommodating test telephones, they shall be allocated evenly to the respective frames, and their accommodation positions shall be changed test by test. Toll outgoing trunk circuits for test shall also be changed test by test.

b) Setting of operation points of the air conditioner, dehumidifier and ventilation fan

All of the air conditioner, dehumidifier and ventilation fans are designed to run automatically by means of detectors provided. Although those detectors are properly regulated before shipment, the following must be checked for proper operation.

i)Dehumidifier

While it can be set for a range from about 30% to 80% of relative humidity, it should normally be set for 60%.

ii) Ventilation fan

It can be set for a range from about 10°C to 40°C. Normally, it is to be set for 35°C or higher, and not to run while the air conditioner is in operation. It must be set for 35°C at all times in case of shutting down the air conditioner for such purposes as inspection.

iii) Air conditioner

Air conditioner shall be set to retain the temperature within a range 27°C through 30°C. This setting should not be changed carelessly, otherwise sweating can take place on the exchange.

(2) Manual trunk switching equipment

a) Wiring for power line

DC main power for the switchboard and trunks shall be provided from the existing power supply equipment. The wiring shall be, as indicated in Annex II.6, divided into two systems of the switchboard, and the line testing device and trunk frame through the aisle distribution fuse box. Since power is supplied from the existing equipment during the work, connection shall be made by providing a changeover switch and a fuse of small capacity for precluding adverse effects on the equipment in service.

After cut-over, the existing side shall be disconnected, for making a proper connection.

b) Idle line indicator

Only outgoing trunk circuit shall be accommodated in the idle line indicator.

c) Lighting for the switchboard

In case indoor illumination is not sufficient for the operation of the switchboard, auxiliary illumination shall be provided. It is advisable that the lighting fixture be positioned at about 550mm from the front side of the jack panel. Under the present design, the positions of switchboard and reinforoement have been decided in consideration of the foregoing. One 40-watt fluorescent lamp or two 20-watt fluorescent lamps shall be procured and installed by PTC.

1.2 Specifications for Modification of C2 Type Automatic Exchange

1.2.1 Overhaul of Exchange

(1) Exchange equipment

Various equipments and parts shall be cleaned and inspected, and defective parts shall be replaced. Points requiring special attention are detailed in the following. For replacement of parts, parts which have the same or equivalent shall be used.

a) Contacts

Contacts shall be cleaned. Relays having defective contacts shall be replaced.

b) Trouble recording equipment

Trouble recording equipment shall be disassembled for cleaning, and necessary lubrication shall be provided.

c) Jumper on MDF in C2 type automatic exchange

On MDF in C2 type automatic exchange, jumper shall be provided for tie cables between inside terminal block and MDF in the existing exchange. Terminal blocks on MDF in the exchange shall be used by dividing them into the following three groups:

Subscriber terminal	600P (1 - 600)
Subscriber terminal	400P (601 - 1,000)
Junction line terminal	400P (1,001 - 1,400)

(2) Storage battery

Storage battery shall be renewed.

(3) Power supply equipment

a) Rectifier

The rectifier shall be modified or replaced so that it can cover the input voltage 3-phase, 230V (Phase to neutral), 50Hz.

b) Illumination and outlet wiring

Single phase 100V wiring for illumination and outlets shall remain as it is, and power necessary, therefore, shall be obtained by stepping down single phase 230V through a transformer.

1.2.2 Specifications for Modification of the Exchange

At the time of overhaul of the exchange, the capacity of the exchange shall be increased as detailed below and modification necessary for its application to the telephone network in Burma shall be performed. C2 type automatic exchange shall, after due modification, satisfy specifications mentioned in Sections 1.2.2.1-1.2.2.5.

Number of subscriber terminals	1,000 terminals/unit
Traffic capacity	160 Erl./unit

1.2.2.1 Outline

(1) Composition of the telephone network

a) Existing telephone network

The Rangoon telephone network to which C2 type automatic exchange is to be connected is as illustrated in Fig. III.1.2.1, and the existing automatic exchanges in the city of Rangoon are as shown in Table III.1.2.1. C2 type automatic exchange after modification is required to be connected to this existing telephone network.

b) Telephone network following the completion of the World Bank Project

Fig. III.1.2.2 shows the telephone network in Rangoon following the completion of the World Bank Project.

Under the project of constructing telephone network covering the country of Burma, the entire area is to be divided into two regional areas and 8 zones, and each zone is to be divided into groups. C2 type automatic exchange after modification is also required to be connected to the future telephone network.

- o Rangoon Regional Area

Rangoon Zone	Code 01
Moulmein Zone	Code 03
Bassein Zone	Code 04
Prome Zone	Code 05

- o Mandalay Regional Area

Mandalay Zone	Code 02
Magwe Zone	Code 06
Myitkyina Zone	Code 07
Taunggyi Zone	Code 08

(2) Numbering Plan

The following two types of numbering plans shall be applied to the C2 type automatic exchange: These two numbering plans, however, shall not be used together.

a) Existing numbering plan

Local	5 digits
Special service code	3 digits (00X)

b) Numbering plan to be employed after completion of the World Bank Project

Local	5 digits
STD	0 + 6 digits, or 7 digits
Special service code	3 digits (1XX)

(3) Routing

Alternative routing facility toward Hanthawaddy Exchange Office shall be provided for the traffic to Maungtaulay Exchange Office. For the future usage, furthermore, alternative routing facility up to seven routes shall be provided.

(4) Charging

a) Local calls

Single metering shall be effected upon answer of a called subscriber, and each subscriber shall be provided with a message register that proceeds one step by each charging pulse.

b) Trunk calls

- o Manual calls

  Charging of manual calls shall be made according to the records on the exchange ticket prepared by the operator.

- o Semi-automatic calls

  Charging of semi-automatic calls shall be made according to the records on the exchange ticket prepared by the operator.

o Subscriber trunk dialling calls

Charging of subscriber trunk dialling calls is effected by charging pulse of Karlsson system which is sent from the higher ranking exchnage office over junction circuit. Interval of charging pulses shall be 1 pulse per 5 sec. at minimum. Exchange shall be designed so that the ANI (automatic number identification of the calling subscriber) facility may be adopted by providing additional equipment or parts, when the toll ticketing (TT) system is introduced in the future.

c) International calls

International calls shall be handled manually and its charging shall be made according to the records on the exchange ticket to be prepared by operators.

The introduction of TT system in the future for charging of international calls is planned. Exchange shall be designed so that the ANI facility may be adopted by providing additional equipment or parts at the time of introduction.

(5) Signalling system

The signalling system shall comprise two types of signals, namely, line signals and register signals.

a) Line signals

DC loop signalling system shall be used. Exchange shall be designed so that the following two types of signalling systems shall be applicable. These two signalling systems shall, however, not be used together with each other.

i) Line signalling system for connection with the existing exchange

Line signals to be employed for interworking with the existing exchange shall be as shown in Table III.1.2.2.

ii) Line signalling system after the completion of the World Bank Project

After the completion of the World Bank Project, the C2 type automatic exchange shall be connected only with new exchanges to be installed in accordance with the World Bank Project, and in this case, signals shown in Tables III.1.2.3, III.1.2.4 and III.1.2.5 shall be applied.

b) Register signals

Exchange shall be designed so that the following two types of signalling systems shall be applicable, but these two types of signalling systems never be employed together with each other.

i) Signalling system for connection with the existing Exchange

DC signalling system indicated in Table III. 1.2.6 shall be employed.

ii) Signalling system after the completion of the World Bank Project

MFC signalling system shown in Table III.1.2.7 shall be employed, and the electrical characteristics of the MFC signalling shall be based on those of CCITT-R2 system.

1.2.2.2 Equipment and Materials

(1) Conditions related to temperature and humidity

The equipment and materials to be provided shall operate satisfactorily under the conditions of temperature and humidity specified below:

- o Temperature — From +5°C to +42°C
- o Relative humidity — From 40% to 95%

The components and parts shall not become defective under the aforesaid conditions of temperature and humidity even in case of failure of the air conditioner, as well as during transportation and installation period.

(2) Prevention of rusting

All the parts shall be prevented from rust under the ambient conditions specified in para.1.2.2.2(1).

(3) Marking

Markings in English or English abbreviation shall be provided on all the equipment for identification of each equipment.

(4) Relays and coils

The electromagnetic circuit shall be made of high quality magnetic steel, and relay contacts shall be of sealed-in type or of twin contact with long life. Furthermore, a spark quenching circuit shall be provided for a part where sparks may arise.

(5) Rack frame and mounting of parts

Relays and parts of related circuits shall be so mounted that each mounting unit may constitute a circuit or circuits or part of circuit unit.

Relays and switching devices shall be protected with covers for avoiding ingress of dust and possible damage.

(6) Cables and wires

All equipment and frames in the exchange shall be wired and tested at the manufacturer's factory.

(7) Quality of equipment

a) System stability

The system shall satisfy the specifications required herein. Traffic capacity, loss probability and other functions required shall be maintained adequate, even if the numbers of circuits and routes may be changed.

b) Parts and materials

All the parts and materials to be employed shall be of high quality.

1.2.2.3 Detailed Technical Specifications

(1) System

a) Storage capacity

Originating register and outgoing sender, as a whole, shall be capable of memorizing national numbering (5, 6 and 7 digits at the initial stage, and 7 and 8 digits at the ultimate stage except for trunk prefix "0"). For international automatic dialling system in the future, storing of 11 digits at the maximum shall be feasible (Cyclic storing principle is also acceptable). Incoming register shall be able to store 4 digits at the maximum. Further, it shall also be capable of transmitting charging area information for charging purpose (Details of such transmission are shown in Table III.1.2.7).

b) Digits to be sent

The exchange shall be capable of transmitting necessary digits of trunk prefix, international trunk prefix as well as called subscriber number.

(2) Facilities

a) Subscriber number

Allocation of subscriber numbers shall be made in accordance with Table III.1.2.8.

b) Subscriber class of service

Subscriber classes of services including ordinary subscriber, public coin box telephone and toll barring shall be provided. Subscriber classes of services shall be provided up to ten for originating calls and terminating calls, respectively.

c) Call barring

Means shall be provided for barring selected subscribers from making calls to predesignated areas. Partial barring of trunk calls to specific permitted areas shall be feasible.

d) Line lockout

In the event that a call cannot be connected for some reasons (such as trouble, abnormal call, called subscriber being engaged, and congestion of junction circuits), the originating subscriber shall be disconnected from the exchange equipment. The originating subscriber is left in a line lockout condition and receives busy tone from the subscriber circuit. Similar procedure shall take place also after the called subscriber has hung up the handset earlier than the calling subscriber and a certain period of time (1 to 2 min. or more) has passed.

e) PBX facility

It shall be possible to accommodate up to 20 percent of all the subscriber terminals as PBX subscribers, and one PBX group shall consist of 10 lines at the maximum. Circuits making up the PBX group may be selected in sequence. Night service function must be provided, i.e., it shall be possible to call any circuit within one group.

f) Public coin box telephone

Pre-pay type public coin box telephone shall be connected. Single metering public coin box telephone shall be employed, and charging shall be carried out on the basis of polarity reversal pulse produced when the called subscriber answers. Barring of calls to specific areas from the public coin box telephone shall be possible. No return of polarity reversal pulse shall be possible in the case of a non-charged call of special service code. It shall be possible to discriminate calls originating from public coin box telephone.

g) Malicious call tracing

Train retaining function shall be provided for tracing malicious calls. Furthermore, recording of calls to subscribers receiving malicious calls (recording of called party's number and used incoming trunk number, in the case of terminating calls; called party's number, used intra-office trunk number and originating caller's number, in the case of intra-office calls) shall be feasible.

When MFC signal is in use, it is preferable that originating subscriber's number and called subscriber's number can be recorded when the information that the called subscriber has received the malicious call is received at the originating exchange.

h) Release

Release of connection shall generally be controlled by the originating subscriber. In special cases such as forced release and malicious call tracing,however, called party control or last party release shall be feasible. When MFC signal is in use, means shall be provided for effecting last party release for specific subscribers or all the subscribers.

i) Offering

Offering by operator, i.e., indicating a trunk call to an engaged subscriber using a signal tone (an offering tone) without interrupting the established call shall bc feasible. An offering call shall be connected via the circuit used for ordinary calls.

j) Emergency restriction

In case of emergency, restriction of originating calls except for specific subscribers shall be feasible by means of simple method. Subscribers to be restricted and subscribers not to be restricted shall be designated in blocks of 100 circuits.

k) Service interception

All calls to changed numbers, vacant/nonworking numbers,vacant office code, etc. shall be connected to the operator at the centralized interception desk at Maungtaulay Exchange Office.

l) Time supervision and circuit control

For the prevention of unnecessary holding of the switching equipment and the trunk, holding time of those equipments except time during conversation shall be supervised. When the holding time exceeds the pre-determined period the

equipment shall release automatically thereby placing the originating subscriber in a line lockout condition. Supervising time shall be as follows:

i) Register and sender

o Originating register		
From reception of dial tone to reception of the first digit		20 - 30 sec.
Inter-digit		4 - 6 sec.
Supervising of marker control time		20 - 30 sec.
Release		20 - 30 sec.
o Outgoing sender		
Inter-digit		10 - 20 sec.
Supervising of marker control time		10 - 20 sec.
o Incoming register		
From seizure to reception of the first digit	DC:	4 - 6 sec.
	MFC:	10 - 20 sec.
Inter-digit	DC:	4 - 6 sec.
	MFC:	10 - 20 sec.
Superbising of marker control time		20 - 30 sec.

ii) Trunk

Supervising of non-answer of called party	60 - 120 sec.
From first hang-up by called party to subsequent hang-up by calling party	60 - 120 sec.

m) Make-busy

The respective incoming and outgoing trunks and common control equipment (marker, register and sender) shall be capable of being made busy manually. These means for make busy shall be centralized to be for convenience of maintenance. Marker, register, sender and trunk shall be made busy automatically in case of blowout of a fuse for a corresponding equipment. In the event of breakage of the junction circuit, furthermore, the outgoing trunk shall be capable of being made busy automatically.

n) Busy indication

Equipment for visible busy indication shall be provided for the common control equipment (marker, register and sender). It is preferable that the indication be given at the same position as the equipment for make-busy.

(3) Transmission

a) Loop resistance and insulation resistance

i) Subscriber line

The equipment shall operate through the subscriber line with a maximum loop resistance of 1,700 ohms (including equipment within subscri-

ber's premises) and a minimum insulation resistance of 40,000 ohms (between conductors and between each conductor and earth).

ii) Junction circuit

In the case of DC signalling system, the equipment shall operate with a maximum loop resistance of 2,500 ohms (including equipment at the far end exchange office) and a minimum insulation resistance of 40,000 ohms.

The equipment shall operate, after completion of the World Bank Project, with a maximum loop resistance of 2,000 ohms (including equipment at the far end exchange office) and a minimum insulation resistance of 40,000 ohms.

b) Dial pulse

The equipment shall operate even in case of fluctuation of dial speed from 8 to 22 pulses per second and of make-break ratio from 50/50 to 30/70 of subscriber telephone set.

c) Transmission loss

As for normal connections passing through the local exchange, when terminated at 600 ohms, transmission loss as measured from MDF to MDF inside C2 type automatic exchange shall be 1.0 dB or less at 800 Hz.

d) Noise level

Psophometric noise level of the speech path and signal sender and receiver circuits shall not exceed -65dBm.

e) Crosstalk

Crosstalk attenuation between two terminals in the same local exchange shall be 75 dB or more at 1,000 Hz as measured at MDF in the C2 type automatic exchange.

f) Unbalance to earth

Unbalance to earth in the exchange shall be 30 dB or more within a frequency range from 300Hz to 3,400Hz.

(4) Switching equipment calculation

a) Traffic

Traffic to be applied shall conform to Fig. III.1.2.1 and Fig. III.1.2.2.

b) Average call holding time

Average call holding time shall be as follows:

Local call	120 sec.
Subscriber trunk dialling call	180 sec.
Semi-automatic trunk call	180 sec.
Manual trunk call	300 sec.
Special service code call	40 sec.
Booking call	45 sec.

c) Loss probability

Equipment provided shall satisfy the following loss probability:

Intra-office trunk	0.02
Outgoing trunk (excluding alternative circuit)	0.01
Incoming trunk	0.01

Details of the switching equipment calculation shall conform to Table III. 1.2.9.

(5) Special service

a) Special service calls

Special service calls shown below shall be centralized direct or via Hanthawaddy Exchange Office to Maungtaulay Exchange Office.

i) Before completion of the World Bank Project

Code	Service	Charges
001	Booking for calls (trunk and international)	Free
002	Complaints	Free
005	Time	Charged (single metering)
008	Ambulance	Free
009	Police	Free
000	Fire	Free

ii) After completion of the World Bank Project

o Public local special service

Code	Service	Charges
100	Local information	Free
101	Booking for trunk calls	Free
102	Complaints	Free
103	Trunk information	Free
104	Telegrams	Charged (single metering)

o Emergency local special services

Code	Service	Charges
191	Fire	Free
192	Ambulance	Free
199		Free

o Centralized special service

Code	Service	Charges
150	Time	Charged (single metering)

o Centralized international services

Code	Service	Charges
130	Information on international calls	Free
131	Booking for international calls	Free

b) Charging of special service calls

Charging for charged special service calls shall be based on single metering and started when the operator has answered. Discrimination between charged calls and non-charged calls shall be made at the originating exhcnage office on the basis of dialled numbers. Manual hold facility shall be unnecessary.

(6) Subscriber's message register and photographing apparatus

a) Subscriber's message register

A five-digit message register of non-resettable type shall be provided and connected to the terminal of a corresponding subscriber. The figures on the rotary disk shall be engraved and colored in such color that is contrast to the disk color (white figures against black base are desirable) for good photographic results. The message register shall register charging pulse of each completed call or unit call. The message register shall, following registering of 99,999 calls or unit calls, automatically turn back to the original position (reset at 00000). The message register shall operate at an interval of 0.65 sec. per pulse. The message register shall be so mounted as to be photographed properly.

b) Photographing apparatus

The message register and guide pin for the camera hood shall be so positioned that the existing photographing apparatus may be utilized. Their positions shall be as shown in Fig. III.1.2.4.

(7) Maintenance facilities

a) Test equipment

Equipment for various equipment units and connection tests and equipment for testing subscriber line shall be provided in the container, and tests to be listed below shall be feasible:

- o Loop resistance of subscriber line
- o Insulation resistance of subscriber line
- o Capacity of subscriber line
- o External current of subscriber line
- o Shortcircuit of subscriber line
- o Speech test
- o Ringing test
- o Dial test (dial speed, make-break ratio, and digit counting test)

A function that enables a line man to connect the subscriber's premises to the line test equipment by dialling the special code 112 shall be provided.

b) Call measuring

The call measuring function shall be provided covering the following items:

- o Number of operations of registers and senders
- o Number of operations of markers for each type of connection
- o Number of calls per route
- o Number of marker failures

- o Number of called subscriber's line busy
- o Number of all trunks busy

c) Remote test equipment

Equipment necessary for performing subscriber line test from Maungtaulay Exchange Office shall be provided. Circuit for the test may be provided separately from ordinary circuits. Good or no good of the results of the test shall be given by audible tone.

d) Alarm

Alarm shall be classified into two groups.

i) Major alarm

In case of the following status, major alarm shall be sent ot the maintenance exhcnage office.

- o Interruption of AC or DC power supply
- o Abnormal output of DC power
- o Blow-out of the main fuse
- o Blow-out of fuse of such common equipment as marker, ringing-signal generator, and MFC oscillator
- o Abnormal output from booster power supply unit, ringing signal generator and MFC oscillator
- o Other troubles with the exchange system requiring emergency measures

ii) Minor alarm

In case of following status, minor alarm shall be sent to the maintenance exchange office:

- o Blow-out of pilot fuse corresponding to the equipment
- o Release of common equipment owing to excess of supervising time
- o Other cases where issuing of alarm is necessary for the exchange system operation.

(8) Drawings and descriptions

Six copies each of circuit diagrams, mounting drawings and descriptions written in English shall be provided. Such literature to be provided shall include jumper wire distribution lists consisting of jumper table as of cut-over time, and jumper changing table necessary for changes to the World Bank Project telephone network upon completion of the said Project.

(9) Spares

Spares listed in Table III.1.2.10 shall be provided.

(10) Final test

Each equipment test and connection test shall be performed so as to confirm that they satisfy the designated specifications.

Further, artificial call test shall be conducted as overall test for the purpose of verifying the stability of performance of the system. In artificial call test, number of failures shall be less than one per 1,000 calls.

1.2.2.4 Specifications of Power Supply

(1) AC Power supply

a) Input voltage and frequency

The requrements of AC power supply shall be as follows:

3 phases, 230 V. (phase to neutral) ±15%, 50Hz ± 5%

b) Phase control equipment

Power supply equipment capable of detecting voltage abnormality of each phase, unbalance between the phases, etc. and of disconnecting input AC power supply in such cases shall be provided.

(2) Rectifying equipment

a) General

Two sets of rectifiers using thyristors shall be installed in the container. One of the two sets shall have initial charge function. These two rectifiers may be operated in parallel.

b) Fluctuation of output

Fluctuation of output voltage of the rectifying equipment shall be ±2% or less, with the battery connected, when the load varies from zero to the maximum under input voltage fluctuation of ±10% and input frequency fluctuation of ±5%.

c) Operation mode

The rectifying equipment shall be so designed that the operation modes can be changed as follows:

- o Manual mode
- o Automatic mode
- o Charging mode

d) Parallel operation

Two sets of rectifying equipment can run in parallel when the exchange load exceeds the capacity of one rectifying unit. They may be operated always in parallel.

e) Abnormal output

In the event that the output of the rectifying equipment should exceed the upper limit, it shall be automatically isolated.

f) Noise

The rectifying equipment shall be so designed that AC ripple noise must be less than 5mV in terms of psophometric noise (by the method of measurement

recommended by CCITT) under the maximum load and in operation with the battery connected. The rectifying equipment shall, furthermore, operate satisfactorily under the ambient conditions specified in para. 1.2.2.2(1).

(3) Battery

One battery consisting of 24 cells shall be provided, and it shall be of enclosed transparent plastic container type equipped with explosion-proof plugs. The battery shall possess a capacity for 8 busy hours. Necessary accessories shall be supplied.

(4) Power supply for interrupted ringing signal and audible tone

The power supply unit for interrupted ringing signal and audible tone shall consist of regular and stand-by units, for attaining high reliability. The stationary and solid state type is desirable. It shall be so constructed that it may be switched over to the stand-by unit automatically in case of failure of the regular unit.

Interrupted ringing signal and audible tone shall be as follows:

o	Interrupted ringing signal	Voltage:	75V (Nominal)
		Frequency:	25Hz (Nominal)
		Interruption:	One sec. on and 5 sec. off.
o	Dial tone	Frequency:	400Hz (Nominal); Continuous tone.
o	Busy tone	Frequency:	400Hz (Nominal);
		Interruption:	0.25 sec. on and 0.25 sec. off.
o	Ringing tone	Frequency:	400Hz (Nominal);
		Interruption:	One sec. on and 5 sec. off.
o	Offering tone	Frequency:	400Hz (Nominal);
		Interruption:	0.2 sec. on - 0.2 sec. off,
			0.2 sec. on - 0.2 sec. off,
			0.2 sec. on - 0.2 sec. off,
			0.6 sec. on - 0.2 sec. off.
o	Special information tone		
	The frequencies shall be the following three;		950 ± 50Hz, 1,400 ± 50Hz, 1,800 ± 50 Hz

The signal tone shall consist of continuous tones of three different kinds and their frequency shall be sent for 330ms ± 70ms. Pause for 30 to 45 ms or less may be permitted between the above signal tones. Order of sequence of frequencies to be sent out shall be 950Hz, 1,400Hz and 1,800Hz.

Silent period - No tone shall be provided for 1,000ms ± 300ms after sending out the signal.

(5) DC Power supply

Under normal operating conditions, the output side of the rectifying equipment and the battery shall be connected in parallel at all times, and the floating voltage of the rectifying equipment shall be retained constant even in case of fluctuation within the specified range of input voltage and input frequency.

This floating voltage shall be so set as to be sufficient for the load of the exchange as well as to supply with charging current covering self-discharge of the battery, and thus the battery shall be retained properly charged constantly. In case of power failure, the battery shall supply necessary power to the load without interruption. In case where the voltage of the battery should drop below the preset level owing to the continued discharge, alarm shall be given before the battery runs out completely. The rectifying equipment shall start to charge the battery gradually as power supply is resumed, or when the emergency power supply equipment is connected, and upon completion of charging the battery, the rectifying equipment shall be restored to floating charging mode automatically.

The rectifying equipment shall possess initial charging function.

(6) Alarm

In case of trouble with the rectifying equipment, or in the event of power failure, alarm shall be given by means of visible signal or visible and audible signals. Alarms shall vary depending on the nature of troubles or failures.

Specific operation condition (such as charging of the battery) shall be indicated by means of visible alarm.

(7) DC power feeder

Connections necessary for DC power supply to the rectifying equipment, battery and exchange shall be made by means of feeders.

Voltage drops between output terminals of rectifying equipment or battery and fuse in each frame shall not exceed 1.5V at the maximum load. Further, voltage difference between the fuses of two randomly selected racks shall not exceed 0.8V at the fuse post of battery wire and 0.6V of earth wire.

(8) Rack lighting

Fluorescent lamps shall be employed for effective rack lighting.

(9) AC power distribution board and AC wiring

Power distribution board for receiving and distributing AC power and necessary wiring shall be provided. These power distribution board and wiring shall conform to the Japanese Industrial Standard (hereinafter called JIS).

AC power shall be supplied from commercial power source or emergency engine

generator and the switch for switching over commercial power and emergency engine generator shall be provided in the AC power distribution board.

1.2.2.5 Air Conditioner

Air conditioner and dehumidifier shall be provided to keep suitable temperature of the exchange room for operation.

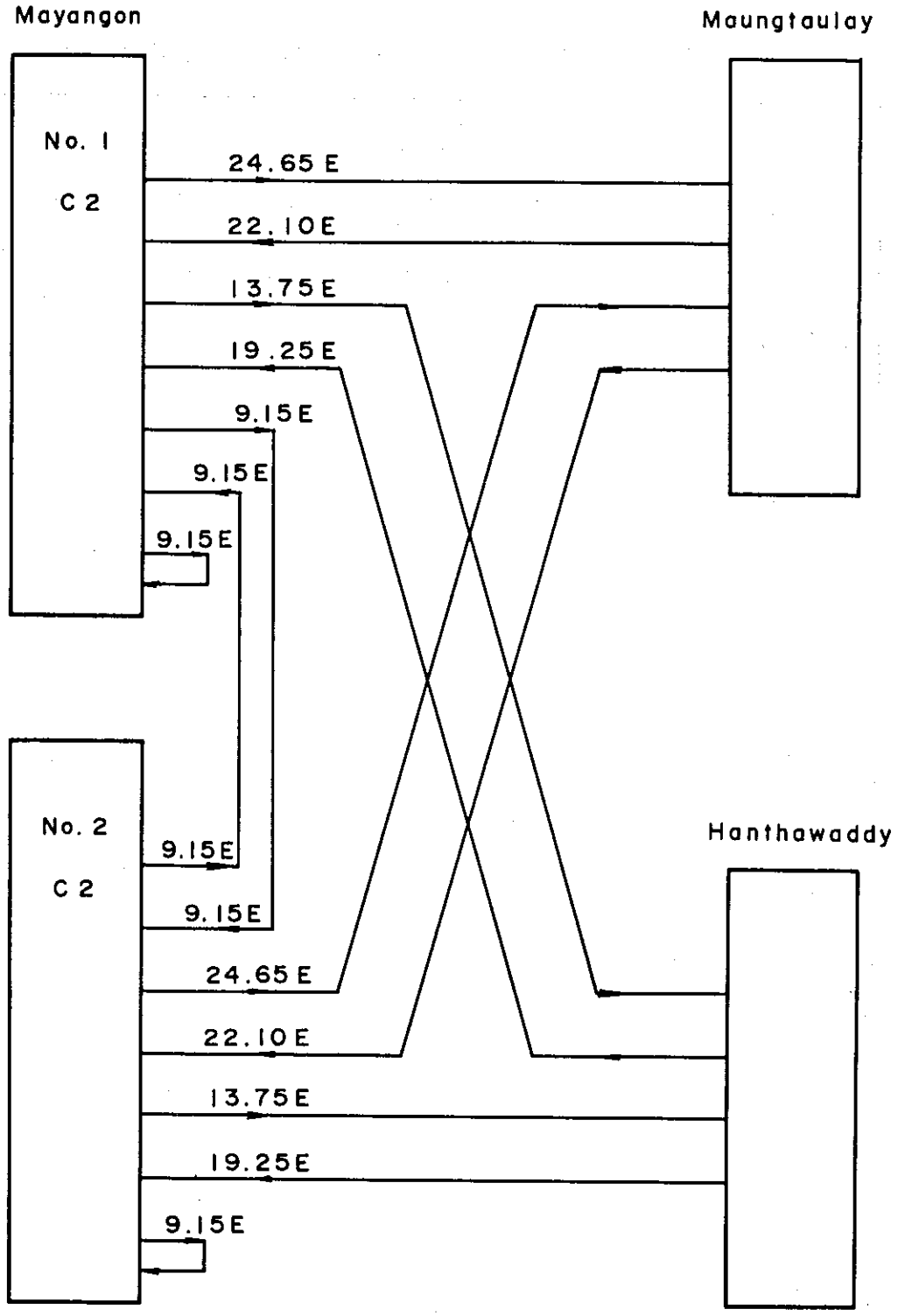


Fig. Ⅲ.1.2.1
Traffic Flow Diagram of Mayangon Exchange
(Before World Bank Project)

Table Ⅲ.1.2.1 Existing Exchange in Rangoon

		Maung taulay	Hantha -waddy	Tamwe	Mayangon	Insein	Total
Capacity		9,000	3,000	3,000	1,000	1,000	17,000
No of subs.	Ordinary	8,076	2,710	2,444	899	630	14,759
	PBX	535	65	44	34	66	744
	Coin	137	24	32	13	17	223
Calling rate (Orig.+Term.)	Present	0.144	0.080	0.087	0.089	0.100	—
	Final	0.216	0.153	0.141	0.141	0.141	—
Equipment	SR	895	300	300	92	100	1,687
	SLM	18	6	6	2	2	34
	LKR	954	310	300	100	80	1,744
	GVM	9	4	3	3	2	21
	REG-L	153	36	36	23	22	270
	SPLR	17	—	—	—	—	—
	ULR	90	—	—	—	—	—
	FUR	217	190	77	72	40	596
	FIR	230	183	79	64	40	596
Power plant	Rectifiers	200A x 3	200A x 2	75A x 2	75A x 2	(No data)	—
	Batteries	1800AH x 2	960AH x 2	515AH x 2	515AH x 2	(No data)	—
	Emergency Generator	73KVA	10KVA	2.5KVA	2.5KVA	(No data)	—
Cable pairs	Subscriber	17,000	4,300	4,200	1,600	1,200	28,300
	Junction	700	800	200	200	100	1,000

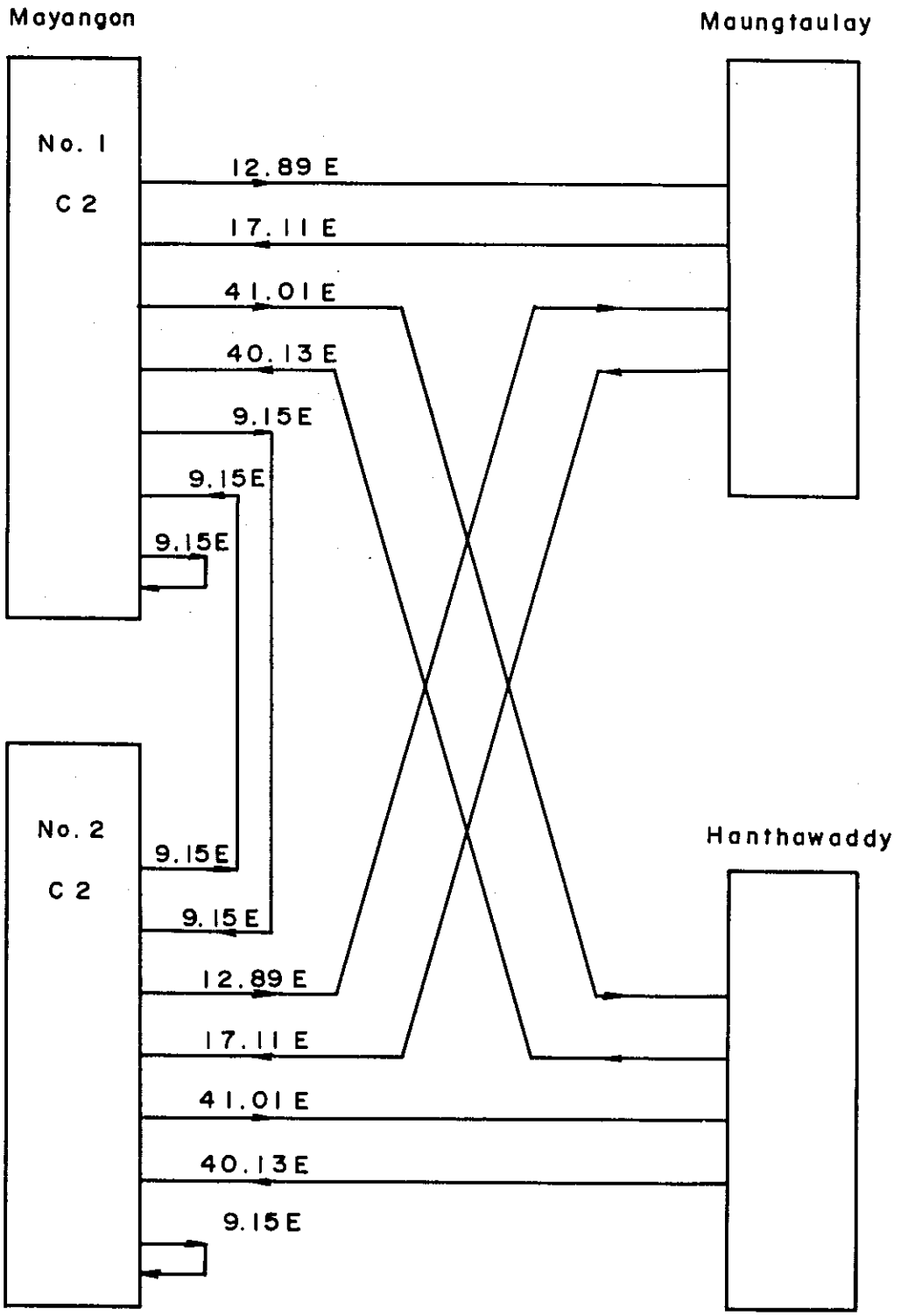
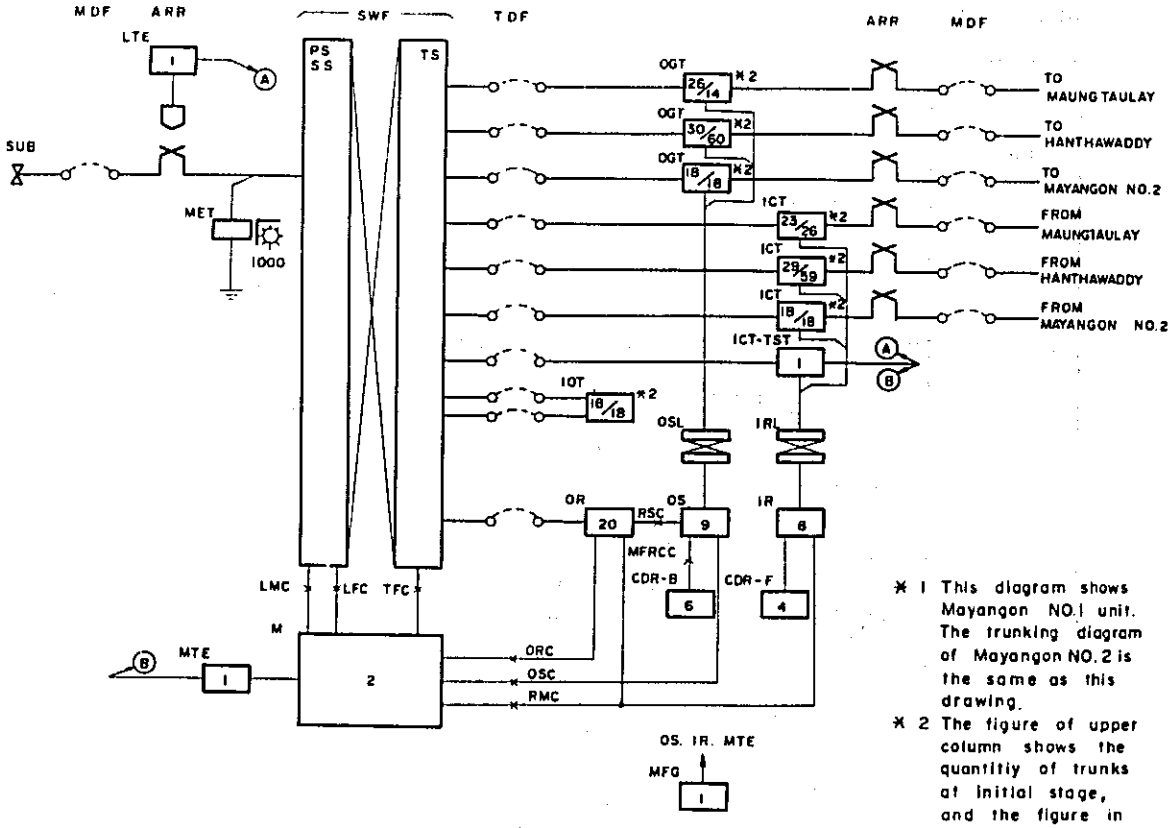


Fig. III 1.2.2 Traffic Flow Diagram of Mayangon Exchange

(After World Bank Project)



* 1 This diagram shows Mayangon NO.1 unit. The trunking diagram of Mayangon NO.2 is the same as this drawing.
* 2 The figure of upper column shows the quantitiy of trunks at initial stage, and the figure in lower column shows the quantity of trunks that is required when the W.B.P. completes

Abbrev	Name of equipment
ARR	Arrester
CDR-B	Code receiver for backward signal (MFC Signal receiver)
CDR-F	Code receiver for forward signal (MFC Signal receiver)
ICT	Incoming trunk
ICT-TST	Incoming trunk for test
IOT	Intra-office trunk
IR	Incoming register
IRL	Incoming register link
LFC	Line frame connector
LMC	Line marker connector
LTE	Line test equipment
M	Marker
MDF	Main distribution frame
MET	Subscriber meter
MFG	MFC signal generator
MFRCC	MFC signal receiver connecter
MTE	Master test equipment
OGT	Outgoing trunk
OR	Originating register
ORC	Originating register connecter
OS	Outgoing sender
OSC	Outgoing sender connecter
OSL	Outgoing sender link
PS	Primary switch
RMC	Register marker connector
RSC	Register sender connector
SS	Secondary switch
SWF	Switch frame
TDF	Trunk distribution frame
TFC	Trunk link connector
TS	Tertiary switch

Fig. Ⅲ. 1.2.3 Trunking Diagram of Mayangon Exchange

Table Ⅲ.1.2.2(1/2) Line Signals – D.C. Signalling

Condition	O/G Side	Direction	I/C Side
Idle	A wire:) High resistance B wire:) loop(Abt.13kΩ)	→	A wire: Ground, through 500Ω B wire: Battery through 500Ω
Seizure	A wire:) Low resistance B wire:) loop (Abt. 770Ω) without line resistance	→	A wire: Ground through 500Ω B wire: Battery through 500Ω After receiving seizure signal, I/C side change to A wire:) Loop through 800Ω B wire:)
Pulsing	A wire:) Polarity reversal B wire:) pulse (Abt. 15 ms per each impulse)	→	A wire:) Loop through 800Ω B wire:)
Proceed to send	A wire:) Loop through signal B wire:) receiving relay (Abt 800Ω)	←	A wire: Battery through 200Ω B wire: Ground through 200Ω Pulse duration: Abt.30ms
Repeat	A wire:) Same as the above B wire:)	←	A wire: Ground through 200Ω B wire: Battery through 200Ω Pulse duration: Abt. 30ms
Congestion (GV Stage)	A wire:) Same as the above B wire:)	←	A wire: Ground through 200Ω B wire: Battery through 200Ω then change to. A wire: Battery through 200Ω B wire: Ground through 200Ω Pulse duration: Abt. 30 ms respectively
B subscriber idle	A wire:) Same as the above B wire:)	←	A wire: Battery through 200Ω B wire: Ground through 200Ω Pulse duration: Abt 30ms
B subscriber busy or lockout	A wire:) Same as the above B wire:)	←	A wire: Battery through 200Ω B wire: Ground through 200Ω then change to A wire: Ground through 200Ω B wire: Battery through 200Ω Pulse duration: Abt 30ms respectively
B sub. is connedted to interception service	A wire:) Same as the above B wire:)	←	A wire: Ground through 200Ω B wire: Battery through 200Ω Pulse duration: Abt. 30ms
A trunk offering operator is connected to B sub line or congestion. (SL stage)	A wire:) Same as the above B wire:)	←	A wire: Ground through 200Ω B wire: Battery through 200Ω then change to A wire: Battery through 200Ω B wire: Ground through 200Ω Pulse duration: Abt. 30ms respectively
Answer	A wire:) Low resistance loop B wire:) (Abt. 770 ohm)	←	A wire: Ground through 500Ω B wire: Battery through 500Ω
A sub. raplaces	A wire:) A.C. release signal B wire:) will be sent. Pulse duration: Abt. 300ms	←	A wire:) A.C. signal receive B wire:) relay operates (For junction only)

Table Ⅲ. 1.2.2. (2/2) Line Signals— D.C. Signalling

Condition	O/G Side	Direction	I/C Side
B sub replaces	A wire :) Low resistance loop B wire :) (Abt. 770 ∿) After 1. to 2. minutes time control relay will disconnect ground to holding relay, If A subscriber holds his handset Then A.C. release signal will be sent.	←	A wire : Battery through 500 ∿ B wire : Ground through 500 ∿
Trunk offering re-ring	A wire :) Low resistance loop B wire :) (About 650∿) will be broken for about 150 ms	←	A wire : Ground through 500 ∿ B wire : Battery through 500 ∿

Note: 1

The specification of A.C. signal is as follows.

Voltage: 150 volt for junction & trunk,

Frequency: 24 Hz.

Note: 2

If the B subscriber does not answer within 1 to 2 minutes, time control relay will disconnect ground to the holding relay, then A.C. release signal will be sent.

Table Ⅲ. 1.2.3 Line Signals
Signalling Scheme for Local Connection

Phase of connection	Name of signal	Direction of signal	Outgoing side	Incoming side	Nominal duration
1. Line idle	—	—	High resistance	− a + b	—
2. Seizure	Seizure	Forward	Low resistance	− a + b	Continuous
3. Call in progress	Answer	Backward	Low resistance	+ a − b	Continuous
4. Called party replaces	Clear-back	Backward	Low resistance	− a + b	Continuous
5. Calling party replaces	Clear-forward	Forward	Break	− a + b or + a − b	600 ms [1]
6. Line idle	—	—	High resistance	− a + b	—

1) Recognition time for the clear-forward is 300−450 ms.

Table III. 1.2.4 Line signals

Signalling Scheme for Connection with Metering Facilities

Phase of connection	Name of signal	Direction of signal	Outgoing side	Incoming side	Nominal duration
1. Line idle	-	-	High resistance	- a + b	-
2. Seizure	Seizure	Forward	Low resistance	- a + b	Continuous
3. Call in progress	Answer	Backward	Low resistance	+ a - b	Continuous
4. Metering	Metering	Backward	Low resistance	- a + b	150 ms[2]
5. Called party replaces[3]	-	-	Low resistance	+ a - b	-
6. See footnote 4)	Forced release	Backward	Low resistance	Break	600 ms[5]
7. Calling party replaces	Clear-forward	Forward	Break	+ a - b or - a + b	600 ms[6]
8. Line idle	-	-	High resistance	- a + b	-

1) The same signalling scheme is to be used for connections employing toll ticketing for charging, excepting the metering impulses (No. 4) which become unnceessary in this case.

2) Interval between impulses minimum 500 ms.

3) The outgoing side is not informed directly when the called party clears, i.e. the clear-back signal is not used in this signalling scheme.

4) The called party has cleared, but the calling party does not clear within a specified time limit.

5) Recognition time 200 - 350 ms.

6) Recognition time for the clear - forward is 300 - 450 ms.

Table III.1.2.5. Line Signals
Signalling Scheme for Connection with Operator's Facilities

Phase of connection	Name of signal	Direction of signal	Outgoing side	Incoming side	Nominal duration
1. Line idle	–	–	High resistance	– a + b	–
2. Seizure	Seizure	Forward	Low resistance	– a + b	Continuous
3. Start of operator's intervention	Offering	Forward	Break	– a + b	150 ms[1]
4. End ditto	Cancelling	Forward	Break	– a + b	150 ms
5. Called party's line becomes free during intervention[2]	"False answer"	Backward	Low resistance	+ a – b	150 ms
6. Call in progress	Answer	Backward	Low resistance	+ a – b	Continuous
7. Called party replaces	Clear-back	Backward	Low resistance	– a + b	Continuous
8. Start of re-ringing	Re-ring	Forward	Break	– a + b	150 ms
9. Calling party replaces	Clear-forward	Forward	Break	– a + b or + a – b	600 ms[3]
10. Line idle	–	–	High resistance	– a + b	–

1) Interval between signals No. 3 and 4, minimum 300 ms.

2) This signal is utilized only if the trunk offering procedure includes supervision by the operator and can be sent only after the cancelling signal (No.4). Thus the signalling sequence with "False answer" signal (No. 5) is as follows:

1: The called party becomes free during supervision.

2: The operator cancels the intervention by sending signal No.4.

3: This is immediately acknowledged by signal No. 5 which causes for instance a steady light on the operator's indicator lamp.

3) Recognition time for the clear-forward is 300-450 ms.

Table III. 1. 2. 6.
Register Signals (D.C. Signalling)

Digit	Wires Polarity
1	A + B −
2	A + − B − +
3	A + − + B − + −
4	A + − + − B − + − +
5	A + − + − + B − + − + −
6	A − + − + − B + − + − +
7	A − + − + B + − + −
8	A − + − B + − +
9	A − + B + −
10	A − B +

Note. Pulse duration is as follows.

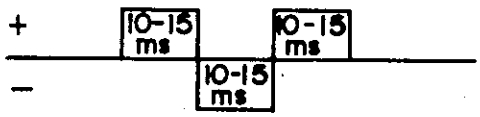


Table Ⅲ.1.2.7 (1/3)
Register signals (MFC Signalling)

1 The complete signal code shall be proposed by the supplier but shall include the signals as in the para 2, 3, 4, & 5. Additional signals may be proposed to provide the full facilities required by the specification. Detail of the meanings and method of operation shall be furnished for each signal.

2 Group I. Forward Signals

Signal	Meaning of the signals
I - 1	Digit 1
I - 2	Digit 2
I - 3	Digit 3
I - 4	Digit 4
I - 5	Digit 5
I - 6	Digit 6
I - 7	Digit 7
I - 8	Digit 8
I - 9	Digit 9
I - 10	Digit 0
I - 11	Access to operator
I - 12	Request not accepted
I - 13	Access to maintenance equipment
I - 14	Spare
I - 15	End of pulsing

3 Group II. Forward Signals

Signal	Meaning of the signals (Category of calling party)
II.- 1	Subscriber
II.- 2	Subscriber with priority
II.- 3	Maintenance equipment
II.- 4	Coin box
II.- 5	Operator (With trunk offering facility)
II.- 6	Reserved for data transmission call
II.- 7	Reserved for international categories
II.- 8	Reserved for international categories
II.- 9	Reserved for international categories
II.-10	Reserved for international categories
II.-11	Reserved for international categories
II.-12	Spare
II.-13	Spare
II.-14	Spare
II.-15	Spare

Table Ⅲ. 1.2.7. (2/3)

Register Signals (MFC Signalling)

4 Group A. Backward Signals

Signal	Meaning of the signals
A-1	Send next digit (n + 1)
A-2	Send last but one digit (n-1)
A-3	Send category of calling party and changeover to reception of B signal
A-4	Congestion (National)
A-5	Send category of calling party
A-6	Setup speech conditions
A-7	Send last but two digits (n-2)
A-8	Send last but three digits (n-3)
A-9	Spare
A-10	Send next digit of area code (n+1)

5 Group B. Backward Signals

Signal	Meaning of the signals
B-1	Subscriber line free, last party release
B-2	Subscriber transferred
B-3	Called subscriber line busy
B-4	Congestion
B-5	Unallocated number
B-6	Subscriber line free, charge
B-7	Subscriber line free, no charge
B-8	Subscriber line out of order
B-9	Spare
B-10	Spare

6 Sending procedure of area code is as follows.

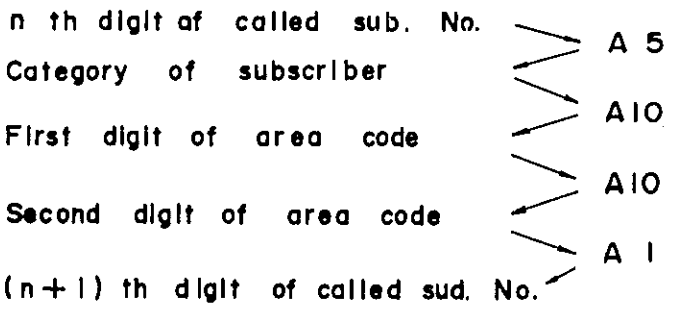


Table Ⅲ. 1.2.7 (3/3)

Register Signals. (MFC Signalling)

7 Composition of the R - 2 multifrequency code

Combinations		Frequencies (Hz)						
No.	Numerical Value = x + y	Forward direction (Signals of groups I & II)	1380	1500	1620	1740	1860	1980
		Backward direction (Signals of groups A & B)	1140	1020	900	780	660	540
		Index (x)	f_0	f_1	f_2	f_3	f_4	f_5
		Weight (y)	0	1	2	4	7	11
1	0 + 1		x	y				
2	0 + 2		x		y			
3	1 + 2			x	y			
4	0 + 4		x			y		
5	1 + 4			x		y		
6	2 + 4				x	y		
7	0 + 7		x				y	
8	1 + 7			x			y	
9	2 + 7				x		y	
10	4 + 7					x	y	
11	0 + 11		x					y
12	1 + 11			x				y
13	2 + 11				x			y
14	4 + 11					x		y
15	7 + 11						x	y

Table III. 1. 2. 8 Conditions for Accommodating Subscriber Lines

Correlation between the directory number and the line location.

Directory Number	Line Location
Hundreds	Corresponds to FG (Frame Group) and FN (Frame Number).
Tens	Corresponds to LV (Level).
Units	Corresponds to HG (Horizontal Group) and LVG (Level Group).

Details are shown below.

Hundreds	FG	FN	Tens	LV	Units	HG	LVG
0	0	0	0	0	0	0	0
1	1	0	1	1	1	1	0
2	0	1	2	2	2	2	0
3	1	1	3	3	3	3	0
4	0	2	4	4	4	4	0
5	1	2	5	5	5	0	1
6	0	3	6	6	6	1	1
7	1	3	7	7	7	2	1
8	0	4	8	8	8	3	1
9	1	4	9	9	9	4	1

Table III.1.2.9 Traffic Calculation

1. Grade of Service

Originating Register (OR)	:	Probability that dial tone delay exceeds 3 seconds is not more than 0.01, by Riordan's formula.
Outgoing Sender (OS)	:	W = 40 milli-seconds.
Incoming Register (IR)	:	W = 80 milli-seconds.
MFC Signal Receiver for OS (CDR-B)	:	W = 40 milli-seconds.

2. Average Holding Time of A Call

Local call	:	120 seconds
STD call	:	180 seconds
Semi-automatic Toll call	:	180 seconds
Manual call	:	300 seconds
Special service call	:	40 seconds
Booking call	:	45 seconds

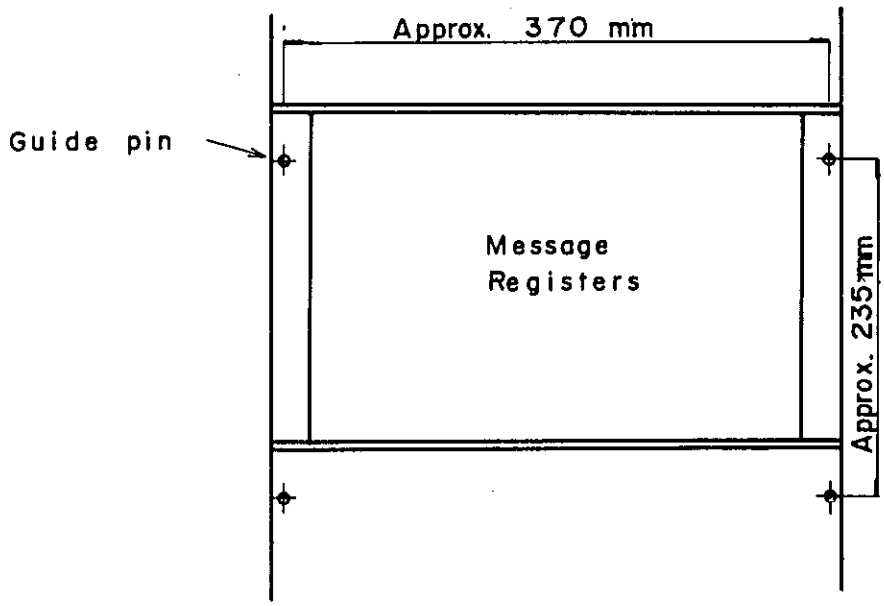
3. Non-effective call

Kind of calls		OR	OS
Intra-office call		45 %	——
Outgoing call	Local	45 %	35 %
	Toll	65 %	55%
Special service call		20%	15%

4. Required Number of Equipment per Unit

	OR	OS	CDR-B	IR	CDR-F	IOT	OGT	OGT*	ICT	ICT*
Before World Bank project completes	18	9	—	8	—	18	56	18	52	18
After World Bank Project completes	20	9	6	5	5	18	74	18	85	18
No. of equipment to be supplied	20	9	6	8	5	18	74	18	85	18

* Shows the number of trunks for connection between 2 units of C2 Type Automatic Exchange



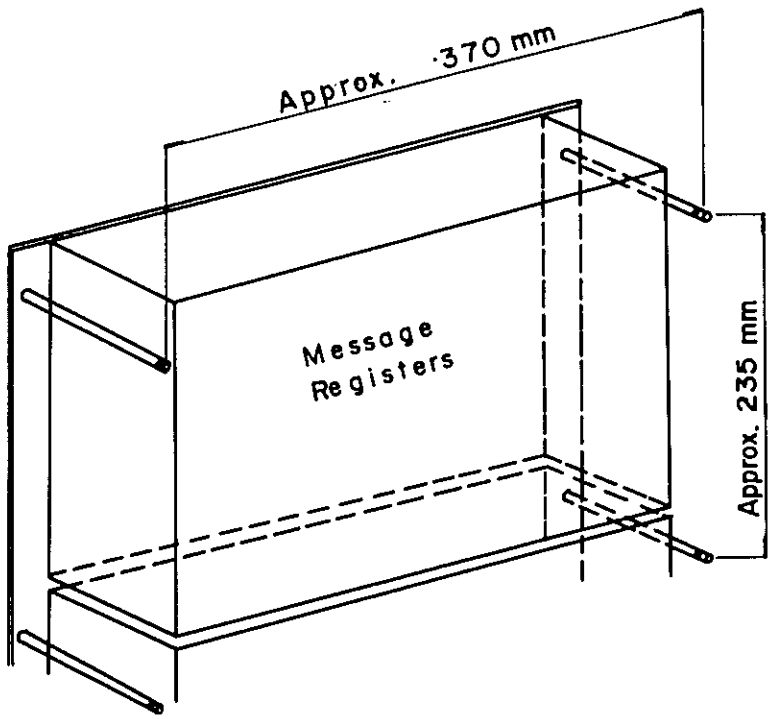


Fig. Ⅲ.1.2.4

Arrangement of Subscriber Meter

Table Ⅲ. 1. 2. 10.

Spare Parts List (C2 Type Automatic Exchange)

Item	Name of Part	Unit	Q'ty	Remarks
1	Crossbar Switch Vertical Unit	pcs.	20	
2	Crossbar Switch Select Magnet	pcs.	10	
3	Wire Spring Relay (Type WA)	pcs.	6	
4	Wire Spring Relay (Type WJ)	pcs.	50	
5	Wire Spring Relay (Type WG)	pcs.	10	
6	Wire Spring Relay (Type WK)	pcs.	50	
7	Reed Relay	pcs.	20	
8	Resistor (Type X)	pcs.	20	
9	Carbon Resistor	pcs.	2	
10	Rectifier	pcs.	20	
11	Capacitor (Type MP)	pcs.	4	
12	Spark Quencher (Type Q)	pcs.	10	
13	Varistor (Type V)	pcs.	20	
14	Coil	pcs.	4	
15	Subscriber Meter	pcs.	10	
16	Lamp (Type#2)	pcs.	60	
17	Resistor Lamp (Type#10)	pcs.	10	
18	Fuse	pcs.	60	0.5A, 1.3A, 2.0A, 3.0A and 5.0A, 2pcs/each
19	Fuse Wire	pcs.	10	
20	Electrolytic Capacitor	pcs.	10	
21	Trouble Recorder	set	1	
22	Tape for Trouble Recorder	roll	30	
23	Distilled Water	bottle	2	
24	Parts for Air Conditioner	set	2	
25	Filter for Ventilation Fan	set	4	
26	Carbon Arrester	pcs.	200	
27	Heat Coil	pcs.	60	
28	Arrester Element	pcs.	4	A.C. low tension
29	Jumper Wire (Twist Wire)	m	400	
30	Jumper Wire (Single Wire)	m	200	

The quantity shows the number for 2 units of C2 type exchanges

1.3 Specifications for Modification of C1 Type Automatic Exchange

1.3.1 Conditions of Exchange Design

Jumpering for the exchange shall be made in accordance with the conditions of exchange design as shown in Table III.1.3.1 in order to satisfy the trunking diagram as illustrated in Fig. III.1.3.1.

1.3.2 Conditions for Accommodating Subscribers

In-exchange subscriber class jumpering shall be made on the basis of the subscriber class assignment chart as shown in Fig. III.1.3.2.

1.3.3 Overhaul of the Exchange

(1) Overhaul and inspection

Each equipment and parts shall be insepcted and cleaned, and defective part shall be replaced. For replacement, parts of identical, equivalent or better types shall be used. In the following shall be given instructions to be obeyed in overhaul:

a) Contacts

All the contacts shall be cleaned. Relays with damaged contacts shall be replaced.

b) Trouble recorder

Overhaul and lubrication shall be performed.

(2) MDF jumper in C1 type automatic exchange

For MDF in C1 type automatic exchange, jumpers shall be provided between the inside terminal block of the exchange and the terminal block for CDF tie cable. Uses of tie cable shall be as listed in the following. As for subscribers, the manner of the arrester spring accommodation on CDF shall be the same as that of the arrester spring accommodation inside the C1 type automatic exchange. As regards OGT and ICT jumpers for circuits to be accommodated initially only shall be provided:

Cable conductor number:	1 - 400	For subscribers
	401 - 480	For OGT
	481 - 500	For misc. trunks
	501 - 570	For ICT

575 - 580	For signals
580 - 600	Not usable

(3) Removal of unnecessary equipment

Three-minute speech interrupter for public coin box telephone shall be removed.

(4) Change of local call charging system

Local call charging system shall be based on a single metering system and shall start operation when call has been answered. The multi-metering system shall be modified as above. As for the modification method, multi-metering circuit only shall be modified without removing the related equipment.

1.3.4 Modification of the Power Supply Equipment

(1) Rectifying equipment

Specifications of AC input voltage of the rectifying equipment incorporated in C1 type automatic exchange shall be changed from 3 phases, 200V (phase to to phase), 60Hz to 3 phases, 230V (phase to neutral), 50Hz. Design conditions concerning input voltage and frequency fluctuations shall be the same as before the modification, i.e., voltage fluctuation shall be ±10% and frequency fluctuation 47Hz ~ 51Hz. The specifications on the output and other conditions shall be the same as that before modification.

A phase control equipment shall be provided for the protection of the rectifying equipment in case of fluctuation in excess of fluctuation condition of the AC input voltage and unbalance of phase-to-phase voltage.

(2) Battery

The storage battery shall be replaced with an enclosed type fully charged battery having a capacity of 108AH. It shall be charged additionally before shipped.

(3) Low voltage arrester

Element of the arrester shall be replaced.

1.3.5 Container and Accessories

(1) Container and front room

As for the container, front room and its accessories, damaged and deteriorated parts shall be repaired and parts/components shall be replaced if necessary. Furthermore, removing of rust and application of proper coating shall be conducted for the outer walls of the container and the front room. Keys to the entrance door and to the door of the battery room shall be inspected, and if found defective they shall be replaced and shall not be repaired.

(2) Accessories

a) Ventilation fan

The fan shall be cleaned and inspected and also lubricated. The filter is to be renewed.

b) Dehumidifier

The dehumidifier shall be cleaned and inspected.

c) Thermostat and humidistat

Humidistat for the dehumidifier and the ventilation fan shall be inspected, and if found defective, it shall be replaced.

d) Air conditioner

Air conditioner satisfying the specifications to be listed below shall be mounted.

i) To have a cooling performance of retaining indoor temperature at 40°C or lower when outdoor temperature stands at 42°C.

ii) Input voltage shall be single phase, AC 230V, and it shall operate satisfactorily as long as voltage fluctuation is ±10%.

iii) A device for detecting input voltage fluctuation in excess of ±10 percent, and such device shall, in case of such fluctuation, stop input power supply. Positions for attaching the detectors are not limited to inside the air conditioner. (They may be fixed on the wiring circuit in the exchange)

e) Lighting and wiring for outlets

Power supply for lighting and outlets shall be 100V which is to be obtained by stepping down from single phase AC 230V with a transformer. No phase control equipment shall be required for this wiring. Apparatuses workable only on 60Hz (fluorescent lamps) shall be replaced with those workable on 50Hz.

f) Wiring to the emergency power equipment

Equipment capable of receiving power supply from the emergency power equipment shall be the rectifiers only. Arrangement shall be made so that necessary connections may be made easily on the outer wall distribution panel.

1.3.6 Test

(1) Equipment requirements

a) Operation limits of dial pulse of register

The following conditions shall be satisfied at power supply voltage of -48 volts:

Receiving pulse speed: 12 pps, make ratio: 26%

As for external conditions, however, series resistance shall be 0 ohm and parallel

resistance shall be infinite.

b) Dial pulse repeating distortion on trunk

The specifications to be detailed below shall be satisfied at power supply voltage -48V:

Receiving pulse	Speed 10 pps.
	Make ratio 33%
Sending pulse	Make ratio 33% ±5%

As for the external conditions, series resistance shall be 600 ohms and parallel resistance shall be infinite.

As for measurement results, arrangement shall be so made that the results can be submitted whenever required to do so.

(2) Final tests

Unit equipment test and connection test shall be performed and it shall be confirmed that the results of such tests satisfy the conditions given in para. 1.3.1 and 1.3.2 and that they operate satisfactorily. As for overall test, furthermore, artificial call test for verifying the stability of operation of the equipment shall be carried out. Through such artificial call test, number of faults to be recorded by troulbe recorder shall be less than one per 1,000 calls.

1.3.7 Attachements

As attachments the following shall be provided

(1)	Circuit diagrams mounting drawings written in English	6 copies
(2)	Description in English	6 copies
(3)	Spare parts for maintenance	See Table III. 1.3.2.

(4) Test instruments attached

Test instruments attached to the exchange shall be cleaned and inspected, and they shall be confirmed as to their proper operation.

o	Test handset (41-D)	1 set
o	Subscriber meter testing equipment (C11-A)	1 set

Table Ⅲ.1.3.1. Exchange Designing Requirement

Item	Description
Office Rank	Terminal 'Exchange
Numbering Plan	(1) Local 4D (2XYZ) (2) Special Service 3D (109) (3) Local Special. Service 3D (Fire 119, Police 110)
Parent Exchange	Maymyo Manual · Trunk Switchboard
Pattern	Parallel Type - B (BSC + EXT)
AC Power Supply	3 phase, 230 V (phase to neutral) and Single phase 230 V 50 Hz

Special Trunk Distribution

TRK / LF No.		TIT	AAT	FIRT	POLT	DNT	FLT No.0	FLT No. 1	TST	Numbering (Hundred)	Remarks
BSC unit	LF 0	O	O	O	O	O			O	0	
	LF 1						O			1	
	LF 2							O		2	
EXT unit	LF 3	O	O							3	
	LF 4									4	
	LF 5									5	

Number of Trunk Equipments and Interface.

TRK	Circuits Mounted	Circuits Connection	Signalling	Interface	Remarks
IOT	22	12			
OGT	26	5	LP	SP - ICT	
RICT	15	0	LD	T - OGT	
RTICT	12	12	LD	T - OGT	
NICT	2	1	LD	T - OGT	
TSTICT	1	1	LD	T - OGT	
FPT (119)	1	1	—	Telephone	
FPT (110)	1	1	—	Telephone	
DNT	1	1	LP	SP - ICT	
FLT No.0	1	1	—	Telephone	"2100"
FLT No. 1	1	1	—	Line Test Equipment	"2200"

Public Coin Box Telephone	Single metering (Local only)
Remarks	

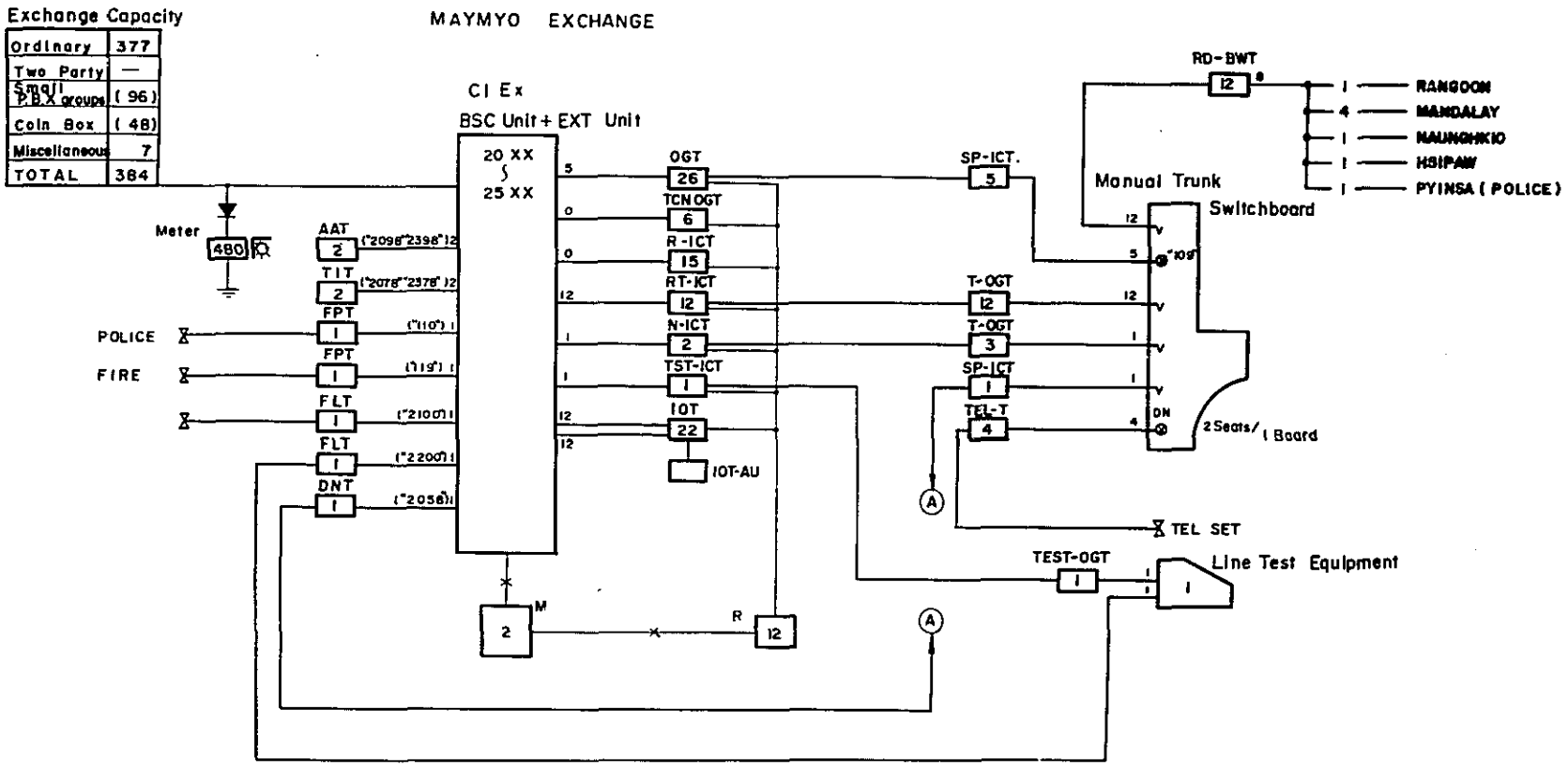


Fig. Ⅲ. 1. 3. 1 Trunking Diagram of Maymyo Exchange

LF0 (20YZ) BSC.

LG0		LG1		LG2		LG3		SM
GA	GB	GA	GB	GA	GB	GA	GB	
				O			TIT AAT	9
				O				8
	O		POL	O	FIR	O	DNT	7
				O				6
				O				5
				O				4
				O				3
TST				O				2

LF1 (21YZ) BSC.

LG0		LG1		LG2		LG3		SM
GA	GB	GA	GB	GA	GB	GA	GB	
				O				9
				O				8
				O				7
				O				6
				O				5
				O				4
O	O	Ⓟ	O	P	O	P	O	3
FLTo				O				2

LF2 (22YZ) BSC.

LG0		LG1		LG2		LG3		SM
GA	GB	GA	GB	GA	GB	GA	GB	
				O				9
				O				8
				O				7
C	O	C	O	C	O	C	O	6
				O				5
				O				4
				O				3
FLT1				O				2

LF3 (23YZ) EXT.

LG0		LG2		LG3		LG4		SM
GA	GB	GA	GB	GA	GB	GA	GB	
				O			TIT AAT	9
				O				8
				O				7
				O				6
				O				5
				O				4
				O				3
(TST)				O				2

LF4 (24YZ) EXT.

LG0		LG1		LG3		LG4		SM
GA	GB	GA	GB	GA	GB	GA	GB	
				O				9
				O				8
				O				7
				O				6
				O				5
				O				4
				O				3
				O				2

LF5 (25YZ) EXT.

LG0		LG1		LG2		LG3		SM
GA	GB	GA	GB	GA	GB	GA	GB	
				O				9
				O				8
				O				7
C	O	C	O	C	O	C	O	6
				O				5
				O				4
				O				3
				O				2

PSW Numbering Distribution (Y.Z)

LG0		LG1		LG3		LG4		SM
GA	GB	GA	GB	GA	GB	GA	GB	
90	95	91	96	92	97	93	98	9
80	85	81	86	82	87	83	88	8
50	55	51	56	52	57	53	58	7
40	45	41	46	42	47	43	48	6
30	35	31	36	32	37	33	38	5
20	25	21	26	22	27	23	28	4
10	15	11	16	12	17	13	18	3
00	05	01	06	02	07	03	08	2

O : Ordinary

P : PBX Groups Ⓟ:Pilot Number

C : Public Coin Box

Fig. Ⅲ.1.3.2. Subscriber Class Chart

Table Ⅲ. 1. 3. 2.

Spare Part List (C1 Type Automatic Exchange)

Item No.	Name of Part	Unit	Quantity	Remarks
1	Crossbar Switch Vertical Unit	pcs.	20	
2	Crossbar Switch Select Magnet	pcs.	10	
3	Wire Spring Relay (Type WA)	pcs.	4	
4	Wire Spring Relay (Type WJ)	pcs.	48	
5	Wire Spring Relay (Type WG)	pcs.	8	
6	Wire Spring Relay (Type WK)	pcs.	54	
7	Polarized Relay	pcs.	2	
8	Reed Relay	pcs.	6	
9	Resistor (Type XB)	pcs.	8	
10	Carbon Resistor	pcs.	2	
11	Rectifier (Type SDR)	pcs.	8	
12	Capacitor (Type MP)	pcs.	2	
13	Spark Quencher (Type Q)	pcs.	6	
14	Varistor (Type V)	pcs.	8	
15	Coil (Type BW)	Pcs.	2	
16	Subscriber Meter	pcs.	5	
17	Lamp (Type # 2)	pcs.	48	
18	Resistor Lamp (Type # 10)	pcs.	4	
19	Fuse	pcs.	15	
20	Fuse Wire	pcs.	each 1	~~(0.5A, 1~~ 1.33A, 2A, 3A~~, 5A~~)
21	Electrolytic Capacitor	pcs.	2	
22	Trouble Recorder	set	1	
23	Tape for Trouble Recorder	roll	20	
24	Distilled Water	bottle	1	
25	Filter for Ventilation Fan	set	4	
26	Air Conditioner Parts	set	2	
27	Arrester Element	pcs.	4	AC low tension
28	Jumper Wire (Twist Wire)	m	200	
29	Jumper Wire (Single Wire)	m	200	

1.4 Specifications of Materials

1.4.1 Trunk Switching Equipment

(1) Composition of manual switchboard

a) A manual switchboard to be porvided shall be of cord type and shall consist of two positions, built-in pigeonholes, and/or shelves for keeping telephone directory, etc. Each position shall be provided with a key board and a multiple jack field.

b) Each position shall be provided with eight connecting cord circuits.

c) Each position shall be provided with a rotary dial (10 p p s) and a position dial circuit.

d) The switchboard shall be provided with auxiliary signal circuit for combined function positions.

e) The switchboard shall be provided with night bell circuit.

f) The following accessories shall be supplied for each board:

Description	Quantity
Cable turning section	1
End panel	1
600 type operator's headset	4
Spare parts for maintenance	As shown in Table III.1.4.2

(2) Operational and technical requirements

Each position shall be provided with necessary related equipment and shall have the following functions:

a) For calling subscriber or distant operator : indication of call, answering, connection and call establishment.

b) For called subscriber : connection of call from a calling subscriber, transmission of ringing signal, call establishment, call clearing and indication of call clearing.

c) Trunk offering to an engaged call, monitoring of a call, splitting a speech path and speaking with a calling or called subscriber, separately.

d) Indication of call establishment by "ON" and "OFF" of a supervisory lamp.

e) Transmission of dial pulses through dial circuit.

f) Double connection preventing function (for connecting cord).

g) Click testing.

h) It shall be possible to add in the future such functions as time metering and line holding during the time an operator leaves her position.

i) Fuse alarm

j) Night switching and alarm functions.

(3) Multiple jack field

a) One set of multiple jack strip on a jack panel shall be composed of twenty jacks and the lamp sockets.

b) Facilities capable of indicating one preferential idle circuit in each outgoing circuit group (except RDT circuits) shall be provided.

c) For the layout of multiple jack field, refer to Fig. III.1.4.2.

(4) Limit in operation

All the equipment provided shall operate satisfactorily under the following conditions:

a)	Operating voltage:	DC -45V to -51V
b)	Junction line condition	
	Loop resistance:	Less than 1200 ohms
	Insulation resistnace:	More than 40000 ohms (between wires)
c)	Position dial pulse	
	Speed:	8 ~ 12 pps
	Make ratio:	33 ± 5%
	Minimum pause:	600 msec.

(5) Interface equipment associated with manual switchboard

Table III.1.4.1 presents the necessary interface equipment between the manual switchboard and other switching equipment, etc.

(6) Dimensions of switchboard

Dimensions of the switchboard to be provided shall be approximately as follows:

Height 1,300mm
Width 1,300mm
Depth 930mm (as measured from the front key board)

For the external appearance, refer to Fig. III.1.4.1.

(7) Drawings and descriptions

Six copies each of circuit diagrams, mounting drawings and descriptions written in English shall be provided.

1.4.2 Distribution Frame

(1) Composition

A distribution frame to be provided shall be composed of vertical side and horizontal side, i.e., shall be of both-side type.

It shall be possible to mount terminal block, spring, etc. on each side.

(2) Types

The following three types of distribution frames shall be supplied:

Combined distribution frame (CDF)
Main distribtuion frame (MDF)
Trunk distribtuin frame (TDF)

For their dimensions, refer to Fig. III. 1.4.3.

(3) Combined distribution frame (CDF)

CDF shall be installed in Maymyo Exchange Office and used to accommodate

subscriber cables on one side and office cables from various equipment in the exchange on the other side. In order to connect these cables terminated on both sides, jumper wires shall be used.

Height of CDF:	Approximately 2,500mm
Terminal block and spring to be used:	Horizontal side terminal block
	Vertical side arrester spring

(4) Main distribution frame (MDF)

MDF shall be installed in Mayangon Exchange Office and used to accommodate subscriber cables and junction cables on one side and office cables from various equipment in the exchange on the other side. In order to connect these cables terminated on both sides, jumper wires shall be used.

Height of MDF:	Approximately 2,810mm or lower
Terminal block and test spring	Horizontal side: terminal block
to be used:	Vertical side: test spring and terminal block

(5) Trunk distribution frame (TDF)

TDF shall be installed in Maymyo Exchange Office and used for easy rearrangement of cross connections between various equipment in the exchange office. It shall be possible to install TDF togehter with CDF.

1.4.3 Terminal Block and Test Spring

Various types of office cables and jumper wires shall be terminated by soldering on the terminal blocks and test springs. Each terminal block and test spring shall be able to be attached or fixed on the distribution frame with ease.

The terminal block and terminals shall be tightly assembled to ensure firm wiring. Test springs shall possess excellent contact performance to ensure firm contact.

As for the electrical requirements, insulation resistance and dielectric strength shall comply with the criteria. (For example, insulation resistnace between terminals shall be more than 50 megohms.)

1.4.4 Arrester Spring

a) The arrester spring shall be able to accommodate 100 pair circuits per spring, and be equipped with heat coils and carbon arresters.

b) The heat coils shall be capable of carrying 0.35A for 3 hours and shall operate within 30 seconds when the current of 0.54A applies at a temperature of 20°C.

c) Carbon arrester shall operate when the potential reaches approximately AC 350V under the condition that a 1000 ohms resistance is put in series.

d) The arrester spring shall be able to be easily mounted on CDF (V side) or ar-

rester frame and firmly tightened to ensure continuity and firm wiring.

The arrester spring shall possess excellent contact performance to ensure firm contact. As for electrical requirement, insulation resistance and dielectric strength shall comply with the criteria.

e) 10 pieces of spare heat coils and 5 pieces of spare carbon arresters per one arrester spring shall be supplied.

1.4.5 Office Cable and Jumper Wire

a) Office cable and jumper wire to be provided shall be strong against abrasion and each shall comprise copper conductors (0.5 mm in diameter) insulated with PVC, except for power feeder.

b) The jumper wire insulation shall be heatproof, flameproof and be hard to burn.

c) The above materials shall have sufficient electrical characteristics.

1.4.6 Line Test Equipment

(1) Construction

The line test equipment is for Maymyo Exchange Office. The equipment shall be of portable type and be able to be installed on a desk, etc.

(2) Function

The line test equipment to be provided shall work at nominal - 48 volts and be able to test and measure the following by key operation:

a) Connection to subscriber's line, ringing and speaking
b) Control of howler transmission
c) Individual tests on line side and exchange side
d) Measurement and test of voltage, current, resistance and capacity of the subscriber's lines
e) Measurement of the speed and make/break ratio of dial impulses
f) Measurement of dialling digits
g) Originating test (B.C.O)
h) Subscribers' meters test
i) Termination of complaint calls

(3) Equipment associated with line test equipment

Test outgoing trunk (TEST OGT) :

This trunk equipment shall be utilized for connecting the line test equipment to the subscriber's lines via automatic exchange equipment.

(4) Accessories

Plugs, jacks and cords necessary for various testings and mesurings shall be supplied.

(5) Drawings and descriptions

Six copies each of circuit diagrams, mounting drawings and descriptions written in English shall be provided.

1.4.7 Miscellaneous Devices

(1) Aisle distribution fuse box

This fuse box shall be used to supply power from the main power source (-48V) to trunk switching equipment, and shall be equipped with at least two main fuses. The device shall be attachable onto the rack side and be capable of producing an alarm when the fuse is blown out. For the example of external appearance, refer to Fig. III.1.4.4.

(2) Aisle supervisory signal equipment

This equipment shall be utilized to indicate fault alarms (MJ and MN) originated from trunk switching equipment, and shall be fixed on the rack side or other convenient place. For the example of external appearance, refer to Fig. III. 1.4.5.

(3) Alarm indicator

This indicator shall comprise alarm lamps and bell in order to issue audible and visible alarms and shall have function to identify individual systems. It shall be easily attachable on pillar, etc.

(4) Repeating coil

a) This coil shall be inserted into the points where mismatchings of impedance occur over the voice-frequency circuits using DC signalling, so that the reflection loss can be decreased.

b) The impedance ratio shall be as follows:
Exchange : Line = 600 : 1,000 (in ohm)

c) Electrical requirements
Repeating coils provided shall have sufficient characteristics for use in the specified transmission frequency band width, i.e., 0.3 ∿ 3.4kHz.

d) Rack height shall be less than 2,810mm.

(5) Power cable and installation materials for reinforcement

Power cable for power supply to switchboard, rack, etc. and installation materials for reinforcement shall all comply with the JIS standard.

1.4.8 Emergency Engine Generator

(1) Diesel engine generator

Diesel engine-driven generator for Mayangon Exchange Office shall operate under the following conditions:

a)	Type	Stationary type
b)	Rated voltage	230V (Phase to neutral) 3-phase, 4-wire.

c)	Rated frequency	50Hz
d)	Rated output	20kVA
e)	Voltage variation	±10% or less, with the load variation from 50% to 100%.
f)	Starting	By starting motor
g)	Working duration	5 hours or more

Accessories

The following accessories necessary for the generator shall be provided. They shall meet the JIS standards.

Cabtyre cables, 20m (long enough to be connected with C2 type EX).
Storage batteries
Circuit breaker
Circuit drawings and manuals in English, six copies each.

(2) Petrol engine generator

Petrol engine-driven generator shall be installed in Maymyo Exchange Office and shall operate under the following conditions:

a)	Type	Mobile type
b)	Rated voltage	230V (phase to neutral), 3-phase, 4-wire.
c)	Rated frequency	50Hz
d)	Rate output	3kVA
e)	Voltage variation	± 10% or less, with the load variation from 50% to 100%.
f)	Starting	Manual starting.
g)	Working duration	5 hours or more.

Accessories

The following accessories necessary for the generator shall be provided. They shall meet the JIS standards.

Cabtyre cables, 20m (long enough to be connected with C1 type EX).
Storage batteries
Circuit breaker
Auxiliary fuel tank (capacity: approx. 15 ℓ)
Circuit drawings and manuals in English, six copeis each.

1.4.9 Tools and Test Instruments

Tools and test instruments necessary for installation and maintenance shall comply with the JIS standard or equivalents and permit easy operation and maintenance. Names, uses, and functions of necessary maintenance tools and test instruments are given in Table III. 1.4.3 and Table III. 1.4.4.

Table Ⅲ 1.4.1. (1/2) Equipment Associated with Manual Trunk Switchboard

Nomenclature	Quantity required	Description
Ringdown Bothway Trunk Equipment (RD-BWT)	12	Provides ringdown line signalling (16Hz ringing current reguired). The relay set is used for terminating ringdown bothway trunk circuits from distant switchboards Used on all types of calls connected to an operator from distant operators.
Special Service Code Incoming Trunk Equipment (SP-ICT)	5	Provides DC line signalling without decadic pulse information signalling and does not have facility reverting line polarity soon after an operator answered. Used for special service calls from subscribers for C1 Type Automatic Exchange equipment to operators.
Toll Outgoing Trunk Equipment (T-OGT)	15	Provides DC line signalling with decadic pulse information signalling and have functions, e,g, trunk call connections from operators to subscribers on C1 Type Automatic Exchange and trunk offering
Telephone Trunk Equipment (TEL-T)	4	Provides 16Hz ringing current causing a telephone bell to ring. Used on all types of calls connected to telephone sets from operators.

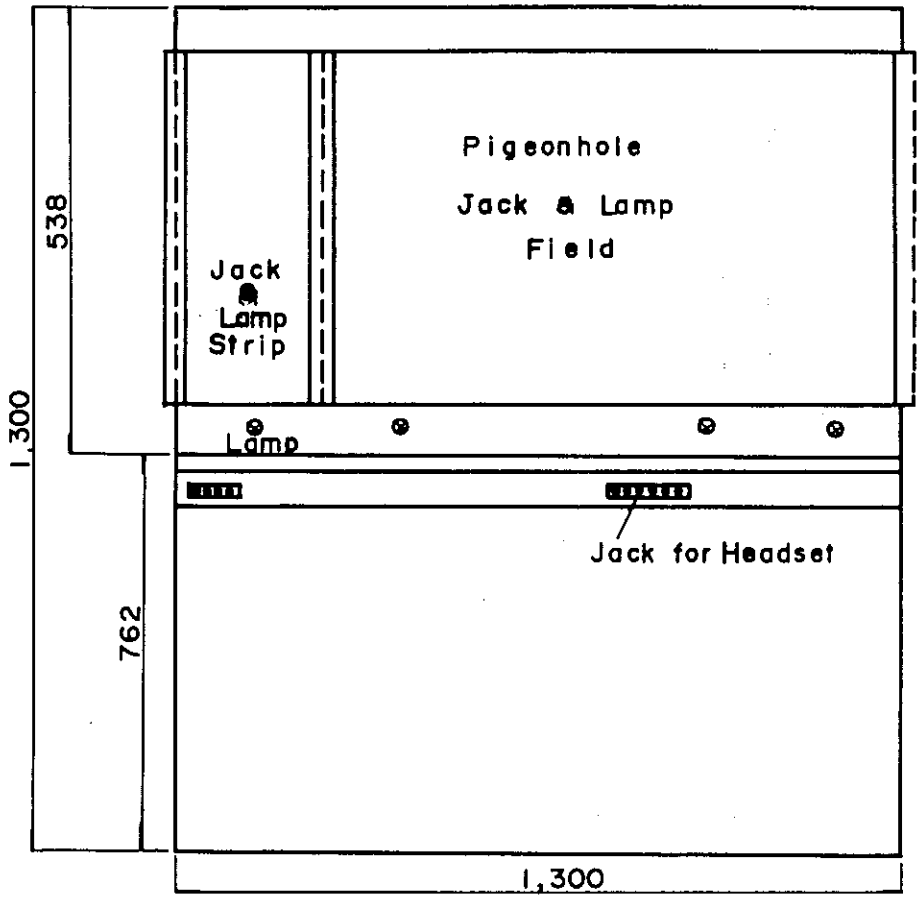
Table Ⅲ 1.4.1 (2/2)

Equipment Associated with Manual Trunk Switchboard

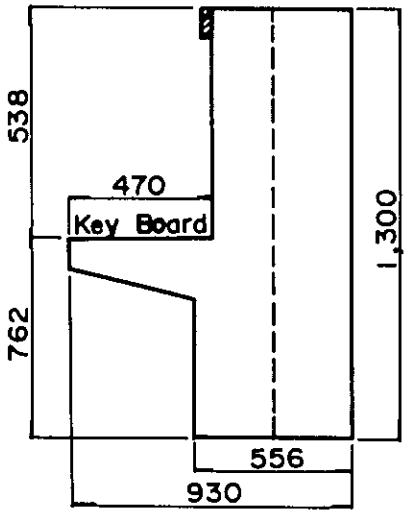
Nomenclature	Quantity required	Description
Idle Line Indication Equipment (I L I)	1	Used for idle line indication for outgoing trunks onto switchboard panel.
Cord Testing Equipment (CODTST)	1	Provides the following test facilities. (1) Noise of connection cord. (2) Testing of signal and supervisory lamps.
Trunk Frame (Mounting Frame Rack)	1	Used for mounting equipment associated with switchboard and has height of 2,500mm or less. Provides various signal currents and power source necessary for the above devices, etc.

Table Ⅲ.1.4.2. Spare Parts for Manual Switchboard

Item No.	Name of parts	Unit	Quantity	Remarks
1	Polarized Relay	pcs.	6	
2	Lamp (Type # 2)	pcs.	142	
3	Pilot Lamp	pcs.	1	
4	Pilot Lamp Cap	pcs.	1	
5	Resitance Lamp (Type # 10)	pcs.	2	
6	Fuse (Type # 38)	pcs.	44	1.3 A 40each 3.0 A 4each
7	Lamp Cap (Type # 68)	pcs.	14	
8	Lamp Cap (Type # 69)	pcs.	2	
9	Connection Cord	pcs.	44	Including plugs
10	Weight	pcs.	12	
11	Dial	pcs.	2	
12	Dial Socket	pcs.	2	
13	Jack (Type # 49)	pcs.	2	
14	Lamp Jack (Type # 12)	pcs.	2	
15	Key	pcs.	3	
16	Terminal Block (# 6)	pcs.	3	
17	Jack Fastener	pcs.	15	



Front View

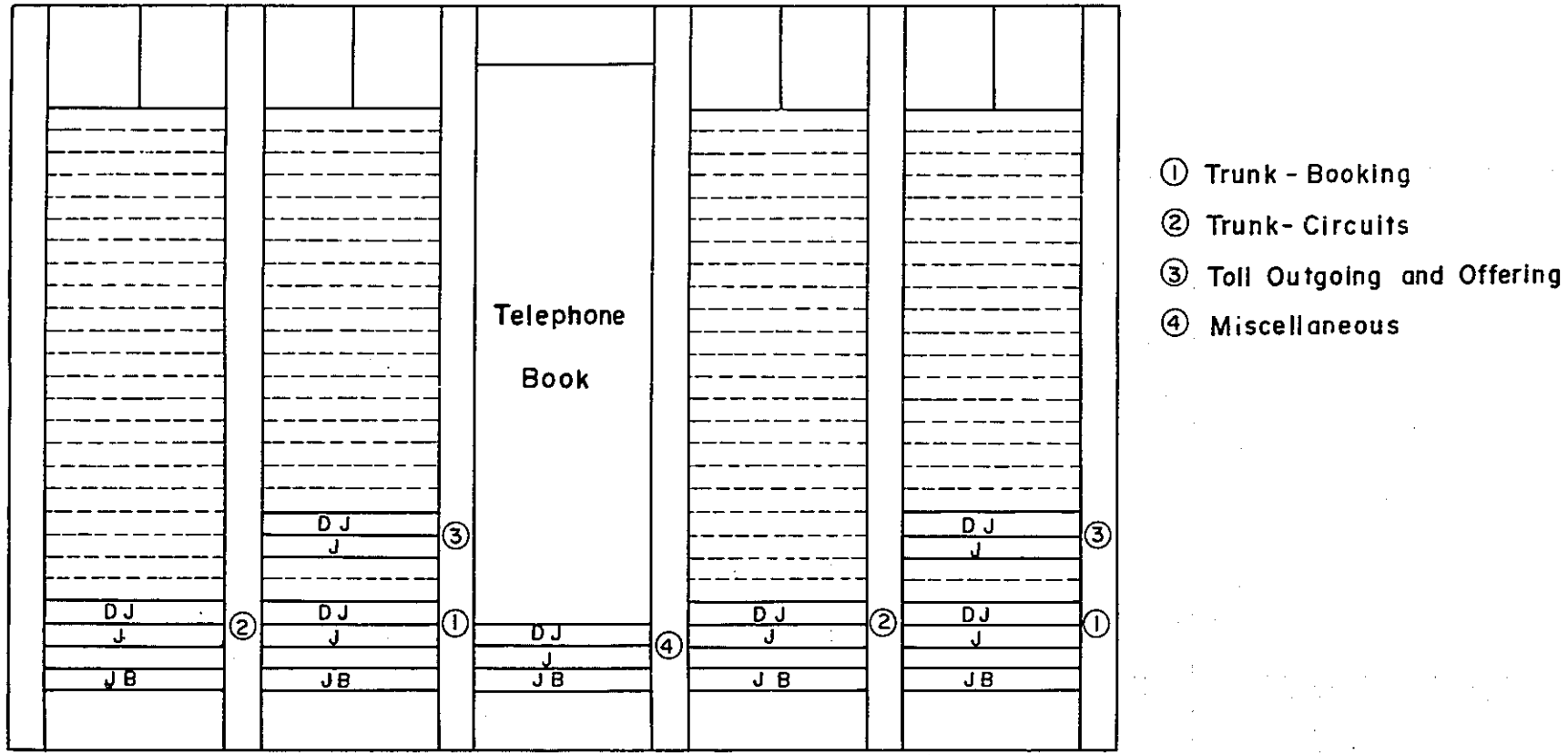


Side View

Note
Figures: shown approximately.

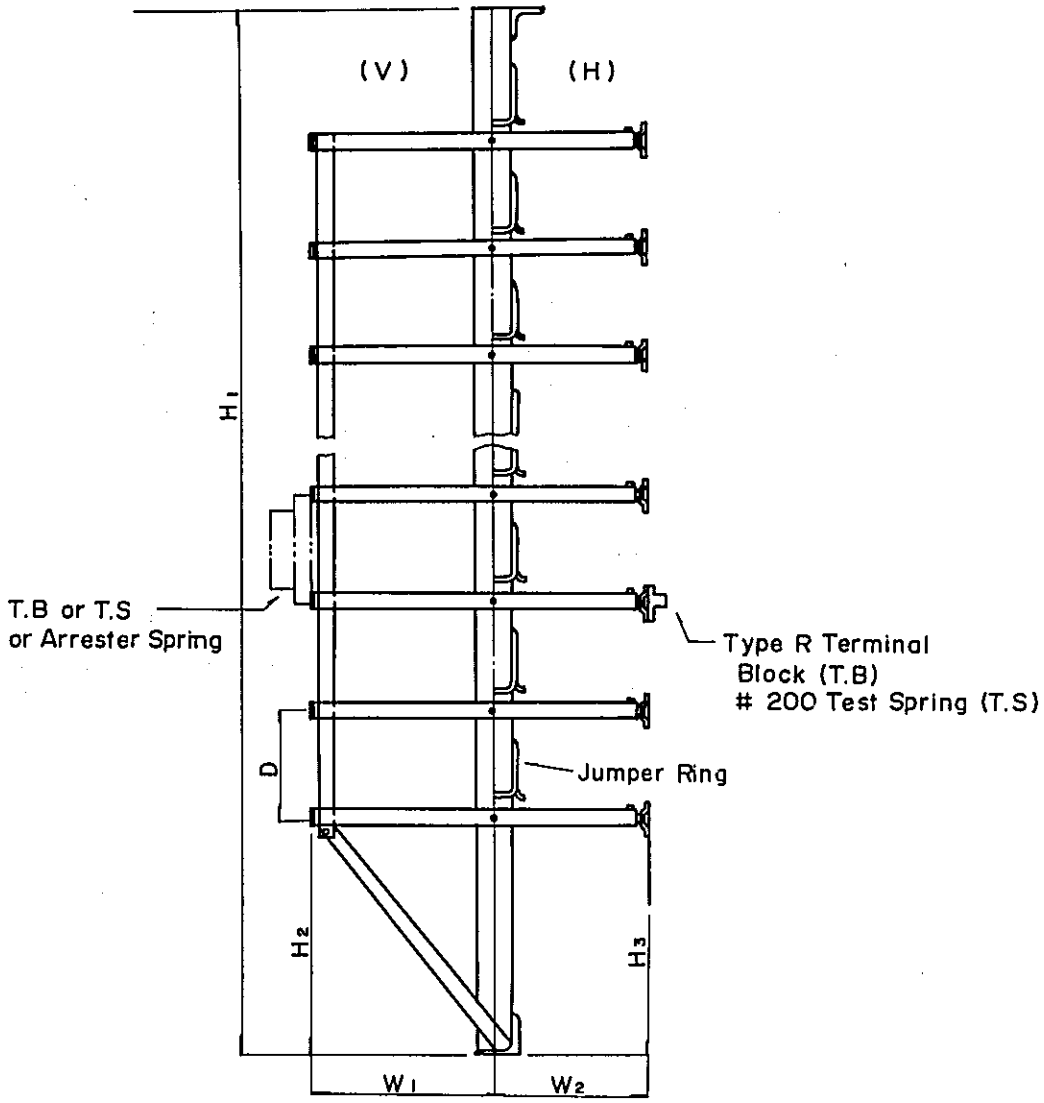
Unit : mm

Fig Ⅲ.1.4.1. Typical Manual Trunk Switchboard



① Trunk - Booking
② Trunk- Circuits
③ Toll Outgoing and Offering
④ Miscellaneous

Fig. Ⅲ. 1.4.2 Jack Field for Maymyo Exchange



Unit : mm

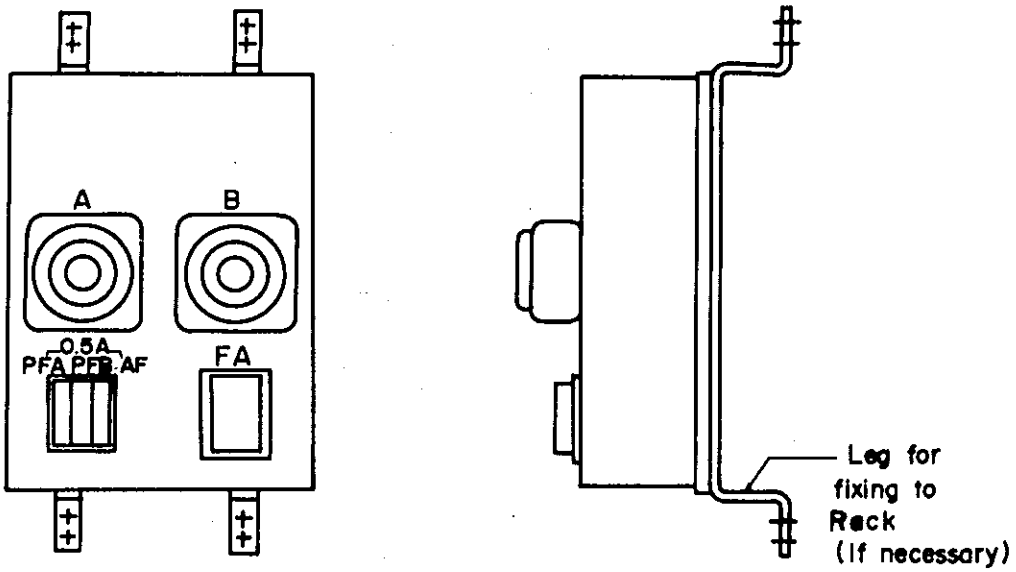
Type of DF	H1	V-Side(V)				H-Side(H)			Remarks
		H2	W1	D	Steps	H3	W2	Steps	
4-A CDF	2 500	301	348	976.5	2*	350	370	11	* : 2 arresters attached. CDF includes cleats. All DFs include expansion bolts, nuts and washers.
T-1 TDF	2 500	350	421	180	10	350	370	11	
T-4 MDF	2 810	300	364.5	180	12	300	370	13	

Notes (1) Guardrails should be provided for all the types of DFs.

(2) Dimensions shown except for guardrails.

(3) Figures shown approximately

Fig. Ⅲ.1.4.3 Dimensions of Distribution Frame (DF)



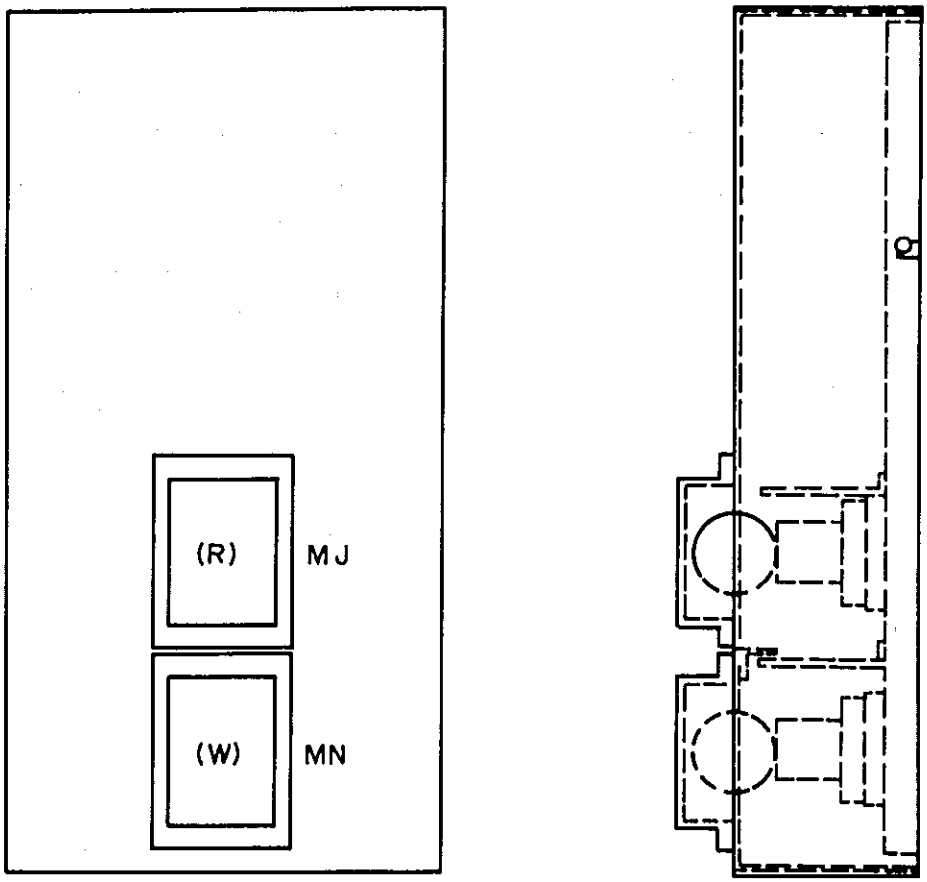
Note

A , B : Main Fuse A & B
PFA,B : Pilot Fuse A & B
F A : Fuse Alarm

Front View

Side View

Fig. Ⅲ. 1. 44 Typical Aisle Distribution Fuse Box



Front View

Side View

Note

MJ : Major Alarm
MN : Minor Alarm
(R) : Red Indication
(W) : White Indication

Fig. Ⅲ.1.45. Typical Aisle Supervisory Signal Equipment

Table Ⅲ.1.4.3.(1/2) Tools for Maintenance

Item No.	Nomenclature	Description
1	Tool Kit for Crossbar Switch	Used for adjusting crossbar switch
2	Tool Kit for Wire Spring Relay	Used for adjusting wire spring relay
3	Tool Kit for Arrester	Used for adjusting and mounting of arrester
4	No. 1 B Wrapping Tool	Electric wire wrapping tool for office cable wires and jumper wires (AC 100 Volt 50/60 Hz)
5	No. 1 A Bit	Used for the above For 0.5mm-conductor wire in diameter
6	No. 2 A Bit	For 0.65 mm-wire
7	No. 3 A Bit	For 0.4 mm-wire
8	No. 1 B Sleeve	For 1 A bit
9	No. 2 B Sleeve	For 2 A bit
10	No. 3 B Sleeve	For 3 A bit
11	No. 1 A Unwrapping Tool	Manual unwrapping tool Used for 1.0mm-square type terminal
12	No. 2 A Unwrapping Tool	Used for 1.2mm-square type terminal
13	No. 3 A Unwrapping Tool	Used for terminal of wire spring relay
14	Electric Relay Contact Cleaner	For cleaning contacts of wire spring relay
15	No. 1 S Soldering Iron	Specified : 140 Watts at AC 100 Volts
16	No. 2 S Soldering Iron	Specified : 70 Watts at AC 100 Volts
17	No. 3 S Soldering Iron	Specified : 40 Watts at AC 100 Volts
18	Special Soldering Iron	Specified : 70 Watts at AC230 Volts
19	Tool for Battery	Contains a hydrostatic balance, etc. necessary for storage battery maintenance
20	No. 2 A Tool Kit	For maintenance staff at crossbar exchange

Table Ⅲ.1.4.3.(2/2) Tools for Maintenance

Item No.	Nomenclature	Description
21	No. 7 Tool Kit	Used for maintenance of type crossbar PBX
22	Tool Kit for Polarized Relay	For adjusting polarized relay
23	Tool Kit for Common Battery System	For maintenance use
24	Tool Kit for No. 5 Dial Unit	For adjusting No. 5 dial unit
25	Tool Kit for Type 600 Telephone Set	For adjusting and repairing type 600 telephone set
26	Step-down Transformer	Input : 230 V 50 Hz Output: 100 V 50 Hz 1 KVA

Table III.1.4.4. Test Instruments

Item No.	Nomenclature	Desription
1	Circuit Tester (No.1)	Used for General Measuring of Electrical Circuit. (Handy utility tester)
2	D.C. Volt-Ampere Meter (P2M17)	Has 17ranges of D.C.Volt and Ampere Measured.
3	A.C. Volt-Ampere Meter (P2S13)	Has 13ranges of A.C.Volt and Ampere Measured.
4	Volt Meter (PIM3/150)	Has 2ranges of D.C.Volt only (150 Volt at Max.). For Storage Battery
5	Fault Locator with Oscillator and Detector	Used for Detecting Cross Connection and Disconnection of Cable Wires.
6	Impulse Recorder (ST-1)	Used for Measuring the Speed and Make-Break Ratio of the Impulse Produced by Pulse Generator.
7	Relay Tester (No.5)	Used for Measuring Characteristics of any Kinds of Relays.
8	Operator Headset (No.600)	Used for Speech among Operators and Maintenance Staffs.
9	Test Handset (41-D)	Used for Simple Testing and Checking of each Equipment Rack.
10	Test Handset (42-A)	Used for Testing Subscriber's Meter by DP Signal System.
11	Testing Equipment for Subscriber Meter (C11-A)	Used for Testing Subscriber's Meter, Associated with Test Incoming Trunk
12	Test Handset (41-J)	Used for Testing C2 Switching Equipment.
13	Cord with Connector (CW11-W)	For Interconnecting between Terminals. Length: 2,500mm
14	Cord with Connector (CW14-W)	Do, Length: 1,500mm
15	Test Cord for Arrestar Spring	For Line Test Equipment
16	Test Cord for Terminal Block	Do.
17	Plug (No. 110 RSB)	For Make-Busy of Equipment
18	Plug (No. 110 TRA)	Do.

CHAPTER 2 MATERIALS LIST

2.1 Mayangon Exchange Office

A list of materials necessary for installation of the inside plant for Mayangon Exchange Office is given in Table III.2.1.1.

2.2 Maymyo Exchange Office

A list of materials necessary for installation of the inside plant for Maymyo Exchange Office is given in Table III.2.2.1.

Table III.2.1.1 (1/3)

Material List for Mayangon Exchange

Item No.	Items	Unit	Quantity	Remarks
1	T – 4 M. D. F.	vertical	8	
2	Terminal Blocks (254 R)	pcs.	75	
3	Test Spring (254 TS)	pcs.	56	
4	Frame for VD coils	frame	1	Installed in Mayangon. Exchange. Height : 2850 mm or Less.
5	VD coil	pcs.	320	600 ohms : 1 000 ohms.
6	Frame for VD coils	frame	1	Installed in Hanthawaddy Exchange self · support rack
7	VD coil	pcs.	240	600 ohms : 1 000 ohms
8	Cable (0.5 ø , 100 pairs)	m	80	For Mayangon Exchange
9	Tie - bar (JIS G 3192) (40 x 40 x 5 L)	m	7	For Mayangon Exchange. With fixing materials
10	Tie - bar (JIS G 3192) (50 x 50 x 6 L)	m	2	For Mayangon Exchange. With fixing materials
11	Tie - bar (JIS G 3192) (65 x 65 x 6 L)	m	9	For Mayangon Exchange. With fixing materials
12	Cable Platform (W=500mm)	m	5.5	For Hanthawaddy Exchange. With fixing materials
13	Cable (0.5 ø , 100 pairs)	m	80	For Hanthawaddy Exchange.
14	Tie - bar (JIS G3192) (50 x 50 x 6L)	m	5	For Hanthawaddy Exchange. With fixing materials
15	Cable Platform (W=300mm)	m	5	For Hanthawaddy Exchange. With fixing materials
16	Jumper Wire	m	2,400	Twist wire (2 wires)
17	Jumper Wire (Green)	m	100	Single wire
18	Jumper Wire (Orange)	m	100	Single wire
19	Power Cable (JIS) (14 mm²)	m	20	600V , vinyl wire
20	Tools for Installation	set	1	Note 1
21	Tools for Maintenance			
21-1	Tool kit for Crossbar Switch	set	1	
21-2	Tool kit for Wire Spring Relay	set	1	
21-3	Tool kit for Arrester Spring	set	1	
21-4	No. 1B Wrapping Tool	pcs.	3	
21-5	No. 1A Bit	pcs.	1	
21-6	No. 2A Bit	pcs.	1	

Table III. 2. 1. 1 (2/3)

Material List for Mayangon Exchange

Item No.	Items	Unit	Quantity	Remarks
21-7	No. 3A Bit	pcs.	1	
21-8	No. 1B Sleeve	pcs.	1	
21-9	No. 2B Sleeve	pcs.	1	
21-10	No. 3B Sleeve	pcs.	1	
21-11	No. 1A Unwrapping Tool	pcs.	2	
21-12	No. 2A Unwrapping Tool	pcs.	2	
21-13	No. 3A Unwrapping Tool	pcs.	2	
21-14	Electric Relay Contact Cleaner	pcs.	1	
21-15	No. 1S Soldering Iron	pcs.	1	
21-16	No. 2S Soldering Iron	pcs.	1	
21-17	No. 3S Soldering Iron	pcs.	1	
21-18	Special Soldering Iron	pcs.	2	
21-19	Tool for Battery	set	1	
21-20	No. 2A Tool Kit	set	2	
21-21	No. 7 Tool Kit	set	1	
22	Test Instruments			
22-1	Circuit Tester (No. 1)	set	1	
22-2	D.C. Volt-Ampere Meter (P2MI7)	set	1	
22-3	A.C. Volt-Ampere Meter (P2SI3)	set	1	
22-4	Volt Meter (PIM 3/150)	set	1	
22-5	Fault Locator with Oscillator and Detector	set	1	
22-6	Impulse Recorder (ST-1)	set	1	
22-7	Relay Tester (No.5)	set	1	
22-8	Operator Headset (No.600)	pcs.	2	
22-9	Test Handset (41-J)	pcs.	1	
22-10	Cord with Connector (CWII-W)	pcs.	100	
22-11	Cord with Connector (CWI4-W)	pcs.	20	
22-12	Test Cord for Arrester	pcs.	10	

Table Ⅲ 2.1.1 (3/3)

Material List for Mayangon Exchange

Items		Unit	Quantity	Remarks
22-13	Test Cord for Terminal Block	pcs.	6	
22-14	Plug (No.110-RSB)	pcs.	40	
22-15	Plug (No.110-TRA)	pcs.	10	
23	Dehumidifier	set	2	
24	Emergency Diesel Engine Generator.	set	2	
25	Terminal Block for Training.	pcs.	8	CR6-10---- 4 pcs. CR7- 5---- 4 pcs.

Note. 1. Tools such as a wire stripper, a spanner, a buzzer, etc. and materials such as vinyl tepe, vinyl tube, etc. shall be Provided.

2. The following are not included in the above List.

1) Transportation Equipment.
2) Materials for Concrete. Foundation.
3) Materials for sunshine shelter.
4) Materials and Equipment for Power, Reception.
5) Interface Equipment in the other Exchange.

Table II.2.2.1(1/3) Material List for Maymyo Exchange

Item No.	Items	Unit	Quantity	Remarks
1	Manual Trunk Switchboard	~~seat~~ board	2/1	
2	Line Test Equipment	set	1	
3	Trunk Frame	frame	1	
4	Toll Outgoing Trunk Equipment	circuit	15	
5	Special Service Code Incoming Trunk Equipment	circuit	6	
6	Telephone Trunk Equipment	circuit	4	
7	Idle Line Indication Equipment	set	1	
8	Test Outgoing Trunk Equipment	circuit	1	
9	Cord Testing Equipment	set	1	
10	Ringdown Bothway Trunk Equipment	circuit	12	
11	Aisle Supervisory Signal Equipment	set	1	
12	Aisle Distribution Fuse Box	set	1	
13	Alarm Indicator	set	1	
14	4-A C D F	vertical	3	
15	T-I T D F	vertical	1	
16	Terminal Block (203R)	pcs.	3	
17	Terminal Block (204R)	pcs.	10	
18	Terminal Block (206R)	pcs.	1	
19	Terminal Block (254R)	pcs.	18	
20	Arrester Spring	pcs.	6	
21	Cable (12W)	m	30	
22	Cable (22W)	m	20	
23	Cable (40W)	m	50	
24	Cable (48W)	m	30	
25	Cable (60W)	m	20	
26	Cable (80W)	m	60	
27	Jumper Wire (single)	m	200	Orange : 100m Green : 100m
28	Jumper Wire (twisted 2wires)	m	200	
29	Jumper Wire (twisted 3wires)	m	200	

Table Ⅲ.2.2.1(2/3) Material List for Maymyo Exchange

Item No.	Items	Unit	Quantity	Remarks
30	Jumper Wire (twisted 4 wires)	m	200	
31	Power Cable (JIS 14 mm²)	m	6	600V vinyl wire
32	Power Cable (JIS 30 mm²)	m	10	600V vinyl wire
33	Power Cable (JIS 38 mm²)	m	45	600V vinyl wire
34	Emergency Petrol Engine Generator	set.	2	capacity 3KVA
35	Cable Platform (w = 200mm)	m	6	With fixing material
36	Cable Platform (w = 300mm)	m	3	With fixing material
37	Cable Platform (w = 400mm)	m	6	With fixing material
38	Tie-bar (Angle JIS 40x40x5)	m	1	With fixing material
39	Tie-bar (Angle JIS 50x50x.6)	m	11	With fixing material
40	Tie-bar (Angle JIS 65x65x6)	m	5	With fixing material
41	Tie-bar (Lip channel JIS 75x45x15x2.3)	m	12	With fixing material
42	Support	pcs.	4	With fixing material
43	Tools of Maintenance			
43-1	Tool Kit for Crossbar Switch	pcs.	1	
43-2	Tool Kit for Wire Spring Relay	pcs.	1	
43-3	Tool Kit for Arrester Spring	pcs.	1	
43-4	No. 1B Wrapping Tool	pcs.	3	
43-5	No. 1A Bit	pcs.	1	
43-6	No. 2A Bit	pcs.	1	
43-7	No. 3A Bit	pcs.	1	
43-8	No. 1B Sleeve	pcs.	1	
43-9	No. 2B Sleeve	pcs.	1	
43-10	No. 3B Sleeve	pcs.	1	
43-11	No. 1A Unwrapping Tool	pcs.	2	
43-12	No. 2A Unwrapping Tool	pcs.	2	
43-13	No. 3A Unwrapping Tool	pcs.	2	
43-14	Electric Relay Contact Cleaner	pcs.	1	
43-15	No. 1S Soldering Iron	pcs.	1	

Table Ⅲ 2.2.1 (3/3)

Material List for Maymyo Exchange

	Items	Unit	Quantity	Remarks
43-16	No.2S Soldering Iron	pcs.	2	
43-17	No.3S Soldering Iron	pcs.	1	
43-18	Special Soldering Irom	pcs.	2	
43-19	Tool for Battery	pcs.	1	
43-20	No.2A Tool Kit	pcs.	2	
43-21	No. 7 Tool Kit	pcs.	1	
43-22	Tool Kit for Polarized Relay	pcs.	1	
43-23	Tool Kit for Common-battery System	pcs.	1	
43-24	Tool Kit for No.5 Dial Unit	pcs.	1	
43-25	Tool Kit for Type600 Telephone Set.	pcs.	1	
44	Test Instruments.			
44-1	Circuit Tester (No.1)	pcs.	1	
44-2	D.C Volt-Ampere Meter(P2MI7)	pcs.	1	
44-3	A.C Volt-Ampere Meter(P2SI3)	pcs.	1	
44-4	D.C Volt-Meter (PIM3/150)	pcs.	1	
44-5	Fault Locator with Oscillator and Detector	pcs.	1	
44-6	Impulse Recorder (ST-1)	pcs.	1	
44-7	Relay Tester (No.5)	pcs.	1	
44-8	Operator Headset (No.600)	pcs.	3	
44-9	Test Handset (41-D)	pcs.	1	
44-10	Cord with Connector (CWII-W)	pcs.	10	
45	Stepdown Transformer	pcs.	1	1KVA 230V/100V 50Hz
46	Tools for Installation	set	1	Note 1
47	Terminal Block for Training.	pcs.	8	CR6-8 ---- 4pcs. CR7-5 ---- 4pcs.

Note.1. Tools such as a wire stripper, a spanner, a buzzer, etc. and materials such as vinyl tape, vinyl tube, etc. shall be provided.

2. The following are not included in the above list.

1) Transportation Equipment.

2) Materials for Concrete Foundation.

3) Materials for sunshine shelter.

4) Materials and Equipment for Power Reception.

5) Materials for Remodeling of Building.

PART IV

TECHNICAL SPECIFICATION OF THE OUTSIDE PLANT AND A LIST OF MATERIALS

CONTENTS

PART IV TECHNICAL SPECIFICATION OF THE OUTSIDE PLANT AND A LIST OF MATERIALS

CHAPTER 1 TECHNICAL SPECIFICATION

1.1 General Description

1.1.1 Summary of Works

This Project covers the Mayangon (in Rangoon) and Maymyo Exchange Offices which shall be constructed as outlined below.

Kind of Cables	Mayangon Exchange office	Maymyo Exchange office	Total
Entrance cable	3,400 pairs (including 400 pairs of junction cable)	600 pairs	4,000 pairs
Underground cable	Approx. 13.1 km	–	Approx. 13.1 km
Junction cable	Approx. 6.8 km	–	Approx. 6.8 km
Aerial cable (including SD wire)	Approx. 82.8 km	Approx. 40.6 km	Approx. 123.4 km

1.1.2 Tie Cable

Under this Project, MDF shall be newly installed in the existint buildings of both the Mayangon and Maymyo Exchange Offices. The newly installed MDF shall be connected to C2 type automatic exchanges and C1 type automatic exchanges with the tie cables mentioned below.

Cable	Mayangon Exchange office	Maymyo Exchange office
Tie cable	2,800 pairs	600 pairs

1.1.3 Installation Procedures and Materials

The installation procedures and materials for the outside plants covered by this Project shall, in principle, conform to Japanese standards except for the following.

Refer to the attached drawings in addition to the installation work specifications given in Paragraph 1.2 and the goods specifications in Paragraph 1.3 of this Chapter.

(1) Attaching accessories to Burmese standard steel tublar poles
   a) Cable installation, anchoring of cable supporting wire and L-shaped clamp mounting shall, in principle, be done by a method using bands.
   b) Pole steps shall not be used.

(2) Aerial cables and SD wires shall not be spliced between poles.

(3) Buried cables shall be protected by suitable protectors, for example,

bricks, by a Burmese method.

(4) The conductors of buried cables shall be spliced as specified in Paragraph 1.2.6 "Underground Cable", and their sheaths shall be connected by a putty method to assure airtightness at the joints. The joints of buried cables shall be protected by durable protectors.

(5) Underground cables (including junction cables) shall have dry air filled in by a dry air supply equipment, but contactors shall not be installed.

1.1.4 Attached Drawings

(1) Key Map

(2) MDF Plan

(3) Guide Map of Subscriber Underground Cable Routes (Mayangon Exchange office only)

(4) Subscriber Underground Cable Plan (Mayangon Exchange office only)

(5) Allotment Plan for Subscriber Underground Cable Unit Numbers (Mayangon Exchange office only)

(6) Diagram of Subscriber Underground Cables (Mayangon Exchange office only)

(7) Index Map of Subscriber Aerial Cable Plan

(8) Subscriber Aerial Cable Plan

(9) Guide Map of Junction Cable Route (Mayangon Exchange office only)

(10) Diagram of Junction Cable and Loading Plan (Mayangon Exchange office only)

(11) Diagram of Cable Laying in Manholes (Mayangon Exchange office only)

1.2 Specifications of Installation Work

1.2.1 Pole

1.2.1.1 Kinds

Japanese standard steel poles (hereinafter called Japanese standard poles) and Burmese standard steel tubular poles (spliced poles) (hereinafter called Burmese standard poles) shall be used in principle.

The kinds of Japanese standard poles are shown in Table IV. 1.2.1.1 and Fig. IV. 1.2.1.1 and Burmese standard poles in Table IV. 1.2.1.2 and Fig. IV. 1.2.1.2.

1.2.1.2 Attachment of Accessories

Attachment of accessories to Japanese standard poles shall, in principle, be done by using bolts. Attachment of accessories to Burmese standard poles shall be done by using bands.

Only Japanese standard poles shall have 5 pole steps in the upper part thereof. Fig. IV. 1.2.1.3 shows the installation technique.

1.2.1.3 Hole Digging

(1) Hole depth

Hole depth shall be the same as setting depth. Setting depth for Japanese standard poles shall be more than one-sixth of the length thereof, but never less than 1.2 m, in case of ordinary ground. In the case of soft ground, log cribs coated with tar shall be mounted on a pole at a position more than 30 cm under the ground as shown in Fig. IV. 1.2.1.4. Setting depth for Burmese standard poles shall conform to Burmese standards (that is, Line Construction Code).

(2) Method of digging holes

a) Cylindrical hole type

In principle, cylindrical holes shall be dug for erecting poles. Cylindrical hydraulic auger crane cars shall be used as much as possible for hole digging. In this case, sufficient care shall be taken of power lines and other underground objects.

In principle, 35 cm augers shall be used for digging holes for Japanese standard poles; and 45 cm augers for Burmese standard poles.

In places where cylindrical hydraulic auger crane cars cannot be used, long-handle shovels and long-handle spoons shall be used for digging cylindrical holes. No log cribs shall in principle be attached to poles constructed in cylindrical holes.

Fig. IV. 1.2.1.5 shows the shape of cylindrical holes.

b) Stepped hole type

When attaching log cribs to Japanese standard poles, stepped holes shall be dug. Log cribs shall be attached to poles in soft ground and struts.

Fig. IV. 1.2.1.6 shows the shape of stepped holes.

(3) Pole setting

Human labor or cylindrical hydraulic auger crane cars shall be used for pole setting. When raising a pole to an upright position, place a patch in the hole opposite to the side from which the pole is raised, and erect the pole as shown in Fig. IV. 1.2.1.7. In cases where poles are constructed near the power lines, the poles should be covered with insulating protective sheets to prevent contact with power lines. The method of mounting a protective sheet is illustrated in Fig. IV. 1.2.1.8.

(4) Back-filling holes

After setting poles in place, the hole shall be filled back with dug-out earth and the earth around the poles shall be tamped hard with hand tampers.

Table Ⅳ.1.2.1.1. Kind of Japanese Standdrd Steel Pole

Name of pole	Length (m)	Diameter of top part (mm)	Diameter of bottom part(mm)	Safe loads (kg)
7.0 -2	7.0	80	173	200
7.5 -2	7.5	80	180	200
7.5 -4	7.5	150	250	430
8.0 -2	8.0	80	187	200
8.0 -4	8.0	150	257	430
9.0 -2	9.0	80	200	200

Table Ⅳ.1.2.1.2. Kind of Burmese Standard Steel Tube

Name of tube	Length (m)	Diameter of top part (mm)	Diameter of bottom part(mm)	Remarks
T	2.4	43	79	Fig. Ⅱ.2.2.1
A	〃	71	104	
B	〃	90	135	
C	〃	119	165	
D	〃	144	197	
E	〃	186	229	
A_4	1.2	90	104	
B_4	〃	119	135	
C_4	〃	144	165	

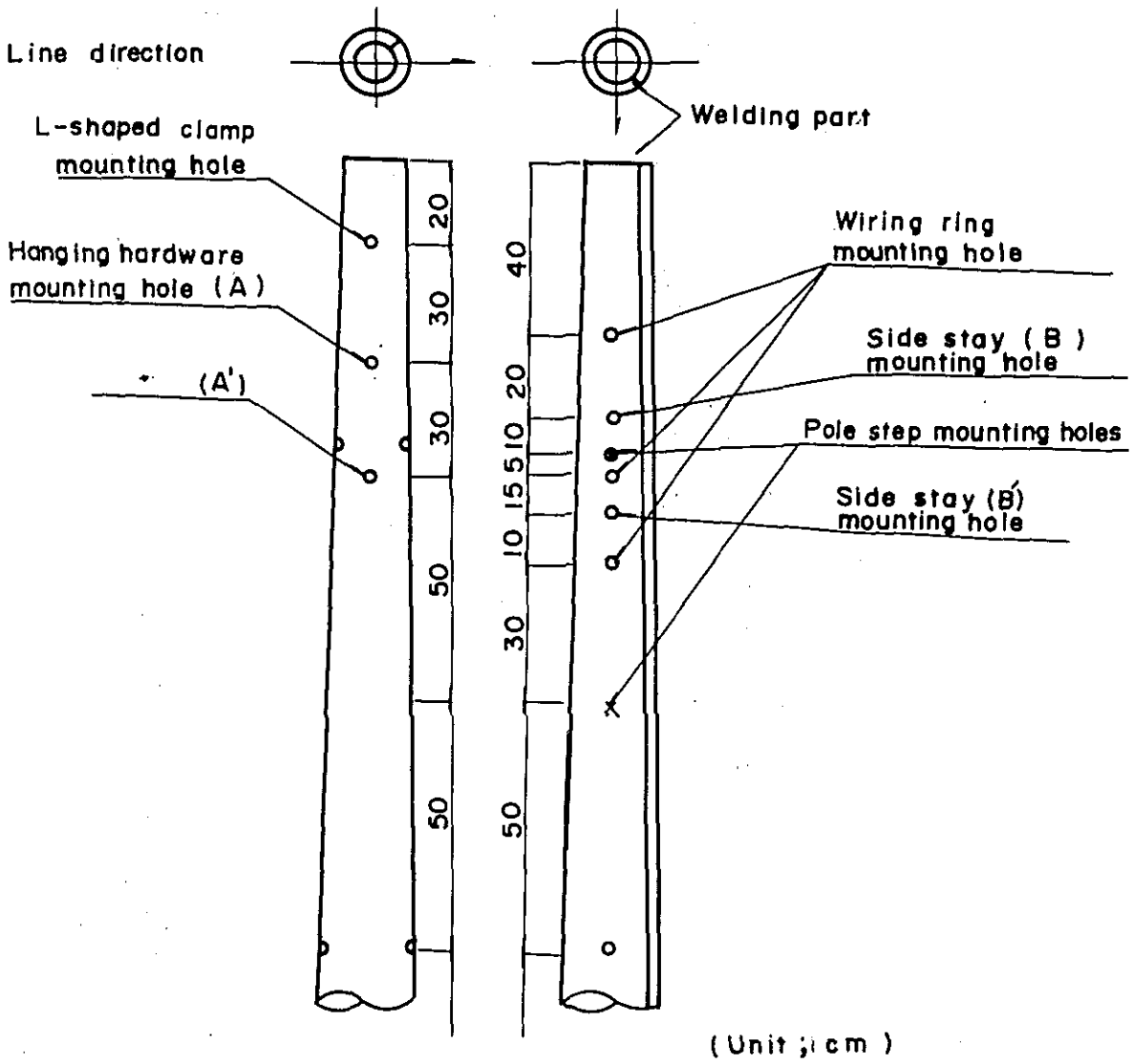
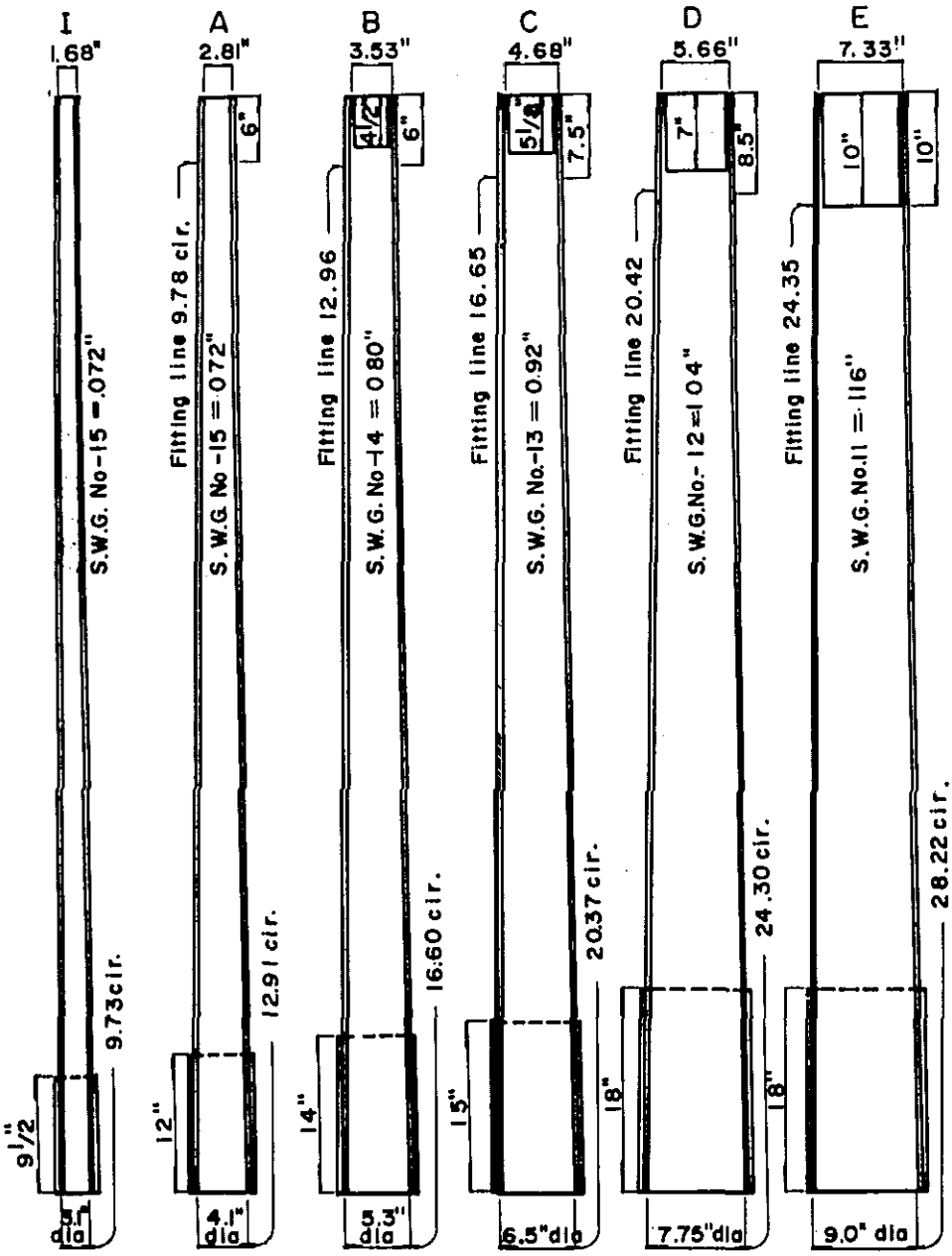


Fig. Ⅳ.1.2.1.1.

Upper-part Structure of Japanese Standard Pole



(Unit : feet)

Tubes (8 feet)

Fig. IV.1.2.1.2(1/4) Burmese Standard Pole

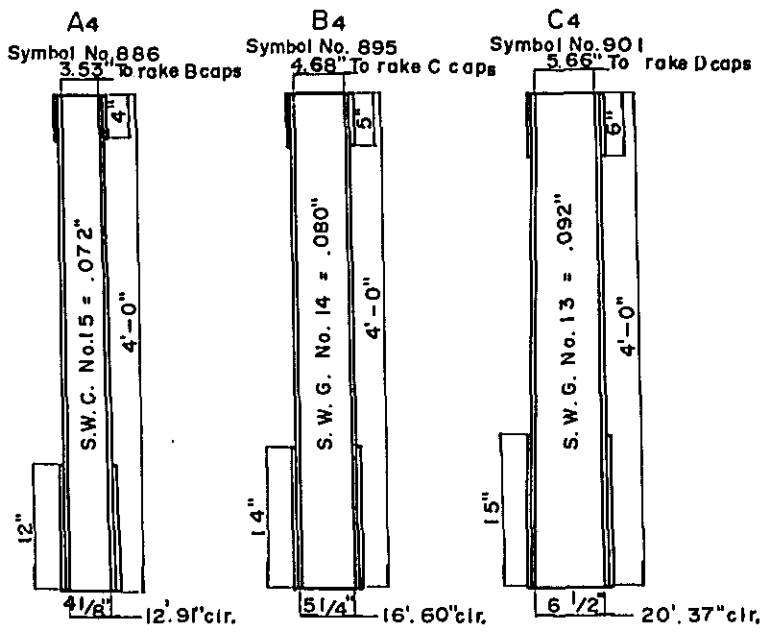


Fig. IV. 1. 2. 1. 2(2/4) Burmese Standard pole

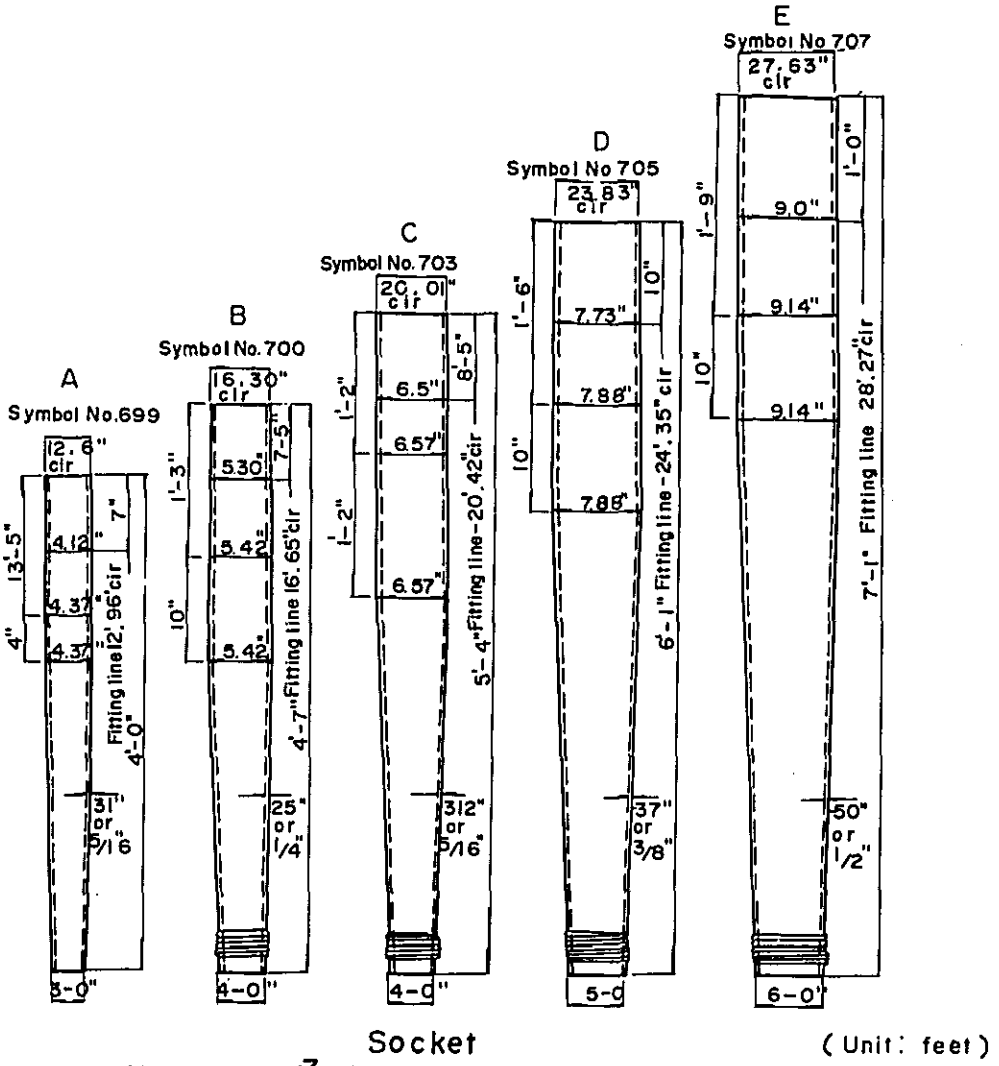
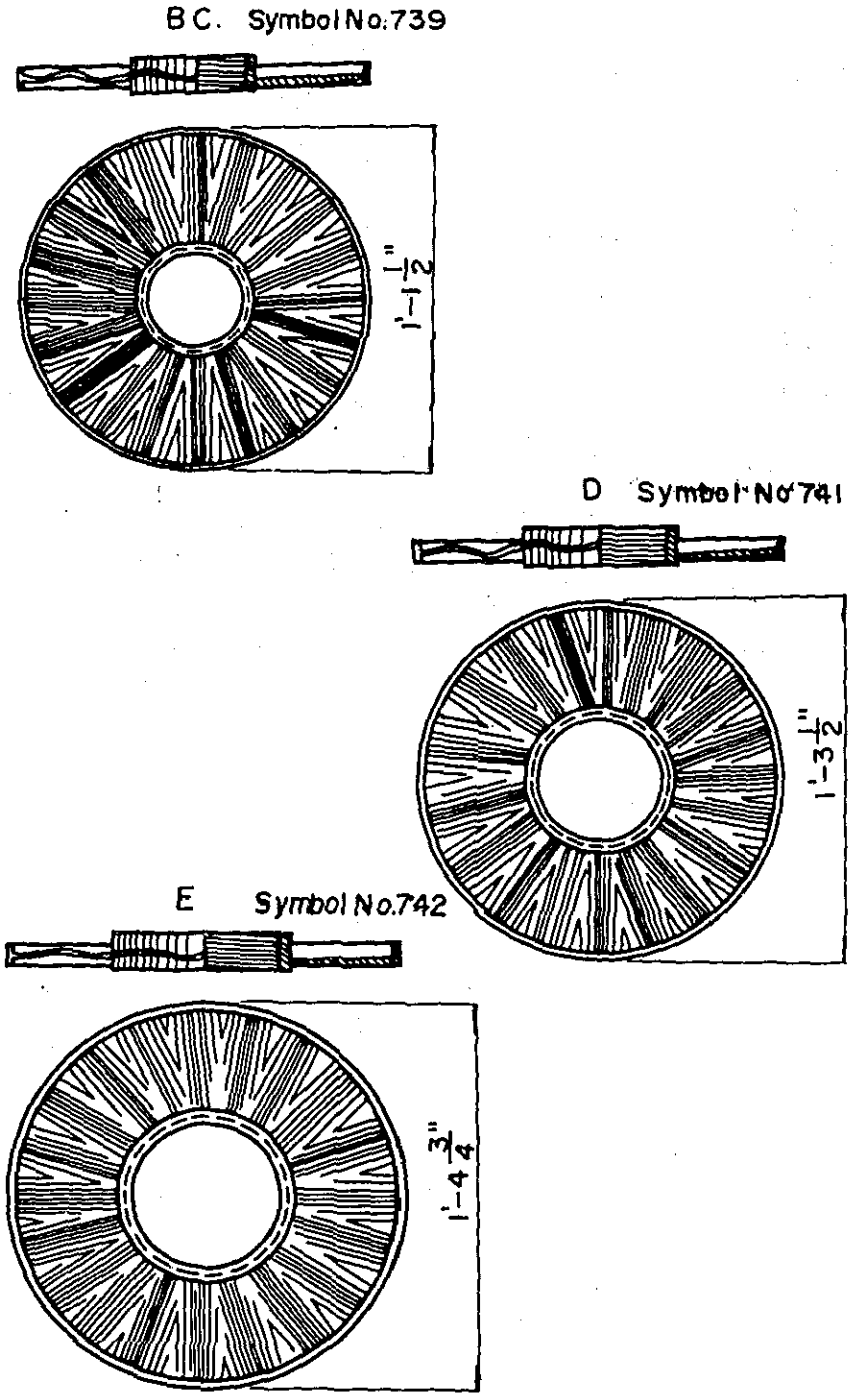
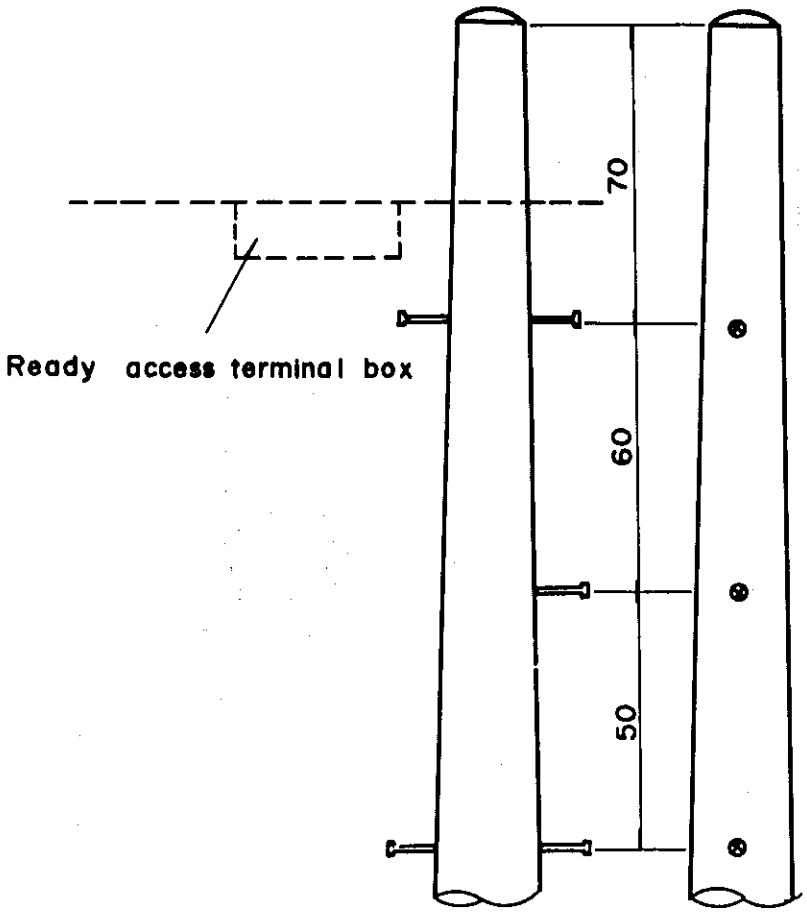


Fig. IV. 1. 2. 1. 2.(3/4) Burmese Standard pole



Sole Plates (Uint : feet)

Fig. IV.1.2.1.2(4/4) Burmese Standard Pole



(Unit : cm)

Fig. Ⅳ. 1.2.1.3. Attachment of Pole Steps

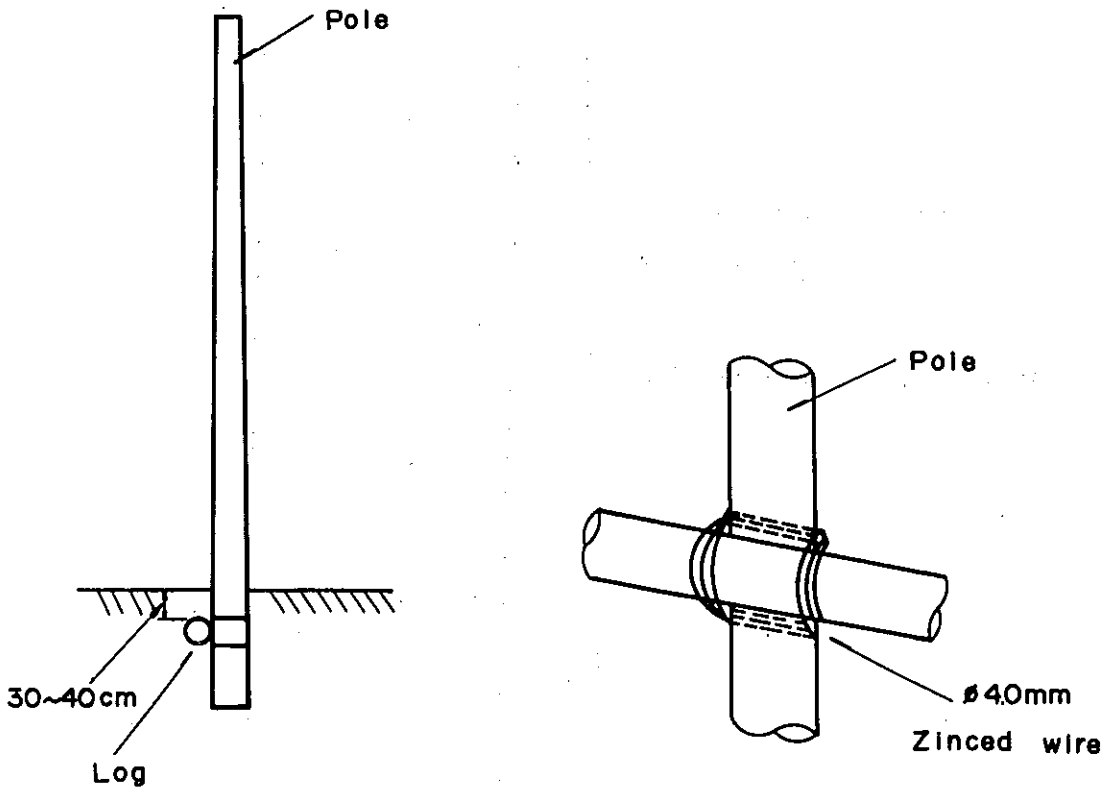


Fig. IV.1.2.1.4. Mounting Log Crib

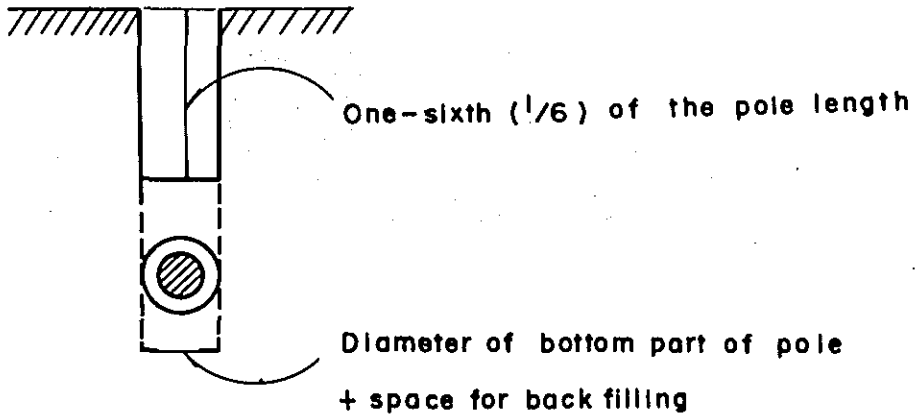


Fig. IV. 1.2 1.5 Cylindrical Hole Type

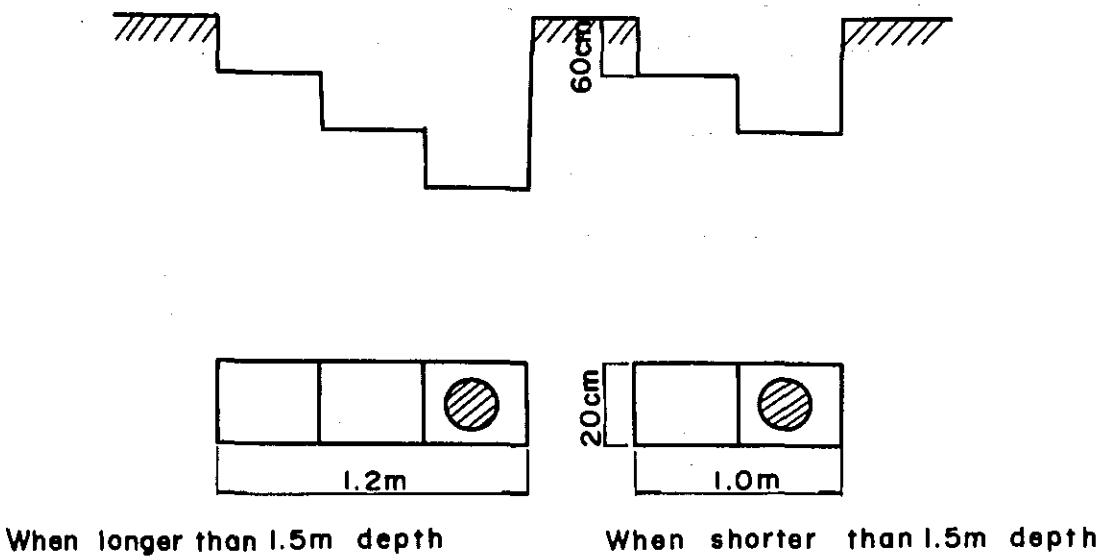


Fig. IV. 1.2.1.6 Stepped Hole Type

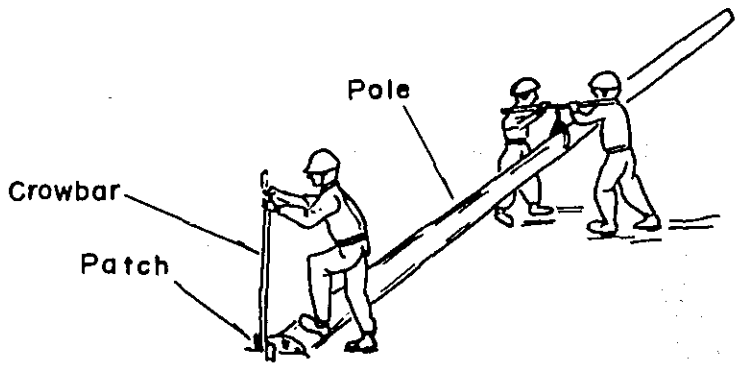


Fig. Ⅳ.1.2.1.7 Installation of Pole

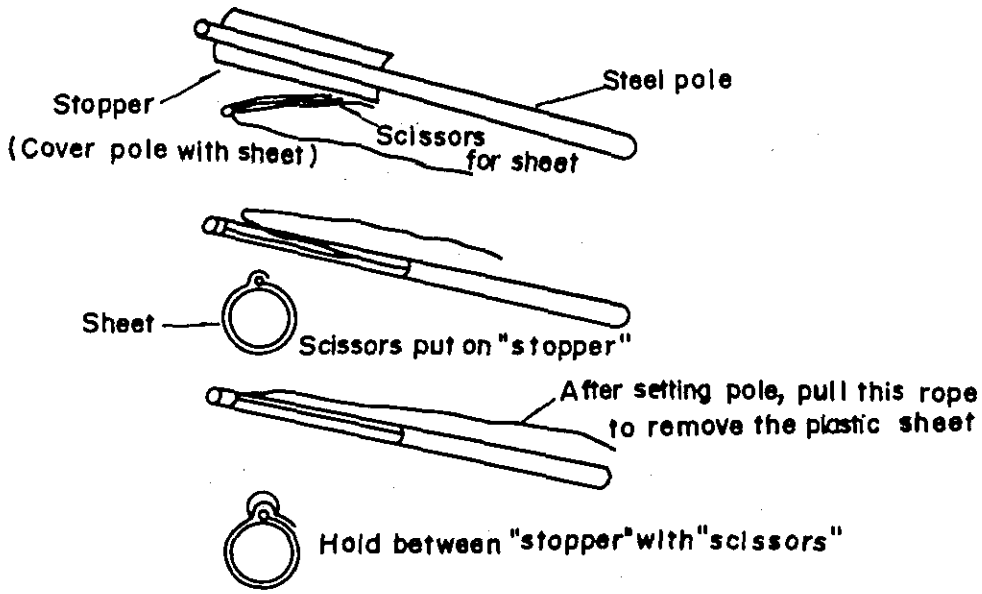


Fig. Ⅳ.1.2.1.8

Mounting a Plastic Sheet to Protect Installation Personnel from Electricity

1.2.2 Stay

1.2.2.1 Composition

A stay shall consist of an upper stay and a lower stay. A steel stranded wire shall be used for the upper stay, and an anchor for the lower stay.

Stays shall be attached to end poles supporting aerial cables and SD wires and angle poles for aerial lines.

1.2.2.2 Stay Installation

(1) Stay installing angle

Stay installing angle shall be from 35° to 45°. In cases where stays cannot be installed within this range of angles, they shall be installed at angles as close to them as possible.

(2) Burying lower stay

Anchors of the construction shown in Fig. IV. 1.2.2.1 shall be used for lower stays, and installed as mentioned below.

a) Digging anchor holes and driving resisting plates

Holes measuring approximately 80 cm long, 30 cm wide and 30 cm deep shall be dug at spots where lower stays will be buried. Drive a resisting plate straight up into a hole dug up by using an anchor driving tool opposite to the side where a pole is located. (See Fig. IV. 1.2.2.2)

Drive guiding plates into the ground until their top is more than 10 cm under the ground level. (See Fig. IV. 1.2.2.3.)

b) Driving stable plates

Insert stable plates into the guiding plates, which have already been driven into the ground, and drive the stable plates along the guiding plates, until the index line shown in Fig. IV. 1.2.2.4 is reached. Push the guiding plates so they will fall toward the stays. If the guiding plates do not fall, the stable plates must be driven in deeper. Drive the stable plates in further until the guiding plates fall toward the stays.

c) Rod installation

Connect the guiding plates to rods with bolts and nuts, and tamp back-filled holes hard. Fig. IV. 1.2.2.5 shows a rod which has been installed.

(3) Upper stay installation

Various kinds of steel stranded wires, 30 mm^2, 35 mm^2 and 45 mm^2, shall be used for upper stays. Install them as mentioned below depending on the kinds of cables and poles to be installed. Table IV. 1.2.2.1 shows the application of steel stranded wires.

a) Attaching upper stays to Japanese standard poles

Attach upper stays to Japanese standard poles by using bolts and guy grips as shown in Fig. IV. 1.2.2.6.

b) Attaching upper stays to Burmese standard poles

Attach upper stays to Burmese standard poles with guy grips as shown

in Fig. IV. 1.2.2.7.

(4) Stay guard

Yellow plastic cylindrical stay guards shall be installed as shown in Fig. IV. 1.2.2.8.

(5) Connecting upper and lower stays

To connect upper stay steel stranded wires to lower stay rods, use a flexible wire pulling tool to pull the stays tautly, and use guy grips. Fit the stay guards over the stays prior to their connection.

The installing method is shown in Fig. IV. 1.2.2.8.

Table Ⅳ. 1. 2. 2. 1 Application of Stay Wire and Rod.

(A) Application of end pole

Kind of S.S wire	Kind of staywire	Kind of stay rod
7/1.6	30mm²	S
7/1.8	30 〃	S
7/2.0	35 〃	S
7/2.3	45 〃	S
7/1.6 x 2	35 〃	S
7/1.8 x 2	45 〃	S
7/2.0 x 2	35 〃 x2	M

(B) Application of angle pole

Kind of S.S wire	Kind of stay wire	Kind of stay rod
7/1.6	30 mm²	S
7/1.8	〃	S
7/2.0	〃	S
7/2.3	〃	S
7/1.6 x 2	〃	S
7/1.8 x 2	〃	S
7/2.0 x 2	45 〃	S

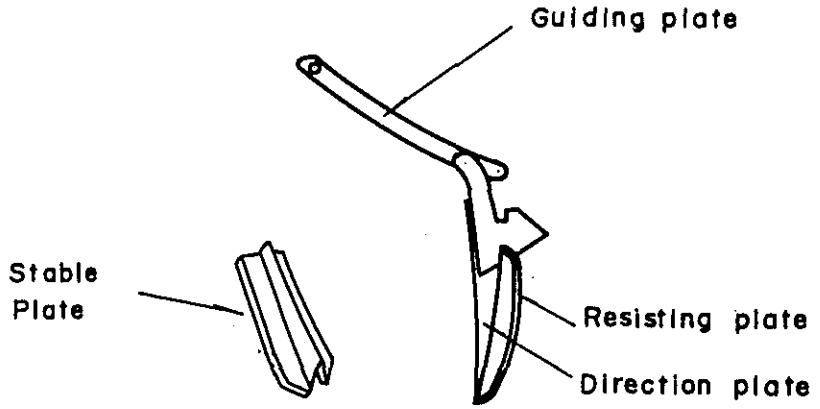


Fig. Ⅳ. I. 2.2.I Stay Anchor

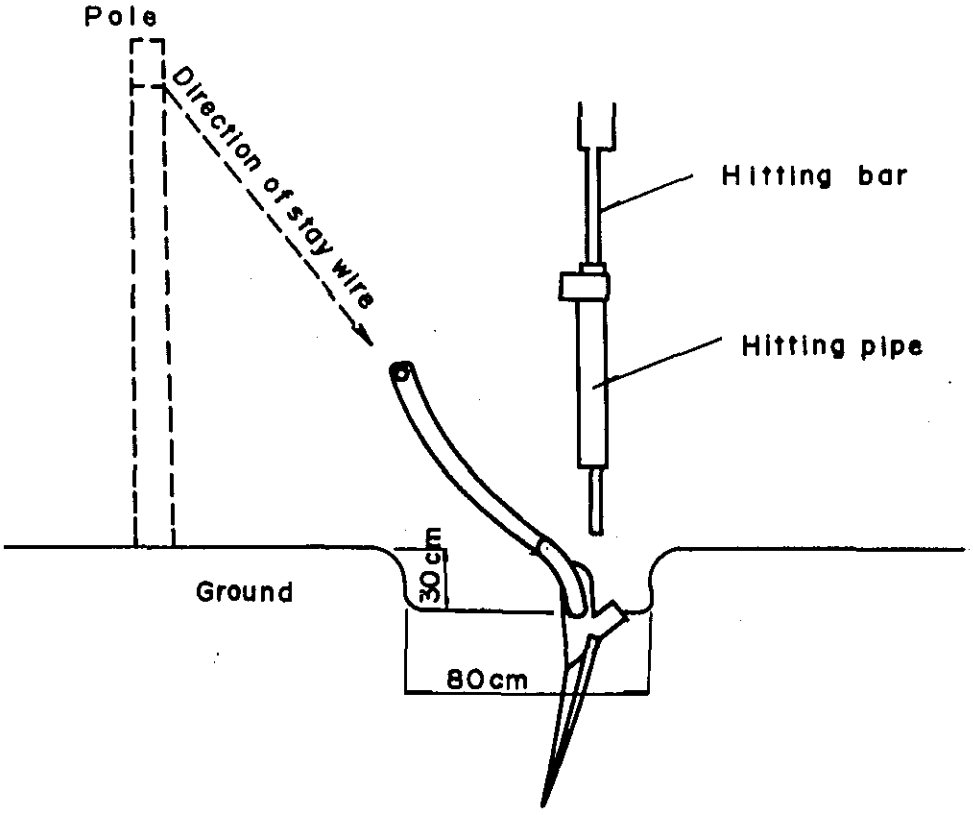


Fig. Ⅳ. I.2.2.2 Installation of Stay Anchor (1/4)

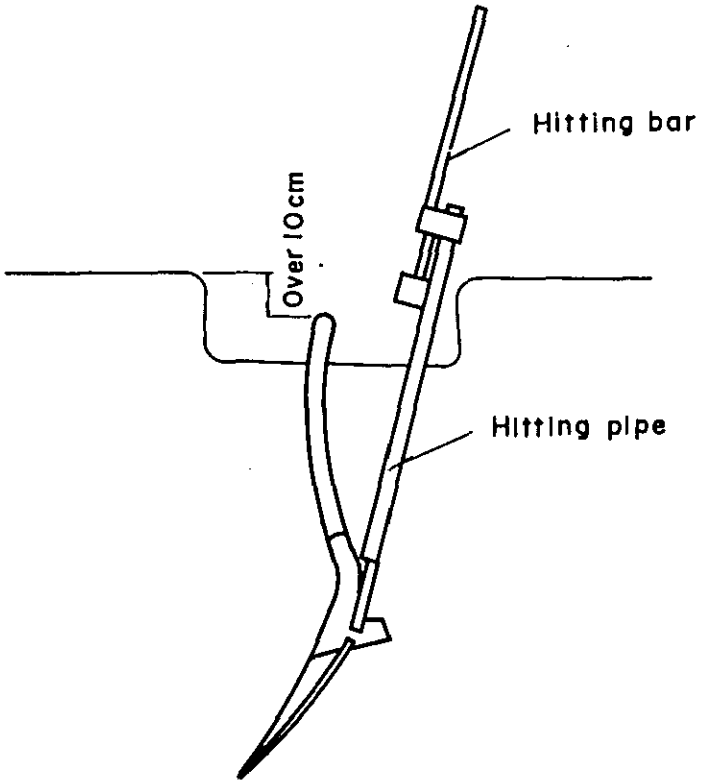


Fig. Ⅳ.1.2.2.3. Installation of Stay Anchor (2/4)

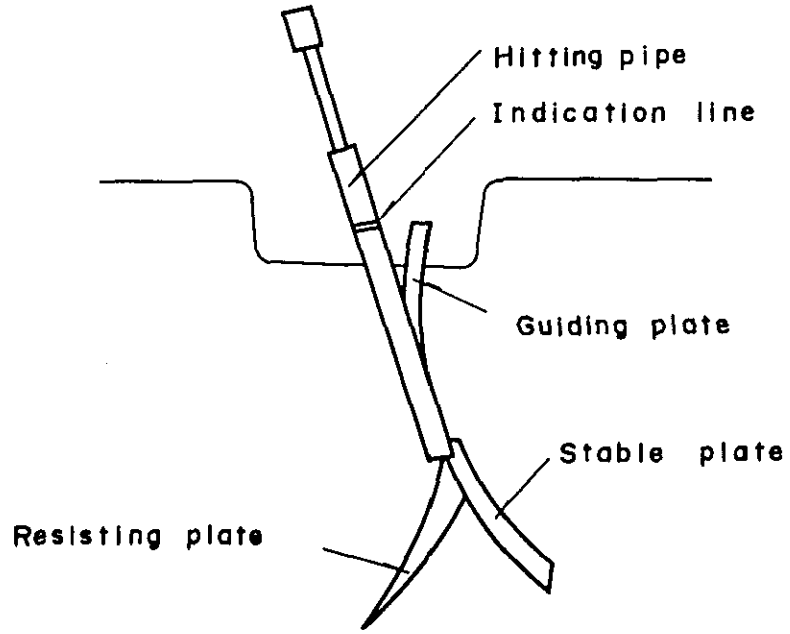


Fig. Ⅳ.1.224. Installation of Stay Anchor (3/4)

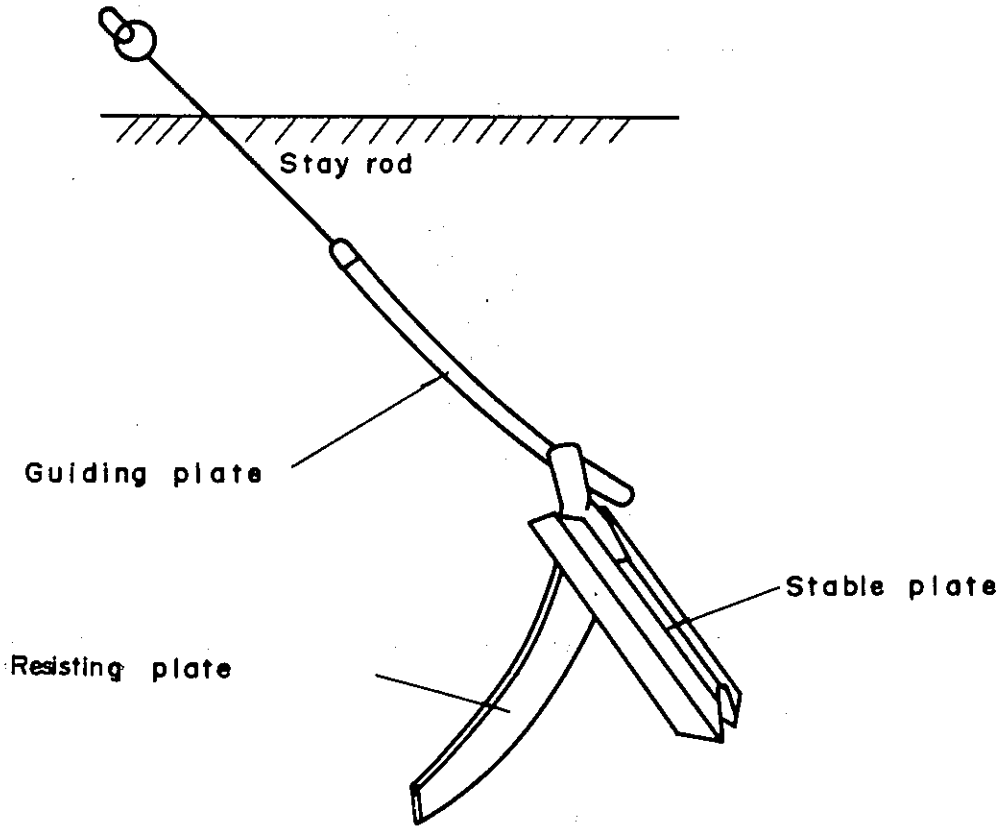


Fig. Ⅳ.1.2.2.5 Installation of Stay Anchor (4/4)

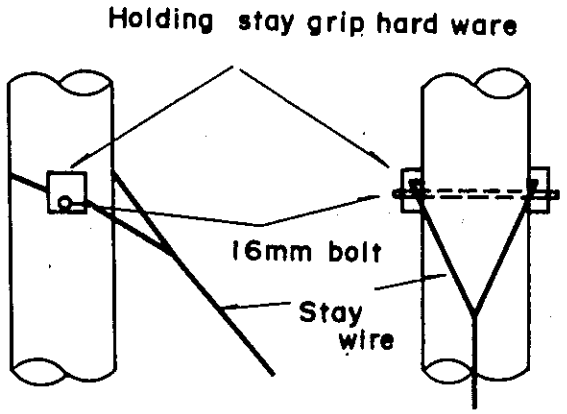


Fig. IV. I. 2. 2.6. Mounting Stay for Japanese Standard Pole

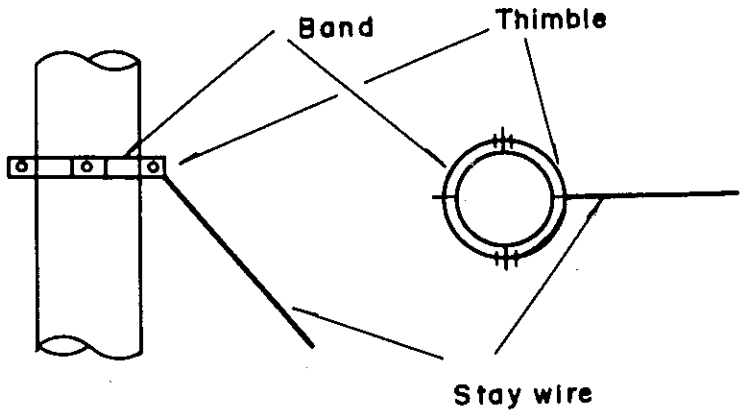


Fig. IV. I. 2. 2.7. Mounting Stay for Burmese Standard Pole

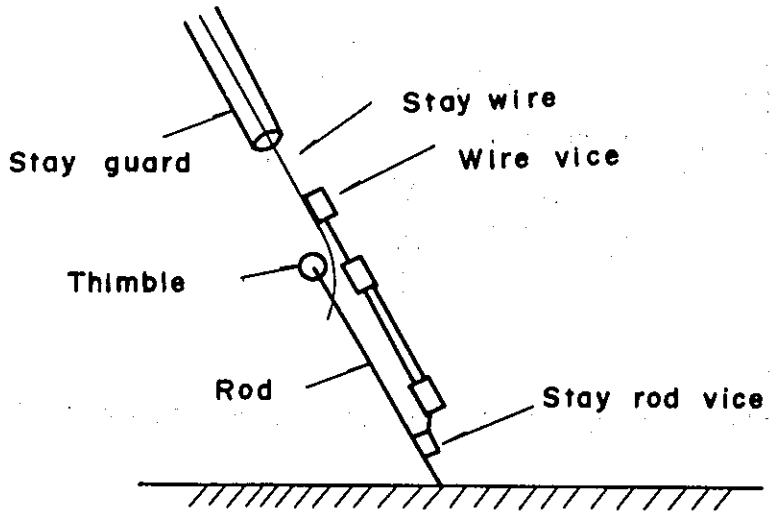


Fig. Ⅳ.1.2.2.8 Connection of Stay Wire and Stay Rod

1.2.3 Strut

Use bands for attaching struts to Japanese standard poles and install log cribs. The installing method is shown in Fig. IV. 1.2.3.1.

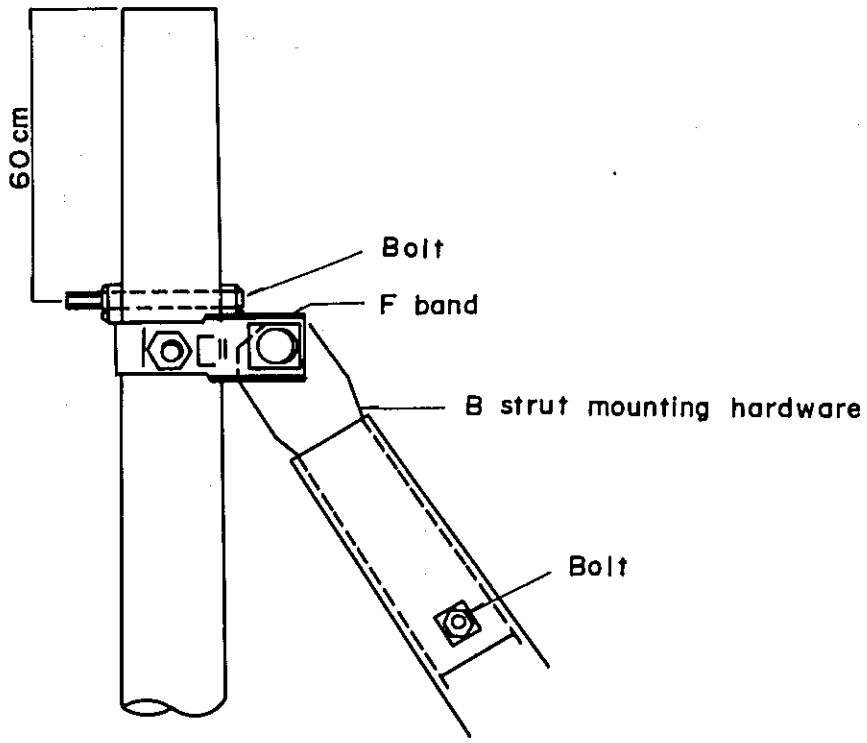


Fig. Ⅳ.1.2.3.1. Mounting Strut

1.2.4 Aerial Cable

CCP-AP-SS cables shall be used as aerial cables under this Project. The kinds of cables used are shown in Table IV. 1.2.4.1.

1.2.4.1 Installation of CCP-AP-SS Cables

Sufficient care shall be taken not to damage the cable sheathing when installing cables. The cable installation work procedure is shown below.

(1) Measurement of pole span

Prior to cable installation, measure pole spans in sections where cables will be installed, and select the necessary cable pieces. When measuring pole spans, a careful check must be made on the stays for looseness, etc.

(2) Attaching SS cable pinch hanger.

Attach SS cable pinch hanger on poles to support self-supporting wires when installing SS cables.

In case of Japanese standard poles, use bolts for attaching SS cable pinch hanger on poles as shown in Fig. IV. 1.2.4.1; and in case of Burmese standard poles, use bands for the same purpose.

(3) Attaching pulleys

Attach No. 4 pulleys on the cable pulling-in side, cable pulling out side and angle poles, and No. 2 pulleys on the other poles by using a pulley hanger as shown in Fig. IV. 1.2.4.2.

(4) Placing cable drums

CCP cables have directivity as indicated by colors. Lay cables so that the "upper end" will come to the exchange and the "lower end" to subscribers.

If the wound end of a cable reel is the "lower end", place the cable drum at the exchange end of a cable laying section; and if the wound end of it the "upper end", place the cable drum at the subscriber end, using a cable jack.

(5) Attaching and pulling pull-rope

As shown in Fig. IV. 1.2.4.3, attach a pull rope to cable with cable grips, run it from pulley to pulley until it covers the entire cable installation section.

When pulling a cable, pull it at a constant speed of less than 20 meters per minute, maintaining an appropriate tension to keep the cable from drooping.

Cable bending radius shall be more than 6 times the cable outside diameter.

(6) Anchoring cables to poles

Keep an appropriate tension for installed cables by using SS wire pulling tools. Anchor them to poles with grips. Fig. IV. 1.2.4.4 shows an example of anchoring a cable to a pole.

(7) Attaching self-supporting wires to SS cable pinch hangers

Attach self-supporting wires to SS cable pinch hangers as shown in Fig.

IV. 1.2.4.5 beforehand, and then mount the hangers on poles with hanger supporting bolts or bands.

First, install self-supporting wires at the center pole in a cable laying section, and then at the center pole in each sub-section as shown in Fig. IV. 1.2.4.6 to equalize cable tension over the entire cable section.

(8) Cable twisting

Twist the cable at the rate of one turn per ten meters to prevent dancing in the wind. When attaching self-supporting wires to SS cable pinch hangers make a twist by using a cable twisting tool so that both spans on the right and left of the pole will have a twist. If there is a difference in span between the right and left sides, the number of twists should be determined on the basis of the shorter span. (See Fig. IV. 1.2.4.6)

(9) Required ground clearance

In case cables should cross main roads, there shall be a clearance of more then 5 meters as a rule.

(10) Separation from power lines

In principle, un-insulated power lines and telephone lines shall be more than 0.6 m apart from one another.

1.2.4.2 Splicing CCP Cables

(1) Cable splicing points

In principle, cables shall be spliced at a point 40 cm or 60 cm from a pole in a ready access terminal box. A ladder car shall, in principle, be used for work to be done at a high place, such as cable splicing. At places where a ladder car cannot be used, a ladder shall be used. Fig. IV. 1.2.4.7 shows a ready access terminal box mounting position and cable splicing position.

(2) Cable splicing

a) Conductors shall be spliced, twisted and then soldered. Fig. IV. 1.2.4.8 shows conductor splicing. In case of splicing CCP cables together, match the conductors by color and start splicing them with the center one (Conductor No. 1) and proceed outward.

b) Splice positions (PE sleeve arrangement) in a ready access terminal box and the application of PE sleeves are shown in Fig. IV. 1.2.4.9 and Table IV. 1.2.4.2.

c) Conductors which are not spliced at cable reduction point shall be provided with an extra splicing length and treated with end PE sleeves.

(3) Installing ready access terminal boxes (RATB)

The shape of the ready access terminal box is shown in Fig. IV. 1.2.4.10. The ready access terminal box is classified into three types, i.e., straight type, single branch type and both branch type, which differ from one another in methods of use as shown in Table IV. 1.2.4.3.

A cable splicing method is shown below.

a) Cutting off cable sheath

Disengage an SS cable self-supporting wire from cable, cut off the cable sheath as shown in Fig. IV. 1.2.4.11. Cut 12 cm of cable sheath by using a lap cutter.

b) Fitting inner clamps

Wind PVC tape and sealing tape together around the cable core until the diameter is equal to the inside diameter of an inner clamp. Then fit the inner clamp over it as shown in Fig. IV. 1.2.4.12. Fig. IV. 1.2.4.13 shows an inner clamp fitted over the cable core.

c) Clamping cables and installing side covers

Clamp self-supporting wires and cables by means of sheath clamps and free sheath clamps.

Fig. IV. 1.2.4.14 shows an installation diagram. After installing ready access terminal boxes, bind every 10 pairs of cables in them with a conductor as the same clored of coarse binding tape and fit a cover.

1.2.4.3 Installing 4-terminal Block

4-terminal block is used for connecting cable conductors and drop wires. A 4-terminal block is shown in Fig. IV. 1.2.4.15.

(1) Installing 4-terminal block

Install 4-terminal block on the bottom plates of ready access terminal boxes.

(2) Connecting 4-terminal block with cable conductors

Use CCP connectors for connecting 4-terminal block with cable conductors. Cable conductor cutting points are shown in Fig. IV. 1.2.4.16. The lower conductor of the cut cable conductors must be placed in order in the ready access terminal box. Fig. IV. 1.2.4.17 shows the connection between 4-terminal block and cable conductors.

(3) Installation of drop wires and SD wires

Install drop wires and SD wires through holes in the ready access terminal boxes, and connect them to the terminals of the 4-terminal blocks.

1.2.4.4 Electrical Protection

(1) At the following points, the cable sheaths and self-supporting wires must be bonded to poles with 2 mm^2 600 V insulated wire.

(a) At every riser pole and end pole.

(b) At ready access terminal box mounted positions at intervals of 300 m to 500 m, in case the distance between the above-mentioned grounded points is in excess of 500 m.

(2) In case the self-supporting wires separate from each other, self-supporting wires must be bonded together with 2 mm^2 600 V insulated wires.

Table Ⅳ.1.2.4.1 Structure of CCP-AP-SS Cable

Kind of cable	Sheath thickness (mm)	External diamter (mm)	Self suporting wire (number/mm)	Approximate weight (kg/m)
0.4-30 CCP·AP·SS cable	More than 1.36	13.0	7/1.6	0.32
0.4-50 〃	〃 〃	15.0	7/1.6	0.40
0.4-100 〃	〃 〃	18.5	7/1.8	0.59
0.4-200 〃	〃 〃	24.0	7/2.0	0.96
0.5-30 〃	〃 〃	15.0	7/1.6	0.38
0.5-50 〃	〃 〃	17.0	7/1.8	0.51
0.5-100 〃	〃 〃	22.0	7/2.0	0.81
0.5-200 〃	〃 1.44	28.5	7/2.3	1.35
0.65-30 〃	〃 1.36	17.0	7/1.8	0.51
0.65-50 〃	〃 〃	20.5	7/1.8	0.69
0.65-100 〃	〃 1.44	27.0	7/2.3	1.20
0.9-30 〃	〃 1.36	22.5	7/2.0	0.79
0.9-50 〃	〃 1.44	27.0	7/2.3	1.17

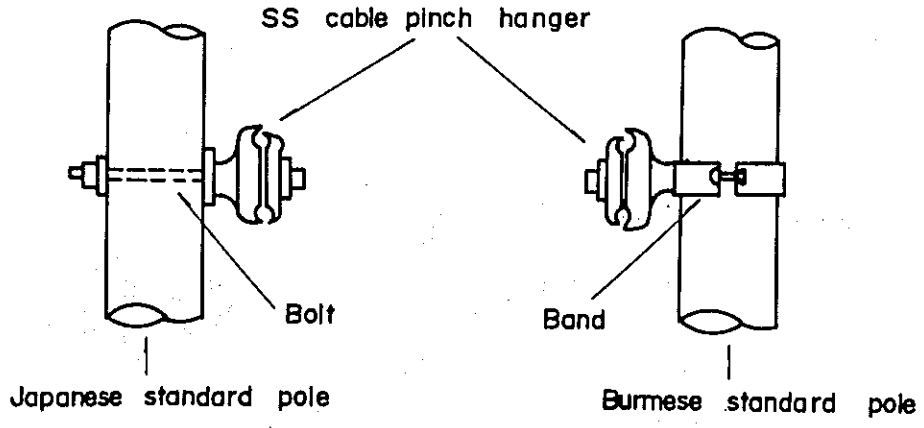


Fig. Ⅳ. 1.2.4.1 Attaching the Pinch Hanger

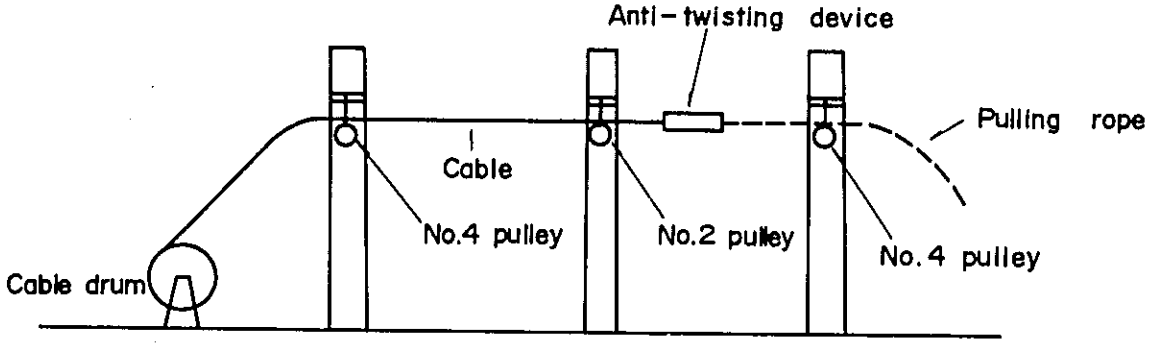


Fig. Ⅳ. 1.2.4.2. Used of Pulley

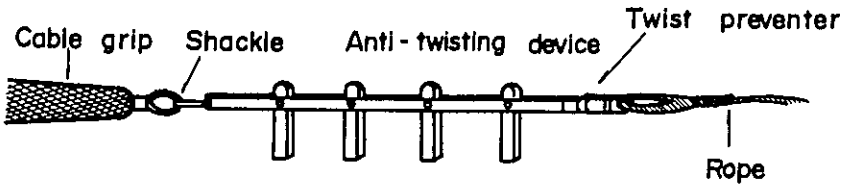
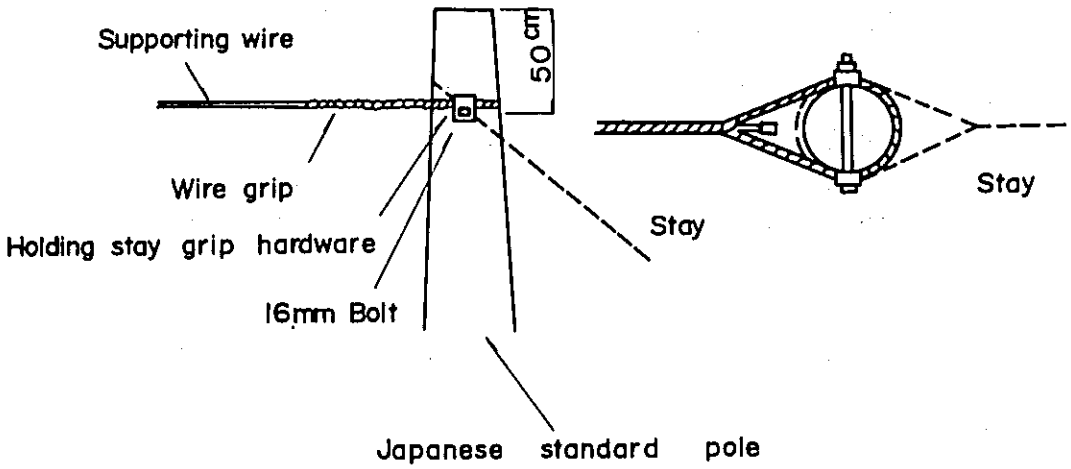


Fig. Ⅳ. 1.2.4.3. Attaching the Cable to The Rope



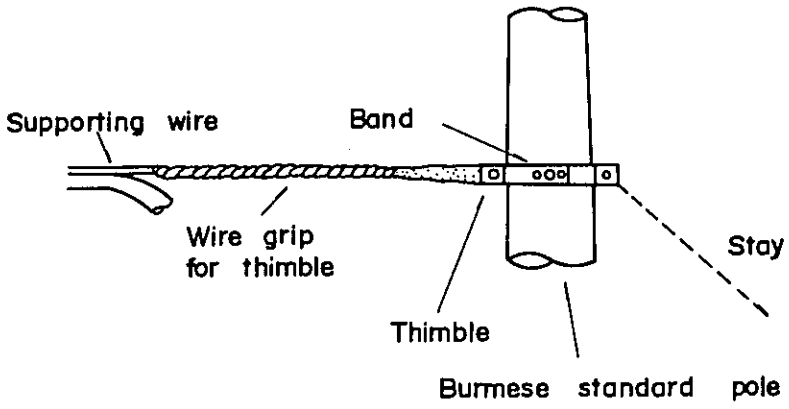


Fig. Ⅳ.1.2.4.4. Anchoring Cable

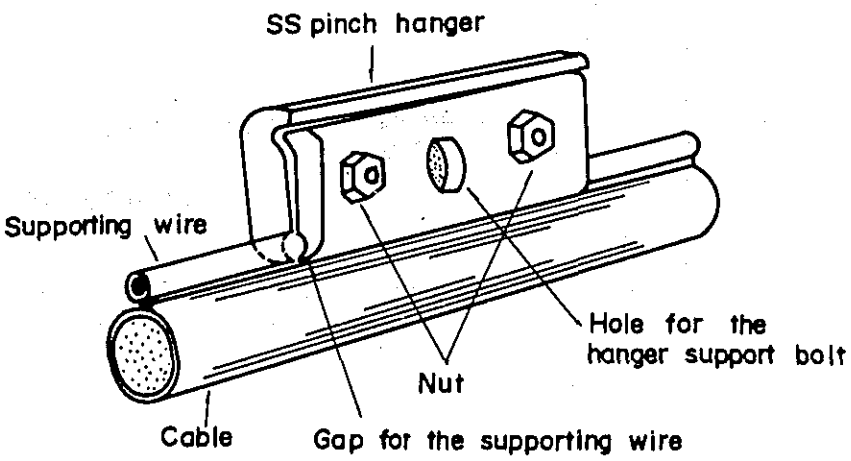
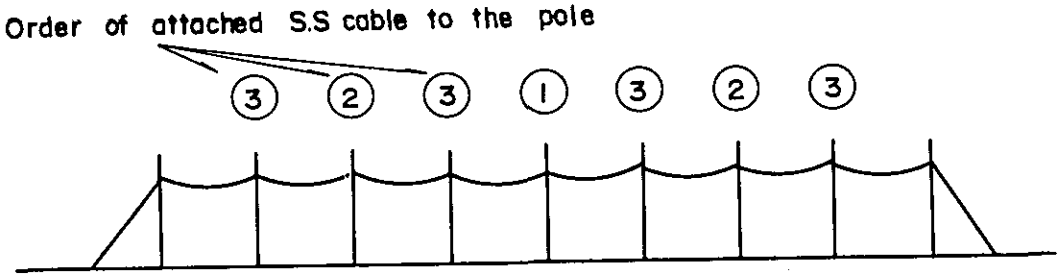


Fig. Ⅳ. 1. 2. 4. 5 Attached the Self-supporting Wire to the SS Pinch Hanger



Note; 1 On twisting the cable at the pole of order number "3", the cable of the both side span is twisted.

2 First pole attached S.S cable is center of all spans.

Fig. Ⅳ. 1. 2. 4. 6. Attached S. S. Cable to the Pole

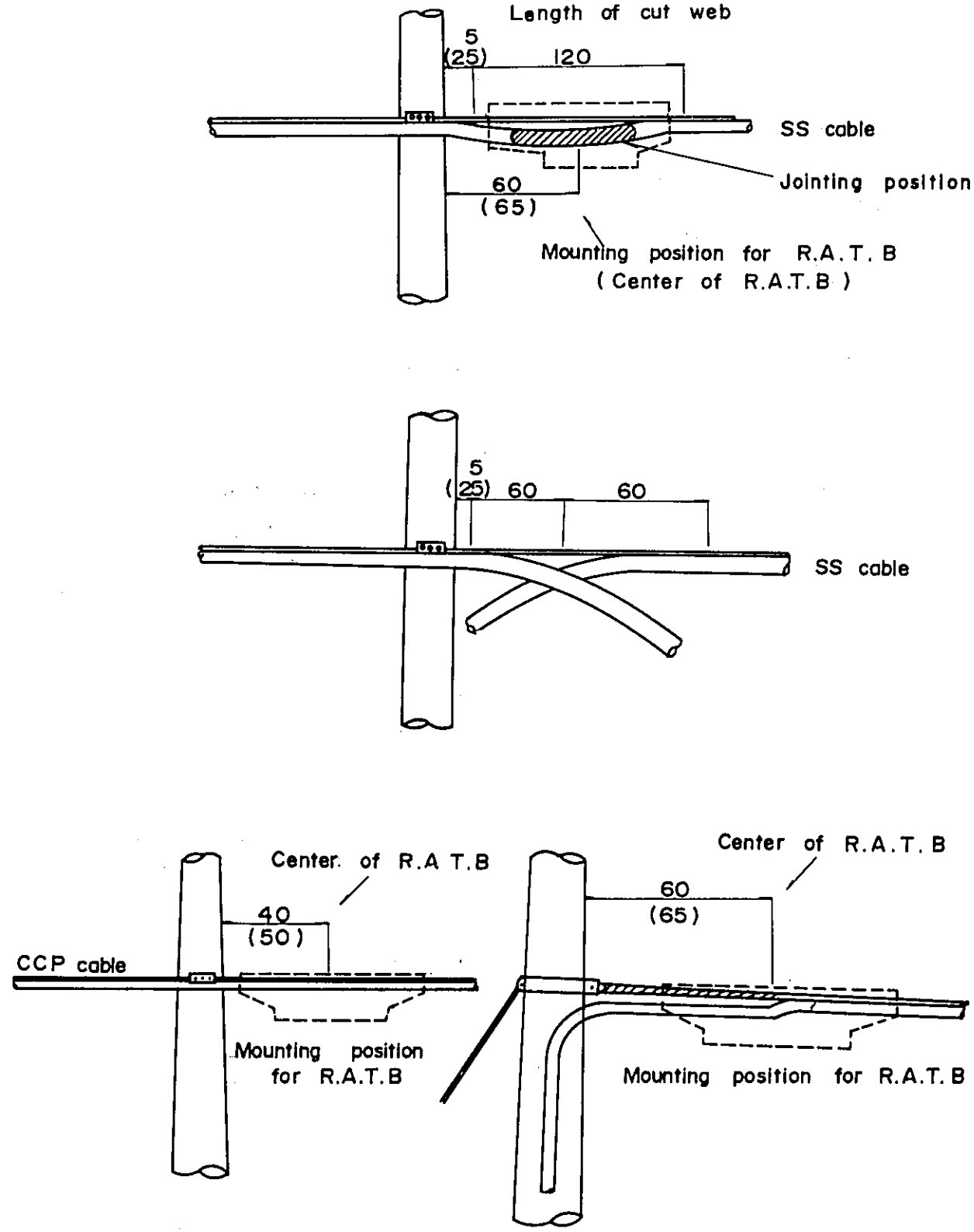


Fig. Ⅳ.1.2.4.7. Mounting Position

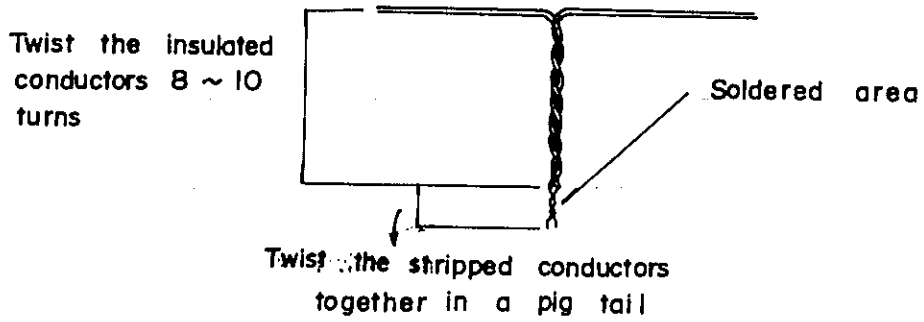
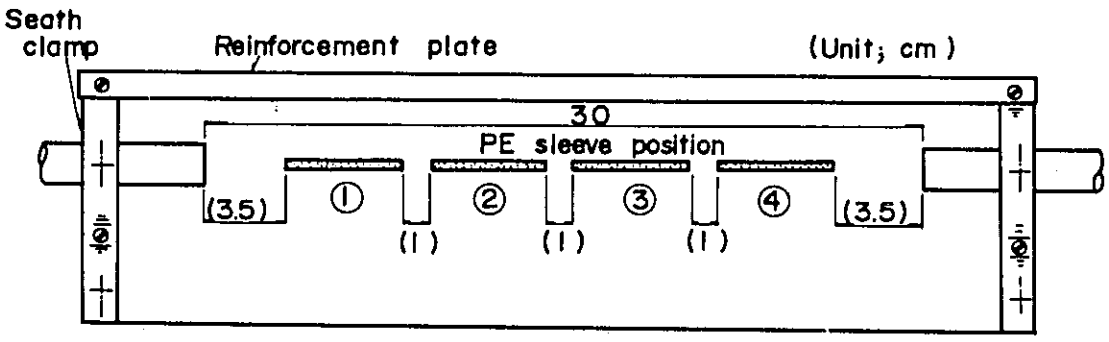


Fig. Ⅳ.1.2.4.8 Splicing the Conductor



Note; PE sleeve position (when splicing between CCP cables)

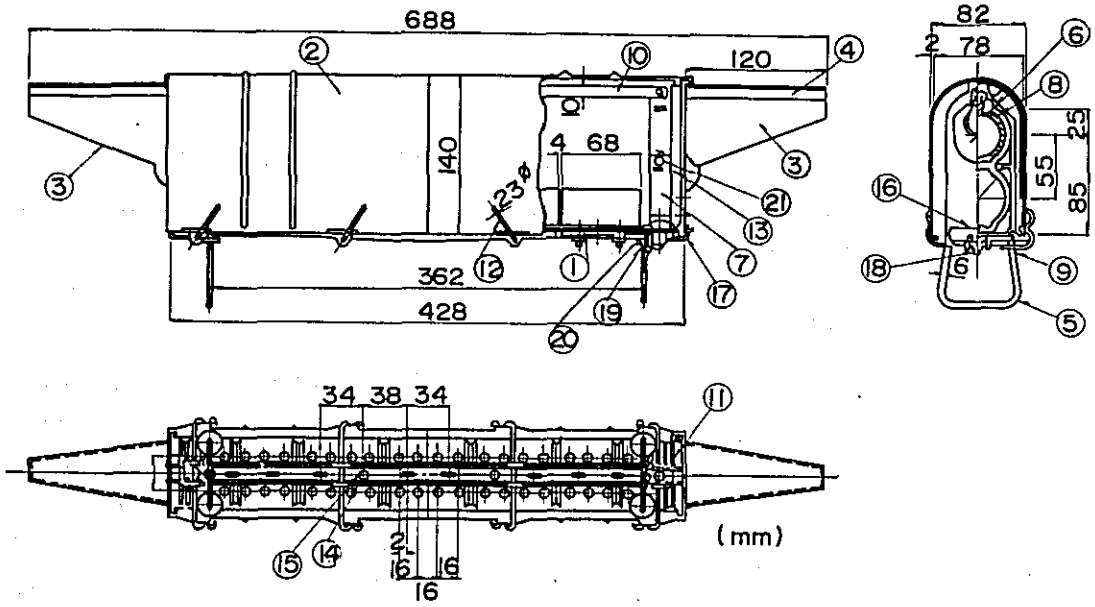
(a) Straight splice — The splices are made at points 1,2,3 and 4.

(b) Branch splice — The splices are made at three points, leaving at 1 point on the side of the branch cable. As an example, showing branching of the cable from the right of the figure, splicing is done at the three points 1,2 and 3.

Fig. Ⅳ 1. 2. 4. 9
Splice Position in the Ready Access Terminal Box
(PE sleeve position)

Table Ⅳ. 1. 2.4.2. Application of PE Sleeve

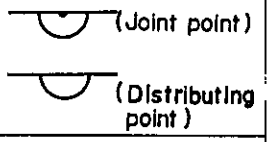
Kind of PE sleeve	Jointing conductors diameter	
	Straight joint	Multiple joint
0.4 mm	0.4 x 0.4 , 0.4 x 0.5	———
0.5mm	0.4 x 0.65, 0.5 x 0.5 0.5 x 0.65,	0.4 x0.4 x0.4, 0.5 x0.4 x0.4 0.5 x0.5 x0.4,
0.65 mm	0.4 x 0.9 , 0.5 x 0.9 0.65 x 0.65	0.5 x0.5 x0.5, 0.65x0.4 x0.4 0.65x0.5 x0.4, 0.65x0.5 x0.5 0.65x0.65x0.4, 0.65x0.65x0.5
0.9S	0.65 x 0.9	0.65x0.65x0.65, 0.4 x0.4x0.9 0.9 x0.5 x0.4, 0.9 x0.5 x0.5 0.9 x0.65x0.4, 0.9 x0.65x0.5
0.9L	0.9 x 0.9	0.9 x0.65x0.65, 0.9 x0.9 x0.4 0.9 x0.9 x0.5, 0.9 x0.9 x0.65 0.9 x0.9 x0.9,



No.	Name	Q'ty	Material	Plating
1	Bottom plate	1	PE	
2	Cover	1	"	
3	Straight side cover	2	"	
4	Nozzle lock	2	"	
5	Guide ring	2	"	
6	Sheath clamp	2		
7	Free sheath clamp	2		
8	Inner clamp	2	Stainless steel	
9	Angle for reinforcement of the bottom plate		"	
10	Reinforcement plate	1	"	
11	Rivet	2	"	
12	Cover stopper	4	"	
13	Sheath clamp screw	4	Brass	Nickel
14	Screw	2	"	"
15	Nut	2	"	"
16	Plane plate for reinforcement of the bottom plate	1	Stainless steel	
17	Side cover stopper	2	"	
18	Side cover stopper screw	2	Brass	Nickel
19	Side cover stopper nut	2	"	"
20	Side cover stopper washer	2	"	"
21	Ground washer	2	"	"

Fig. IV. 1.2.4.10 Ready Access Terminal Box

Table Ⅳ.1.2.4.3. Application of R. A. T. B

Type	Number of 4 pair Terminal block	Number of terminal pairs	Symbol	Remarks
Straight type	5	20 pairs		400 pair type terminal box is only use at the jointing point of Riser cable. : shows 200pair type : shows 400 pair type
Blanch type	4	16 pairs		
Both blanch type	3	12 pairs		

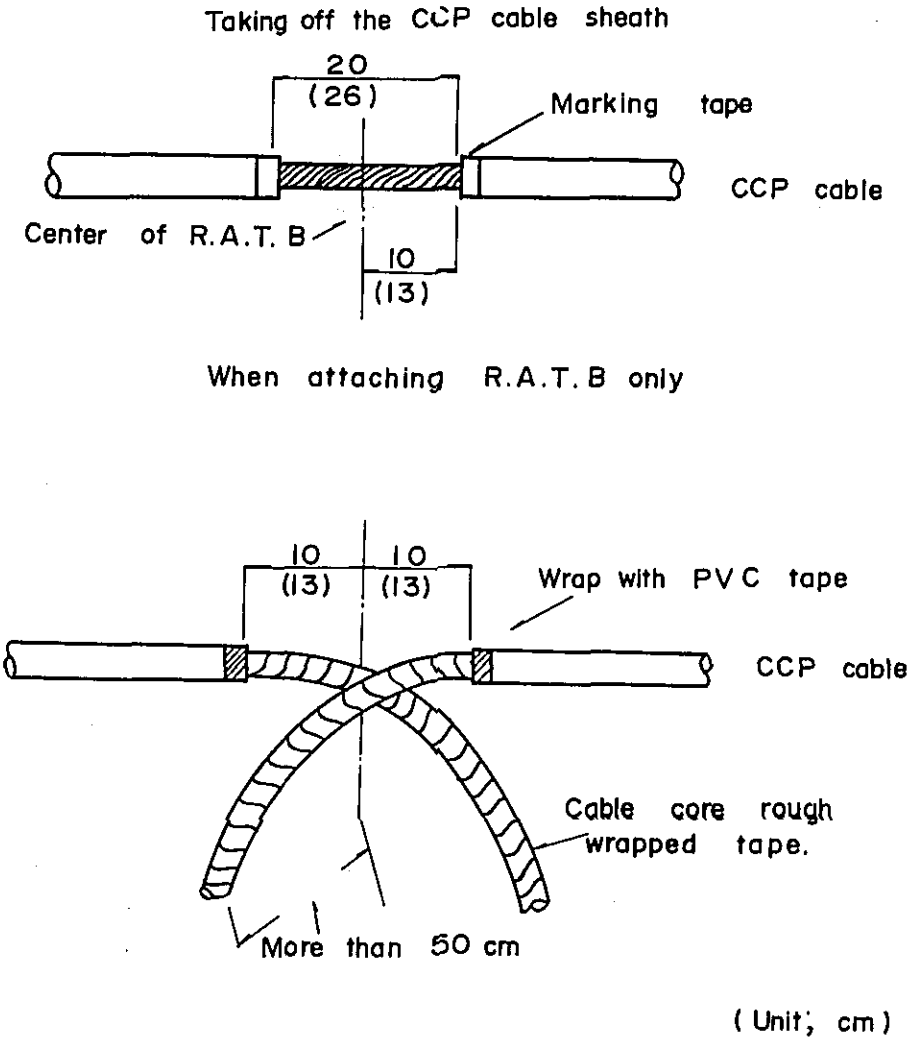
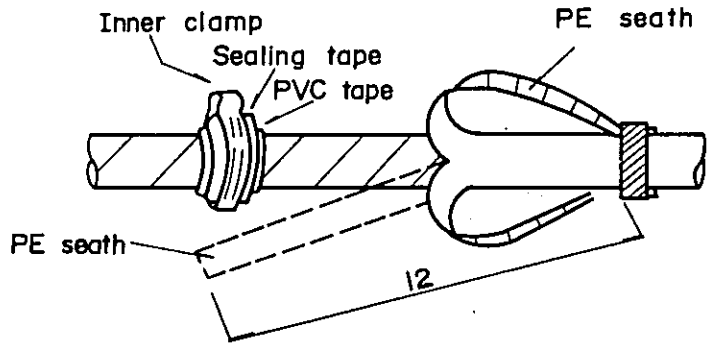
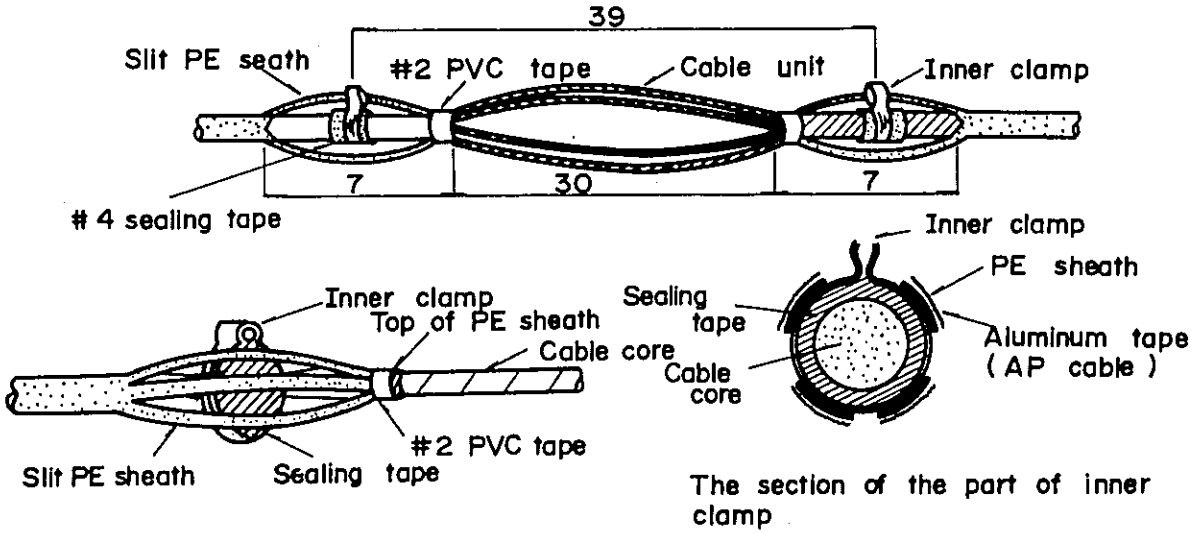


Fig. IV.1.2.4.11
Example of Taking off the CCP Cable Sheath for Attaching R.A.T.B.



(Unit : cm)

Fig. Ⅳ.1.2.4.12. Attaching the Inner Clamp (A)



Note: Do not .remove the rough wrapped tape.

(Unit : cm)

Fig. Ⅳ.1.2.4.13 Attaching the Inner Clamp. (B)

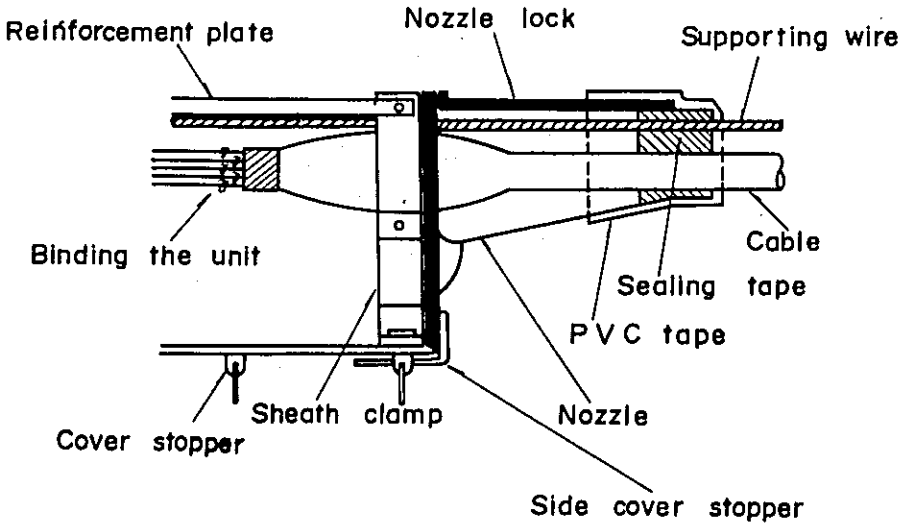
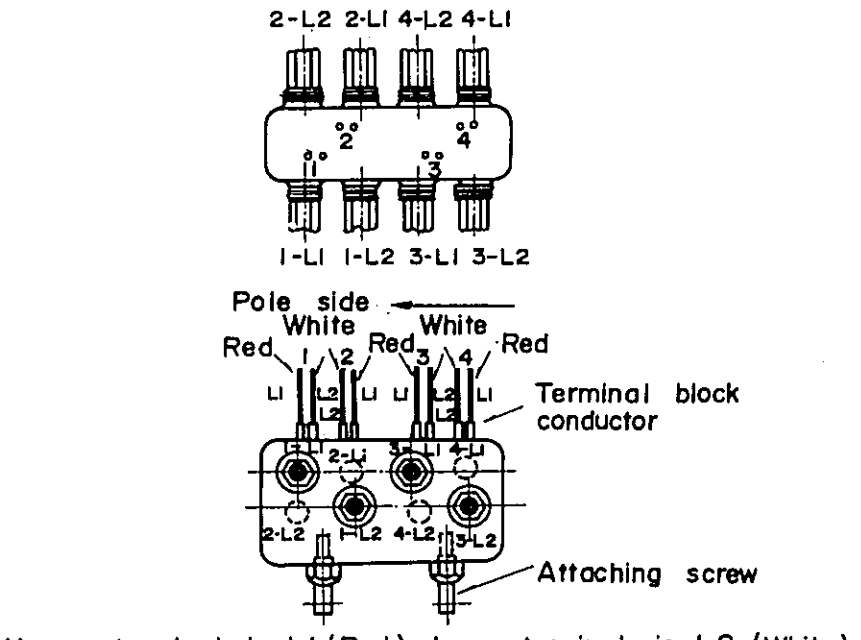


Fig. Ⅳ.1.2.4.14 Attaching the Side Cover



Upper terminal is L1 (Red), lower terminal is L2 (White)

Fig. Ⅳ.1.2.4.15. Terminal Block

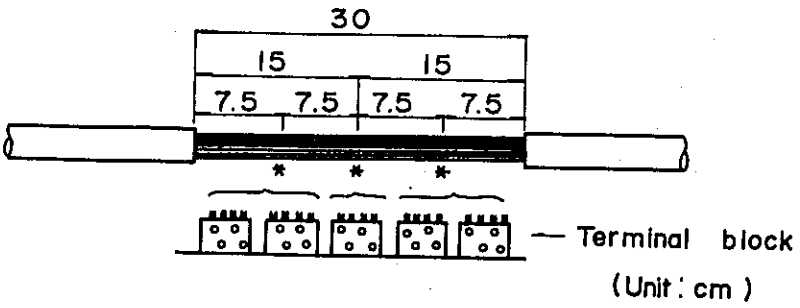
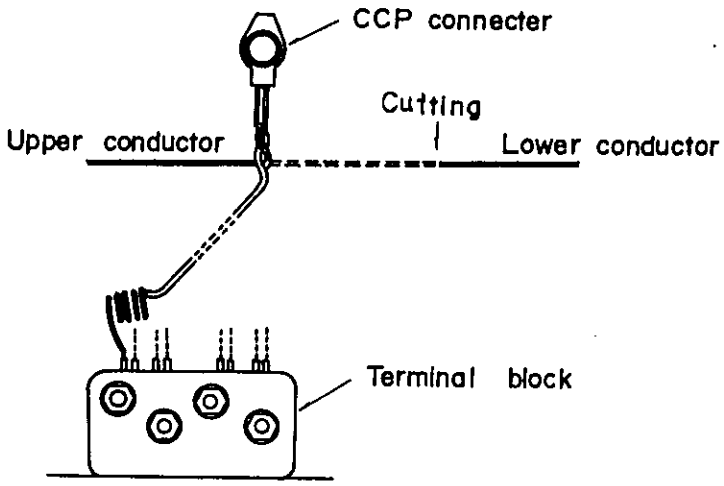


Fig. Ⅳ.1.2.4.16 Cutting the Cable Conductor



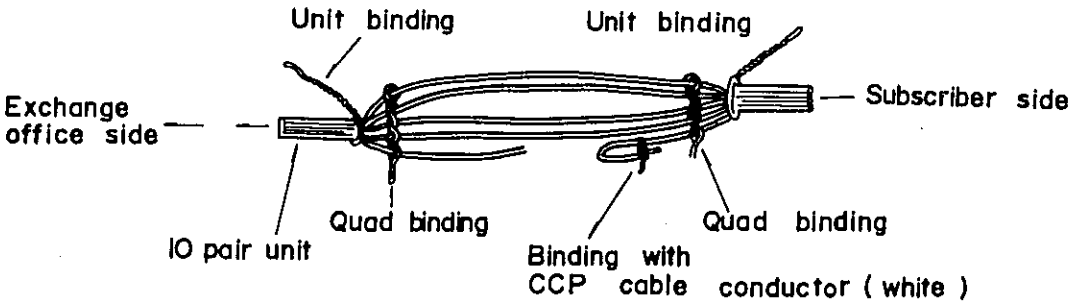


Fig. Ⅳ.1.2.4.17 Jointing Method of CCP Connecter

1.2.5 SD Wire

1.2.5.1 Kinds

Two kinds of SD wires, that is, 0.65 mm 6-pair SD wire and 0.9 mm 2-pair SD wire, shall be used.

1.2.5.2 SD Wire Installation

As in aerial cable installation, pulleys shall be used for installing SD wires.

SD pinch hanger shall be used for mounting SD wires to poles; and the C shaped wire detainer shown in Fig. IV. 1.2.5.1 for anchoring SD wires to poles.

1.2.5.3 Mounting SD Terminal Box

2-pair SD terminal boxes shall be mounted on poles with stainless steel bands as shown in Fig. IV. 1.2.5.2.

1.2.5.4 SD Wire Connection

SD wires shall be connected by using 2-pair SD terminal boxes.

1.2.5.5 Connecting SD Wires and Open Wires

Pole mounted protectors shall be installed at the points where SD wires are connected with open wires.

1.2.5.6 Electrical Protection

(1) In cases where SD wires are anchored, SD wire self-supporting wires shall be bonded with other self-supporting wires by 2 mm^2 600 V insulated wire.

(2) At the following points, SD wire self-supporting wires shall be bonded to poles.

a) Poles with pole mounted protectors.

b) End poles.

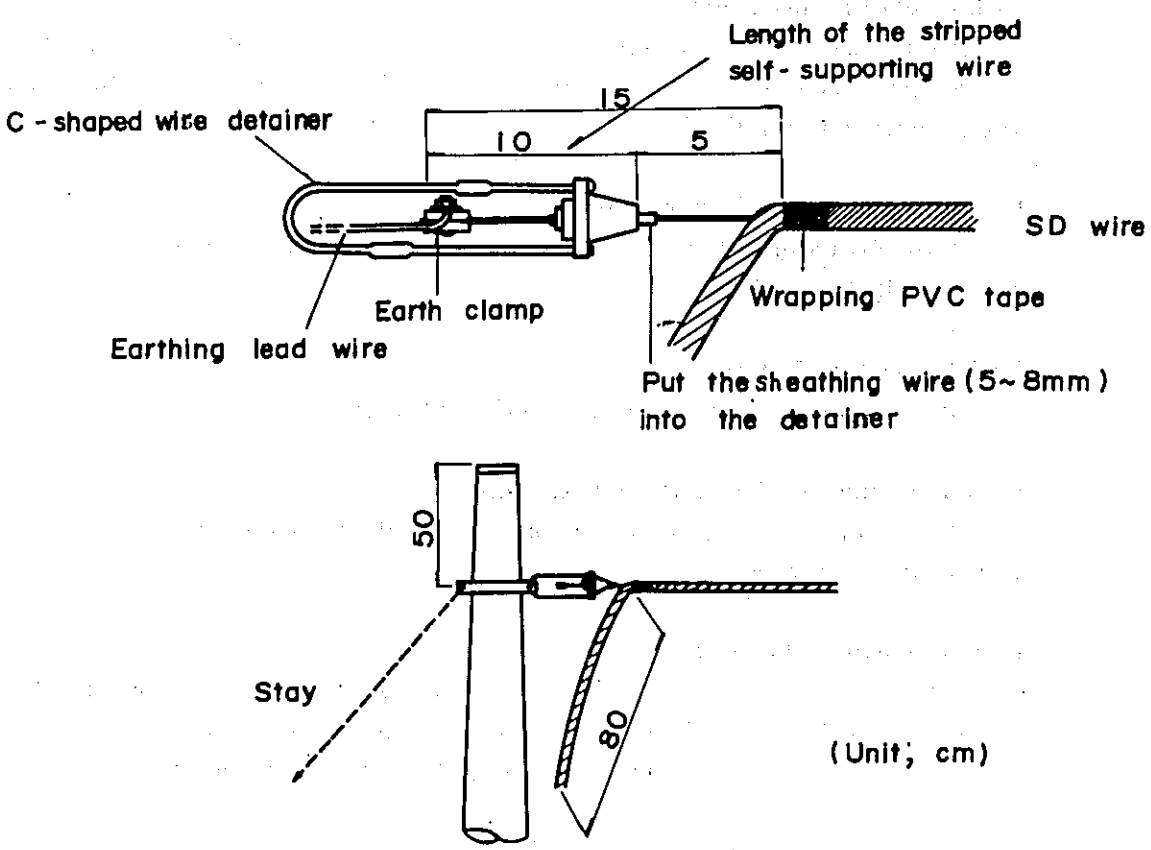
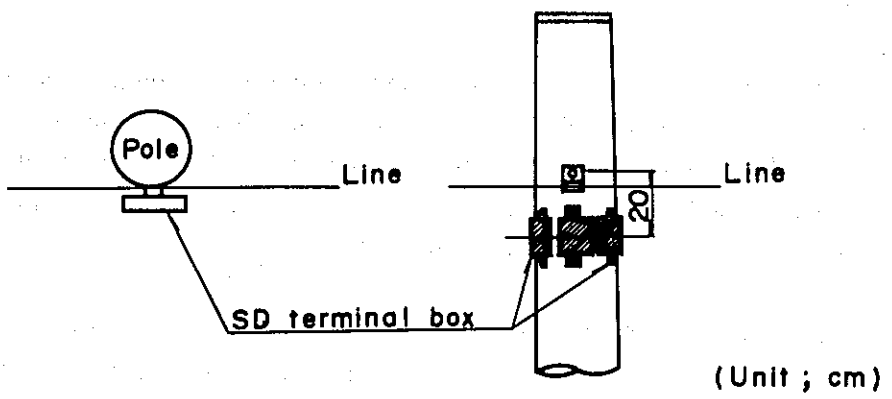


Fig. Ⅳ.1.2.5.1. Anchoring SD Wire



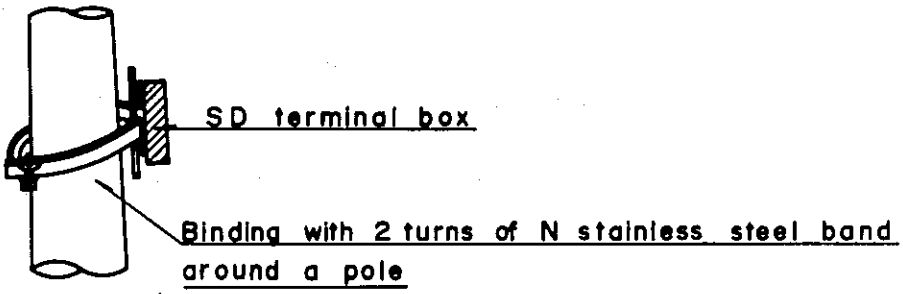


Fig.Ⅳ.1.2.5.2. Attaching the SD Terminal Box

1.2.6 Underground Cable

1.2.6.1 General

(1) Kinds of cables

PEF-LAP cables shall be used as underground cables under this Project. In principle, non-armored cables shall be used in conduit sections, and tape armored cables in direct buried sections. However, tape armored cables with jelly filled-in (JF cables) shall be used in underground section of distribution cable route.

Cable composition is shown in Table IV. 1.2.6.1.

(2) Cable laying

Cables shall be handled with due care so as not to damage the sheathing. Cable bending radius shall be more than 6 times the cable diameter, and repeated bends shall be avoided.

a) Check and record filled-in gas pressure before and after cable laying and confirm that it is correct.

b) Cable laying in conduit sections.

i) Before laying cables in conduit sections, conduct a test to see that cables can be passed through conduits, clean and check the conduits using wire brushes and waste as shown in Fig. IV. 1.2.6.1. A.

ii) After the inspection mentioned above, confirm the safety of cable laying by using a mandrel and/or a chisel such as the one shown in Fig. IV. 1.2.6.1. B, and lay cables.

iii) In laying cables, care shall be exercised not to apply an abrupt tension to cables. Cables shall be laid at a rate of about 10 meters per minute.

c) Cable laying in direct buried sections

i) Cable burying depth

Buried cables shall, in principle, be laid at a depth of 120 cm. In case of laying them across hard-paved roads or railways, or along bridges, 100 mm anti-corrosion steel pipes shall be used.

ii) Cable protection

Buried cables shall be protected with bricks or the like. After back-filling, the earth shall be tamped hard, and the roads shall be restored to the original condition so as not to impede traffic after completion of cable laying. An outline of cable protection is shown in Fig. IV. 1.2.6.2.

(3) Cable splicing

a) Precautions to be taken before splicing

i) In case of splicing cables in manholes filled with water, water

must be discharged. After water has been pumped out, moisture in the manholes shall be sufficiently removed before starting to work.

ii) Conductor joint shall be done while preventing intrusion of moisture and keeping the atmosphere dry.

b) Conductor joint

i) Cables shall be spliced in the following procedure:

- o Determining how much cable sheath should be cut off.
- o Inserting the lead sleeve.
- o Cutting off cable sheath. See Fig. IV. 1.2.6.3.
- o Splicing conductors.
- o Plumber work on cable sheath.

ii) Cable sheaths shall be connected by using lead sleeves and putty to keep the joints watertight, and the joints shall be strong enough to resist gas leaks, vibration and tension. Cable sheaths shall be connected with an aluminum tape bond as shown in Fig. IV. 1.2.6.4.

iii) In jointing conductors, twisted joint shall be made. Junction cables shall be soldered on all pairs. See Fig. IV. 1.2.6.5.

iv) Conductors shall be jointed as continuously as possible, avoiding interruptions in work as much as possible. If work must be interrupted, the conductors shall be covered with adhesive rubber sheets or other temporary waterproof means. A method of temporary waterproof protection is shown in Fig. IV. 1.2.6.6.

v) Spliced joints in direct buried sections shall be protected with metal protective covers, and a waterproof compound shall be injected into them. A joint protection method is shown in Fig. IV. 1.2.6.7.

vi) Dry air shall be filled into junction cable and subscriber underground cables (except JF cable).

1.2.6.2 Junction Cable

(1) Cable laying

Hanthawaddy Exchange Office shall be regarded as the upper end and Mayangon Exchange Office as the lower end. Care shall be exercised in laying junction cables not to make mistakes in directions.

(2) Loading

a) Loading type shall be 88 m H-type.

b) At the loading point, pair numbers shall be cross checked with those of the upper ranking exchange office. After that, loading coils shall be inserted.

c) The number of conductors to be loaded shall be 350 pairs.

d) Stub cable conductors shall be connected by a balloon connecting method as shown in Fig. IV. 1.2.6.8.

(3) Final tests

The following final tests shall be made on junction cables. Reference final test values are shown below.

Item	Power supply	Measuring circuit	Reference value	Remarks
Insulation resistance	DC	Side circuit	More than 50 M ohms	250 V 50 M ohms megger
Conductor resistance and unbalance	DC	Side circuit	Less than 58 ohms in loop resistance Less than 1% of conductor resistance (loop resistance)	Except loading coil resistance
Characteristic impedance	800 Hz	Side circuit	1015 ohms ±10%	Short-circuit and open-circuit impedances are measured and calculated
Near end crosstalk attenuation	800 Hz	Side circuit	More than 65 dB	

Note: Characteristic impedance calculating formula:

$$|Zo| = \sqrt{|Zs| \cdot |Zf|} \qquad \varphi o = \frac{\varphi s + \varphi f}{2}$$

where,

Zs: short-circuit impedance

Zf: open-circuit impedance

φs: short-circuit phase angle

φf: open-circuit phase angle

1.2.6.3 Subscriber Feeder Cables

(1) Riser cables

a) 0.4 mm, 400-pair cable with dam shall be used as riser cables at riser points. The composition of these cables is shown in Fig. IV. 1.2.6.9.

b) In case of raising spare units, such units shall be provided with extra length for splicing, given cable-end treatment, and held up in the ready access terminal box.

1.2.6.4 Tie Cables

(1) Kinds of cables

a) PVC terminating cables shall be used for termination to MDF. The between MDFs and C2 type automatic exchanges. They shall be aerial cables and installed with 45 mm² stranded wires.

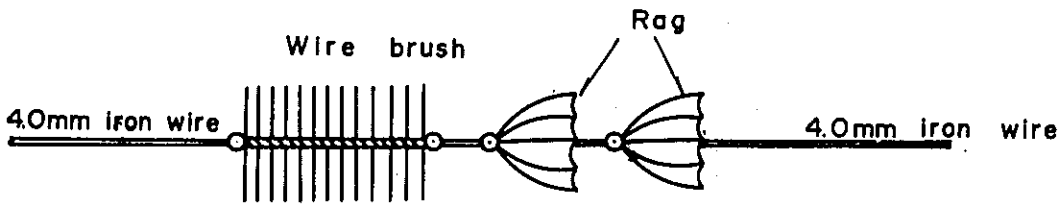
b) Two hooks shall be installed on the building of Mayangon Exchange Office to anchor the stranded wire. Cable outlets shall be reinforced as shown in Fig. IV. 1.2.6.10 and then given waterproof treatment.

Table Ⅳ.1.2.6.1 (A) Kind of PEF - LAP Cables

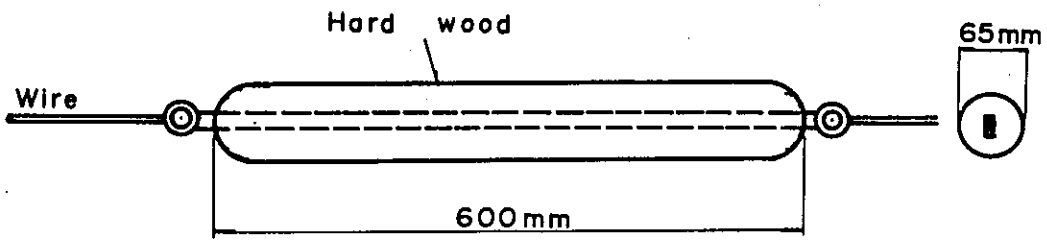
Conductor		Diameter of cable core (m.m)	Laminate -sheath thickness (mm)	Non-armoured cable		Armoured cable		Remarks
Diameter (mm)	Number of pairs			External Diameter(mm)	Weight (kg/m)	External Diameter(mm)	Weight (kg/m)	
0.9	400	54	more than 4.0	62	5.9	—	—	Junction conduit cable
"	400	54	3.4	—	—	72	9.4	Junction & subscriber cable
0.5	400	30	2.04	—	—	45	3.6	Subscriber cable
"	600	36	2.12	—	—	53	5.3	
0.4	400	24	1.87	—	—	39	2.7	
"	600	29	1.95	—	—	44	3.4	
"	800	34	2.12	—	—	49	4.2	
"	1 000	38	2.21	—	—	55	5.6	
"	1 400	44	2.38	50	4.2	—	—	Tie cable

(B) Kind of CCP - JF Cables

Conductor		Laminate -sheath thickness (mm)	Armoured cable		Remarks
Diameter (mm)	Number of pairs		External Diameter (mm)	Weight (kg/m)	
0.4	30	more than 1.36	24	1.0	



(A) Conduit cleaner



(B) Mandrel

Fig. Ⅳ. 1. 2. 6. 1. Materials for Test of Conduits

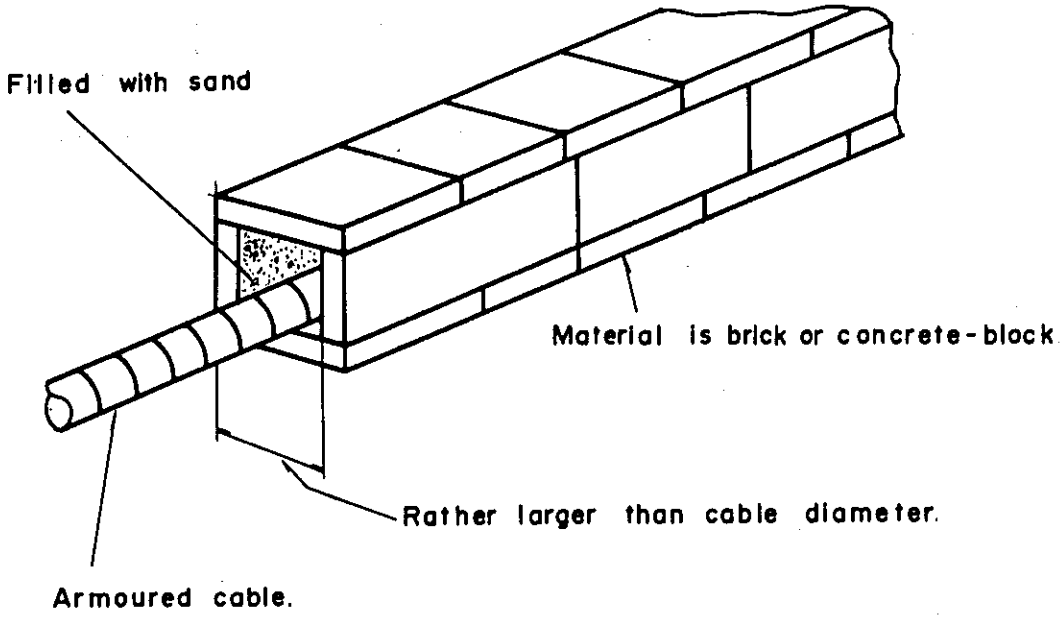
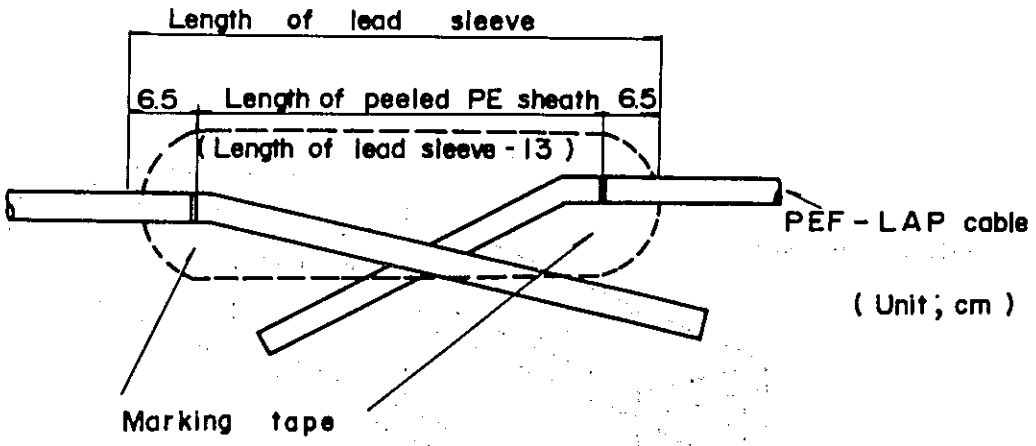


Fig. IV. I. 2. 6. 2. Protection of Cable



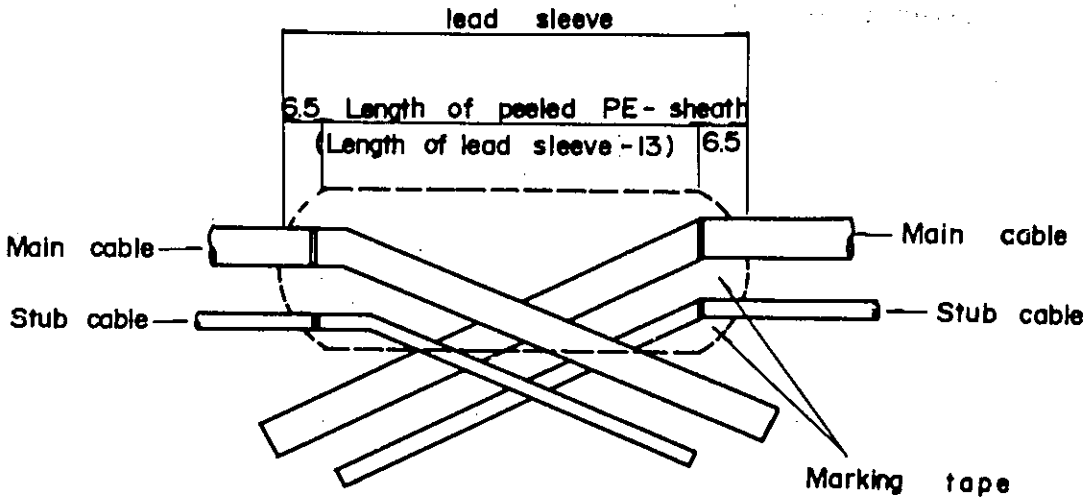


Fig. Ⅳ. 1. 2. 6. 3. Peeled PE -sheath

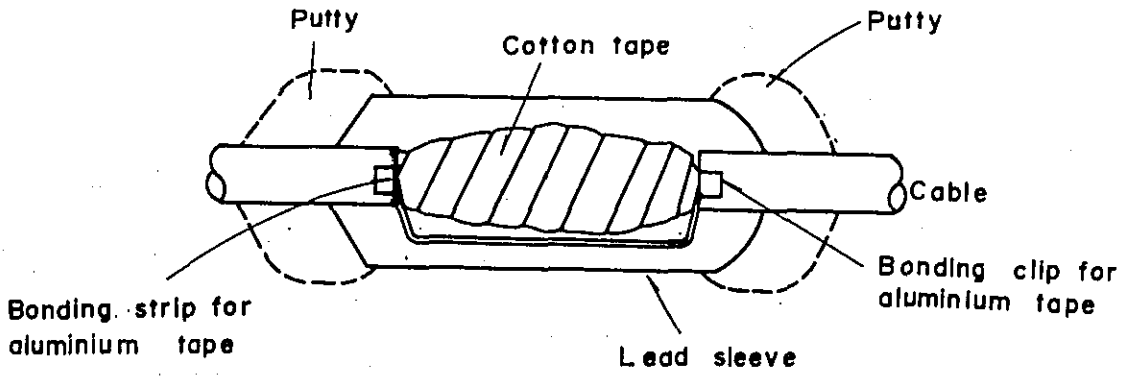
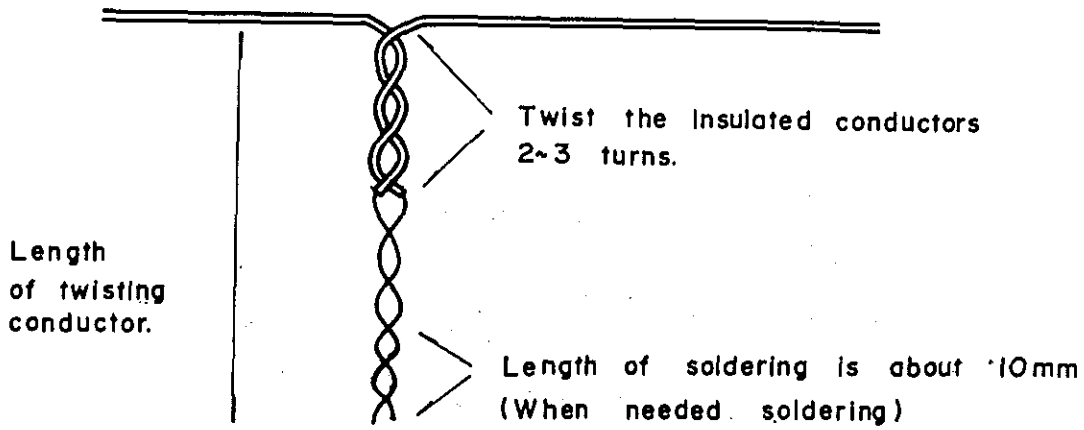
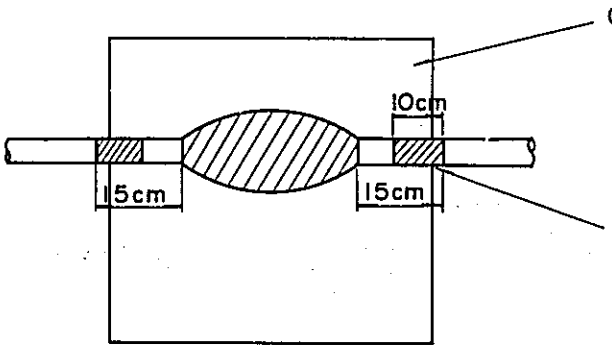


Fig. Ⅳ. 1. 2.6. 4. Attached Bonding Clip

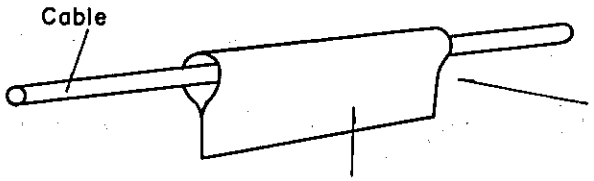


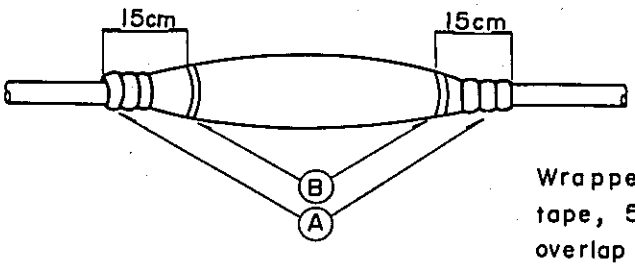
Diameter of conductor	Length of twisting	Number of twisting
0.4	20 ~ 25 mm	10 ~ 12 turns
0.5	25 ~ 30	〃
0.9	30 ~ 35	8 ~ 10

Fig. Ⅳ. 1. 2. 6. 5. Length of Splicing Conductor



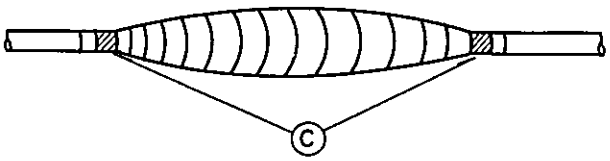
Enclosed the desiccat in the part of jointing point and wrapped with cotton tapes, 1/2 overlap bothways.





Wrapped with the rubber tape, 50mm width, 1/2 overlap bothways on the part of A

Wrapped with the adhesive V. N. tape on the part of B.



Wrapped with the rabber tape, 100mm width, on whole parts.

Wrapped with the adhesive V. N. tape on the part of C.

(Unit : cm)

Fig. IV.1.2.6.6. The Provisional Water-proof for the Joint

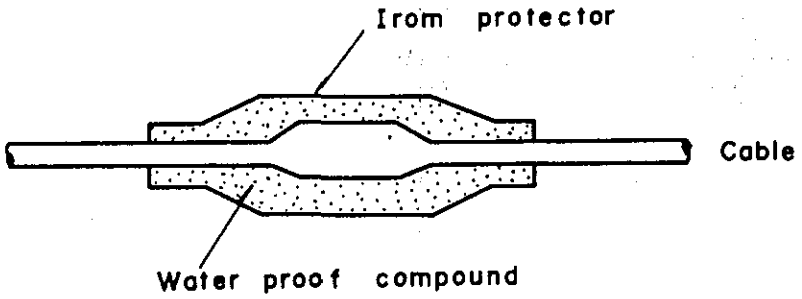


Fig. TV. 1. 2.6.7 Iron Protector

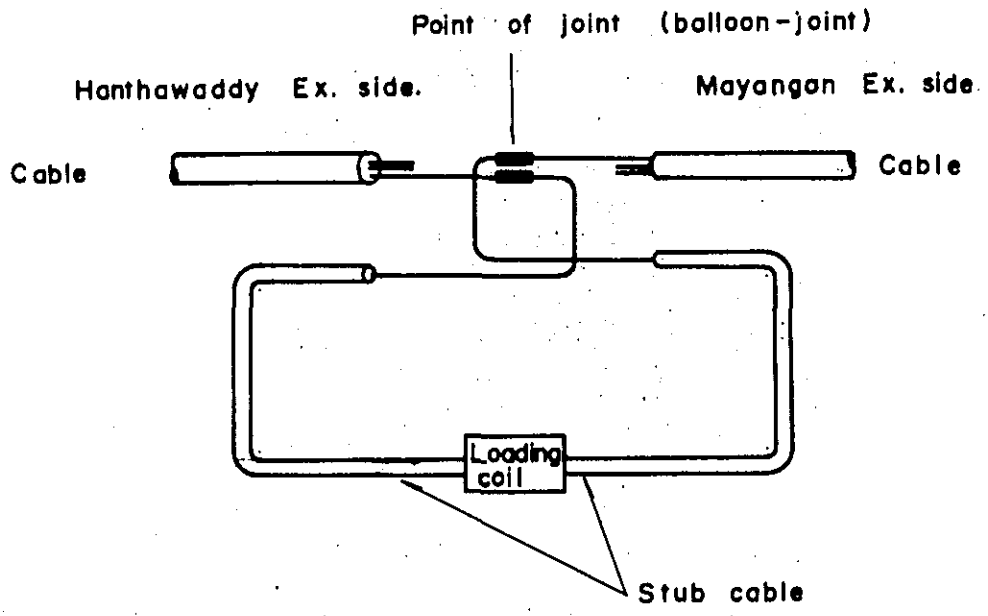
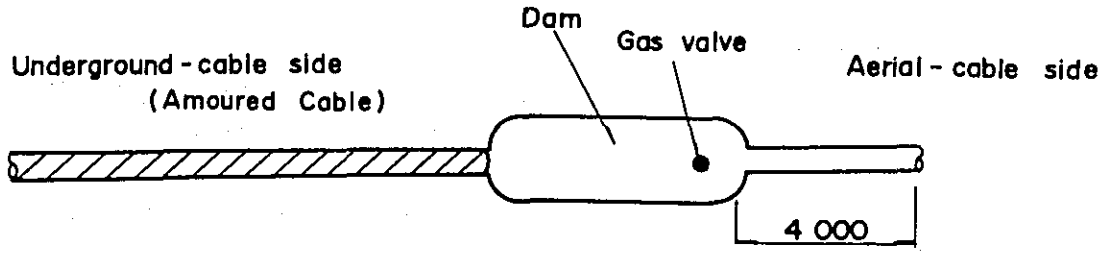
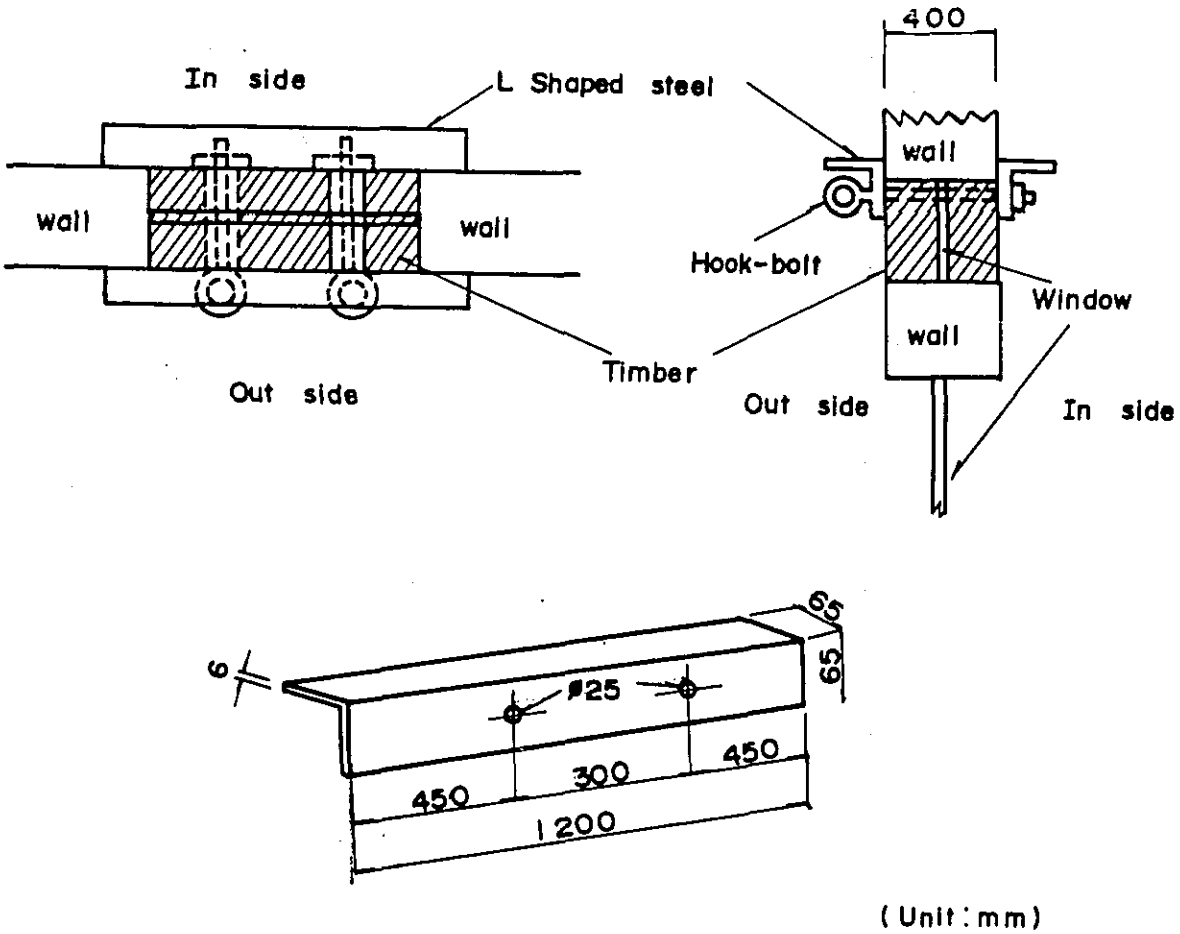


Fig. TV. 1. 2.6. 8. Balloon – Joint



(Unit : mm)

Fig. Ⅳ.1.2.6.9. CST Riser Cable with Dam and Gas-valve



(Unit : mm)

Fig. Ⅳ.1.2.6.10. Attaching Hook-bolt

1.2.7 Termination at MDF

1.2.7.1 Kinds of Cables

a) PVC terminating cables shall be used for termination to MDF. The composition of the cables is shown in Table IV. 1.2.7.1. Splicing PVC terminating cables with entrance cables is as shown in Fig. IV. 1.2.7.1.

b) PVC terminating cables' conductor covering is liable to expand, contract, or burn by heat. In cases where work involves use of a soldering iron, care shall be exercised not to keep it in contact with the conductor covering so long, nor bring it into contact with other conductors.

c) PVC terminating cables easily turn back from bent positions. This shall be kept in mind in selecting bending points. If necessary, cable bends shall be clamped with a suitable means.

1.2.7.2 PVC Terminating Cable Laying and Fanning Out

a) The terminating cable length shall be determined, based on the extra length for joint, the length required for laying in cable vault, the length necessary for farming out including the extra length for it, as shown in Fig. IV. 1.2.7.2. However, necessary length varies with the shapes of cable vault and MDF. Therefore, measurements shall be made whenever necessary in cable laying.

Standard extra length for fannning out shall be 80 cm and extra length for joint 50 cm. Junction cables shall have another 30 cm extra length for testing purposes.

b) Place a terminating cable on a work bench with nails spaced in the same way as actual wiring as shown in Fig. IV. 1.2.7.3, fix the cable with two nails at the butt and carry out fanning.

1.2.7.3 Raising Terminating Cables

After finishing the above, raise terminating cables to the MDF in the following order and bind them. Fig. IV. 1.2.7.4 shows terminating riser cable.

(1) Straightening terminating cables

Terminating cables are liable to return to former shapes even when they have been straightened so they must be well straightened before positioning them. All straightening shall be done by hand.

(2) Fastening terminating cables

After running terminating cables down from the MDF, fasten them as suitable to the shape of the cable vault.

(3) Binding terminating cables

Hook the straight portion of every terminating cable in comb form, and bind it to the flat steel of MDF.

1.2.7.4 Electrical Protection at Termination Portion

At termination portion, solder 2 mm² 600 V insulated wire to the aluminum tape wound around entrance cables, and connect the insulated wire to the ground terminal on MDF. (See Fig. IV. 1.2.7.8.)

1.2.7.5 Raising Cables in C Type Automatic Exchange

(1) Divide 1,400-pair tie cables into three parts and raise them to the terminal board of C2 type automatic exchange as shown in Fig. IV. 1.2.7.5. Splicing with terminating cables shall be horizontal.

(2) Three 200-pair cables shall be led in the C1 type automatic exchange and shall be raised to the terminal board of C1 type automatic exchange as shown in Fig. IV. 1.2.7.6.

1.2.7.6 Termination Dam

Termination dam shall be built at a point where the entrance cable and the terminating cable are connected to prevent moisture from entering from the terminating cable and shutting out gas (dry air) passage. In case of PEF-LAP cable, whose sheath is of laminated construction, a laminated tape for the termination dam must be wound around its sheath as shown in Fig. IV. 1.2.7.7 to prevent gas leakage along the sheath.

a) Termination dam shall be made in the following order.
Preparations → Inserting cable into tube and sleeve terminative cover → Bonding laminated tape → Peeling PE sheath → Treating the peeled part → Inserting floss silk → Conductor jointing → Injecting No. 5 compound → Installing spacer tape → Installing terminating covers, sleeves and tube → Injecting No. 3 A compound → Injection waterproof compound → Installing top cover.

b) Install ground wire by using aluminum tape connecting bond as shown in Fig. IV. 1.2.7.8, and connect them via the top cover to the ground terminal by using a 2 mm² 600 V insulated wire.

c) The No. 5 compound is a quick dry type so it must be injected quickly by changing injection points so it will reach all conductors in inner and outer layers as shown in Fig. IV. 1.2.7.9. If a hardener is added to the No. 5 compound, it must be used in less than 30 minutes.

1.2.7.7 Handling Compounds

a) No. 3A and No. 5 compounds will deteriorate with long storage. So their purchases must be so timed that they will be used within the valid period (less than a year and a half).

b) They shall be stored in a dry, cool, dark place.

c) If a hardener is added, the compound will start hardening in 1 or 2 hours. In that case, be sure to use it in less than 30 minutes.

d) Compounds are inflammable and so must be kept away from fire.

e) A hardener may inflame the skin if it touches it. Wash the skin well immediately with soap and water.

f) Use ethyl-alcohol for cleaning instruments in a well ventilated place, avoiding fire.

g) The hardener for the No. 3 A compound may burn if it is brought near fire or subjected to shock. Avoid such acts.

h) Before adding the hardener to the No. 3 A compound be sure to add a hardening accelerator and stir the compound well. If the hardener and hardening accelerator are mixed together, a great amount of heat will be generated. Never mix them together at the same time.

i) When disposing of any leftover of the No. 3 A hardener, dig a hole in the ground and let it permeate into the soil.

1.2.7.8 Waterproof Work

a) After laying entrance cables, the space in the conduits shall be made waterproof. Other empty conduits shall also be made waterproof.

b) After laying terminating cables, the slots shall be filled by the waterproof work.

Table Ⅳ.1.2.7.1

Kind of P.V.C Terminating Cables

Conductor		Sheath thickness (mm)	External diameter (mm)	Remark
Diameter	Number of pairs			
0.5	400	more than 1.98	50	
0.4	400	〃 1.89	42	
0.4	600	〃 2.07	52	

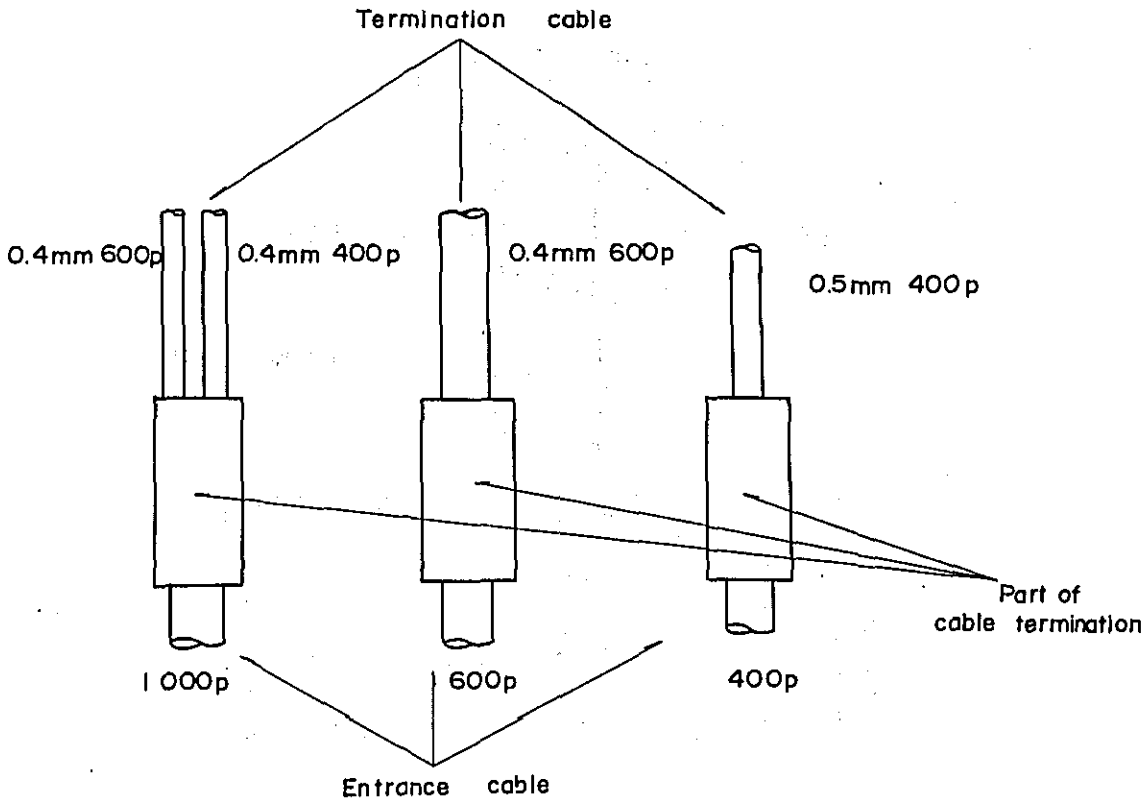


Fig. Ⅳ. 1. 2. 7. 1. Cable Termination

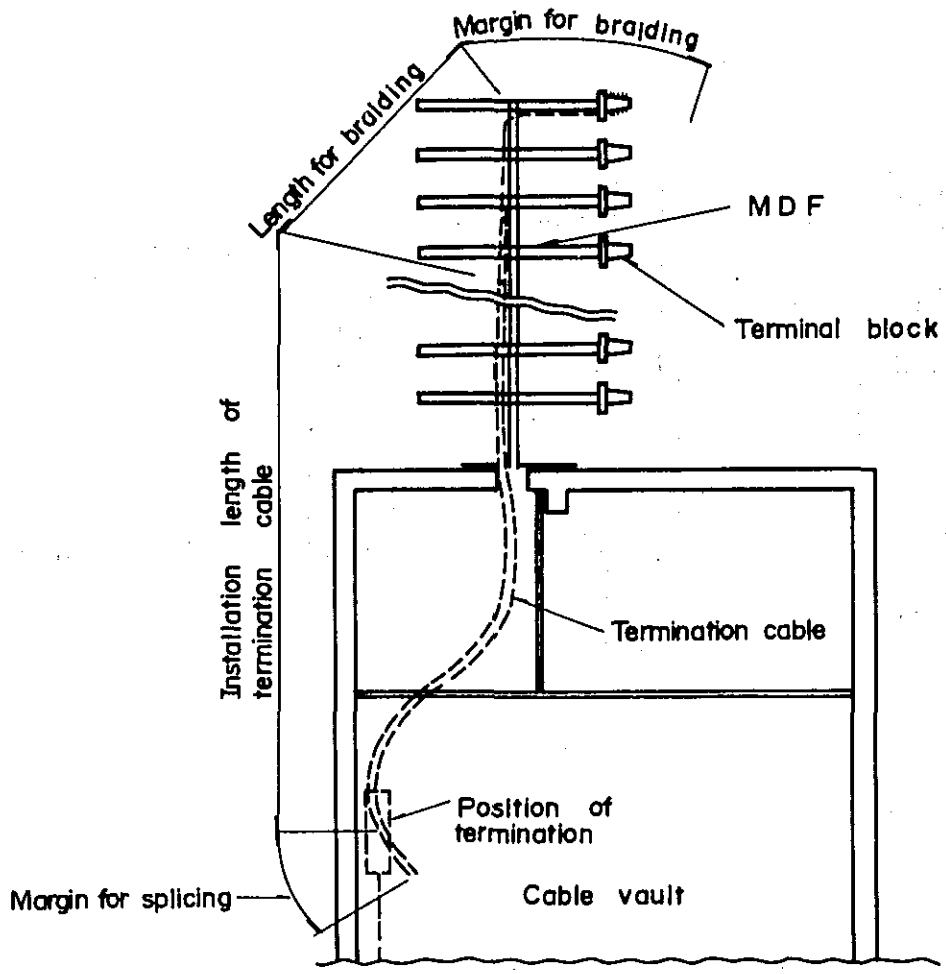
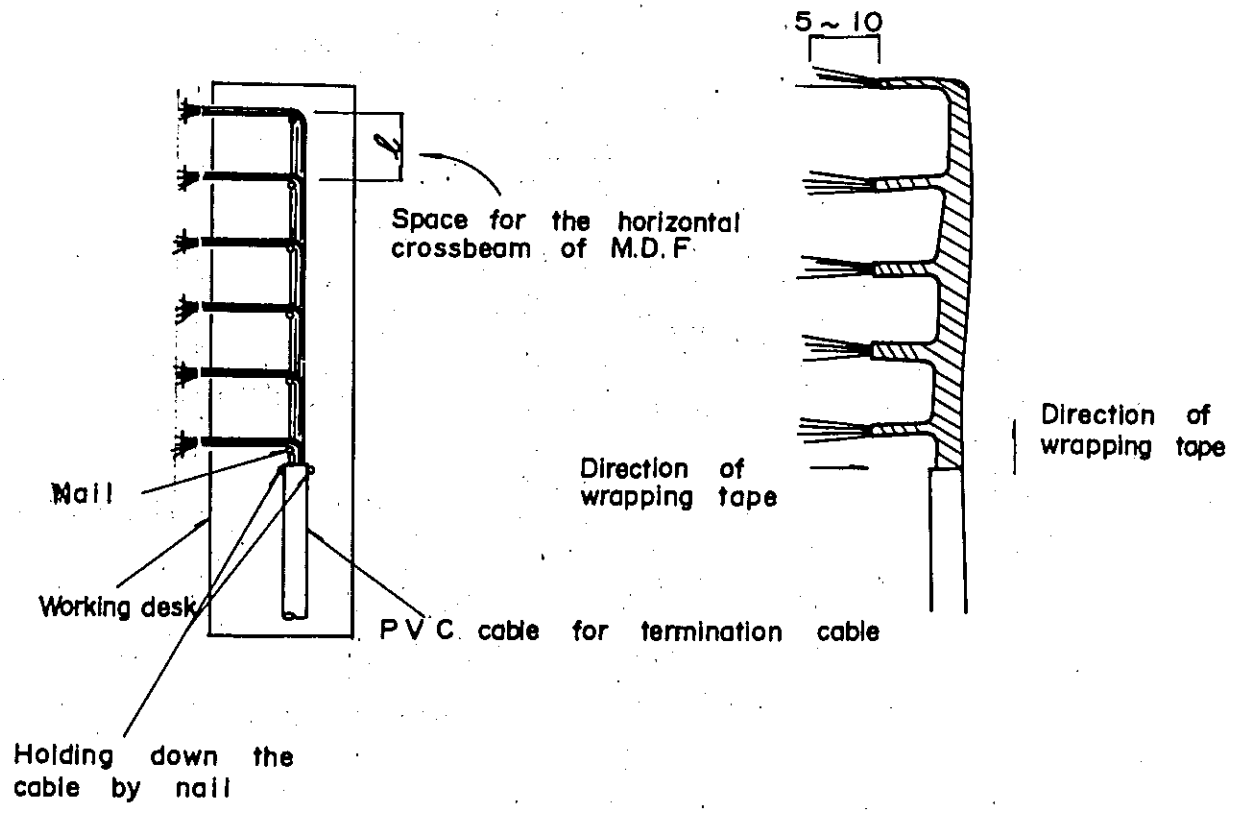


Fig. IV.1.2.7.2. Installation of the Termination Cable



Note ; When non air - conditioning wrapping with the tape for termination in 1/2 overlap.

Fig. Ⅳ.1.2.7.3. Braiding Cable

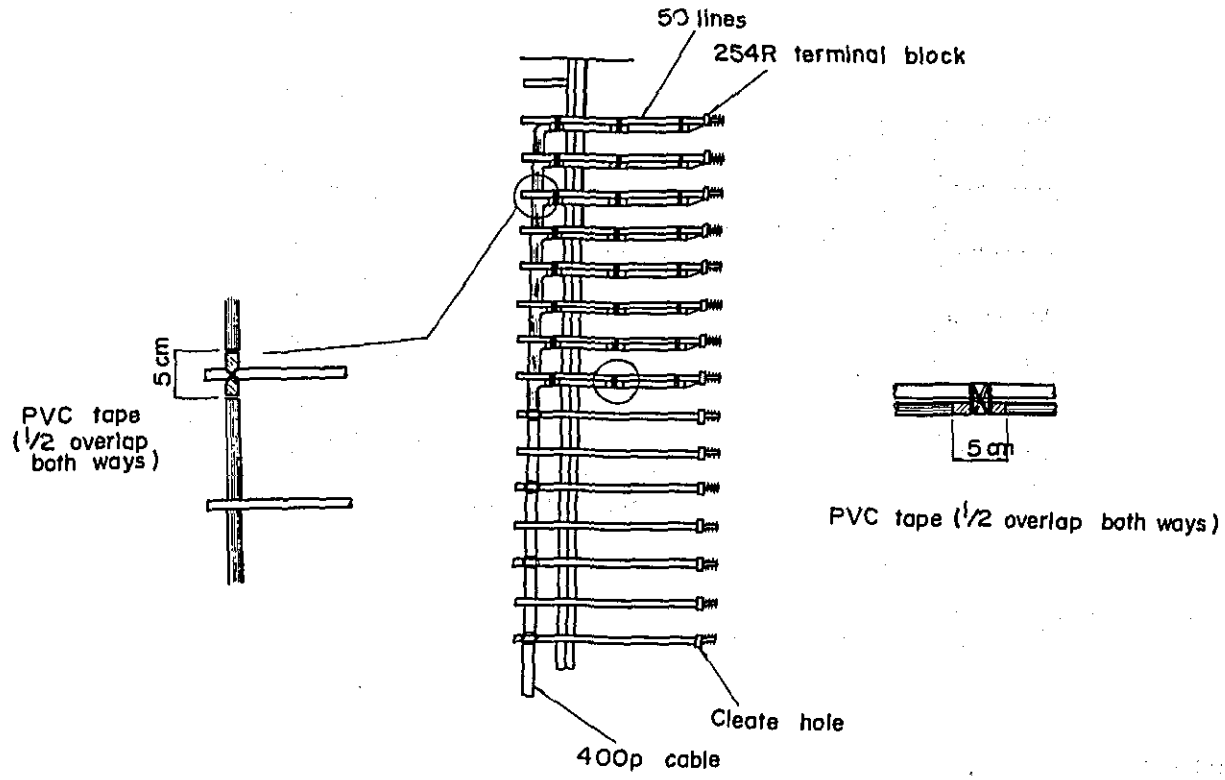
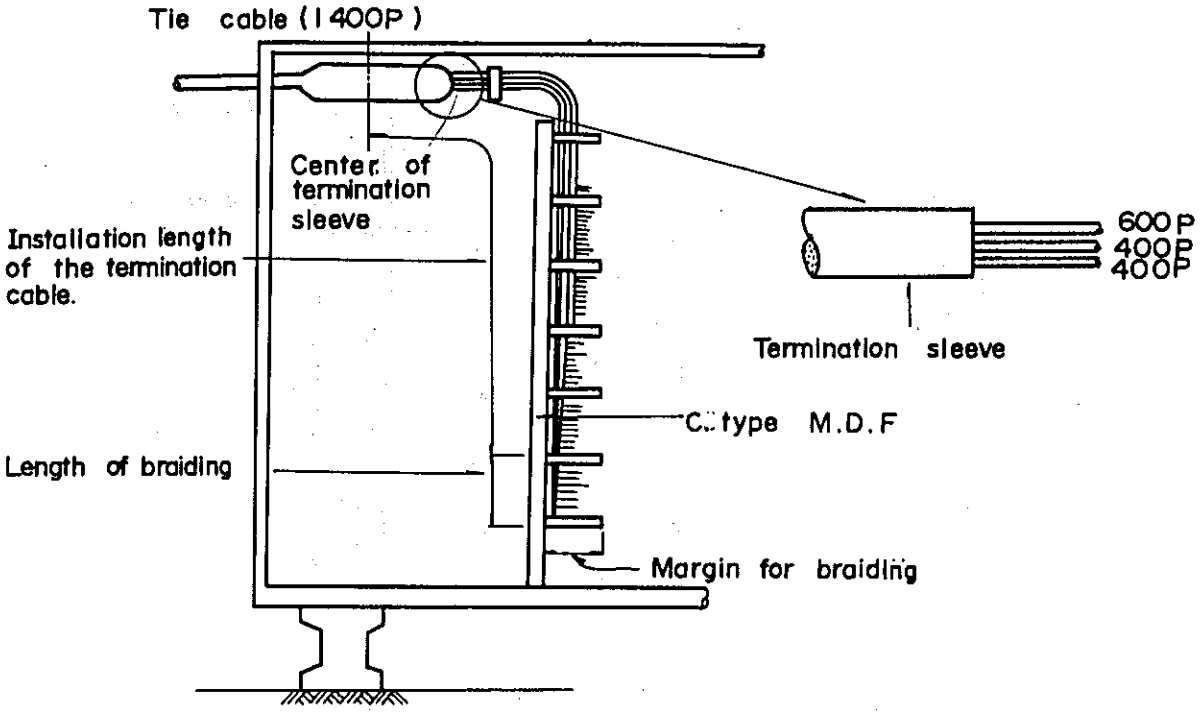


Fig. Ⅳ. 1. 2. 7. 4.

Installing the Termination Cable to M.D.F.



Note; Length of the termination cable = Margin for splicing (50cm) + installation length of the termination cable (Actual measurement) + length of braiding (21 cm) + margin of braiding (60 cm).

Fig. IV.1.2.7.5.
Installation Length of the Termination Cable in C2 Type Exchange

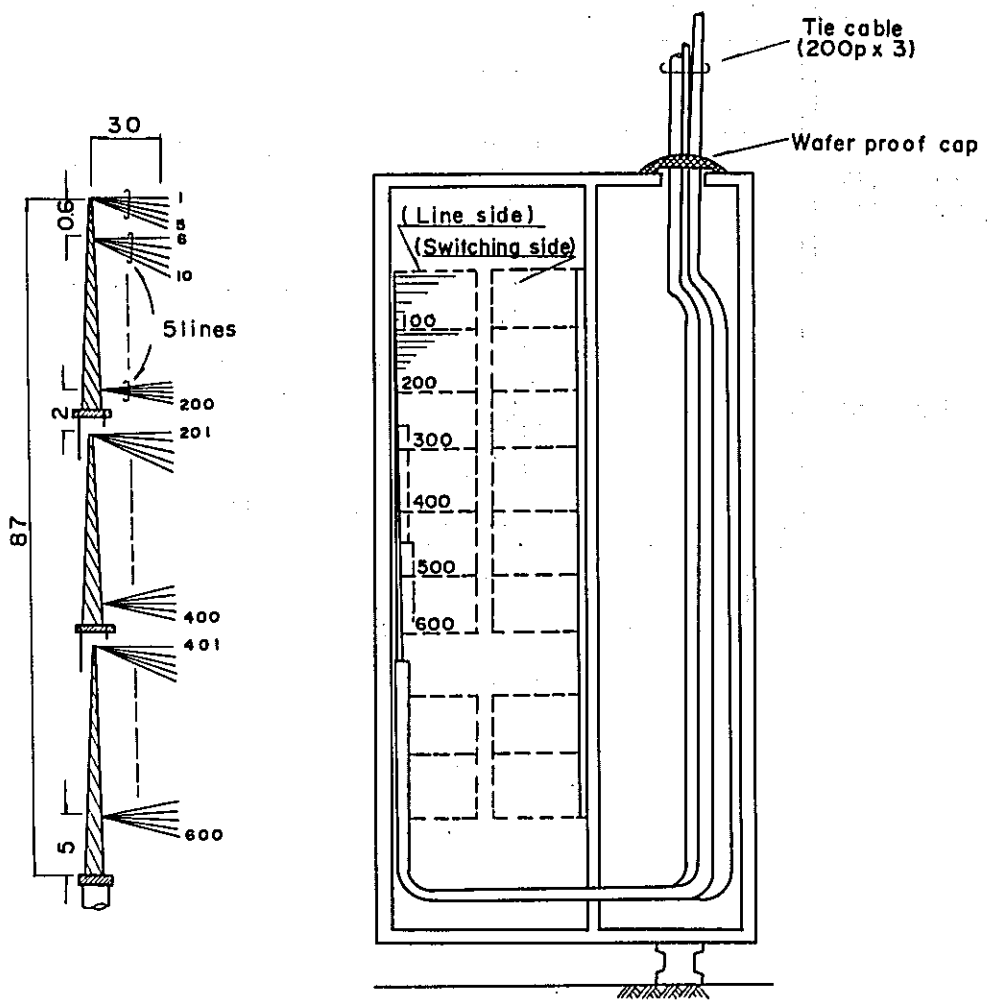


Fig. Ⅳ. 1. 2. 7. 6.
Installation Length of the Cable in CI Type Exchange

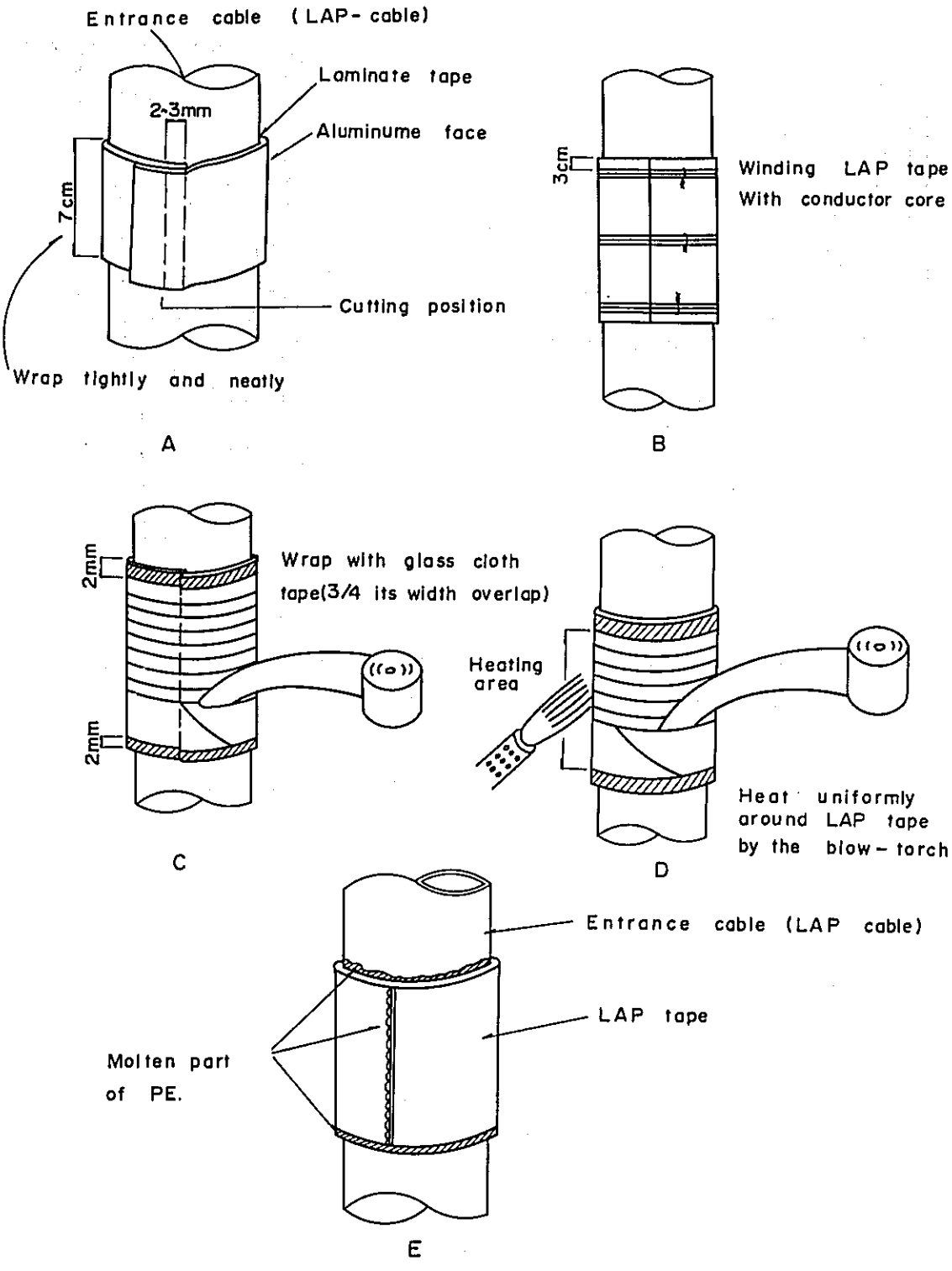
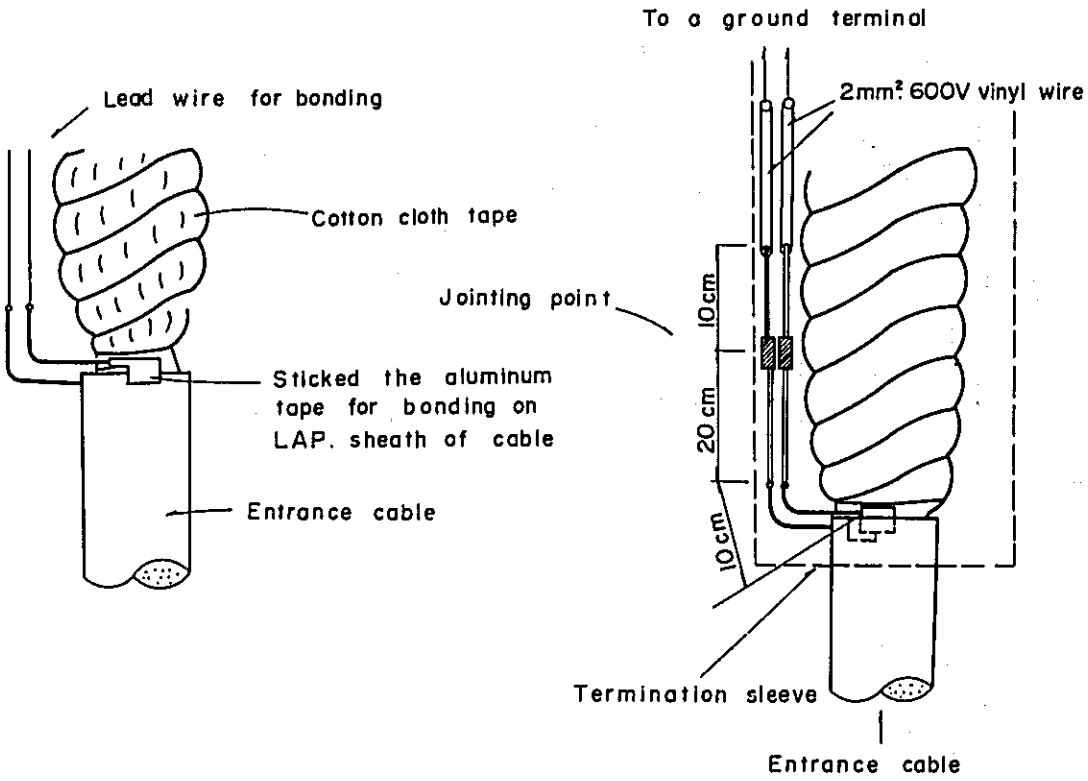


Fig. Ⅳ.1.2.7.7. Fitting LAP Tape on the Entrance Cable



Note ; The lead wire for bonding is jointed with 2mm² 600V vinyl wire by 1.6 x 2 mm² copper sleeve.

Fig. Ⅳ.1.2.7.8 Attaching the Earthing Lead Wire

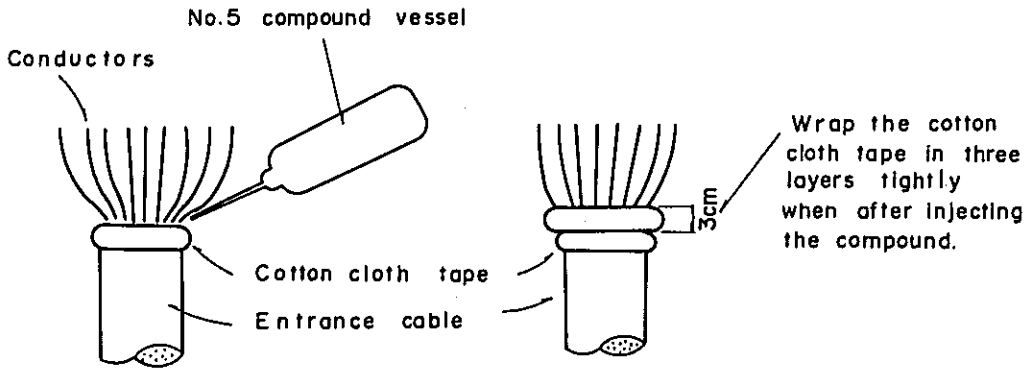


Fig. Ⅳ.1.2.7.9.
Filling the Gap among the Conductors with the Compound

1.2.8 Gas Pressurization System

1.2.8.1 General

A gas pressurization system shall be installed for supplying dry air to the subscriber underground cables for Mayongon Exchange office and the junction cable between Mayangon and Hanthawaddy Exchange Offices. The system shall consist mainly of a dry air supply equipment, a dry air distribution equipment, gas pipes for supplying dry air from these equipments to the cables, and an alarm equipment.

For the installation of the components of the system, refer to the drawings in this section as well as Annex III.3.1.

1.2.8.2 Dry Air Supply Equipment

A floor type dry air supply equipment shall be used. It will operate on a single-phase AC 50 Hz, 230 V, and supply dry air continuously at a pressure of 0.65 kg/cm^2.

The flow rate of dry air shall be more than 15 liters per minute, and its dryness shall be such that its dew point is −40°C or below under atmospheric pressure.

Fig. IV. 1.2.8.1 shows a diagram of a foundation for the dry air supply equipment.

1.2.8.3 Dry Air Distribution Equipment

A wall type dry air distribution equipment shall be used to distribute the dry air supplied by the dry air supply equipment to each cable.

The distribution equipment shall be fitted with a flow monitor for each cable, and an alarm circuit which will give an alarm when the air flow rate to a cable exceeds an adjusted level. The flow monitor shall be adjustable.

1.2.8.4 Gas Pipes

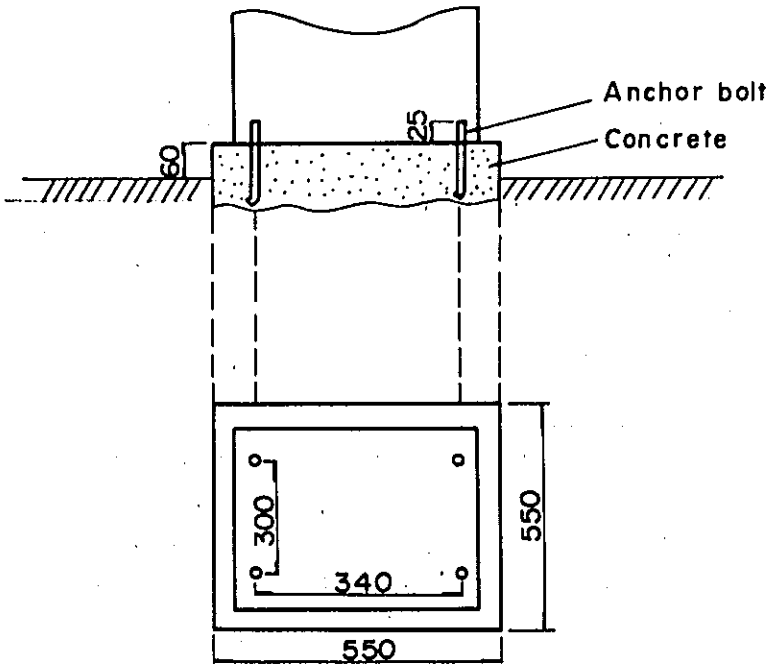
Two kinds of gas pipes (16 mm and 6 mm) shall be used as mentioned below.

a) 16 mm gas pipes shall be used for connecting the dry air supply equipment to the dry air distribution equipment.

b) 6 mm gas pipes shall be used between the distribution equipment and each cable.

No. 3 gas pipe joints shall be used for connecting 6 mm gas pipes to the cables.

Fig. IV. 1.2.8.2 shows a schematic diagram of the gas pressurization system.



(Unit : mm)

Fig. Ⅳ.1.2.8.1.
Foundation of Dry Air Supply Equipment

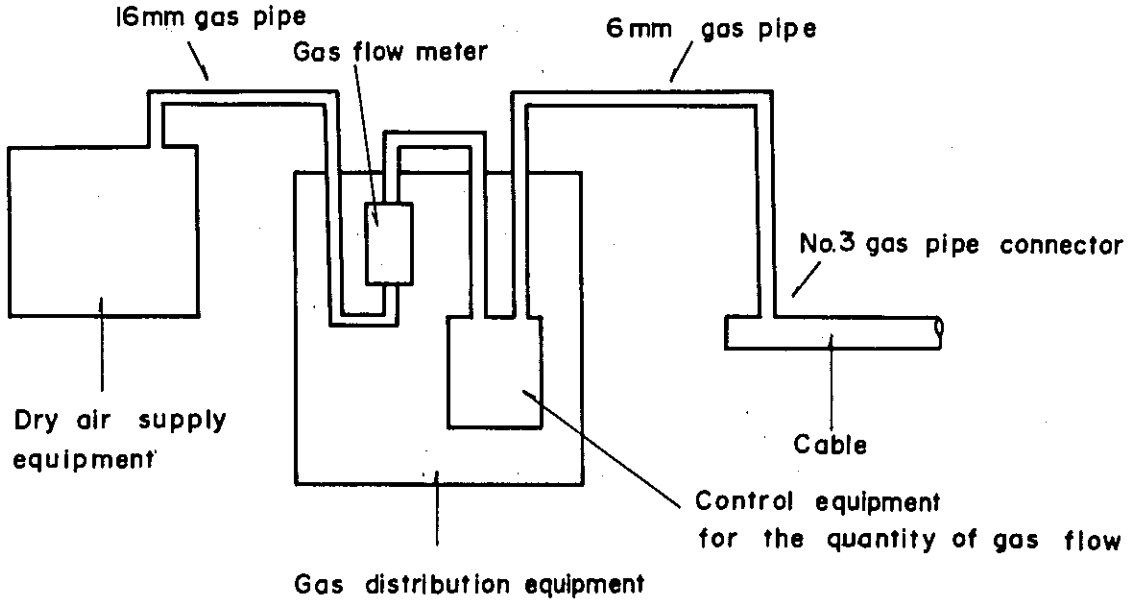


Fig. Ⅳ.1.2.8.2. Continuous Gas Flow System

1.2.9 Subscriber Premises Equipment

1.2.9.1 General

(1) The subscriber premises equipments (except PBX equipment) and public coin box telephones in the areas covered by Mayangon and Maymyo Exchanges Offices shall be replaced with new equipments under this Project.

(2) As for the PBX equipment, up to cable lead-in to the indoor terminal boards shall be covered by this Project. In other words, indoor terminal boards shall be the demarcation points of responsibilities.

(3) Until the cutting over to the new exchanges (i.e., C1 and C2 type automatic exchanges), both existing and new subscriber premises equipments shall be connected to both existing and new exchanges, in principle. After the cutting over, the existing equipments shall be removed by PTC.

1.2.9.2 Drop Wires

(1) PVC insulated self supporting drop wires with a diameter of 0.65mm shall be used as drop wires.

(2) Drop wires shall be fastened to poles with L-shaped clamps, and to subscriber building with C-shaped clamps or 6mm or 9mm drive hook.

(3) L-shaped clamps shall be installed on Japanese standard poles by using bolts; and on Burmese standard poles by the band method.

(4) Drop wires shall be anchored by drop wire detainers

(5) Drop wires shall not be spliced between the poles

(6) Drop wires shall not be branched between poles

(7) Connecting SD wires with drop wires shall be done by using SD terminal boxes.

(8) The following shall be kept in mind in selecting points for anchoring drop wires on subscriber buildings.

a) Points that are close to telephone positions and can make the lead-in wire length as short as possible.

b) Points where the necessary clearance above the ground can be secured.

c) Points where the required separation from the power line and other interfering objects can be secured.

d) In cases where drop wires must be protected from interfering objects, they shall be protected by PVC wire protector.

e) Poles, walls, etc. shall be sufficiently capable of holding out drop wire tension.

(9) The drop wire attaching method is shown in Fig. IV. 1.2.9.1.

1.2.9.3 Subscriber Telephone Protectors

(1) Subscriber telephone protectors shall be installed only in Maymyo Exchange Office area. No. 4 subscriber telephone protectors shall be used for this purpose.
(2) In case of installing subscriber telephone protectors under eaves, or close to eaves, there must be enough space above them to remove and put back the cover.
(3) Avoid installing subscriber telephone protectors at the following places.

a) Within 1 meter from power lines.
b) Places subject to great vibration.
c) Places with much moisture, steam and dust.
d) Near chimneys, heaters and other heat-dissipating objects.
e) Places with chemical vapors or gases.
f) places where it is impossible to drive an earth bar directly below.

1.2.9.4 Subscriber Grounding

(1) A single metal earth bar shall be used for subscriber grounding.
(2) In principle, the metal earth bar shall be buried directly under the subscriber telephone protector.

1.2.9.5 Indoor Wire Laying

(1) Double core parallel PVC-covered wires with a diameter of 0.65mm shall be used as indoor wires.
(2) Indoor wires shall not be connected between subscriber telephone protector or rosette and telephone set.
(3) Wiring cleats or staples shall be used for indoor wire laying.
(4) In cases where exposed wires on the floor requires protection, wire protectors shall be used. Wire protectors shall be such that they can be nailed.
Fig. IV. 1.2.9.2 shows a wire protector.
(5) In case of leading in an indoor wire or a drop wire running throught a wall at an indoor point, wires in the wall shall be protected with PVC wire protectors.

(6) In the Mayangon Exchange Office area shall be used no subscriber telephone protectors but rosettes for connecting drop wires to indoor wires.
(7) In cases where branch telephones exist, rosettes shall be used in principle.

1.2.9.6 Telephones

(1) An external view of the telephone to be used is shown in Fig. IV. 1.2.9.3.
(2) Neither Mayangon Exchange Office nor Maymyo Exchange Office shall have party-line subscribers.
(3) The number of extension telephone sets shall be 2 or less.
(4) The standard of telephone set shall be as follows:

a) Conversation

Volume and articulation shall be satisfactory without noise, vibration and distortion.

b) Insulation resistance (measured with a 250V 50M megger)

i) More than 25M ohms across L1 and L2 with the handset hooked on.

ii) More than 25M ohms across L2 and the bottom plate with the handset picked up.

iii) More than 25M ohms across L2 and the finger stop on the dial with the handset picked up.

c) Transmitter

Sensitivity shall be more than -65dB at 1kHz, provided that a T-60 coupler is used.

d) Receiver

Sensitivity shall be more than 60dB at 1kHz, provided that an R-60 coupler is used and a 0.5 mW current is supplied.

e) Handset cord

Conductor resistance shall be less than 1.8 ohms.

f) Telephone cord

Conductor resistnace shall be less than 1.9 ohms.

g) Dial

i) Speed shall be within the range of 9.2 to 10.8 pps.

ii) Make ratio shall be 30 to 36%.

1.2.9.7 Subscriber Installation Tests

(1) After installing a telephone set, installation tests shall be conducted between it and the test board.

(2) The tests to be conducted shall be as follows:

- o Originating test and talk test
- o Terminating test and talk test
- o Dial impulse and speed measurement
- o Impulse ratio measurement
- o Loop resistnace measurement

1.2.9.8 Public Coin Box Telephones

(1) Two kinds of public coin box telephones (single metering indoor and outdoor types) shall be used as public coin box telephones. Fig. IV. 1.2.9.4 and Fig. IV. 1.2.9.5 show external views of these telephones.

(2) Public coin box telephones shall have the following functions

a) Only 50 pias coins can be used.

b) When a coin is not dropped into the telephone, speech can only originate from the exchange.

c) In case of a free charge call, parties can talk with each other in an ordinary way, and the coin dropped into the telephone will return after the conversation.

d) Public coin box telephones operate on the power supplied by the exchange.

e) Public coin box telephone standards shall be as follows:

i) Conversation

Volume and articulation shall be satisfactory without noise, vibration and distrotion.

ii) Insulation resistance (measured with a 250V 50M megger)

- o More than 25M ohms across L1 and L2 with the handset hooked on.
- o More than 25M ohms across L2 and the casing with the handset picked up.
- o More than 25M ohms across L2 and the finger stop on the dial with the handset picked up.

iii) Dial

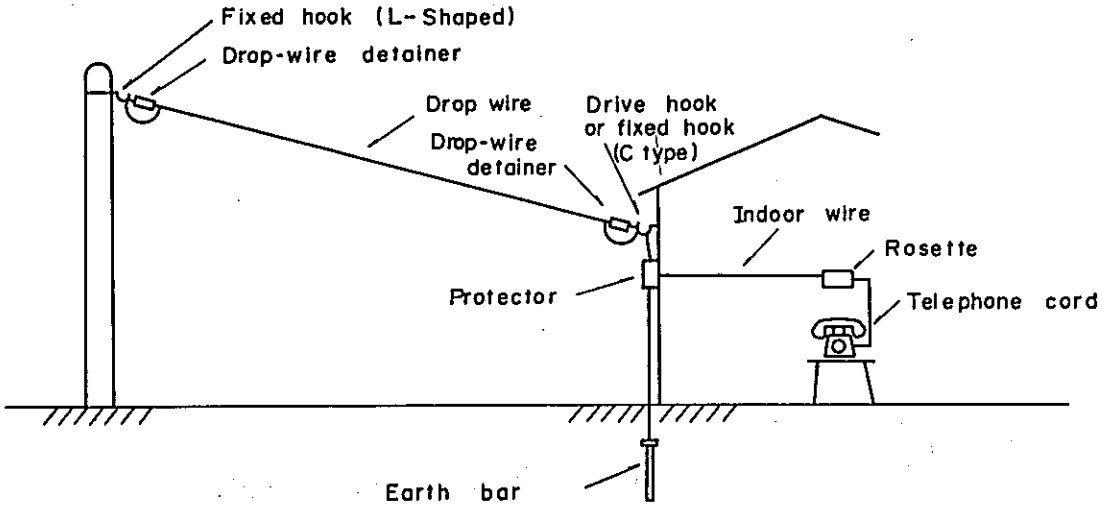
- o Speed shall be within the range of 9.2 to 10.8 pps.
- o Make ratio shall be 30 to 36%.

(3) Public coin box telephones shall be replaced immediately after the cutting over to the C type automatic exchange.

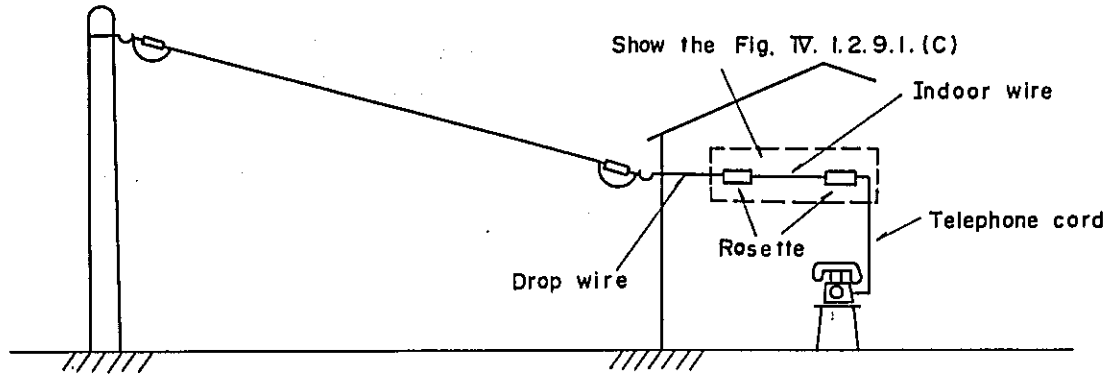
(4) After the existent public coin box telephones have been replaced with new ones, installation tests shall be conducted.

(5) The tests to be conducted shall be as follows:

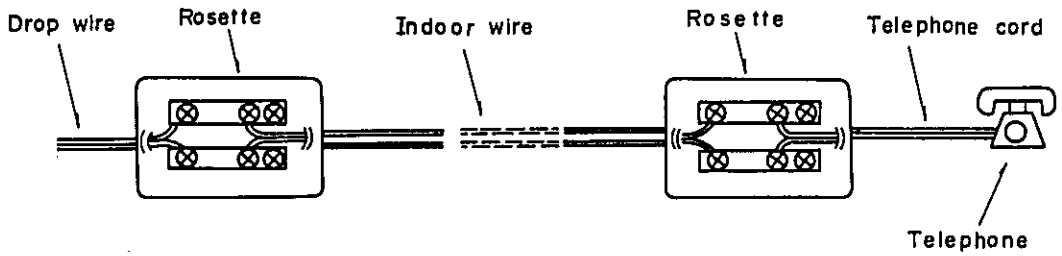
- o Originating test and talk test
- o Terminating test
- o Circuit polarity test
- o Dial test and coin collection test



(A) Attaching the drop wire in maymyo



(B) Attaching the drop wire in mayangon



(C) Attaching the rosette

Fig. Ⅳ.1.2.9.1. Attaching the Drop Wire

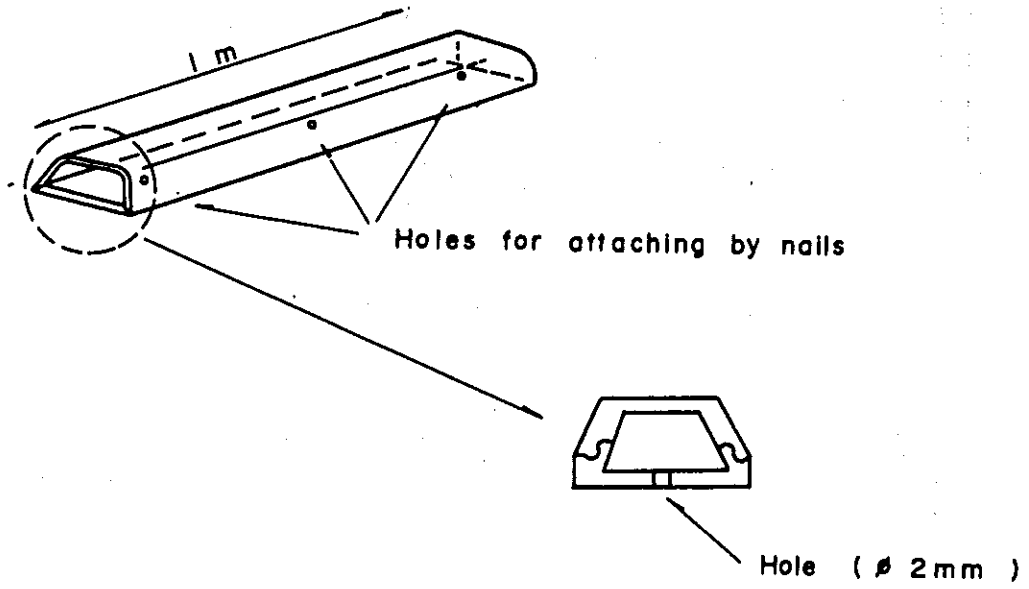


Fig. Ⅳ.1.2.9.2. Attaching the Wire Protector

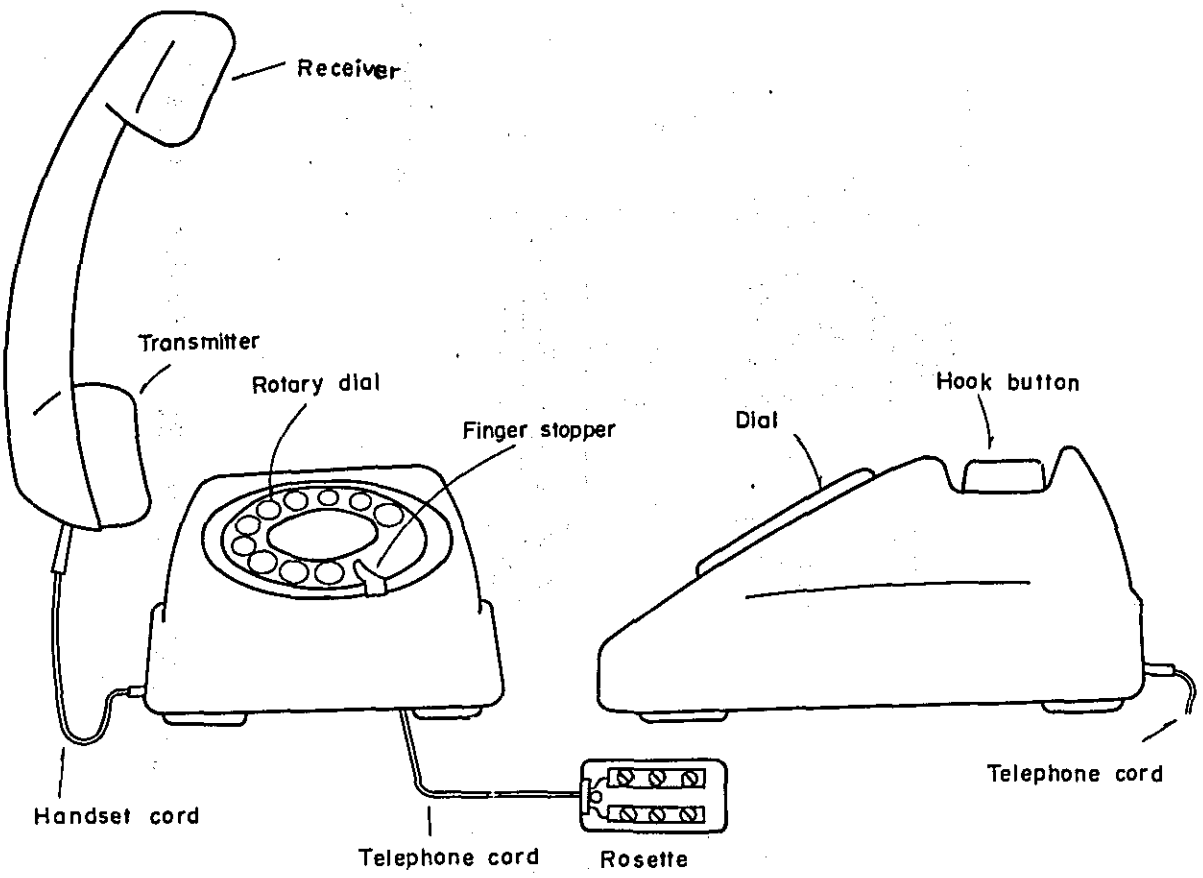


Fig. Ⅳ.1.2.9.3. 600 Type Telephone

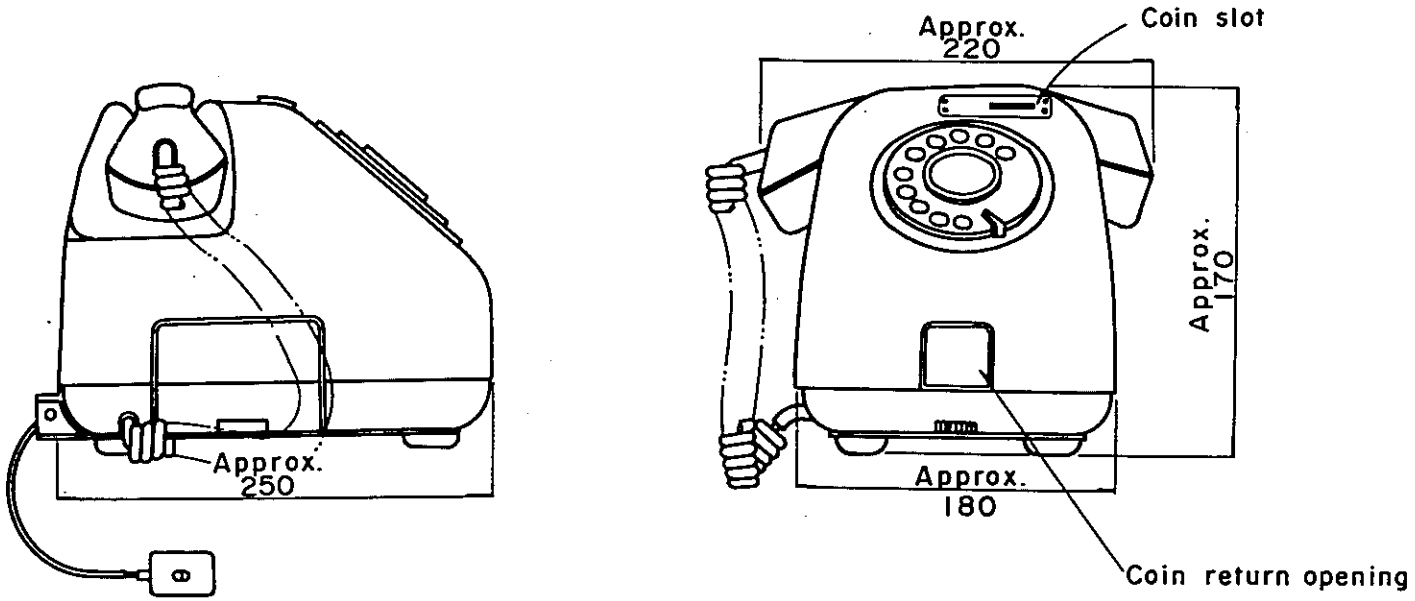


Fig. Ⅳ.1.2.9.4. Typical Public Coin Box (Indoor type)

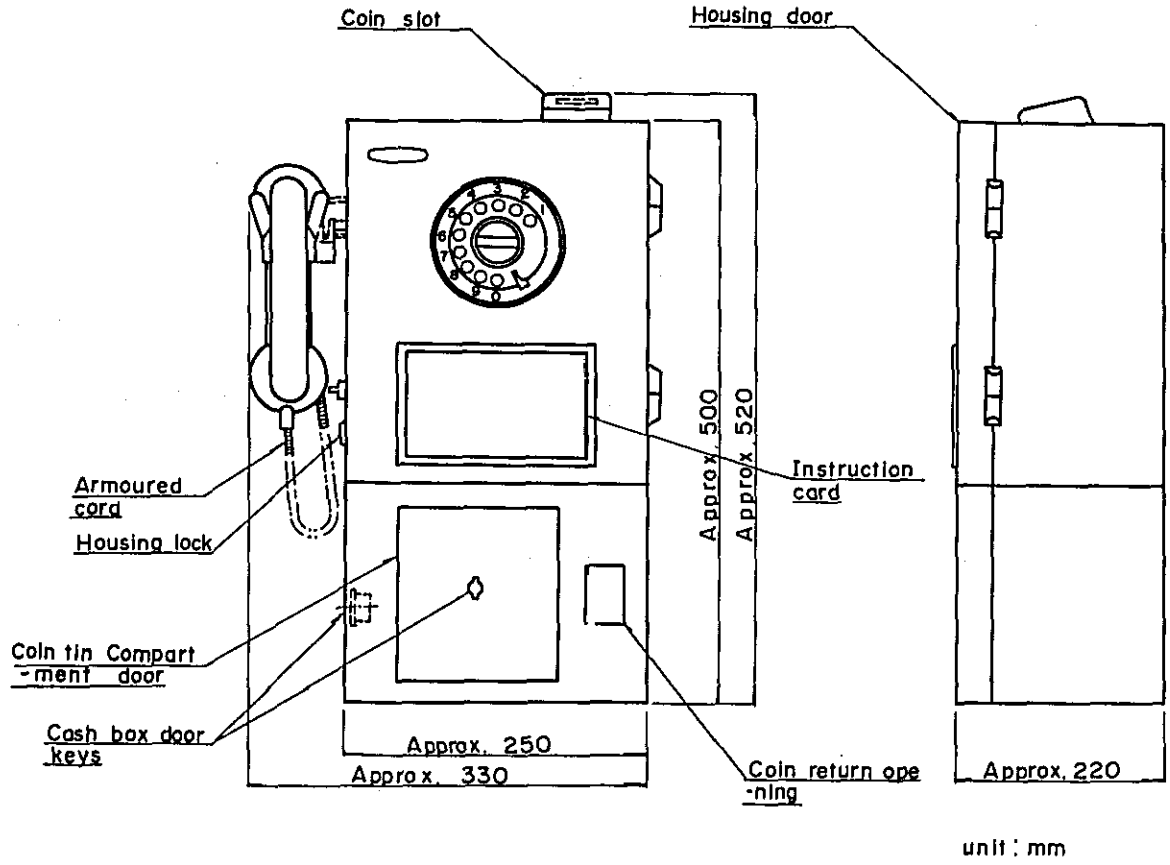


Fig. Ⅳ.1.2.9.5. Typical Public Coin Box (Outdoor type)

1.3 Specifications of Materials

1.3.1 PEF-LAP Cable

1.3.1.1 General

This section deals with PEF*1 insulated and LAP*2 sheathed star quad cables to be used as local and junction cables.

Note *1: PEF ..... Polyethylene foamed

Note *2: LAP ..... Laminated aluminium polyethylene

1.3.1.2 Conductors

Annealed copper conductors conforming to the specifications of JIS-C-3102 for electrical annealed copper wire shall be used. They shall be completely free of any defect arising in the process of manufacture.

Conductor diameter shall be as shown in Table IV. 1.3.1.1. Conductor joint shall be avoided as mach as possible during the manufacturing process, but if it is necessary, a silver-alloy brazing method or a cold weld method shall be used.

1.3.1.3 Insulation

Conductors shall be covered with the PEF which has been about 20% foamed and differently colored as shown in Table IV. 1.3.1.3.

PEF covering thickness shall con form to Table IV.1.3.1.2.

1.3.1.4 Conposition of Conductors

*Two same-colored conductors (mentioned in Table IV. 1.3.1.3) of the four con*ductors which have been insulated as specified in the preceding paragraph shall be uniformly twisted in such a way that they will be diagonally opposite to each other in a square to form a quad.

1.3.1.5 Unit Composition

(1) 25 ro 50 quads prepared as specified in the preceding paragraph shall be arranged in layers as shown in Table IV. 1.3.1.4, and the adjacent layers shall be concentrically twisted in the same direction to form a unit.

(2) Each layer shall be wound with white cotton thread, rayon thread or polyester thread to hold it. The center layer need not be wound with such thread.

(3) Two kinds of quads shown in Table IV. 1.3.1.3 shall be combined as shown in Table IV. 1.3.1.5 to form kinds of units.

(4) A tracer quad shall be inserted into each layer. One Class 2 quad shall be inserted into Class 1 and Class 3 units; and one Class 1 quad into Class 2 and Class 4 units.

1.3.1.6 Unit Grouping

(1) The units prepared as specified in the preceding paragraph shall be arranged into layers as shown in Table IV.1.3.1.6 and each layer shall be twisted concentrically in the same direction to form a cable core.

(2) The cable conductors shall be completely covered with four insulating paper tapes by winding them around the conductors overlapping each tape half-width deep, or otherwise winding them to the same thickness or more.
(3) The insulation paper tapes shall conform to the specifications of JIS-C-2308 for communication cable insulation paper.
(4) If units are grouped in two processes, a plastic tape shall be laterally wound between the layers.
(5) A plastic tape may be laterally wound under the insulating paper tapes if necessary.
(6) The outermost insulating paper tape shall have the manufacturer's name (abbreviation or symbol) and the date of manufacture printed from end to end.
(7) One of the units in each layer shall be the tracer unit specified in Table IV. 1.3.15.
Class 2 unit or Class 4 unit shall be used as tracer unit.
(8) If the center layer consists of a single unit, it shall be a tracer unit.
(9) Units shall be grouped according to the unit arrangement diagram shown in Fig. IV.1.3.1.1.

1.3.1.7 Cable Sheath

(1) Cable conductors shall be longitudinally covered with a laminated tape, and its seam shall be continuously sealed in the longitudinal directions of cable by heating, pressing, etc., and covered with black PE to form a cylindrical covering.
(2) The laminated tape to be used shall be a composite tape consisting of a soft aluminum tape and a polymer composed mainly of ethylene, which are bonded together by a suitable method. Plastic tape shall have a minimum thickness of 0.03mm.
(3) The aluminum tape shall be made of shoft aluminum conforming to the specifications of JIS-H-4000 for aluminum and aluminum alloy plates. The aluminum tape shall have a minimum thickness of 0.18mm.
(4) Polyethylene shall be equivalent to that specified in the specifications of BS 6234, 1969, TYPE 03C.
(5) Polyethylene shall be black in color as specified in the specifications of BS 6746, 1969 Appendix A.
(6) Laminated sheath thickness shall be as specified in Table IV. 1.3.1.7.
(7) Cable outside diameter shall be as specified in Table IV.1.3.1.7.

1.3.1.8 Armor

(1) Buried cables shall be steel-tape armored.
(2) A jute layer shall be closely wound over the PE covering as an jute bed for the steel-tape armor. The jute to be used for the purpose shall be equivalent to, or better than, that specified in the specifications of JIS-L-2402 for jute yarn.
Jute bed thickness shall conform to Table IV.1.3.1.8.

(3) Two steel tapes shall be spirally wound over the jute bed in double layers, each spaced less than one-thired of their width. The spaces in the inner layer of steel tape shall be completely covered with the center part of steel tape outer layer.

If steel tapes must be joined, they shall be joined by welding.

(4) The steel tapes to be used for armouring shall be so soft as not to damage the cable, and equivalent to, or better than, those specified in JIS-G-3141 for cold rolled steel plates and steel tapes.

Steel tape thickness shall be as specified in Table IV.1.3.1.8.

(5) The steel tapes shall be given appropriate and anti-rusty treatment prior to use. Antiseptic compounds shall be the neutral type which is harmless to the steel tapes.

(6) After applying a sufficient amount of a protective compound to the outer surface of the steel tapes, a single layer of jute shall be closely wound so it will not loosen. Then a sufficient amount of the protective compound shall be applied again, and finally chalk shall be applied.

Jute jacket thickness shall be as specified in Table IV.1.3.1.8.

(7) The protective compund to be applied to cables shall be the neutral type which has an appropriate softness and is harmless to the PE covering and steel.

(8) Steel armored cable external diameter shall be as specified in Table IV.1.3.1.9.

1.3.1.9 Electrical Requirements

(1) Conductor resistance

The DC resistance of each conductor shall conform to the specifications of Table IV.1.3.1.1.

(2) Insulation resistance

When a DC voltage of 100 to 500V is applied across each conductor and the ground (with the aluminum tapes and other conductors grounded) and charging is kept for one minute, the insulation resistnance shall be more than 2,000 M ohms-km.

(3) Dielectric strength

Nothing wrong shall develop when a DC voltage of 500 V or an AC (50Hz or 60 Hz) voltage of 350V (rms) is applied across each conductor and the ground (with the aluminum tapes and other conductors grounded) for one minute.

(4) Static capacity

Static capacity as measured with 1kHz AC shall conform to Table IV.1.3.1.10.

(5) Static coupling

The static coupling of the physical circuits in each quad as measured with 1 kHz AC shall not exceed the value specified in Table IV.1.3.1.11 multiplied by $\sqrt{\ell/\ell o}$. "ℓ" means cable length in meters. If it is less than 100 meters, ℓ shall be taken as 100. "ℓo" means standard length, which is 150 meters for junction cable or 500 meters for local cable.

1.3.1.10 Gas Charging

At the factory and prior to shipment, all the PEF-LAP cables mentioned in this section shall be fitted with gas charging valves and gas pressure measuring valves at cable ends, through which 0.6 ±0.1 kg/cm² dry air or nitrogen gas shall be charged into the cable at an atmospheric pressure of 1033 g/cm² and an ambient temperature of 20°C.

1.3.1.11 Faulty Quads

One faulty quad shall be permissible every 600 pairs and any fraction thereof. In case of 400-pair cables, one faulty quad shall be permissible. If faulty quads exist, a tag showing faults and faulty points shall be attached to the cable drum.

1.3.1.12 Standard Cable Length

The maximum length of cable wound around a drum shall be as specified in Table IV.1.3.1.12.

1.3.1.13 Cable Drums

(1) Cables shall be wound around strong wooden drums which have been treated with an antiseptic or strong steel drums which have been treated to be corrosion resistant, and be so treated as to withstand any and all condtions during transportation.

(2) At least one of the outer surfaces of each cable drum shall carry definite information on the following.

a) Name of manufacturer
b) Type, number of pairs, conductor diameter and length of cable.
c) Drum number
d) Overall weight
e) PTC
f) Arrows on both sides indicating the normal direction of rotation.
Other information deemed necessary for loading, etc. shall be indicated on the other side of the drum.

Table IV. I.3.I.I
Conductor Diameter and Conductor Resistance

Kind of Conductor (mm)	Conductor Diameter (mm)	Maximum Conductor Resistance (ohm/km)
0.4	0.4 ± 0.01	147.5
0.5	0.5 ± 0.01	93.5
0.9	0.9 ± 0.02	29.0

Table IV.I.3.I.2
Thickness of PEF Sheath

Conductor Diameter (mm)	Minimum Thickness of PEF Sheath (mm)
0.4	0.08
0.5	0.10
0.9	0.19

Table IV. I.3.I.3 Classification of Quads

Pairs / Quad	First Pair	Second Pair
First Class Quad	Red - Red	White - White
Second Class Quad	Blue - Blue	White - White

Table IV.1.3.1.4 Layer Composition of each Unit

Kind of Unit	Number of Quads in each Layer				
	Central Layer	First Layer	Second Layer	Third Layer	Total
25 Quad Unit	3	8	14	—	25
50 Quad Unit	4	10	15	21	50

Table IV.1.3.1.5 Classification of Units

Kind of Unit	Classfication of General Quad	Classfication of Tracer Quad	Number of Quads in each Unit.
First Class Unit	First Class Quad	Second Class Quad	50
Second Class Unit	Second Class Quad	First Class Quad	50
Third Class Unit	First Class Quad	Second Class Quad	25
Fourth Class Unit	Second Class Quad	First Class Quad	25

Table IV.1.3.1.6 Arrangement of Cable Units

Kind of Cable	Unit of each Layer			Total		Remarks
	Central Layer	First Layer	Second Layer	25 Quads Unit	50 Quads Unit	
400 Pair	1	✱ 6	—	6	1	✱ : 25 Quads Unit
600 Pair	✱ 3	✱ 9	—	12	—	
800 Pair	✱ 1	✱ 5	✱ 10	16	—	
1000 Pair	✱ 4	8	—	4	8	
1400 Pair	4	10	—	—	14	

Table IV. 1.3.1.7
Thickness of Laminate Sheath and External Diameter of Cables

Number of Pairs	Minimum Thickness of Laminate Sheath			Non-Armoured Cable Nominal external Diameter		
	0.4 (mm)	0.5 (mm)	0.9 (mm)	0.4 (mm)	0.5 (mm)	0.9 (mm)
400	1.87	2.24	4.0	29	35	62
600	1.95	2.12	—	34	41	—
800	2.12	—	—	39	—	—
1 000	2.21	—	—	43	—	—
1 400	2.38	—	—	50	—	—

Table. IV. 1.3.1.8 Thickness of Armour and Jute

Norminal external Diameter of Non-Armoured Cable (mm)	Minimum Thickness of Jute Bed (mm)	Minimum Thickness of Armour (mm)	Minimum Thickness of Jute Jacket (mm)
Less than 41mm	1.0	0.55	1.0
41mm~53mm	1.5	0.74	1.5
More than 53mm	1.5	0.74	1.5

Table IV. 1.3.1.9
External Diameter of Armoured Cables

Number of Pairs	Outer Diameter of Armoured Cable		
	0.4mm	0.5mm	0.9mm
400	39	45	74
600	44	53	—
800	49	—	—
1 000	55	—	—
1 400	62	—	—

Table IV. 1.3.1.10 Electrostatic Capacity

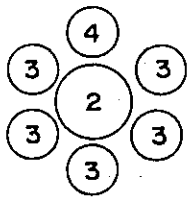
Standard Value		50 nF/km
Local Cable	Avg. Value of max. Value (nF/km)	55 nF/km
Junction Cable	Deviation (%) between avg. Value .of each Frame and Standard Value.	± 10%

Table IV. 1.3.1.11 Electrostatic Coupling

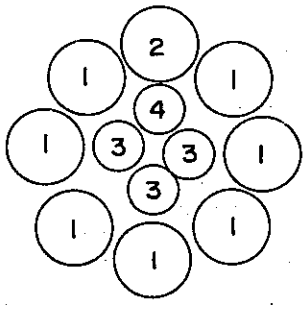
	Avg. Value (pF)	Max. Value (pF)	Lo (m)
Local Cable	300	1 600	500
Junction Cable	50	300	150

Table IV. 1.3.1.12 Maximum Cable Drum Length

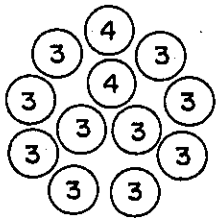
Conductor Dia / Cable Pairs	Non- Aarmoured Cable			Armoured Cable		
	0.4 mm	0.5 mm	0.9 mm	0.4 mm	0.5 mm	0.9 mm
400	300 m	300m	300 m	300 m	300m	300 m
600	〃	〃		〃	〃	
800	〃	〃		〃	〃	
1000	〃	〃		〃	〃	
1400	〃	〃		〃	〃	



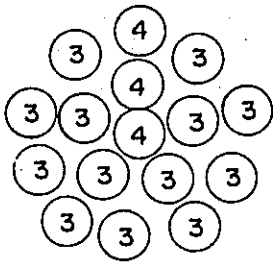
400 Pair



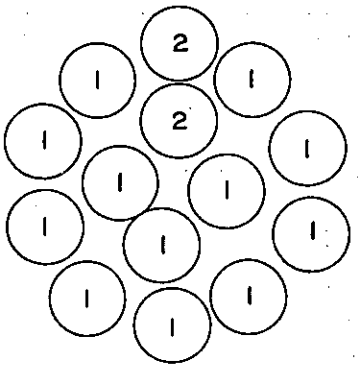
1 000 Pair



600 Pair



800 Pair



1 400 Pair

(1) First Class Unit
(2) Second Class Unit
(3) Third Class Unit
(4) Fourth Class Unit

Fig. IV. 1.3.1.1 Arrangement of Cable Units

1.3.2 *CCP-AP-SS Cable*

1.3.2.1 General

The section deals with color coded, polyethlylene (hereinafter called PE) insulated, aluminum PE sheated, star quad and self-supporting type cables (CCP-AP-SS cables) to be used as local cables. For color coding, all the conductors are colored differently, and for self-supporting, steel strands are provided.

1.3.2.2 Conductors

Conductors shall be made of annealed copper which meets the specifications of JIS-C-3102 for electrical annealed copper wire, and free of any and all defects of manufacture.

Conductor diameter shall be as shown in Table IV.1.3.2.1. Conductor joint shall be avoided as much as possible during the manufacturing process, but if it is necessary, a silver-alloy brazing method or a cold weld method shall be used.

1.3.2.3 Insulation

(1) The conductors specified in the proceeding paragraph shall be uniformly covered with PE compound.

(2) PE compound shall meet the specifications of BS 6234, 1969, TYPE 03 for polyethylene compounds.

(3) The coloring of PE compounds shall conform to Table IV.1.3.2.2.

(4) PE covering thickness shall conform to Table IV.1.3.2.3.

1.3.2.4 Quad Composition

(1) Four of the conductors specified in the preceding paragraph shall be uniformly twisted to compose quads, with Class 1 conductor and Class 2 conductor positioned diagonally opposite and Class 3 conductor and Class 4 conductor diagonally opposite in a square according to the colors specified in Table IV. 1.3.2.2.

(2) All the five quads in the 10-pair unit shall be different in pitch from one another.

1.3.2.5 Unit Composition

(1) A unit of 10 pairs shall be prepared by gathering the five quads from the first quad to the fifth quad specified in Table IV.1.3.2.2 approximately in circular form and winding them with a plastic tape (hereinafter called the coarse winding tape).

(2) The coarse winding tape shall be 2.5mm wide. The same colored tape shall be spaced less than 100mm from turn to turn. A transparent plastic tape may be additionally used beside the unit coarse winding tape.

(3) The kinds of colors to be used for the coarse winding tape shall be as specified in Table IV.1.3.2.4.

1.3.2.6 Cable Cores

(1) 10-pair units shall be gathered approximately in circular form by twisting them opposite to their strands as specified in Table IV.1.3.2.4 and Fig. IV.1.3.2.1.
A plastic tape may be wound between layers and over the outermost layer additionally.
(2) A main plastic tape shall longitudinally and completely cover the units thus assembled, and another tape is wound over it to hold it, thus forming a cable core. Or, a main plastic tape may be wound in an overlapping manner to form the same.
(3) A tape printed with the name of the manufacturer (abbreviation or symbol) and the date of manufacture from end to end and a blue plastic tape for cable identification shall be inserted into an appropriate position between the assembled units and the sheath. These tapes may be inserted when grouping the units.

1.3.2.7 Cable sheath

(1) The cable conductors mentioned in the preceeding paragraph shall be longitudinally wrapped with a laminated tape, and its seam shall be continuously sealed in the longitudinal direction of cable by heating, pressing, etc. This and a zinc-plated steel strand coated with a moistureproof compound shall be covered with black PE together.
The cable neck shall be such that it can be easily cut open.
(2) The laminated tape to be used shall be a composite tape consisting of a soft aluminum tape and a polymer composed mainly of ethylene, which are bonded together by a suitable method. Plastic tape shall have a minimum thickness of 0.03mm.
(3) The aluminum tape shall be made of soft aluminum conforming to the specifications of JIS-H-4000 for aluminum and aluminum alloy plates. The aluminum tape shall have a minimum thickness of 0.18mm.
(4) PE compound for sheathing shall meet the specifications of BS 6234, 1969, TYPE 03 C for polyethylene compounds.
(5) Laminated sheath thickness shall be as specified in Table IV.1.3.2.5.
(6) Cable external diameter shall be as specified in Table IV. 1.3.2.5.
(7) Self-supporting wires shall meet the specifications of JIS-G-3537 for zinc-plated steel strands No. 2 (a) Category 1, Class B.
(8) The moistureproofing compound shall be a black compound composed mainly of rubber asphalt series compounds.
(9) The external constructing of SS cables shall be as shown in Table IV.1.3.2.5 and Fig. IV.1.3.2.2.

1.3.2.8 Calbe Sag

A 3-meter specimen shall be taken from a finished cable. The tension specified in Table IV.1.3.2.6 shall be applied to both ends of the specimen's steel strand. Then, the sheath at the center of the specimen shall be peeled 40 cm long.

The strands of 10-pair units of unsheathed part shall be untwisted and the units shall be straighthned.

Then the center of units of the unsheathed section shall be pulled with a force of 1 kg per unit at right angles to the cable. The sag of the units at this time shall conform to Table IV.1.3.2.6.

Deviation, however, shall be as specified in Fig. IV.1.3.2.3.

1.3.2.9 Mechanical Requirements

A specimen, 1 to 2 meters, shall be taken from a finished cable, and bent back and forth, with the seam of the laminated tape (self-supporting wire) at the center of bending, using a mandrel as specified in Table IV.1.3.2.7. The specimen shall not develop a crack or cracks in the aluminum tape which adjoins the PE sheath.

1.3.2.10 Electrical Requirements

(1) Conductor resistance

The DC resistance of each conductor shall conform to Table IV.1.3.2.1.

(2) Dielectric strength

Nothing wrong shall develop when a DC voltage of 500V or an AC (50 or 60Hz) voltage of 350V (rms) is applied across each conductor and the ground (with the other conductors grounded) for one minute.

(3) Insulation resistnace

When a DC voltage of 100 to 500 V is applied across each conductor and the ground (with the other conductors grounded) and charging is kept for one minute, the insulation resistance shall be more than 50,000 M ohms-km.

(4) Static capacity

The mean static capacity of each drum as measured with 1 kHz AC shall conform to Table IV.1.3.2.8.

(5) Static coupling

The static coupling of the hysical circuits in each quad as measured with 1 kHz AC shall not exceed the value specified in Table IV.1.3.2.9 multiplied by $\sqrt{\ell/500}$.

"ℓ" means cable length in meters. If it is less than 100 meters, ℓ shall be taken as 100. For cables of less than 50 pairs, the maximum value given in the Table IV.1.3.2.9 shall apply.

1.3.2.11 Cable End Processing

(1) Both cable ends shall be sealed by a suitable method to keep moisture out.
(2) That cable end where the quads and units are arranged clockwise shall be the upper end, which shall be indicated by winding a red tape printed "Upper End" around the cable sheath.
The other cable end shall be wound with a blue tape printed "Lower End".

1.3.2.12 Standard Cable Length

Unless otherwise specified, the standard cable length shall be 500 meters.

1.3.2.13 Cable Drum

(1) Cables shall be wound around strong wooden drums which have been treated with an antiseptic or strong steel drums which have been treated to be corrosion resistant, and be so treated as to withstand any and all conditions during transport.
(2) At least one of the outer surfaces of each cable drum shall carry definite information on the following.

a) Name of manufacturer
b) Type, number of pairs, conductor diameter and length of cable
c) Drum number
d) Overall weight
e) PTC
f) Arrows on both sides indicating the normal direction of rotation

Other information deemed necessary for loading, etc. shall be indicated on the other side of the drum.

Table IV. I. 3. 2. I.
Conductor Diameter and Conductor Resistance

Kind of Conductor (mm)	Conductor Diameter (mm)	Max. Conductor Resistance ohm/km
0.4	0.4 ± 0.001	147.5
0.5	0.5 ± 0.001	93.5
0.65	0.65± 0.002	56.5
0.9	0.9 ± 0.002	29.0

Table IV. I.3.2.2 Kind of Quad

Core / Quad No.	1st Class Core	2nd Class Core	3rd Class Core	4 th Class Core
1	Blue	White	Brown	Black
2	Yellow			
3	Green			
4	Red			
5	Purple			

Table IV. I. 3.2. 3
Thickness of Polyethylene (PE) Sheath

Conductor Diameter (mm)	Min. Thickness of PE Sheath (mm)
0.4	0.11
0.5	0.13
0.65	0.18
0.9	0.25

Table IV.1.3.2.4 Arrangement of Cable Units

No. of Pairs		Center Layer 10 Pair Unit					Total	1st Layer 10 Pair Unit							Total	2nd Layer 10 Pair Unit												Total	No. of 10 Pair Units Total
		Arrangement & Colour of Coarse Binding Tape						Arrangement & Colour of Coarse Binding Tape								Arrangement & Colour of Coarse Binding Tape													
30	10 Pair unit no.	1	2	3			3																						3
	Coarse binding tape.	Blue	Yellow	Green																									
	Pair count	1–10	11–20	21–30																									
50	10 Pair unit no.	1	2	3	4	5	5																						5
	Coarse binding tape	Blue	Yellow	Green	Red	Purple																							
	Pair count	1–10	11–20	21–30	31–40	41–50																							
100	10 Pair unit no.	1	2	3			3	4	5	6	7	8	9	10	7														10
	Coarse binding tape	Blue	Yellow	Green				Red	Purple	Blue-White	Yellow-White	Green-White	Red-White	Purple-White															
	Pair count	1–10	11–20	21–30				31–40	41–50	51–60	61–70	71–80	81–90	91–100															
200	10 Pair unit no	1	2				2	3	4	5	6	7	8		6	9	10	11	12	13	14	15	16	17	18	19	20	12	20
	Coarse binding tape	Blue	Yellow					Green	Red	Purple	Blue-White	Yellow-White	Green-White			Red-White	Purple-White	Blue-Brown	Yellow-Brown	Green-Brown	Red-Brown	Purple-Brown	Blue-Black	Yellow-Black	Green-Black	Red-Black	Purple-Black		
	Pair count	1–10	11–20					21–30	31–40	41–50	51–60	61–70	71–80			81–90	91–100	101–110	111–120	121–130	131–140	141–150	151–160	161–170	171–180	181–190	191–200		

Table IV.1.3.2.5 Composition of SS Cable

Conductor Dia. (mm)	No. of Cable Pairs (Pair)	Actual No.of Pairs (Pair)	Min. Thickness of Laminated Sheath (mm)	Cable Outer Dia (mm)	Supporting Wire No. /mm	Cable Height (mm)
0.4	30	30	1.36	13.0	7/1.6	22.5
〃	50	50	〃	15.0	〃	24.5
〃	100	100	〃	18.5	7/1.8	28.5
〃	200	200	〃	24.0	7/2.0	34.5
0.5	30	30	〃	15.0	7/1.6	24.5
〃	50	50	〃	17.0	7/1.8	27.0
〃	100	100	〃	22.0	7/2.0	32.5
〃	200	200	1.44	28.5	7/2.3	40.0
0.65	30	30	1.36	17.0	7/1.8	27.0
〃	50	50	〃	20.5	〃	30.5
〃	100	100	1.44	27.0	7/2.3	38.5
0.9	30	30	1.36	22.5	7/2.0	33.0
〃	50	50	1.44	27.0	7/2.3	38.5

Table IV.1.3.2.6 Sag in Self-Supporting(SS)Cable

	Item	Tensile Strength	Specified Value
Steel Strand-ed Wire	1.6 mm 7 strands	300 ± 20kg	
	1.8 mm 7 strands	400 ± 20kg	
	2.0 mm 7 strands	500 ± 20kg	
	2.3 mm 7 strands	650 ± 20kg	
Amount of Sag	Spacing of Optional 10 Pair Unit in Center Layer of 30 Pair, 50 Pair, 100 Pair and 200 Pair		15 mm or more
	Amount of Displacement in Layer other than Center Layer of 100 Pair and 200 Pair.		10 mm or more

Table IV. I. 3. 2.7 Bendability of SS Cable

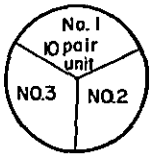
Cable external Dia	Bending Radius of Mandril	No. of Bends
Less than 32 mm	6-Fold of Cable outer Dia.	10 Times
32 mm or more	6-Fold of Cable outer Dia.	6 Times

Table IV. I. 3. 2.8 Electrostatic Capacity

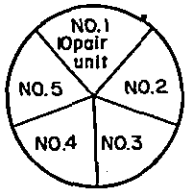
	Average Value
Cable of 50 Pairs or less	60 nF/km or less
Cable of 100 Pairs or more	55 nF/km or less

Table IV. I. 3. 2.9 Electrostatic Coupling

Specified Value		Remarks
Average Value	150 pF	(Excluding 50 Pairs or less)
Maximum Value	800 pF	



30 Pair Cable Core



50 Pair Cable Core

Note:

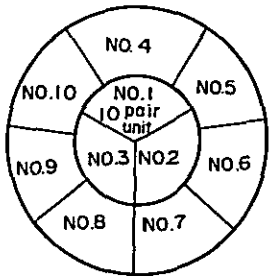
(1) 10 Pair units are divided according to the Colour of the coarse binding Tape as shown in the Table below.

(2) Arrangement of 10 Pair Units is given in Cross Section as seen from the "Upper Part"

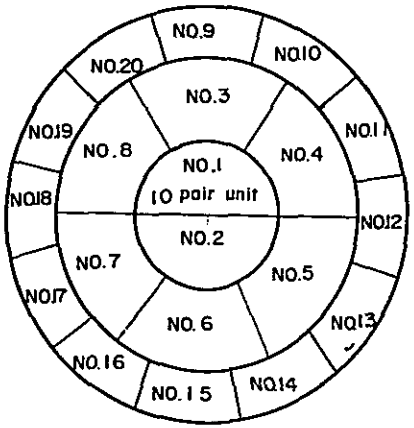
(3) Cable Cross Section of each 10 Pair Unit is irrespective of relative Position.

(4) Position of Core in quad Shall be, in Principle, Clock-wise as 1st Class, 3rd Class, 2nd Class and 4th Class core.

No. 1 10 Pair Unit	(Coarse binding Tape	Blue)	No. 11. 10 Pair Unit	(Coarse bind-ing Tape- Green-Brown)
" 2 "	("	Yellow)	" 12 "	(" Yellow-Brown)
" 3 "	("	Green)	" 13 "	(" Green-Brown)
" 4 "	("	Red)	" 14 "	(" Red -Brown)
" 5 "	("	Purple)	" 15 "	(" Purple-Brown)
" 6 "	("	Green-White)	" 16 "	(" Green-Black)
" 7 "	("	Yellow-White)	" 17 "	(" Yellow-Black)
" 8 "	("	Green-White)	" 18 "	(" Green-Black)
" 9 "	("	Red-White)	" 19 "	(" Red -Black)
" 10 "	("	Purple-White)	" 20 "	(" Purple-Black)

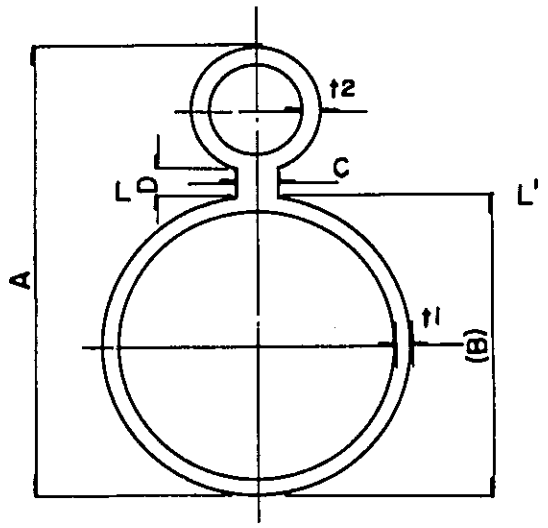


100 Pair Cable Core



200 Pair Cable Core.

Fig. IV. 1.3.2.1 Lay-Up of CCP-AP-SS Cable



A : Cable Height

(B) : Cable outer Diameter (Conversionfrom outer Sheath)

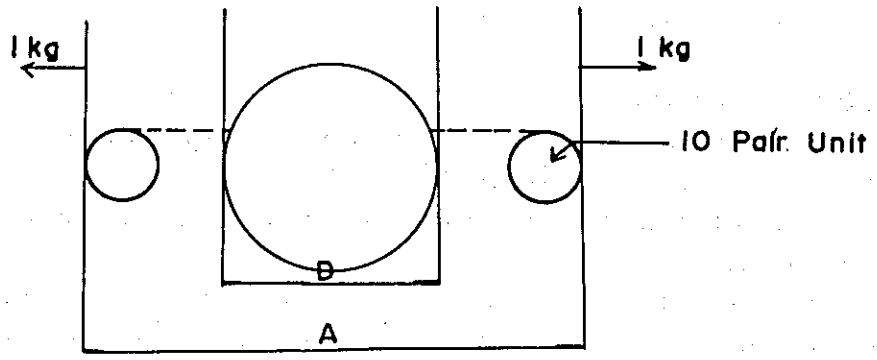
C : PE Thickness of Neck Portion. 2.0 mm

D : PE Length of Neck Portion. 2.0 mm

t1 : Thickness of Cable PE Sheath or laminated Sheath

t2 : Thickness of PE Sheath of Messenger Wire. 1.0mm

Fig. IV. 1.3.2.2 External Structure of SS Cable



Amount of Deviation is the Value of S shown In the Formula below.

$$S = \frac{A - D}{2}$$

S : Amount of Deviation

D : External Diameter of Layer of bundled. 10 Pair units before Unstranding.

A : The widened external Diameter of Two units when the 10 pair units at both ends of the Cable Cross Section are each pulled in opposite directions at a Strength of 1kg. after Unstranding of the 10 Pair units.

Fig. IV. 1.3.2.3 Deviation Amout of SS Cable

1.3.3 CCP-AP-JF Cable

1.3.3.1 General

This section deals with color coded, PE insulated, aluminium PE sheathed, and jelly filled star quad cables to be used as local cables. For color coding, all the conductors are colored differently.

1.3.3.2 Conductors

Annealed copper conductors conforming to the specifications of JIS-C-3102 for electrical annealed copper wire shall be used.

Conductors shall be completely free of any defect arising in the process of manufacture.

Conductor diameter shall be 0.4 ± 0.01 mm. Conductor joint shall be avoided as much as possible during the manufacturing process, but if it is necessary, a silver-alloy brazing method or a cold weld method shall be used.

1.3.3.3 Insulation

(1) The conductors specified in the preceding paragraph shall be uniformly covered with PE compound.

(2) PE compound shall meet the specifications of BS 6234, 1969, TYPE 03 for polyethylene compounds.

(3) The coloring of the PE compound shall conform to Table IV.1.3.3.1.

(4) PE covering thickness shall be more than 0.11 mm.

1.3.3.4 Quad Composition

(1) Four of the conductors specified in preceding paragraph shall be uniformly twisted to compose quads, with Class 1 conductor and Class 2 conductor diagonally opposite and Class 3 conductor and Class 4 conductor diagonally opposite in a square according to the colors specified in Table IV. 1.3.3.1.

(2) All the five quads in the 10-pair unit shall be different in pitch from one another.

1.3.3.5 Unit Compostion

(1) A unit of 10 pairs shall be prepared by gathering the five quads from the first quad to the fifth quad specified in Table IV.1.3.3.1 approximately in circular form and winding them with a plastic tape, i.e., the coarse winding tape.

(2) The coarse winding tape shall be 2.5 mm wide, and coarse winding pitch shall be less than 100 mm.

(3) The kinds of colors to be used for the coarse winding tape shall be as specified in Table IV.1.3.3.2.

1.3.3.6 Cable Cores

(1) 10-pair units shall be gathered approximately in circular form by twisting them opposite to their strands or twisting all layers in the same direction as specified in Table IV.1.3.3.2.

(2) A plastic tape may be wound over each layer, and the outermost layer may be covered with a coarsely wound plastic tape, or with other means to hold it.

A suitable filler may be inserted to finish the cable round.

(3) The cable conductors coarsely wound as mentioned in the preceding paragraph shall be covered with a paper tape or a cloth cylindrically or longitudinally to form a round cable core. In case of longitudinal covering, a suitable additional winding may be made.

(4) The name of the manufacturer (abbreviation or symbol) and the date of manufacture shall be indicated on the cable cores by a suitable method.

(5) The void in the cable shall be filled with compound, which shall be composed mainly of a polybutene substance, and shall be semi-solid at normal temperature. It shall be light-colored, have no foul smell, contain none of foreign matter and other substances harmful to the human body, and not adversely affect the compound, which is a constituent of the cable, due to physical properties, electrolytic corrosion or other causes.

The compound shall conform to the specifications of Table IV. 1.3.3.3.

1.3.3.7 Cable Sheath

(1) Cable conductors filled with the jelly shall be longitudinally covered with a laminated tape, and then with black PE in cylindrical form.

(2) The laminated tape to be used shall be a composite tape consisting of a soft aluminum tape and a polymer composed mainly of ethylene, which are bonded together by a suitable method. Plastic film shall have a minimum thickness of 0.03 mm.

(3) The aluminum tape shall be made of soft aluminum conforming to the specifications of JIS-H-4000 for aluminum and aluminum alloy plates.

The aluminum tape shall have a minimum thickness of 0.18 mm.

(4) PE compound for cable sheath shall conform to the specifications of BS 6234, 1969, TYPE 03C for polyethylene compounds.

(5) Laminated sheath thickness and cable external diameter shall be as specified in Table IV.1.3.3.4.

(6) No sheath PE shall enter the cable through laminated tape seams.

1.3.3.2 Armor

(1) Buried cables shall be steel-tape armored.

(2) A jute layer shall be closely wound over the PE covering as an jute bed for the steel-tape armor. The jute to be used for the purpose shall be equivalent to, or better than, that specified in the specifications of JIS-L-2402 for jute yarn.

Jute bed thickness shall be more than 1.0 mm.

(3) Two steel tapes shall be spirally wound over the jute bed in double layers, each spaced less than one-third of its width. The spaces in the inner layer of steel tape shall be completely covered with the center part of steel tape outer layer.

If steel tapes must be joined, they shall be joined by welding.

(4) The steel tapes to be used for armoring shall be so soft as not to damage the cable, and equivalent to, or better than, those specified in JIS-G-3141 for cold rolled steel plates and steel tapes.

Steel tape thickness shall be more than 0.55 mm.

(5) The steel tapes shall be given appropriate anti-rusty treatment prior to use. Anti-septic compound shall be a neutral type which is harmless to the steel tapes.

(6) After applying a sufficient amount of protective compound to the outer surfaces of the steel tapes, a single layer of jute shall be closely wound so it will not loosen. Then a sufficient amount of the protective compound shall be applied again, and finally chalk shall be applied. Outer jute jacket thickness shall be more than 1.0 mm.

(7) The protective compound to be applied to cables shall be a neutral type which has an appropriate softness and is harmless to the PE covering and steel.

(8) The external diameter of steel-tape armored cables shall be as specified in Table IV.1.3.3.4.

1.3.3.9 Mechanical Requirements

A specimen, 1 meter long, shall be taken from a finished cable, and bent back and forth at normal temperature, with the seam of the laminated tape at the center of bending, using a mandrel as specified in Table IV.1.3.3.5. The specimen shall not develop a crack or cracks in the aluminum tape which adjoins the PE sheath.

1.3.3.10 Waterproof Requirements

A 110 cm long specimen shall be taken from a finished cable, 5 cm each of the laminated sheath and holding tape shall be peeled from both ends of the specimen, and the conductors shall be cut at both ends to a specimen length of 100 cm.

The specimen placed horizontally shall be subjected to a hydraulic pressure of 120 cm in initial head in cross sectional directions at normal ambient temperature. No water shall flow out of either end of the specimen in 24 hours after start of measurement.

1.3.3.11 Electrical Requirements

(1) Conductor resistance

The DC resistance of each conductor measured with DC shall be less than 147.5 ohms per 1 Km of cable at 20°C.

(2) Dielectric strength

Nothing wrong shall develop when a DC voltage of 500 V or an AC (50 or 60 Hz) voltage of 350 V (rms) is applied across each conductor and the ground (with the other conductors grounded) for one minute.

(3) Insulation resistance

When a DC voltage of 100 to 500 V is applied across each conductor and the ground (with the other conductors grounded) and charging is kept for 1 to 3 minutes, the insulation resistance shall be more than 5,000 M ohms-km.

(4) Static capacity

The mean static capacity of each drum as measured with 1 kHz AC shall be as specified in Table IV.1.3.3.6.

(5) Static coupling

The static coupling of the physical circuits in each quad as measured with 1 kHz AC shall not exceed the value specified in Table IV.1.3.3.7 multiplied by $\sqrt{\ell/500.}$

"ℓ" means cable length in meters. If it is less than 100 meters, ℓ shall be taken as 100. For cables of less than 50 pairs, the maximum value given in Table IV.1.3.3.7 shall apply.

1.3.3.12 Cable End Processing

(1) Both cable ends shall be sealed by a suitable method to keep moisture out.

(2) That cable end where the quads and units are arranged clockwise shall be the upper end, which shall be indicated by winding a red tape printed "Upper End" around the cable sheath.

The other cable end shall be wound with a blue tape printed "Lower End".

1.3.3.13 Standard Cable Length

Unless otherwise specified, the standard cable length shall be 500 meters.

1.3.3.14 Cable Drums

(1) Cables shall be wound around strong wooden drums which have been treated with an antiseptic or strong steel drums which have been treated to be corrosion resistant, and be so treated as to withstand any and all conditions during transport.

(2) At least one of the outer surfaces of each cable drum shall carry definite information on the following.

a) Name of manufacturer
b) Type, number of pair, conductor diameter and length of cable.
c) Drum number.
d) Overall weight
e) PTC
f) Arrows on both sides indicating the normal direction of rotation

Other information deemed necessary for loading, etc. shall be indicated on the other side of the drum.

Table IV. 1.3.3.1 Kinds of Quads

Core / Quad No.	1st Class Core	2nd Class Core	3rd Class Core	4th Class Core
1	Blue	White	Brown	Black
2	Yellow			
3	Green			
4	Red			
5	Purple			

Table IV. 1.3.3.2 Arrangement of Cable Units

No. of Pairs		Center Layer Unit			
		Arrangement & Colour of Coarse binding Tape			Total
30	10 Pair Unit No.	1	2	3	3
	Coarse binding Tape	Blue	Yellow	Green	
	Pair count	1 – 10	11 – 20	21 – 30	

Table IV. 1.3.3.3 Characteristics of Compound

Item	Specified Value	Test Method
Drop Point	55°C or above.	According to JIS K 2561.
Flash Point	200°C or above.	〃 JIS K 2274.
Total Acidity	5 mg or less	〃 JIS K 2501.
Reduction by vaporizing	0.4% or less	〃 Clause 5.7 of JIS K 2320.
Ash Content	0.1 % or less	〃 JIS K 2272.
Volume Natural Resistance	1×1.0^{12} Ohm-cm or above	According to Clause 5.15 of JIS C 2320. However, the measuring Temperature shall be 100 ± 2°C.

Table IV.1.3.3.4 Composition of JF Cable

Conductor Dia. (mm)	No. of Pairs (Pair)	Actual No. of Pairs (Pair)	Min. Thickness of laminated sheath (mm)	External Dia. of Non-Armoured Cable (mm)	External Dia. of Armoured Cable (mm)
0.4	30	30	1.36	13.5	23

Table IV 1.3.3.5 Bendability of JF Cable

Cable External Dia.	Bending Radius of Mandril	No. of Bends
Less than 32 mm	6 fold of Cable External Dia.	5 Times
32 mm or more	6 fold of Cable External Dia.	3 Times

Table IV 1.3.3.6 Electrostatic Capacity

	Average Value
Cable of 50 Pairs or less	70 nF/km or less
Cable of 100 Pairs or more	65 nF/km or less

TableIV. 1.3.3.7 Electrostatic Coupling

Specified Value		Remarks
Average Value	150 pF	Excluding 50 or less Pairs
Maximum Value	800 pF	

1.3.4 Riser Cable With Gas Dam

1.3.4.1 General

This section deals with color coded, plastic insulated, and stalpeth or laminate sheathed star quad cables which are provided with gas dams and used as the riser cables in the gas pressurized sections.

1.3.4.2 Conductors

Annealed copper conductors conforming to the specifications of JIS-C-3102 for electrical annealed copper wire shall be used, and shall be completely free of any defect arising in the process of manufacture.

Conductor diameter shall be 0.4 ± 0.01 mm. Conductor joint shall be avoided as much as possible during the manufacturing process, but if it is necessary, a silver-alloy brazing method or a cold weld method shall be used.

1.3.4.3 Insulation

(1) The conductors specifeid in the preceding paragraph shall be uniformly covered with PE compound.

(2) PE compound shall meet the specifications of BS 6234, 1969, TYPE 03 for polyethylene compounds.

(3) The coloring of the PE compound shall conform to Table IV.1.3.4.1.

(4) Minimum PE covering thickness shall be 0.11 mm.

1.3.4.4 Quad Composition

(1) Four of the conductors specified in the preceding paragraph shall be uniformly twisted to compose quads, with Class 1 and Class 2 conductors diagonally opposite and Class 3 and Class 4 conductors diagonally opposite to each other approximately in a square according to the colors specified in Table IV.1.3.4.1.

(2) All the five quads of the 10-pair unit shall be different in pitch from one another.

1.3.4.5 Unit

(1) 10-pair unit composition

a) A unit of 10 pairs shall be prepared by gathering the five quads from the first quad to the fifth quad specified in Table IV.1.3.4.1 approximately in circular form and winding them with a plastic tape, i.e., the coarse winding tape.

b) The coarse winding tape shall be 2.5 mm wide and the same colored tape shall be spaced less than 100 mm from turn to turn.

c) The kinds of colors to be used for the coarse winding tape shall be as specified in Table IV.1.3.4.2.

(2) Unit composition

a) A unit of 50 pairs shall be prepared by twisting five 10-pair units, prepared in the manner specified in the preceding paragraph, opposite to their original strands approximately in circular form according to Table IV.1.3.4.2 and Fig. IV.1.3.4.1; or by twisting each layer in the same direction.

b) A colored plastic tape (hereinafter called the unit coarse winding tape) shall be wound around the assembled units in the direction opposite to the coarse winding tape.

The unit coarse winding tape shall be 5 mm wide, and the same colored tape shall be spaced less than 100 mm from turn to turn.

c) The kinds of colors to be used for the coarse winding tape shall be as specified in Table IV.1.3.4.3.

1.3.4.6 Cable Cores

(1) The units prepared as specified in the preceding paragraph shall be gathered approximately in circular form by twisting each layer in the same direction as shown in Fig. IV.1.3.4.2.

In case of 3-layer composition, a plastic tape may be wound between the first layer and the second layer.

(2) The assembled units shall be wound with a plastic tape in an overlapping manner and then with 4 layers of paper insulating tape over it by overlapping them approximately half-width deep. Or, tape may be wound closely to the same or greater thickness.

(3) On the outermost layer of paper insulating tape shall be printed the name of the manufacturer (abbreviation or symbol) and the year of manufacturer from end to end.

(4) The insulating paper tape shall conform to the specifications of JIS-C-2308 for communications cable insulating paper.

1.3.4.7 Cable Sheath

(1) A corrugated aluminum tape shall be longitudinally placed along the cable conductors, 1 to 15 mm apart, and then a corrugated tin-plated steel tape shall be wound over the aluminum tape, overlapping it 5 to 25 mm deep, and the seams

shall be continuously soldered securely.

(2) The soldered part of the corrugated tape shall be such that its ridges and grooves are engaged properly, and shall be free of solder spatter or projections.

(3) The aluminum tape to be used shall be a soft aluminum tape with a standard thickness of 0.2 mm which conforms to the specifications of JIS-H-4000 for aluminum and aluminum-alloy plates.

(4) The tin-plated steel tape to be used shall be a 0.18 mm thick steel tape, which is composed of as specified in Table IV.1.3.4.5, and plated with tin on both sides.

(5) The sizes of the corrugated aluminum tape and corrugated steel tape shall be as specified in Table IV.1.3.4.4.

(6) A moistureproofing compound shall be uniformly applied to the corrugated, tin-plated steel tape which covers the conductors.

(7) The moistureproofing compound shall be a black compound composed mainly of rubber-asphalt series compound.

(8) After applying the moistureproof compound, sheath PE shall cover the cylindrical form.

(9) The sheath PE compound shall conform to the specifications of BS 6234, 1969, TYPE 03C for polyethylene compounds.

(10) PE sheath thickness and cable external diameter shall be as specified in Table IV.1.3.4.6. However, the PE sheath's thickness shall be measured at the ridge portion of the steel tape (where PE thickness is small).

1.3.4.8 Gas Dam Portion

(1) The gas dam portion shall be a part of a cable and shall have a gas partitioning function.

(2) The gas dam portion shall contain the compound to partition the gas in the cable, and be swollen from the rest of the cable.

(3) The gas dam portion shall have a No. 6 gas valve for gas pressure measurement and gas supply.

(4) The longer cable portion at an end of the gas dam portion is called the longer cable portion; and the shorter one is called the shorter cable portion. The standard lengths of these portions shall be as shown in Fig. IV.1.3.4.3.

1.3.4.9 Armor

(1) The longer portion of the cable shall be steel-tape armored as it will be directly buried underground.

(2) A jute layer shall be closely wound over the PE covering as an jute bed for

the steel-tape armor. The jute to be used for the purpose shall be equivalent to, or better than, that specified in the specifications of JIS-L-2402 for jute yarn.

Jute bed thickness shall be more than 1.0 mm.

(3) Two steel tapes shall be spirally wound over the jute bed in double layers, each spaced less than one-third of its width. The spaces in the inner layer of steel armor shall be completely covered with the center part of the steel tape outer layer.

If steel tapes must be joined, they shall be joined by welding.

(4) The steel tapes to be used for armoring shall be so soft as not to damage the cable, and equivalent to, or better than, those specified in JIS-G-3141 for cold rolled steel plates and steel tapes.

Steel tape thickness shall be more than 0.55 mm.

(5) The steel tapes shall be given appropriate anti-rusty treatment prior to use. Anti-septic compound shall be a neutral type which is harmless to the steel tapes.

(6) After applying a sufficient amount of protective compound to the outer surfaces of the steel tapes, a single layer of jute shall be closely wound so it will not loosen. Then a sufficient amount of the protective compound shall be applied again, and finally chalk shall be applied.

Outer jute jacket thickness shall be more than 1.0 mm.

(7) The protective compound to be applied to cables shall be the neutral type which has an appropriate degree of softness and is harmless to the PE covering and steel.

(8) Steel armored cable outer diameter shall be as specified in Table IV.1.3.4.6.

(9) That part of the longer cable portion from a point 1.0 meter away from the center of the gas dam portion shall be completely armored with steel tapes. The gas dam portion and the shorter cable portion shall not be armored.

1.3.4.10 Electrical Requirements

(1) Electrical connection of cable sheaths

The aluminum and steel tape sheaths at both cable ends shall have satisfactory electrical continuity.

(2) Conductor resistance

The resistance of a single conductor measured with DC shall be less than 147.5 ohms per 1 km of cable at 20°C.

(3) Dielectric strength

Nothing wrong shall develop when a DC voltage of 500 V or an AC (50 or 60 Hz) voltage of 350 V (rms) is applied across each conductor and the ground (with the aluminum tape, steel tape and other conductors grounded) for one

minute.

(4) Insulation resistance

When a DC voltage of 100 to 500 V is applied across each conductor and the ground (with the aluminum tape, steel tape and other conductors grounded) and charging is kept for 1 to 3 minutes, the insulation resistance shall be more than 10 KM ohms-km.

(5) Static capacity

The mean static capacity of each drum as measured with 1 kHz AC shall be less than 5.5 nF per 100 meters.

(6) Static coupling

The static coupling of the physical circuits in each quad as measured with a 1 kHz AC shall not exceed the value specified in Table IV.1.3.4.7 multiplied by $\sqrt{\ell/150}$. "ℓ" means cable length in meters. If it is less than 100 meters, ℓ shall be taken as 100.

1.3.4.11 Mechanical Requirements

The upper end of the cable shall be filled at normal temperature with gas at a pressure corresponding to 700 g/cm^2 at −30°C, and be left for 48 hours. The cable shall maintain airtightness and show nothing wrong in appearance even after that.

1.3.4.12 Gas Charging

The upper end of the cable shall be fitted with a metal cap having a gas valve, through which dry air or nitrogen gas having a pressure of 0.6 ± 0.1 kg/cm^2 at an atmospheric pressure of 1033 g/cm^2 and an ambient temperature of 20°C shall be charged prior to shipment.

1.3.4.13 Cable End Processing

(1) Both cable ends shall be completely sealed to keep moisture out.
The upper cable end shall be fitted with a metal cap having a gas valve.

(2) That cable end where the quads and units are arranged clockwise shall be the upper end, which shall be indicated by winding a red tape printed "Upper End" around the cable sheath.
The outer cable end shall be wound with a blue tape printed "Lower End".

1.3.4.14 Standard Cable Length

Standard cable length shall be as specified in Table IV.1.3.4.8.

1.3.4.15 Cable Drum

(1) Cables shall be wound around strong wooden drums which have been treated with an antiseptic or strong steel drums which have been treated to be corrosion resistant, and be so treated as to withstand any and all conditions during transport.

(2) The gas dam portions and gas valves shall be so protected as not to be greatly bent or distorted.

(3) At least one of the outer surfaces of each cable drum shall carry definite information on the following.

a) Name of manufacturer
b) Type, number of pairs, conductor diameter and length of cable
c) Drum number
d) Overall weight
e) PTC
f) Arrows on both sides indicating the normal direction of rotation

Other information deemed necessary for loading, etc. shall be indicated on the other side of the drum.

Table IV. 1.3.4.1 Kinds of Quads

Conductor / Quad No.	1st Class Conductor.	2nd Class Conductor.	3rd Class Conductor.	4th Class Conductor.
1	Blue	White	Brown	Black
2	Yellow	White	Brown	Black
3	Green	White	Brown	Black
4	Red	White	Brown	Black
5	Purple	White	Brown	Black

Table IV. 1.3.4.2 Composition of Cable Unit

		Center Layer Unit Arrangment & Colour of Coarse Binding Tape				
50 Pair Unit	10 Pair Unit No.	1	2	3	4	5
	Coarse binding Tape	Blue	Yellow	Green	Red	Purple
	Parir count	1-10	11-20	21-30	31-40	41-50

Table IV. 1.3.4.3 Arrangement of Cable Units

		Center Layer Unit Arrangement & Colour of Unit Coarse Binding Tape			Lst Layer Unit Arrangement & Colour of Unit Coarse Binding Tape		
400 Pair	Unit No.	1			2	3	4
	Unit Coarse binding Tape	Blue			Yellow	Green	Red
	Pair count	1-50			51-100	101-150	151-200

5	6	7	8
Purple	Blue-White	Yellow-White	Green-White
201-250	251-300	301-350	351-400

Table IV. 1.3.4.4

Dimensions of Aluminum Tape & Steel Tape

Kind of Tape	Pitch of corrugation (mm)	Height of corrugation (mm)
Corrugated Aluminum Tape	2.5	1.0
Corrugated tinplated steel	2.5	1.0

Table IV. 1.3.4.5 Ingredients of Steel Tape

Ingredients	Carbon	Manganese	Phosphorus	Sulfur	Iron
Content (%)	0.1 or less	0.6 or less	0.05 or less	0.05 or less	Balance

Table IV. 1.3.4.6

Thickness of PE Sheath and Cable external Diameter

Conductor Dia. (mm)	NO. of Pairs (Pair)	Min. Thickness of PE Sheath (mm)	External Dia. of Non-Armoured Cable (mm)	External Dia. of Armoured Cable (mm)	Remarks
0.4	400	1.27	39	49	50 Pair Unit

Table IV. 1.3.4.7

Electrostatic Coupling

Specified Value	
Average Value	80 pF
Maximum Value	440 pF

Table IV. 1.3.4.8

Cable Standard Length

Cable Conductor Dia. (mm)	NO. of Pairs of Cable (Pair)	Cable Standard Length L (m)
0.4	400	20
"	"	30
"	"	40
"	"	50
"	"	60

50Pair unit

10 Pair units are divided according to the Colour of the coarse binding Tape as Shown in the Table below.

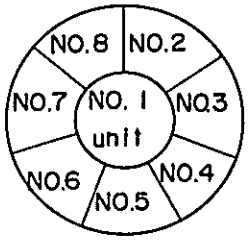
Arrangement of the 10 Pair units is given in Cross Section as seen from the upper Part.

Position of Core in quad shall be. in Principle. Clockwise as 1st Class. 3rd Class. 2nd Class and 4th Class.

The Cable Cross Section of each unit is irrespective of relative Position.

NO.	1	10 Pair unit	–	Blue
"	2	"	–	Yellow
"	3	"	–	Green
"	4	"	–	Red
"	5	"	–	Purple

Fig. IV. 1.3.4. 1 Composition of 50 Pair Coble Unit



400 Pair
Cable Core

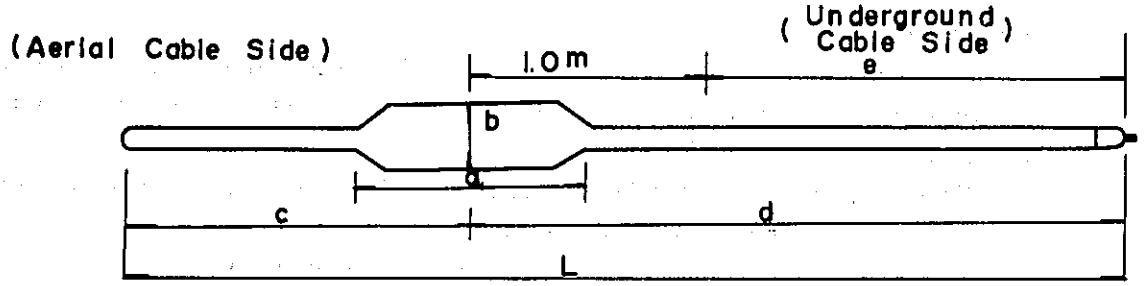
The units are divided according to the Colour of the coarse binding Tape as Shown in the Table below.

Arrangement of the units is given in Cross Section as seen from the upper Part.

Cable Cross Section of the units is irrespective of relative Position.

NO.	1	unit	–	Blue
"	2	"	–	Yellow
"	3	"	–	Green
"	4	"	–	Red
"	5	"	–	Purple
"	6	"	–	Blue – White
"	7	"	–	Yellow – White
"	8	"	–	Green – White

Fig. IV. 1.3.4.2 Arrangement of Cable Units



a : Gas Dam Length --- 510 mm or less
b : Gas Dam external Diameter -- 85 mm or less
c : Short Cable Length ---- 4.0 m
d : Long Cable Length
e : Armoured Sheath Section
L : Cable Length

Fig. IV. I. 3. 4. 3 Cable Length and Position of Dam

1.3.5 SD Wire

1.3.5.1 General

This section deals with SD wires for local telephone lines, which are of pair construction, insulated with PE and covered with polyvinyl chloride (hereinafter called PVC).

1.3.5.2 Conductors

Annealed copper conductors conforming to the specifications of JIS-C-3102 for electrical annealed copper shall be used, and shall be completely free of any defect arising in the process of manufacture.

Conductor diameter shall be as specified in Table IV.1.3.5.1. Conductor joint shall be avoided as much as possible during the manufacturing process, but if it is necessary, a silver-alloy brazing method or a cold weld method shall be used.

1.3.5.3 Insulation

(1) Class 1 conductor shall be covered with insulating PE and color PE, and Class 2 conductor with insulating PE as shown in Table IV.1.3.5.2 and Fig. IV.1.3.5.1.

(2) The PE compound to be used shall conform to the specifications of BS 6234, 1969, TYPE 03 for polyethylene compounds.

(3) The insulating PE and color PE shall perfectly adhere to each other and be identifiable, and finished conductors shall appear approximately concentric.

(4) The insulating PE shall be black, and the color PE white.

1.3.5.4 Pairs

(1) Class 1 and Class 2 conductors shall be uniformly twisted to compose a pair, which shall then be covered with black PVC as shown in Fig. IV.1.3.5.1 and Table IV.1.3.5.2.

(2) Two-pair conductors covered with black PVC shall be wound with 1.5 mm wide PVC of the color specified in Fig. IV.1.3.5.2, and 6-pair conductors covered with black PVC shall be wound with 1.5 mm wide PVC of the color specified in Fig. IV.1.3.5.3, both PVC tapes continuously, distinctly and perfectly adhering to the black PVC.

(3) The PVC compound to be used shall be equivalent to, or better than, those specified in BS 6746, 1969, TYPE 1.

1.3.5.5 Grouping

(1) Pairs shall be grouped around PVC-covered steel wire by twisting them clockwise as shown in Fig. IV.1.3.5.2 and Fig. IV.1.3.5.3.

(2) PVC-covered steel strand shall be a zinc-plated steel wire, 2.6 mm in

diameter, covered with black PVC in cylindrical form to uniform thickness.

(3) Zinc-plated steel wire meeting the specifications of JIS-G-3537 for zinc-plated steel strands Category 1 Class B shall be used.

(4) The PVC compound to be used for covering shall be equivalent to, or better than those specified in BS 6746, 1969, TYPE 1.

PVC covering thickness shall be as specified in Table IV.1.3.5.1.

1.3.5.6 PVC Sheath Thickness

(1) Minimum and average PVC sheath thicknesses shall be as specified in Table IV.1.3.5.2.

Average PVC sheath thickness means the average of measured values taken at 4 or more points (including the minimum point) approximately equi-distance on a vertical cross section of the PVC sheath.

(2) Minimum black PVC sheath thickness at parts where the color tape is wound shall be more than 0.45 mm.

(3) External diameter of SD wire shall be as specified in Table IV.1.3.5.2.

1.3.5.7 Printing

The PVC sheath of self-supporting wire shall be clearly printed, in white, with the name of the manufacturer (abbreviation or symbol) and the year of manufacture from end to end.

1.3.5.8 Electrical Requirements

(1) Conductor resistance

The resistance of each conductor measured with DC shall be as specified in Table IV.1.3.5.1.

(2) Dielectric strength

Nothing wrong shall develop when an AC voltage (50 or 60 Hz) of 2,000 V (rms) is applied across each conductor and the ground (with the self-supporting wire and the other conductors grounded) for one minute.

(3) Insulation resistance

When a DC voltage of 100 to 500 V is applied across each conductor and the ground (with the self-supporting wire and the other conductors grounded) and charging is kept for 1 minute, the insulation resistance shall be more than 1,000 M ohms-km.

(4) Static capacity

The mean static capacity of each drum as measured with 1 kHz AC shall be less than 60 nF per 1 km.

(5) Static coupling

Static coupling between adjacent pairs as measured with 1 kHz AC shall not exceed the product of 300 pF and $\sqrt{\ell/500}$. "ℓ" means wire length in meters. If it is less than 100 meters, ℓ shall be taken as 100.

1.3.5.9 SD Wire End Processing

Both ends of a SD wire shall be sealed by a suitable method to keep moisture out.

1.3.5.10 Standard Length

Standard SD wire length shall be 500 meters.

1.3.5.11 Cable Drum

(1) SD wires shall be wound around strong wooden drums which have been treated with an antiseptic or strong steel drums which have been treated to be corrosion resistant, and be so treated as to withstand any and all conditions during transport.

(2) At least one of the outer surfaces of each SD wire drum shall carry definite information on the following.

a) Name of manufacturer
b) Type, number of pairs, conductor diameter and length of SD wire
c) Drum number
d) Overall weight
e) PTC
f) Arrows on both sides indicating the normal direction of rotation

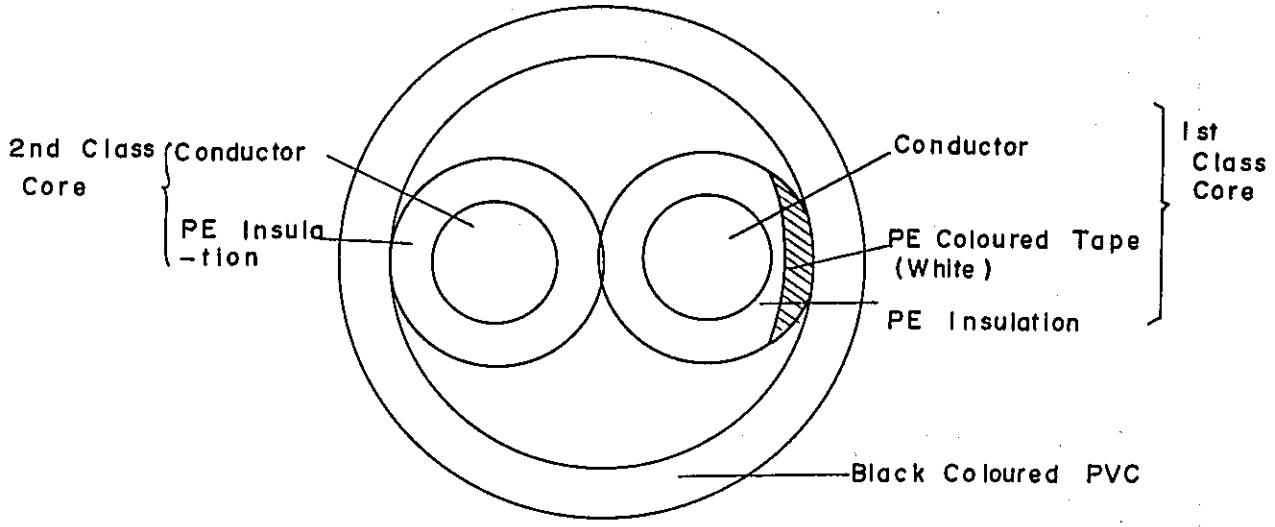
Other information deemed necessary for loading, etc. shall be indicated on the other side of the drum.

Table IV. 1.3.5.1
Conductor Diameter and Conductor Resistance

Kind of Conductor (mm)	Conductor Diameter (mm)	Maximum Conductor Resistance ohm/km at 20°C
0.65	0.65 ± 0.02	56.5
0.9	0.9 ± 0.02	29.0

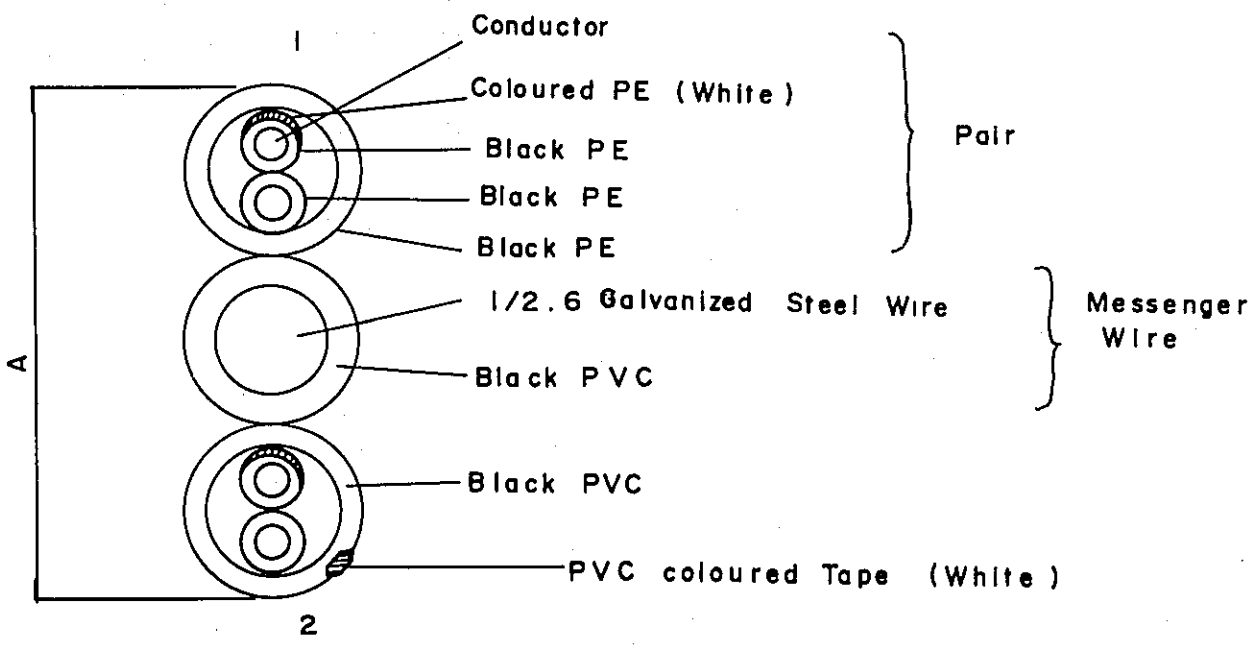
Table IV. 1.3.5.2 Make-Up of SD Wire

Product Name	Conductor		Thickness of PVC Sheath		Wire external Dia.	Messenger Wire	
	Thick-ness of PE insu-lation (mm)	External Dia. (mm)	Min. (mm)	Avg. (mm)	(mm)	Galva-nized Steel Wire (No./mm)	Thick-ness of PVC (mm)
0.9mm 2 Pair SD Wire	0.45	1.8	0.45 or more	0.55 or more	14.2	1/2.6	1.0
0.65mm 6 Pair SD Wire	0.4	1.45	0.45 or more	0.55 or more	12.8	1/2.6	1.0



Note: Thickness of Colour Tape shall be 1/2 or less of the Thickness of PE insulation.

Fig. IV. I.3.5.1 Pair Make-Up of SD Wire



A = Wire External Diameter

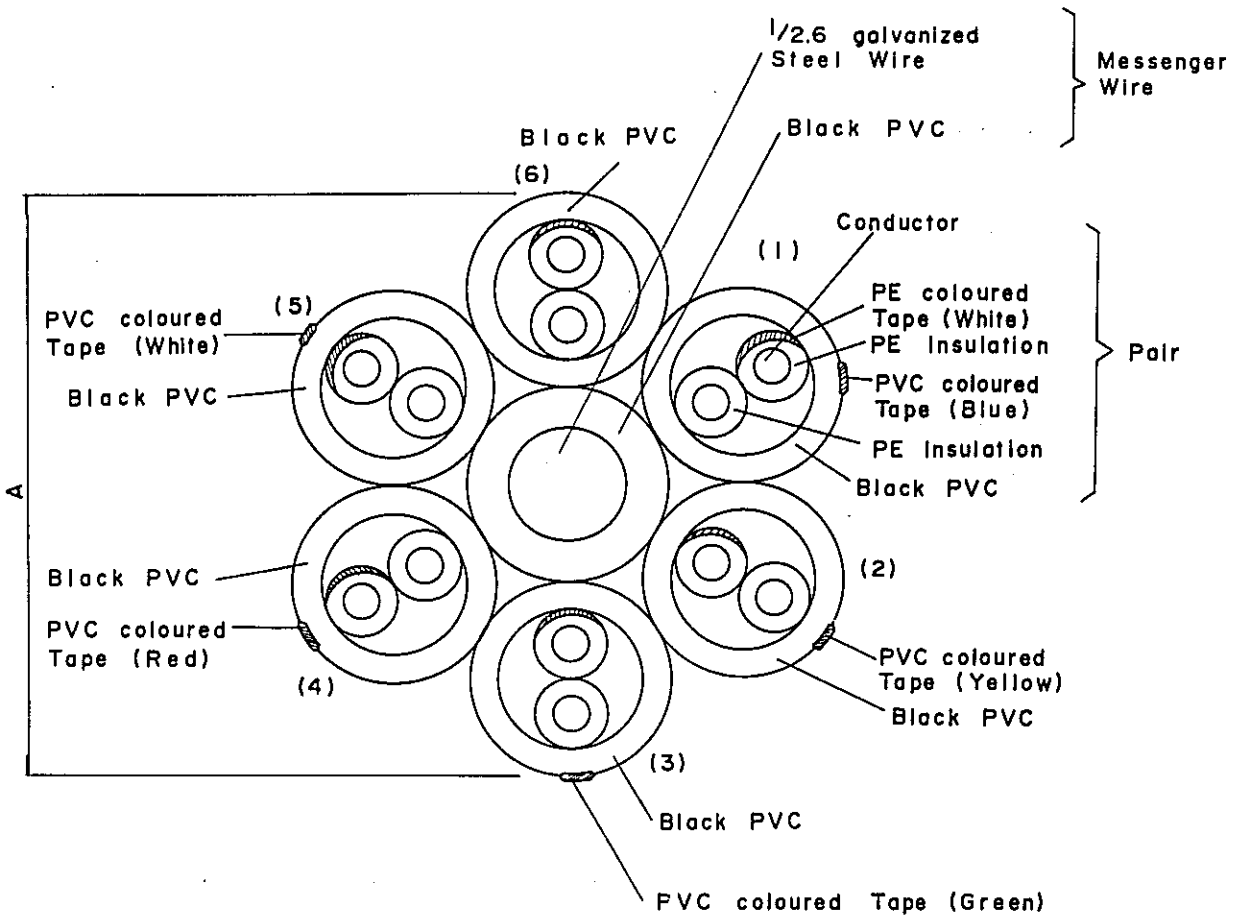
Numerical values indicate the Pair count.

Note : 1. The Colour for the PVC Coloured tape shall be clearly carried out.

2. Pairs over the Messenger Wire are irrespective of relative Position.

Fig. IV. 1.3.5.2

Make-Up of 2 Pair SD Wire



A = Indicates external diameter of Wire.

Figures indicate the Pair count.

Note. The PVC coloured Tape shall be clearly executed.

Fig. IV. 1.3.5.3
Make-Up of 6 Pair SD Wire

1.3.6 PVC Terminating Cable

1.3.6.1 General

This section deals with PVC insulated and PVC sheathed star-quad cables to be used for termination of local cables and junction cables.

1.3.6.2 Conductors

Annealed copper conductors conforming to the specifications of JIS-C-3102 for electrical annealed copper wire, that are plated with tin, shall be used. The conductors shall be completely free of any defect arising in the process of manufacture.

Conductor diameter shall be as specified in Table IV.1.3.6.1. Conductor splicing shall be avoided as much as possible during the manufacturing process, but if it is necessary, a silver-alloy brazing method or an electric welding method shall be used.

1.3.6.3 Insulation

(1) Conductors shall be uniformly covered with PVC compound.

(2) The PVC compounds to be used for the purpose shall be equivalent to, or better than, those specified in BS 6746, 1969, TYPE 1.

(3) The PVC compounds shall be colored for identification of the conductors.

(4) PVC sheath thickness shall be as specified in Table IV.1.3.6.2.

1.3.6.4 Quad Composition

Four of the conductors specified in the preceding paragraph shall be uniformly twisted to compose quads, with Class 1 and Class 2 conductors positioned diagonally opposite and Class 3 and Class 4 conductors diagonally opposite to each other approximately in a square according to Table IV.1.3.6.3.

1.3.6.5 Kinds of Quads

Quads shall be differently colored as specified in Table IV.1.3.6.3 according to the colors of PVC insulations, and any part of the cable shall be easily identifiable by color.

1.3.6.6 Unit Composition

(1) A 51-quad unit shall be prepared by arranging the quads prepared in the manner specified in the preceding paragraph into layers as specified in Table IV.1.3.6.4 and twisting each layer at a different twisting pitch concentrically in the same direction.

(2) Each layer, except the center layer, and the outermost layer shall be wound with cotton, rayon or polyester thread to hold them.

(3) Each layer shall have such a quad arrangement that a tracer quad, serving as

reference, is followed by a sub-tracer quad and an ordinary quad and that this arrangement is repeated.

In case a layer has an even number of quads, however, an ordinary quad shall be used in place of the last sub-tracer quad.

1.3.6.7 Kinds of Units

Units shall be identified by the color of the layer-holding cotton, rayon or polyester thread as specified in Table IV.1.3.6.5

1.3.6.8 Unit Grouping

(1) The units prepared as mentioned in the preceding paragraph shall be arranged into layers as specified in Table IV.1.3.6.6, and adjacent layer units shall be twisted concentrically in the same direction as their strands to form a cable core.

(2) A cotton tape or rayon tape, one side of which is coated with PVC, shall be wound in an overlapping manner to completely cover the cable core.

(3) Each layer shall have a tracer unit and all the rest shall be ordinary units.

(4) If the center layer has only one unit, it shall be a tracer unit.

1.3.6.9 PVC Sheath

(1) The cable core shall be covered concentrically with the grey PVC compound.

(2) The PVC compound to be used shall be equivalent to those specified in the specifications of BS 6746, 1969, TYPE 1.

(3) PVC sheath thickness and cable external diameter shall be as specified in Table IV.1.3.6.7.

1.3.6.10 Printing

(1) The PVC sheath shall be printed with the name of the manufacturer (abbreviation or symbol) and the year of manufacture from end to end.

(2) Cable length shall be printed on the PVC sheath at intervals of one meter starting from 0-meter point and in cable axial directions.

1.3.6.11 Electrical Requirements

(1) Conductor resistance

The resistance of each conductor measured with DC at 20°C shall be as specified in Table IV.1.3.6.1.

(2) Insulation resistance

When a DC voltage of 100 to 500 V is applied across each conductor and the ground (with the other conductors grounded) under normal conditions and charging is kept for one minute, the insulation resistance shall be more than 100 M ohms-km at 20°C.

In case of converting measured insulation resistance values into values at

20°C, they shall be multiplied by the coefficient shown in Table IV.1.3.6.8.

(3) Dielectric strength

Nothing wrong shall develop when a DC voltage of 500 V or an AC (50 or 60 Hz) voltage of 350 V (rms) is applied across each conductor and the ground (with the other conductors grounded).

(4) Static capacity

The mean static capacity of physical circuits for each drum as measured with 1 kHz AC shall be less than 85 nF per 1 km of cable.

(5) Static coupling

The static coupling of the physical circuits in each quad as meausred with a 1 kHz AC shall not exceed 700 pF per 200 meters.

If cable length is other than 200 meters, however, the measured value shall be divided by $1/2\ (\ell/200 + \sqrt{\ell/200})$. "$\ell$" means cable length in meters. If it is less than 100 meters, ℓ shall be taken as 100.

1.3.6.12 Cable End Processing

Both cable ends shall be completely sealed to keep moisture and dust out.

1.3.6.13 Standard Cable Length

Unless otherwise specified, the standard cable length shall be 200 meters.

1.3.6.14 Cable Drum

(1) Cables shall be wound around strong wooden drums which have been treated with an antiseptic or strong steel drums which have been treated to be corrosion resistant, and be so treated as to withstand any and all conditions during transport.

(2) At least one of the outer surfaces of each cable drum shall carry definite information on the following.

a) Name of manufacturer
b) Type, number of pairs, conductor diameter and length of cable
c) Drum number
d) Overall weight
e) PTC
f) Arrows on both sides indicating the normal direction of rotation

Other information deemed necessary for loading, etc. shall be indicated on the other side of the drum.

Table IV. 1.3.6.1
Conductor Diameter and Conductor Resistance

Kind of Conductor (mm)	Conductor Diameter (mm)	Maximum Conductor Resistance ohm / km
0.4	0.4 ± 0.01	157.0
0.5	0.5 ± 0.01	100.2

Table IV. 1.3.6.2
Thickness of PVC Insulation

Conductor Diameter (mm)	Minimum Thickness of PVC Insulation (mm)
0.4	0.22
0.5	0.27

Table IV.1.3.6.3 Classification of Quads

Kind of Quad	1st Class Core	2nd Class Core	3rd Class Core	4th Class Core
Quad	Red	Pink	White	Grey
Semi-tracer quad	Blue	Light Blue	White	Grey
Tracer quad	Red	Pink	Blue	Light Blue

Table IV. 1.3.6.4 Layer Composition in Unit

No. of Quads in Each Layer Inside Unit	Center Layer	1st Layer	2nd Layer	3rd Layer	Total
	3	9	16	23	51

Table IV. 1.3.6.5 Kinds of Units

Kinds of Unit	Colour of Coarse Binding Tape
General Unit	White
Tracer Unit	Red

Table IV. 1.3.6.6
Arrangement of Cable Units

No. of Pairs	Center Layer	Ist Layer	Total
400 Pairs	4	—	4
600 Pairs	1	5	6

Table IV. 1.3.6.7
PVC Sheath Thickness and Cable External Diameter

No. of Pairs (Pair)	Conducter Dia. (mm)	Min. Thickness of PVC Sheath (mm)	Cable External Diameter (mm)
400	0.4	1.89	42
400	0.5	1.98	50
600	0.4	2.07	52

Table IV. 1.3.6.8
Temperature Correction Coefficient

Temp. (°C)	Coefficient	Temp. (°C)	Coefficient	Temp. (°C)	Coefficient
0	0.42	12	0.60	24	1.55
1	0.43	13	0.63	25	1.74
2	0.44	14	0.66	26	1.96
3	0.45	15	0.70	27	2.22
4	0.46	16	0.74	28	2.52
5	0.48	17	0.79	29	2.87
6	0.49	18	0.85	30	3.25
7	0.50	19	0.92	31	3.75
8	0.52	20	1.00	32	4.25
9	0.53	21	1.11	33	4.90
10	0.55	22	1.24	34	5.60
11	0.57	23	1.39	35	6.45

1.3.7 Self-supporting Drop Wire

1.3.7.1 General

This section deals with a PVC-insulated, self-supporting drop wire used for leading-in of cables to subscriber premises.

1.3.7.2 Conductors

Annealed copper conforming to the specifications of JIS-C-3102 for electrical annealed copper wire shall be used for making conductors, which shall be completely free of any defect arising in the process of manufacture.

Conductor diameter shall be 0.65 ± 0.02 mm. Conductor joint shall be avoided as much as possible during the manufacturing process, but if it is necessary, a silver-alloy brazing method or a cold weld method shall be used.

1.3.7.3 Steel Wire

(1) A 1.2 mm zinc-plated steel wire meeting the specifications of JIS-G-3537 for Category 1 Class B zinc-plated steel strands shall be used.

(2) A suitable length shall be cut off from a finished drop wire as a specimen, which shall be tested as specified in Paragraph 6 of JIS-G-3537. The test results shall meet the specifications of Table IV.1.3.7.1.

1.3.7.4 Insulation

(1) A PVC compound shall be closely wound around the conductors and steel wire almost concentrically to the form shown in Fig. IV.1.3.7.1 and Table IV.1.3.7.2.

(2) The PVC compound to be used shall be equivalent to, or better than, those specified in BS 6746, 1969, TYPE 1.

(3) The PVC compound shall be colored black.

(4) PVC sheath thickness shall be as specified in Table IV.1.3.7.2.

(5) All lines shall be in close contact with each other in lengthwise directions.

1.3.7.5 Conductor Identification and Indication

(1) Either one of the conductor insulations shall have a continual series of protrusions as shown in Fig. IV.1.3.7.1.

(2) The abbreviation of the manufacturer's name and the year of manufacture shall be printed in white PVC ink on the steel core covering from end to end.

1.3.7.6 Electrical Requirements

(1) Conductor resistance

Conductor resistance measured with DC shall be less than 56 ohms per 1 Km at 20°C.

(2) Dielectric strength

When a finished drop wire in bundled form is immersed in normal temperature water for 4 hours and an AC voltage (50 or 60 Hz) of 1,500 V (rms) is applied across the conductors and the ground for one minute, the drop wire shall develop nothing wrong.

(3) Insulation resistance

When a DC voltage of more than 100 V is applied across the conductors of the specimen specified in the preceding paragraph and the ground and charging is kept for one minute, the insulation resistance shall be more than 100 M ohms-km at 20°C.

However, those conductors which are not being tested shall be grounded during the test. Measured insulation resistance values can be converted into values at 20°C by multiplying the measured values by the coefficient shown in Table IV.1.3.7.3.

(4) Crack test on self-supporting wire

Under the same condition as mentioned in paragraph (2) above, an insulation test shall be conducted by applying 250 V or 500 V across the steel wire and the ground. There shall be no crack as the result of the test.

1.3.7.7 Standard Length and Packaging

(1) Standard length shall be 300 meters, and each wire shall be continuous without a joint.

(2) Drop wires shall be wound into bundles with an inside diameter of more than 200 mm, and shall be packaged suitably for transport.

1.3.7.8 Printing

The following information shall be printed at a suitable place on the package.

a) 0.65 mm drop wire
b) Name of manufacturer
c) Wire length

Table IV. 1.3.7.1
Standards of Galvanized Steel Wire

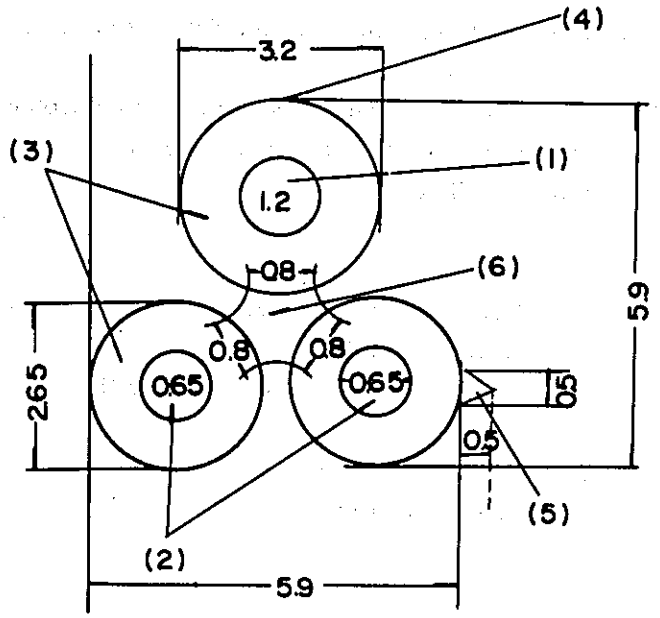
Item	Specified Value
Tensile strength (kg/mm²)	125 or more
Elongation (%)	2 or more
Number of twists (Times)	12 or more
Volume of zinc plating (g/m²)	50 or more

Table IV. 1.3.7.2 Make-Up of Drop Wire

No. of Conductor	Core			Suspension Wire			Finished External Dia. (mm)
	Conductor Dia. (mm)	PVC Insulation		Dia. of Galvanized Steel Wire (mm)	Standard Thickness of PVC (mm)	External Dia. (mm)	
		Standard Thickness (mm)	External Dia. (mm)				
2	0.65	1.0	2.65	1.2	1.0	3.2	5.9 X 5.9

Table IV. 1.3.7.3
Temperature Coefficient of Insulation Resistance

Temp. (°C)	Coefficient	Temp.(°C)	Coefficient	Temp.(°C)	Coefficient
0	0.42	12	0.60	24	1.55
1	0.43	13	0.63	25	1.74
2	0.44	14	0.66	26	1.96
3	0.45	15	0.70	27	2.22
4	0.46	16	0.74	28	2.52
5	0.48	17	0.79	29	2.87
6	0.49	18	0.85	30	3.25
7	0.50	19	0.92	31	3.75
8	0.52	20	1.00	32	4.25
9	0.53	21	1.11	33	4.90
10	0.55	22	1.24	34	5.60
11	0.57	23	1.39	35	6.45



(1) Steel Wire
(2) Annealed Copper Wire
(3) PVC Insulation
(4) Identification Print
(5) Protrusion
(6) Bridge

Unit : mm

Fig. IV. 1.3.7.1 Make-Up of Drop Wire

1.3.8 Indoor Wire

1.3.8.1 General

This section deals with a single-pair PVC-insulated indoor wire used between telephone protectors or rossettes and telephones.

1.3.8.2 Conductors

Annealed copper conductors conforming to the specifications of JIS-C-3102 for electrical annealed copper wire shall be used, and shall be completely free of any defect arising in the process of manufacture.

Conductor diameter shall be 0.65 ± 0.02 mm. Conductor joint shall be avoided as much as possible during the manufacturing process, but if it is necessary, a silver-alloy brazing method or a cold weld method shall be used.

1.3.8.3 Insulation

(1) Two conductors arranged as shown in Fig. IV.1.3.8.1 shall be almost uniformly and concentrically covered with colored PVC.

(2) The PVC compound to be used shall be equivalent to, or better than those specified in BS 6746, 1969, TYPE 1.

(3) The PVC compound shall be grey-colored.

(4) PVC sheath thickness shall be more than 0.54 mm.

1.3.8.4 Printing

(1) The name of the manufacturer (abbreviation or symbol) and the year of manufacture shall be printed continuously on the PVC insulation which covers the L1 conductor of each of the two parallel conductors as shown in Fig. IV.1.3.8.1.

(2) A blue line shall be clearly printed as shown in Fig. IV. 1. 3. 8. 1.

1.3.8.5 External Appearance

The surface of a finished wire shall be smooth, free of cracks, pinholes, and color unevenness, and there shall be no separation of the parallel conductors.

1.3.8.6 Electrical Requirements

(1) *Conductor resistance*

The resistance of each conductor measured with DC shall be less than 61 ohms per 1 Km at 20°C.

(2) Dielectric strength

When a finished indoor wire in bundled form is immersed in normal temperature water for 1 hour or more and an AC (50 or 60 Hz) voltage of 600 V (rms) is

continuously applied across the conductor and the ground (with the other conductor grounded) for one minute, the indoor wire shall develop nothing wrong.

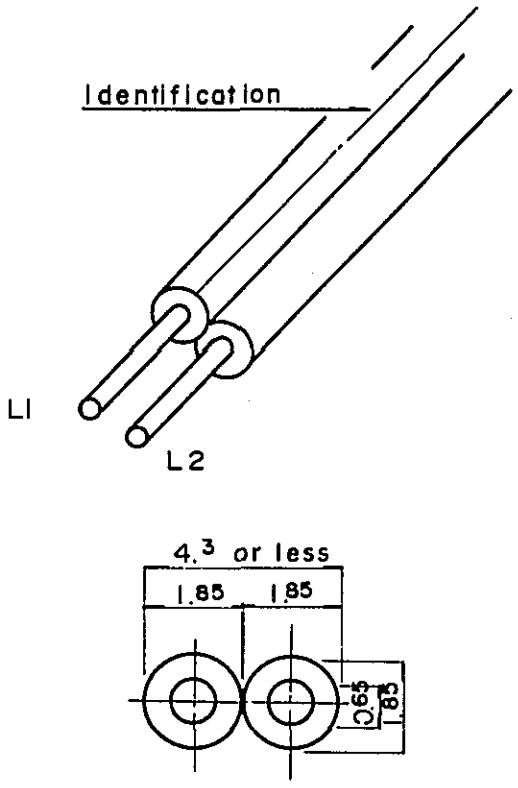
(3) Insulation resistance

When a DC voltage of 100 to 500 V is applied for one minute across a conductor and the ground (with the other conductor grounded), using the specimen as it is which has finished the test specified in the preceding paragraph, the insulation resistance shall be more than 20 M ohms-km at 20°C.

1.3.8.7 Standard Length and Packaging

(1) Standard length shall be 200 meters, and each wire shall be continuous without a joint.

(2) Indoor wires shall be wound into bundles with an inside diameter of more than 150 mm, and shall be packaged suitable for transport.



2 Core Parallel Row Indoor Wire

Fig. IV.1.3.8.1 Make-up of PVC Indoor Wire

1.3.9 Jumper Wire

1.3.9.1 General

This section deals with a single-pair, PVC-insulated jumper wire which is used for wiring distribution frames in the inside plant.

1.3.9.2 Conductors

Annealed copper conductors conforming to the specifications of JIS-C-3102 for electrical annealed copper wire, that are tin-plated, shall be used.

The conductors shall be free of any defect arising in the process of manufacture. Conductor joint shall be avoided as much as possible during the manufacturing process, but if it is necessary, a silver-alloy brazing method shall be used.

1.3.9.3 Insulation

(1) Conductors shall be closely and concentrically covered with colored PVC.

(2) The PVC compound to be used shall conform to the specifications of BS 6746, 1969, TYPE 1.

(3) The PVC compound shall be white- and red-colored.

(4) PVC insulation thickness shall be more than 0.27 mm.

1.3.9.4 Conductor Twisting

One red and one white conductor shall be evenly twisted clockwise at a pitch of 50 to 70 mm.

1.3.9.5 Electrical Requirements

(1) Conductor resistance

Conductor resistance measured with DC shall be less than 100.2 ohms per 1 Km at 20°C.

(2) Insulation resistance

When a DC voltage of 100 to 500 V is applied for one minute across a conductor of a finished jumper wire, which has been immersed in normal temperature water for more than an hour in bundled form, and the ground, the insulation resistance shall be more than 5.0 M ohms-km. The other conductors shall remain grounded during the test.

1.3.9.6 Standard Length and Packaging

(1) Standard length shall be 200 meters and each wire shall be continuous without a joint.

(2) Jumper wire shall be suitably packaged to withstand any and all conditions during transport.

1.3.10 Terminal Boxes

1.3.10.1 General

This section deals with ready access terminal boxes for CCP cable, 2-pair SD terminal box for SD wire and 10-pair No. 2 A indoor terminal block for cable or SD wire lead-in termination.

1.3.10.2 Ready Access Terminal Box

This terminal box is used for CCP cable connection and, by fitting it with a 4-pair terminal block, can be used for connecting drop wires.

(1) Kinds

The ready access terminal box comes in the following kinds which may be used according to the number of CCP cable pairs and the form of cable connection.

a) 200-straight type ready access terminal box
b) 200-single branch type ready access terminal box
c) 200-both branch type ready access terminal box
d) 400-straight type ready access terminal box
e) 400-single branch type ready access terminal box
f) 400-both branch type ready access terminal box

(2) Construction

a) The ready access terminal box shall consist of a main body, side cover, cover, inner clamp, etc., and conform to the specifications of Fig. IV.1.3.10.1 through Fig. IV.1.3.10.6.

b) The ready access terminal box can be fitted with a 4-terminal block for connecting drop wires.

c) The ready access terminal box shall be entirely fitted to and supported by cable and self-supporting wire.

d) The case cover is so designed that the case cover can be lifted open to permit installation of a 4-terminal block in the box and easy connection of cable conductors.

e) The terminal box shall have holes in the bottom plate for leading out drop wires connected to the 4-terminal block.

f) The ready access terminal box shall be printed with an abbreviated product name, the name of the manufacturer (abbreviation) and the year of manufacture.

(3) Material requirements

a) The aluminum to be used for the ready access terminal box shall conform to the specifications of JIS-H-400 for aluminum and aluminum alloys.

b) The steel to be used for the ready access terminal box shall be equivalent to, or better than, the stainless steel specified in JIS-G-4303, JIS-G-4305 or JIS-G-4309.

c) The polyethylene (hereinafter called PE) to be used for the ready access terminal box shall be a polymer consisting mainly of ethylene, and black-colored.

It shall be able to sufficiently withstand the weather of tropical zones.

(4) Others

a) The ready access terminal box shall be provided with all the necessary materials for mounting to CCP-AP-SS cables.

b) However, 4-terminal blocks, PE sleeves, CCP connectors and auxiliary bars for the ready access terminal box are excluded.

1.3.10.3 2-pair SD Terminal Box

This terminal box is used for connecting one SD wire to another and SD wires to drop wires.

(1) Construction

a) The SD terminal box shall consist of a main body, main body cover, metal clamps, terminal board, terminals, etc., and conform to the specifications of Fig. IV.1.3.10.7.

b) The terminal box shall be printed with an abbreviated product name, the name of the manufacturer (abbreviation) and the year of manufacture.

(2) Electrical requirements

a) Insulation resistance

When the SD terminal box, kept at a relative humidity of more than 90% for more than 30 minutes and then left under normal conditions for 10 minutes, is subjected to a DC voltage of 500 V, insulation resistance across terminals shall be more than 1,000 M ohms.

b) Dielectric strength

Nothing wrong shall develop when an AC (50 or 60 Hz) voltage of 350 V or a DC voltage of 500 V is applied across the terminals of the SD terminal box, which has been subjected to the conditions specified in the preceding paragraph, for one minute.

(3) Material requirements

a) Metal clamps shall conform to the specifications of JIS-G-4305 for cold-rolled stainless steel plates.

b) Brass plates for terminals, etc. shall conform to the specifications of JIS-H-3201 for brass plates. Clamp screws shall conform to the specifications of JIS-H-3521 for brass wire. They shall be uniformly nickel-plated.

c) Insulating material for the terminal board shall be high-quality polyester

resin, whose moldings shall be free of cracks, breaks and other abnormalities.

d) Polyethylene for the terminal box shall be a polymer consisting mainly of polyethylene, and shall be able to sufficiently withstand tropical weather.

1.3.10.4 10-pair No. 2 A Indoor Terminal Block

This terminal block is used for terminating cables or SD wires which have been led into subscriber buildings.

(1) Construction

a) The construction of the terminal block shall be as shown in Fig. IV.1.3.10.8.

b) A finished terminal block shall be free of cracks, flaws, burrs, etc. and be satisfactorily finished.

c) The main body of the terminal block shall be printed with an abbreviated product name, the manufacturer's name (abbreviation) and the date of manufacture.

d) The terminal block shall be provided with screws for installation.

(2) Material requirements

a) The main body of the terminal block shall be made of phenol resin which conforms to the specifications of JIS-K-6915 PM-EG.

b) Brass plates for the terminal block shall meet the specifications of JIS-H-3201 for brass plates.

c) Brass bars for the terminal block shall meet the specifications of JIS-H-3201.

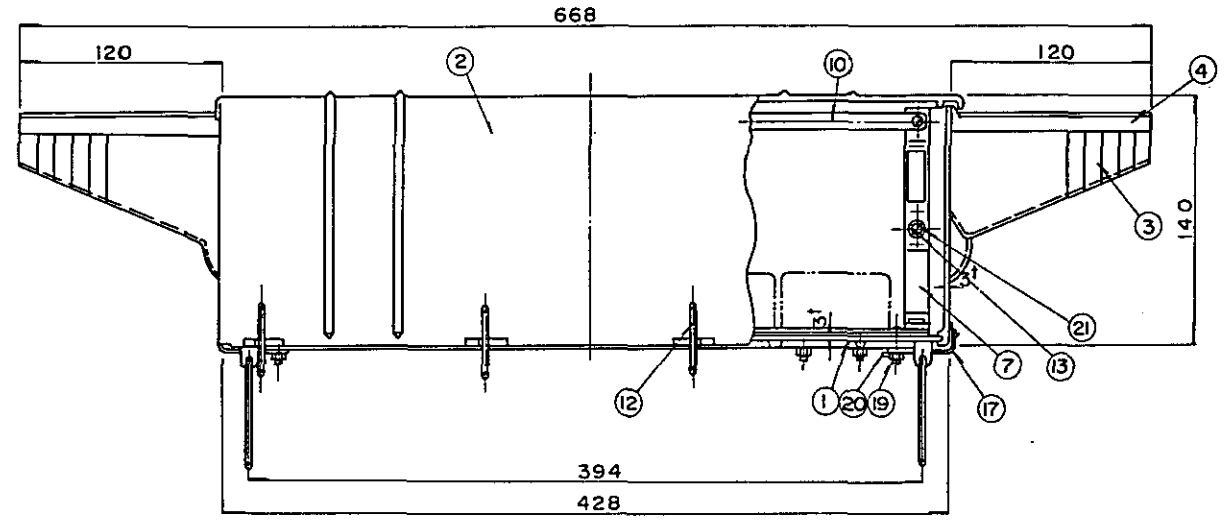
(3) Electrical requirements

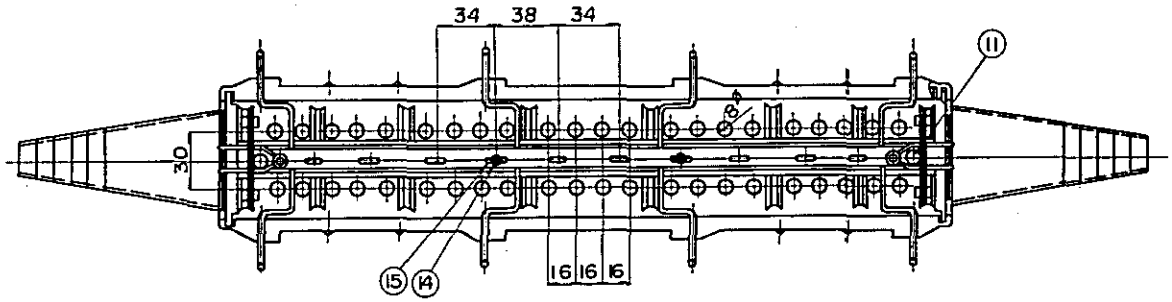
a) Insulation resistance

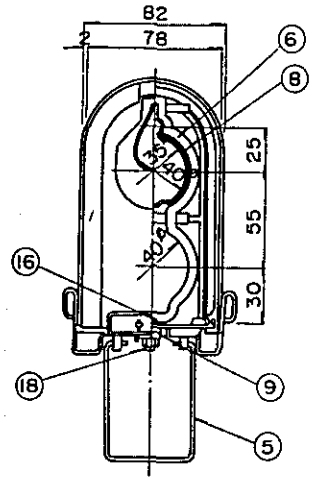
Insulation resistance across terminals themsevles, and across all terminals and clamp screws shall be more than 50 M ohms at normal temperature and a humidity of 85%.

b) Dielectric strength

Nothing wrong shall develop when a DC voltage of 500 V or an AC (50 or 60 Hz) voltage of 350 V is applied to the same measuring points as specified in the preceding paragraph for one minute under the same condition.





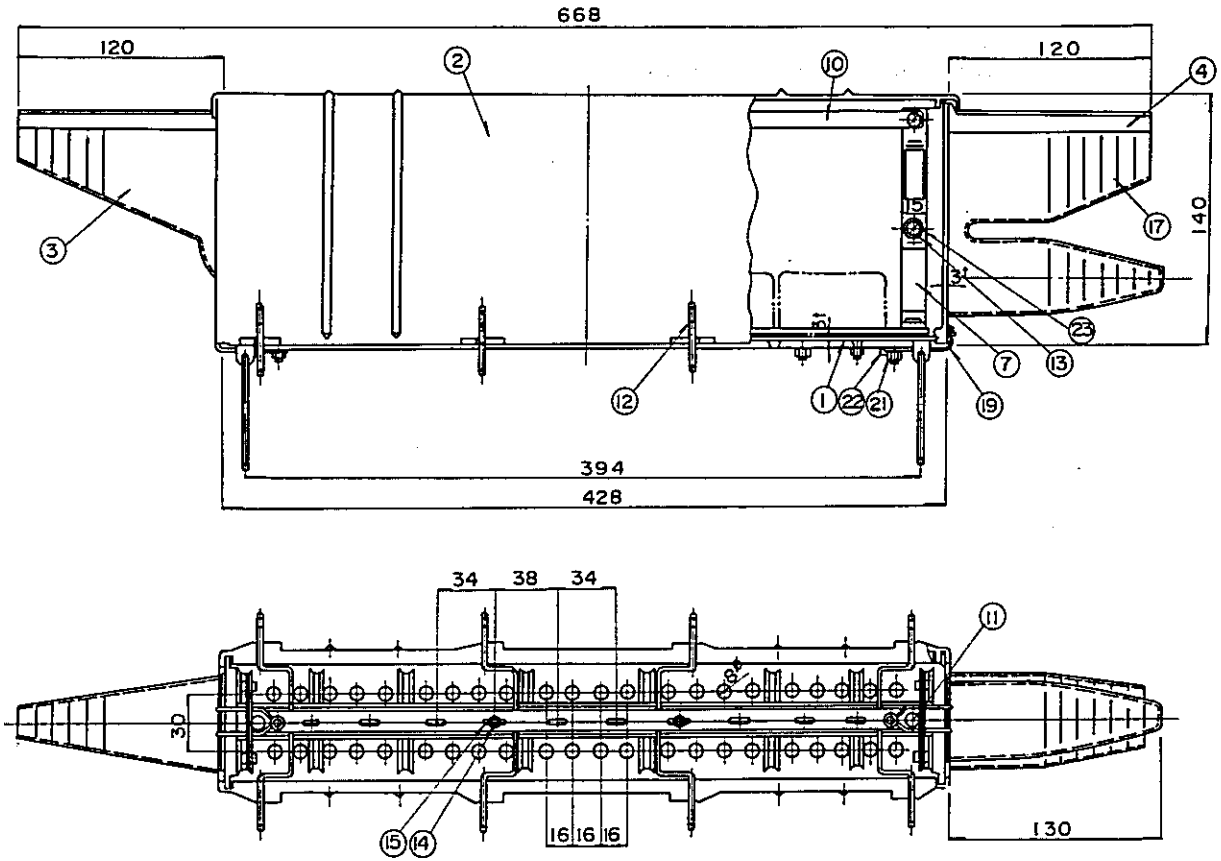


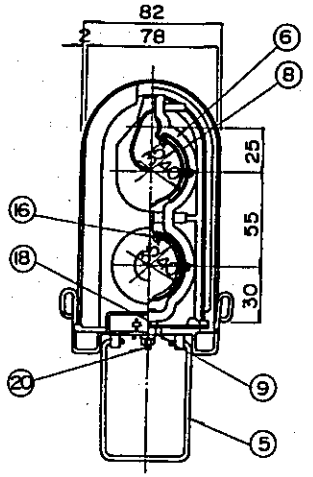
(Unit : mm)

No.	Name
21	Ground washer
20	Side cover stopper washer
19	Side cover stopper nut
18	Side cover stopper screw
17	Side cover stopper
16	Plane plate for reinforcement of the bottom plate
15	Nut
14	Screw
13	*Sheath clamp screw*
12	Cover stopper
11	Rivet
10	Reinforcement plate
9	Angle for reinforcement of the bottom plate
8	Inner clamp
7	Free sheath clamp
6	Sheath clamp
5	Guide ring
4	Nozzle lock
3	Straight side cover
2	Cover
1	Bottom plate

Fig. Ⅳ.1.3.10.1

Ready Access Terminal Box (for 200- pair) Straight Type



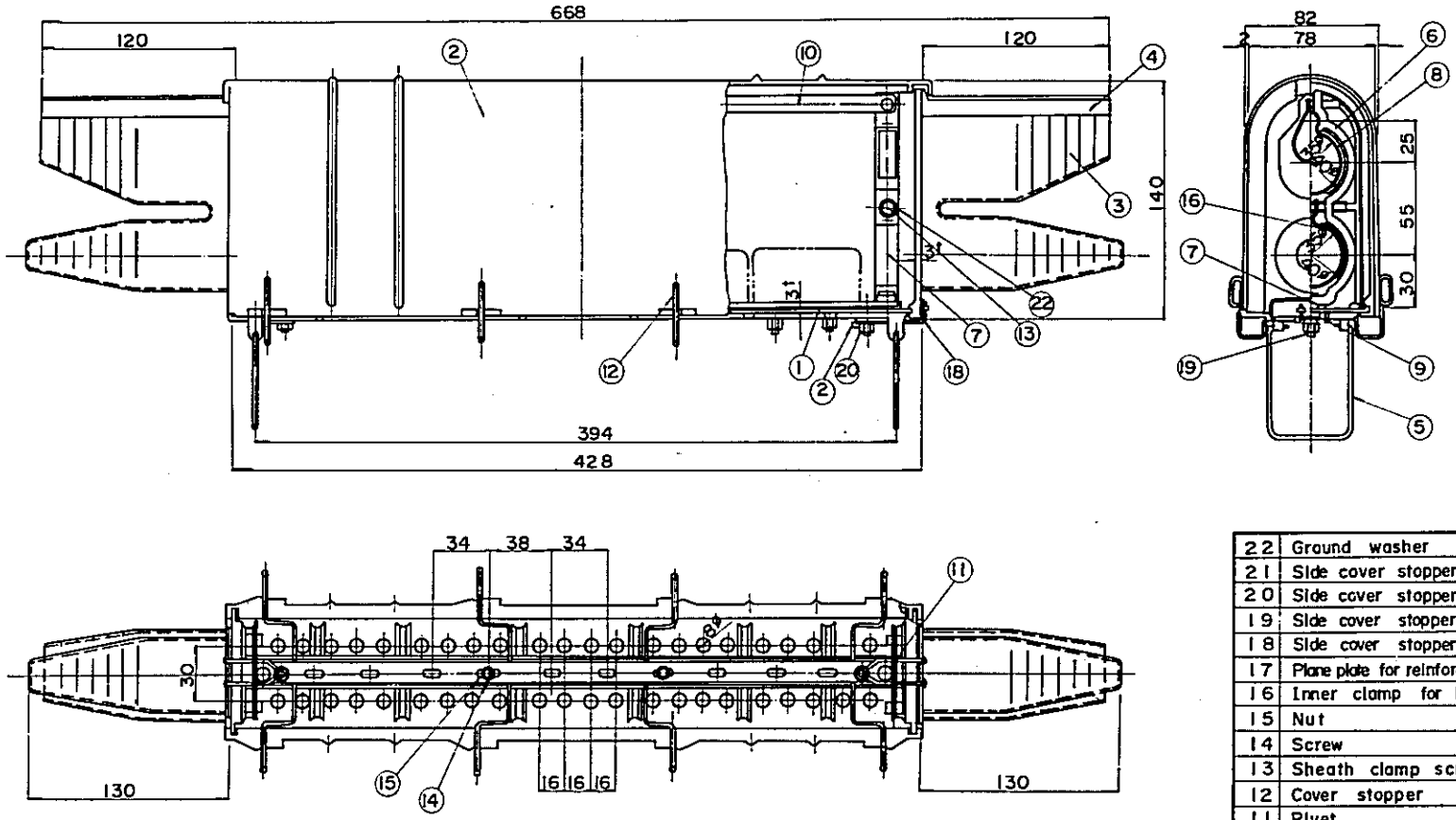


(Unit : mm)

No.	Name
23	Ground washer
22	Side cover stopper washer
21	Side cover stopper nut
20	Side cover stopper screw
19	Side cover stopper
18	Plane plate for reinforcement of the bottom plate
17	Branch side cover
16	Inner clamp for branch
15	Nut
14	Screw
13	Sheath clamp screw
12	Cover stopper
11	Rivet
10	Reinforcement plate
9	Angle for reinforcement of the bottom plate
8	Inner clamp
7	Free sheath clamp
6	Sheath clamp
5	Guide ring
4	Nozzle lock
3	Branch side cover
2	Cover
1	Bottom plate

Fig. Ⅳ.1.3.10.2

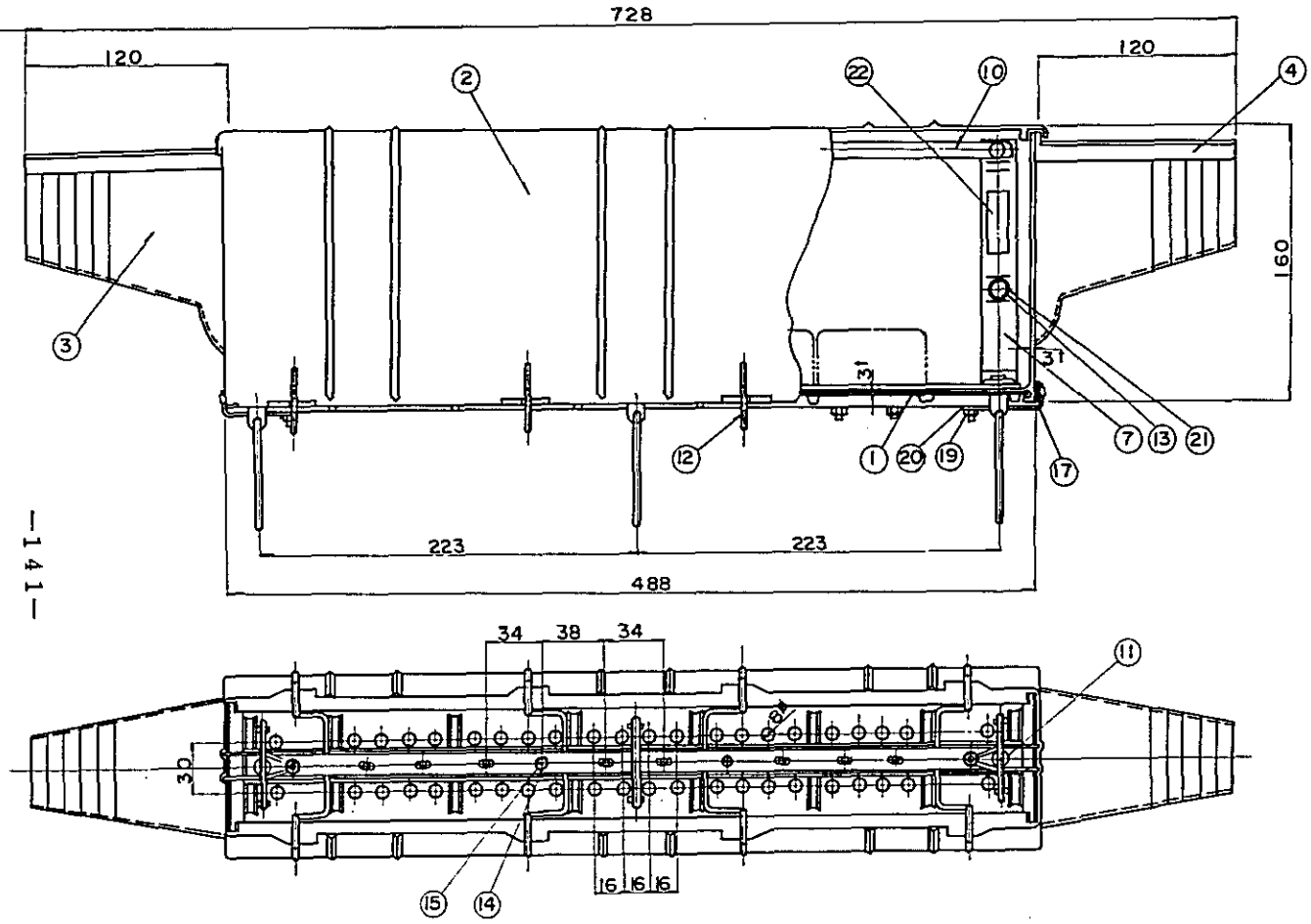
Ready Access Terminal Box (for 200-pair) Branch Type

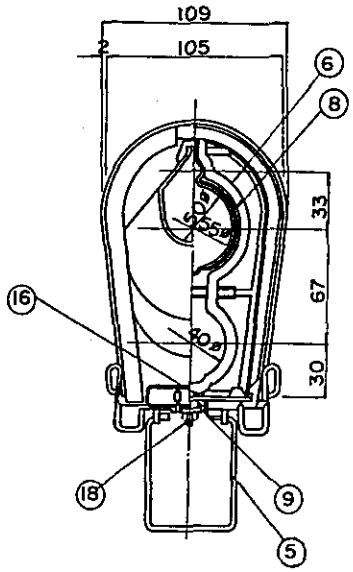


No	Name
22	Ground washer
21	Side cover stopper washer
20	Side cover stopper nut
19	Side cover stopper screw
18	Side cover stopper
17	Plane plate for reinforcement of the bottom plate
16	Inner clamp for branch
15	Nut
14	Screw
13	Sheath clamp screw
12	Cover stopper
11	Rivet
10	Reinforcement plete
9	Angle for reinforcement of the bottom plate
8	Inner clamp
7	Free sheath clamp
6	Sheath clamp
5	Guide ring
4	Nozzle lock
3	Branch side cover
2	Cover
1	Bottom plate

Fig. Ⅳ.1.3.10.3

Ready Access Terminal Box (for 200-pair) Both Branch Type



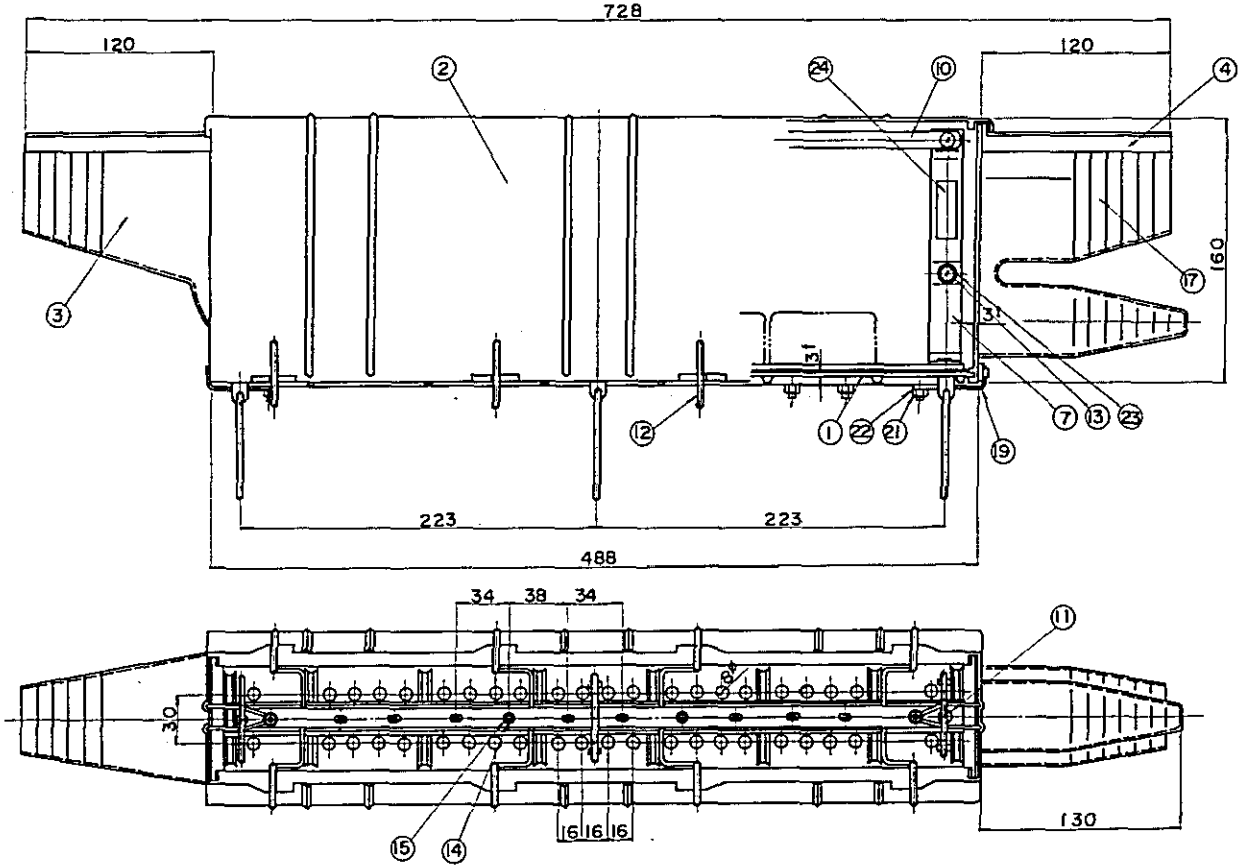


(Unit : mm)

No.	Name
1	Bottom plate
2	Cover
3	Straight side cover
4	Nozzle lock
5	Guide ring
6	Sheath clamp
7	Free sheath clamp
8	Inner clamp
9	Angle for reinforcement of the bottom plate
10	Reinforcement plate
11	Rivet
12	Cover stopper
13	Sheath clamp screw
14	Screw
15	Nut
16	Plane plate for reinforcement of the bottom plate
17	Side cover stopper
18	Side cover stopper screw
19	Side cover stopper nut
20	Side cover stopper washer
21	Grount washer

Fig. IV.1.3.10.4

Ready Access Terminal Box (for 400-pair) Straight Type

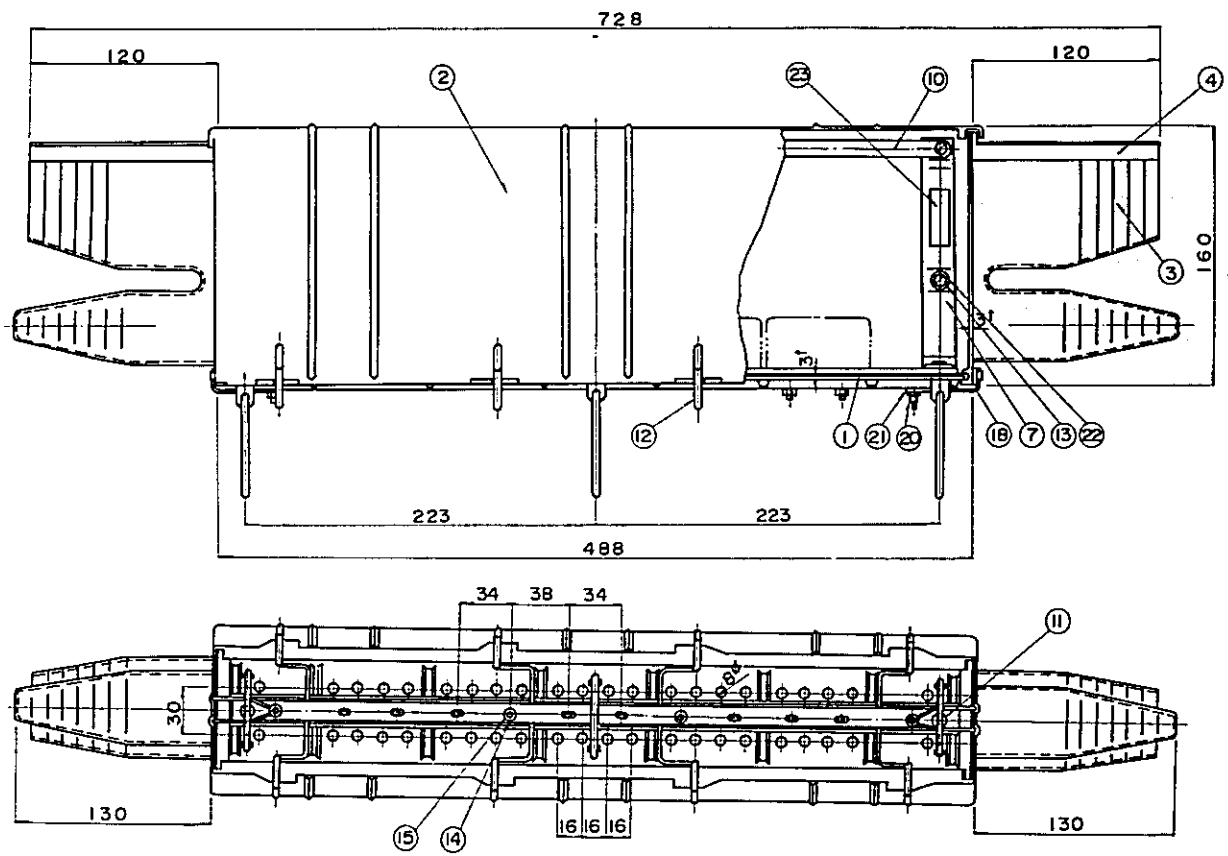


(Unit : mm)

No.	Name
23	Ground washer
22	Side cover stopper Washer
21	Side cover stopper nut
20	Side cover stopper screw
19	Side cover stopper
18	Plane plate for reinforcement of the bottom plate
17	Branch side cover
16	Inner clamp for branch
15	Nut
14	Screw
13	Sheath clamp screw
12	Cover stopper
11	Rivet
10	Reinforcement plate
9	Angle for reinforcement of the bottom plate
8	Inner clamp
7	Free sheath clamp
6	Sheath clamp
5	Guide ring
4	Nozzle lock
3	Branch side cover
2	Cover
1	Bottom plate

Fig. IV. 1. 3. 10. 5

Ready Access Terminal Box (for 400-pair) Branch Type

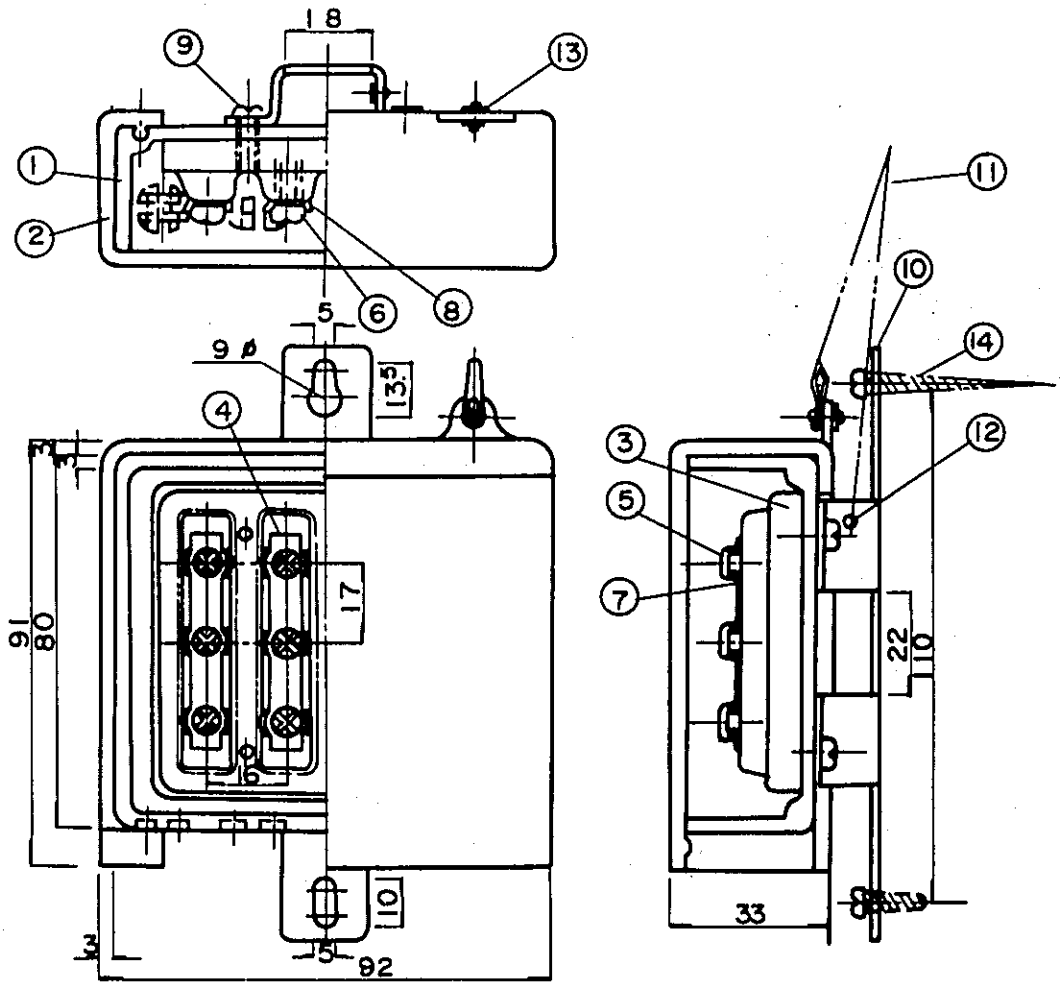


(Unit : mm)

No.	Name
22	Ground washer
21	Side cover stopper washer
20	Side cover stopper nut
19	Side cover stopper screw
18	Side cover stopper
17	Plane plate for reinforcement of the bottom plate
16	Inner clamp for branch
15	Nut
14	Screw
13	Sheath clamp screw
12	Cover stopper
11	Rivet
10	Reinforcement plete
9	Angle for reinforcement of the bottom plate
8	Inner clamp
7	Free sheath clamp
6	Sheath clamp
5	Guide ring
4	Nozzle lock
3	Branch side cover
2	Cover
1	Bottom plate

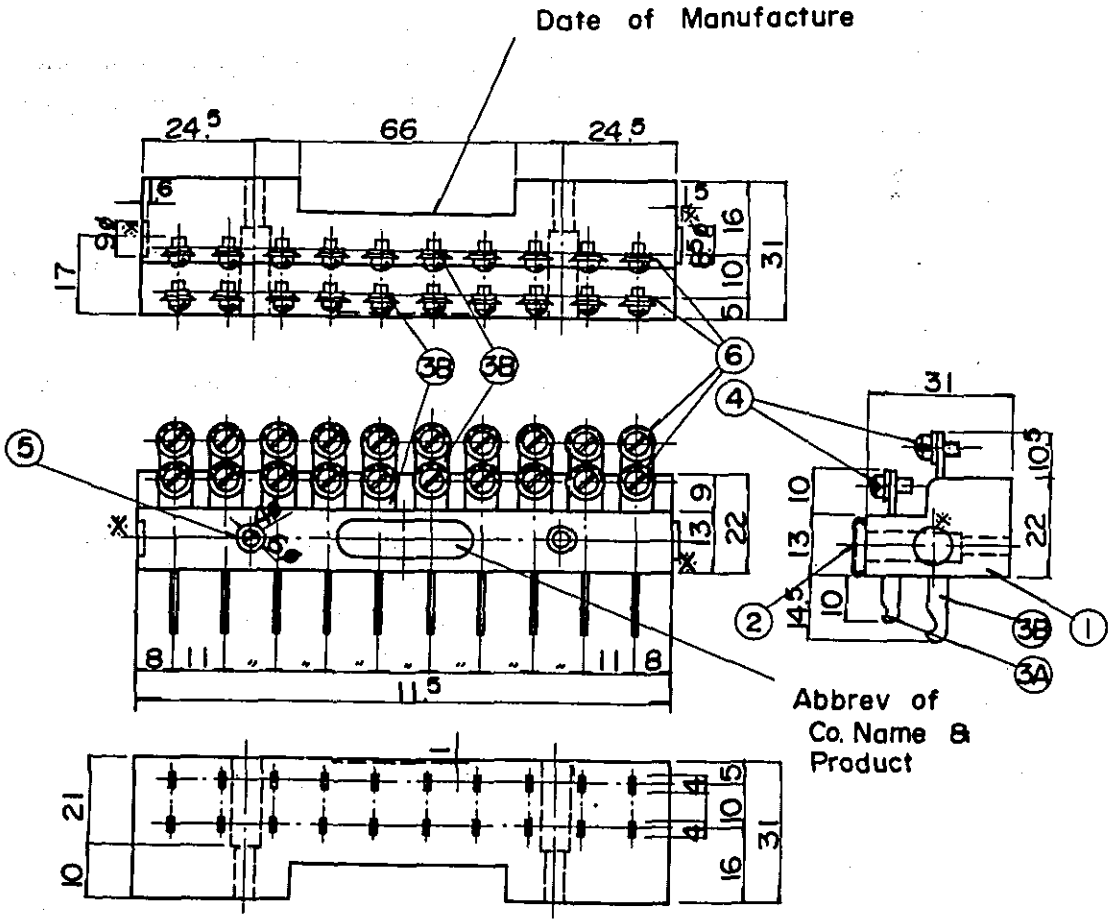
Fig. Ⅳ.1.3.10.6

Ready Access Terminal Box (for 400-pair) Both Branch Type



No.	Item
1.	Case
2.	Cover
3.	Terminal Block
4.	Imbedded Connecting Plate
5.	Binding Screw
6.	Spring Washer
7.	Washer
8.	Imbedded Clamp
9.	Terminal Block Fixing Screw
10.	Fixing Clamp
11.	Chain
12.	Rivet
13.	Washer
14.	Wood Screw

Fig. IV. 1.3.10.7 Construction of 2 Pair SD Terminal Box



Note : The Protrusion and Indentation indicated by the Asterisk Mark (*) are not absolutely necessary.

No.	Name of Part
1	Terminal holder
2	Designation Strip
3A	Terminal (small)
3B	Terminal (large)
4	Terminal Screw
5	Terminal Block fixing Screw
6	Terminal Washer

Fig. IV 1.3.10.8 10 Pair No. 2A Indoor Terminal Block

1.3.11 No. 4 Subscriber Telephone Protector

1.3.11.1 General

This section deals with a single-pair protector to be installed in subscriber buildings to protect telephones and other premises devices from lightning and other trouble, by use of drop wires, cables, etc.

1.3.11.2 Construction

(1) The protector shall consist of a main body, cover, fuse tube and a lightning arrester; and the main body and cover shall meet the specifications of Fig. IV.1.3.11.1.

(2) The fuse tube shall be a No. 1 small-sized subscriber fuse tube, and the lightning arrester shall be a No. 2 carbon lightning arrester.

(3) Wiring terminals shall be a plug-in type.

(4) The cover shall be a press-fit type.

(5) An abbreviated product name, the name of the manufacturer (abbreviation or symbol) and the year of manufacture shall be printed.

(6) Screws, etc. necessary for installation shall be provided as accessories.

1.3.11.3 Electrical Requirements

(1) Insulation resistance

a) The insulation resistance of each terminal measured by applying a DC voltage of 500 V at normal temperature and normal humidity shall be more than 100 M ohms.

b) Nothing wrong shall develop when a voltage of 3.5 kV is applied across line wire terminals, across a line wire terminal and an indoor wire terminal, and across a line wire terminal and the ground terminal at normal temperature and humidity.

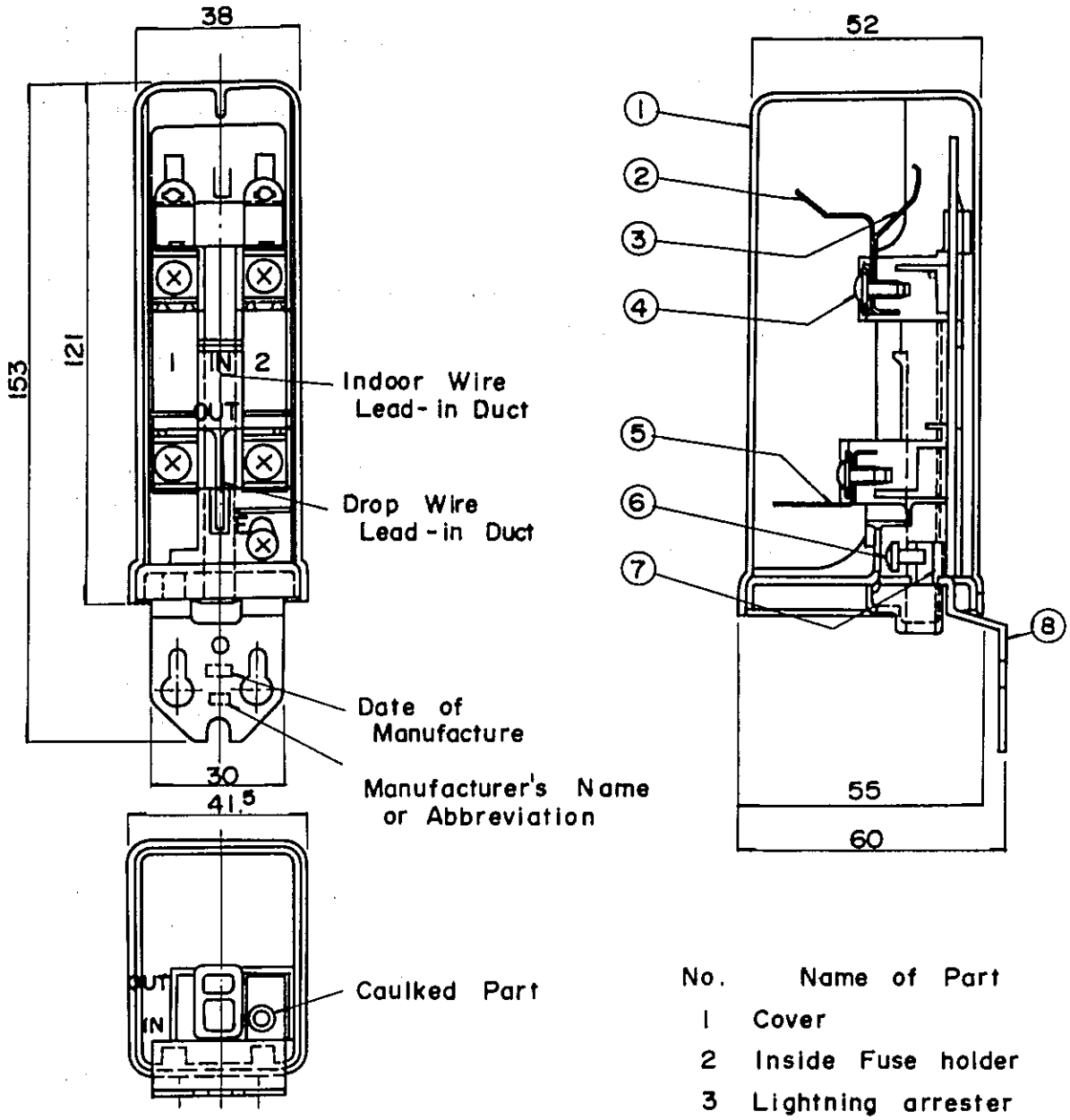
(2) Lightning arrester

a) Insulation resistance across both electrodes shall be more than 50 M ohms when a DC voltage of 250 V is applied across them at normal temperature and humidity.

b) When an AC (50 or 60 Hz) voltage is applied across both electrodes, the lightning arrester shall start self-sustained discharge in the voltage range of 300 to 500 V.

(3) Fuse tube

The fuse shall blow in less than 10 seconds when a current of 6 A is supplied, but shall not blow at a 4 A DC.



No.	Name of Part
1	Cover
2	Inside Fuse holder
3	Lightning arrester holder spring
4	Terminal Screw
5	Outside Fuse holder
6	Earth terminal Screw
7	Earth terminal
8	Supporting Plate

Fig. IV. 1.3.11.1 Construction of Subscriber's Telephone Protector

1.3.12 Double-pair Pole Mounted Protector

1.3.12.1 General

This section deals with a double-pair pole mounted protector which is installed along with an SD terminal box for wiring open wires and protecting the SD wires, cables and other devices that are connected to the open wires from lightning and other troubles caused by them.

1.3.12.2 Construction

(1) The double-pair pole mounted protector shall consist of a main body, cover, fuse tube and a lightning arrester, and the main body and cover shall meet the specifications of Fig. IV.1.3.12.1.

(2) The fuse tube shall be a plug-in type fuse tube, and the lightning arrester shall be a No. 2 carbon lightning arrester.

(3) The terminal board shall be printed with the marks L1 and L2 at its output terminal and input terminal and the letter E at the root of the ground terminal.

(4) An abbreviated product name, the name of the manufacturer (abbreviation or symbol) and the year of manufacture shall be printed.

1.3.12.3 Electrical Requirements

(1) Insulation resistance

Insulation resistances across each terminal and the case and across the terminals themselves shall be more than 1,000 M ohms when the protector is kept at normal temperature and a humidity of more than 80% for more than 3 hours and measured by applying a DC 500 V.

(2) Dielectric strength

The protector shall develop nothing wrong when it is exposed to the same conditions as mentioned in the preceding paragraph and an AC (50 or 60 Hz) voltage of 1,500 V or a DC voltage of 2,000 V is applied across each terminal and the case and across the terminals themselves for 1 minute.

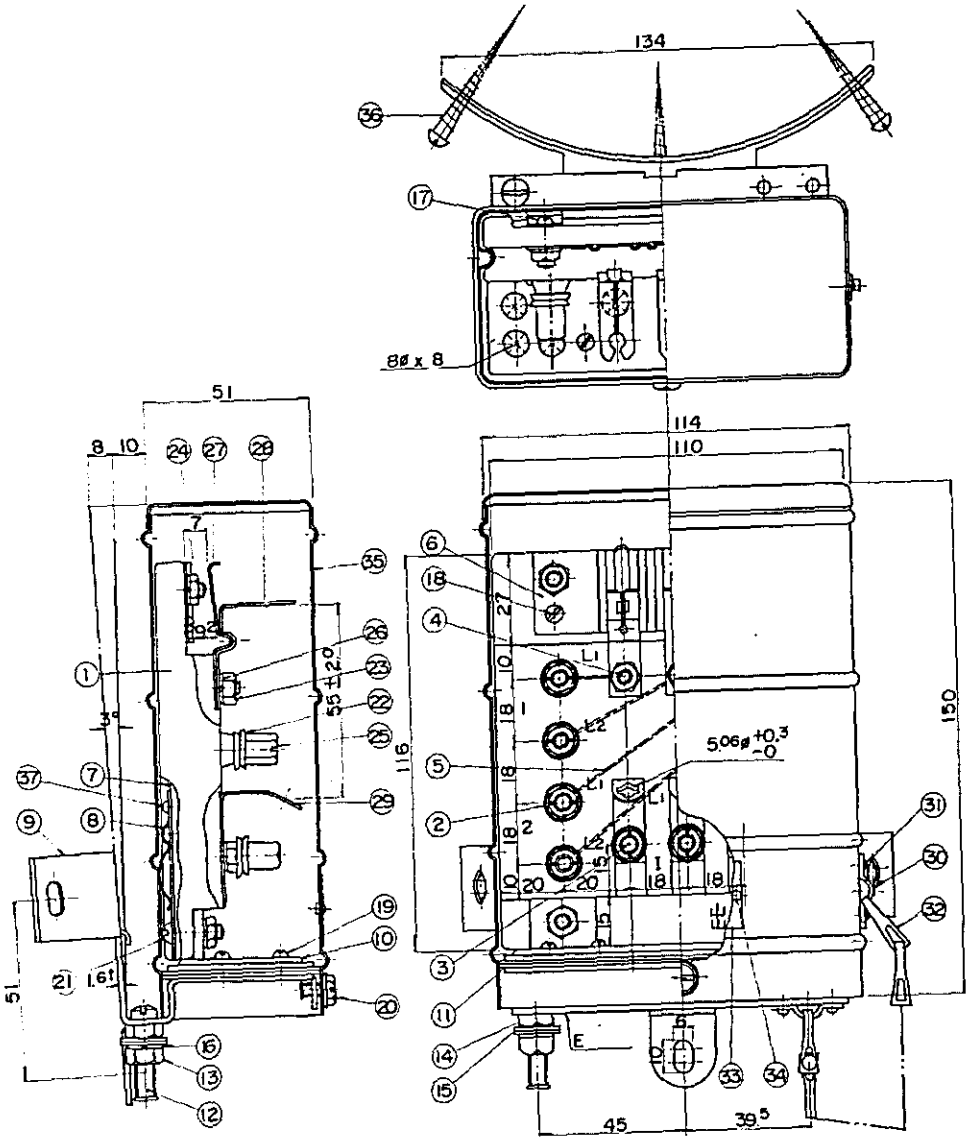
(3) Lightning arrester

a) Insulation resistance across both electrodes shall be more than 50 M ohms when a DC voltage of 250 V is applied across them at normal temperature and relative humidity.

b) When an AC (50 or 60 Hz) voltage is applied across both electrodes, the lightning arrester shall start self-sustained discharge in the voltage range of 300 to 500 V.

(4) Fuse tube

The fuse shall blow in less than 10 seconds when a current of 7 A is supplied, but shall not blow when a current of 5 A is supplied for 20 minutes.



No.	Name of Part
1	Terminal Block
2	Terminal 4 ø x 27
3	〃 4 ø x 27
4	〃 4 ø x 27
5	Connecting Bar
6	Earth Bar
7	Earth Bar
8	Cover Earth Spring
9	Fastener
10	Base Plate
11	Packing
12	Earth Bolt
13	Hexagonal Nut 6ø x 5
14	Hexagonal Nut 6ø x 4
15	Washer
16	Spring Washer
17	Earth Bar fixing Screw
18	Earth Bar fixing Screw
19	Base Plate fixing Screw
20	Cover Stopper Screw
21	Terminal Block fixing Screw
22	Flat Washer
23	Hexagonal Nut 4ø x 4
24	Hexagonal Nut 4ø x 3
25	Hexagonal Nut 4ø x 10
26	Spring Washer
27	Lightning arrester holder Spring
28	Fuse press Spring
29	Fuse receiving Spring
30	Chain Fastener
31	Rivet
32	Chain
33	Name Plate
34	Rivet for Name Plate
35	Cover
36	Wood Screw
37	Rivet for Earth Spring

Unit : mm

Fig. IV. 1.3.12.1 2 Pair Pole Mounted Protector

1. 3. 13 Loading Coil

1. 3. 13. 1 General

This section deals with a manhole type 88 mH 400-pair loading coil to be used for loading junction cables.

1. 3. 13. 2 Composition

The loading coil shall consist of coil elements, coil box and stub cables.

1. 3. 13. 3 Coil Elements

(1) The loading coil shall have 400 coil elements that are connected to stub cables.

(2) Each of the coil elements shall consist of 2 nearly same windings that are wound around insulation bobbins and a pot type ferrite core which has high electrical characteristics.

1. 3. 13. 4 Coil Box

(1) The coil box shall be square-shaped and equivalent to, or better than, the SPH1 that is specified in JIS-G-3307 for steel tapes. Minimum steel tape thickness shall be 4 mm.

(2) The coil box shall have its corners smoothly finished and all joints shall be made by electric welding.

(3) All coil boxes shall have two grip rings attached for loading coil installation.

(4) A protective frame for stub cable support and protection shall be installed.

(5) A finished coil box shall not leak when an air pressure of 3 kg/cm^2 is applied for more than 10 minutes.

(6) The coil box shall be zinc-plated and then given suitable anti-corrosive treatment.

1. 3. 13. 5 Stub Cables

(1) Conductors

a) Conductors shall be 0.5 ± 0.01 mm annealed copper wire.

b) The conductors shall be insulated by spirally overlapping differently colored insulation paper tapes specified in Table IV. 1. 3. 13. 1, or by uniformly concentrically covering them with an insulating pulp layer.

(2) Quads

a) Two each same-colored conductors (Table IV. 1. 3. 13. 1) shall be uniformly twisted to be approximately diagonally opposite to each other across a square to form a quad of 4 conductors.

b) Quads shall be classified by winding insulating paper tapes or insulating pulp layers of different colors as specified in Table IV. 1. 3. 13. 1.

(3) Unit composition

a) Quads shall be arranged into layers to group them into units as specified in Table IV. 1. 3. 13. 2.

b) Each layer shall have a Class 2 quad as a tracer.

c) Adjacent quads shall be different from one another in twisting pitch.

d) Adjacent layers shall be twisted at different pitches in the same direction.

e) Each layer and the outermost unit layer shall be wound coarsely with cotton thread or polyester thread.

f) The coarse winding cotton, rayon or polyester thread between each inner layer of the same unit and over the outermost unit layer shall be same-colored, and the colors of the threads shall be as specified in Table IV. 1. 3. 13. 3.

(4) Unit grouping

a) Four units which have been wound with differently colored coarse winding threads shall be twisted together to form a cylindrical shape in the order of Class 1, Class 1 again, Class 2 and Class 2 again.

b) The grouped units shall be completely covered with two insulating paper tapes in double layers, close to each other, to form a cable core.

c) The insulating paper tapes shall be clearly printed with the name of the manufacturer (abbreviation or symbol) and the year of manufacture.

(5) Lead sheath

a) The cable core shall be concentrically and uniformly covered with alloy lead.

b) Standard lead sheath thickness shall be 2.8 mm.

c) The lead sheath shall be free of pinholes, damage and other flaws, and shall be able to withstand an air pressure of 3 kg/cm^2.

(6) Electrical requirements

a) Conductor resistance

The resistance of each conductor measured with DC shall be less than 93.5 ohms per 1 km at 20°C.

b) Insulation resistance

Insulation resistance shall be more than 1,000 M ohms when a DC voltage of 100 to 500 V is applied across a conductor and the ground (with the lead sheath and the other conductors grounded) for 1 minute.

c) Dielectric strength

Nothing wrong shall develop when a DC voltage of 700 V or an AC (50 or 60 Hz) voltage of 500 V (rms) is applied across a conductor and the ground (with the lead sheath and the other conductors grounded) for 1 minute.

(7) Others

a) Stub cable shall be installed on the top of the coil box.

b) Stub cable shall be protected by a bracket to prevent damage during transit.

c) Stub cable length shall be 3.0 meters.

d) Stub cable shall be fitted with a valve for charging gas in and measuring gas pressure.

1. 3. 13. 6 Compound

(1) After installing the coil elements in the coil box, it shall be filled with the high-quality compound for insulation.

(2) The compound shall not oxidize or otherwise damage the coil elements and others.

1. 3. 13. 7 Printing

A name plate indicating the product name, manufacturing number, the name of the manufacturer and the date of manufacture shall be installed on the coil box at a point that can be easily seen.

1. 3. 13. 8 Electrical Requirements

The values specified for the loading coil are those measured from the stub cable end at 20°C.

(1) Induction and effective resistance

The specifications of Table IV. 1. 3. 13. 4 shall be satisfied when measured with 1,800 Hz 1 mA AC.

(2) Magnetic stability

a) This test shall be made on a coil element specimen equivalent to this loading coil.

b) When 2A DC is supplied to a single winding for 5 seconds, variation of the induction of the coil afterward shall be less than ±2%.

In this case, 1,800 Hz 1 mA AC shall be used for measuring induction.

c) When 30 mA and 60 mA direct currents are supplied to both windings at the same time, their induction variation shall be less than 10% and 40% respectively.

In this case, 1,800 Hz 1 mA AC shall be used for induction measurement.

(3) Difference between effective resistance and DC resistance

This shall not exceed 12.5 ohms (125 ohms per H) at 0 to 3,400 Hz.

In this case, 1 mA AC shall be used for measurement.

(4) Resistance increase

Resistance increase due to hysteresis shall not exceed 0.76 ohms/mA (equivalent to $24\sqrt{L}$ H × ohms/mA) as measured with 800 Hz AC.

Here, the unit of L shall be H.

(5) Crosstalk

When a physical circuit is formed with this loading coil with one end of it connected to 1,500-ohm non-inductive resistance and 1,000 Hz 5 mA AC supplied to the other end, crosstalk attenuation to other physical circuits shall be more than 87 dB.

(6) Insulation resistance

Insulation resistances across one winding and another and across coil box (including stub cables) shall be more than 10,000 M ohms when measured with a DC voltage of 100 V.

(7) Dielectric strength

Nothing wrong shall develop when an AC (50 or 60 Hz) voltage of 500 V (rms) is applied across one winding and another and across coil box (including stub cables) for 1 minute.

1. 3. 13. 9 Gas Charging

Finished loading coils shall be charged with dry air or nitrogen gas having a pressure of about 600 g/cm^2 at the factory prior to shipment.

Table IV.1.3.13.1 Kind of Quads and Colour Code

	1st Pair	2nd Pair
1st Class Quad	Red - Red	White - White
2nd Class Quad	Blue - Blue	White - White

Table IV.1.3.13.2 Composition of Unit

Layer / No. of Quads	Center Layer	1st Layer	2nd Layer	3rd Layer	Total
51	4	10	16	21	51

Table IV.1.3.13.3 Colour Code of Coarse Binding Tape

by Unit	1st Class Unit	2nd Class Unit
Colour of Coarse Binding Tape	Red	White

Table IV.1.3.13.4 Induced Volume and Effective

Induced Volume		Mean Resistance (ohm)
Standard Value (mH)	Allowable Limit (%)	
88	± 1.5	20 or less

1. 3. 14 Steel Pole

1. 3. 14. 1 General

This section deals with steel poles used for aerial telephone lines.

1. 3. 14. 2 Composition

(1) Steel poles shall be made by cutting steel plates into trapezoids, forming them into true conical trapezoidal poles. They shall be provided with through-holes for holding suspension clamps, etc., nuts for pole steps and bottom cover.

(2) Steel poles shall be tapered 1/75.

(3) Kinds, dimensions and allowance of steel poles shall be as specified in Table IV. 1. 3. 14. 1 and Table IV. 1. 3. 14. 2.

External diameter shall not include the raised parts made by welding. Length figures apply to steel poles with the bottom cover.

(4) Nuts for pole steps shall be located along a longitudinal section which includes the center axis, and shall meet the specifications of Fig. IV. 1. 3. 14. 1 and Fig. IV. 1. 3. 14. 2 (1/2) and (2/2).

(5) Steel poles shall be provided with a bottom cover which meets the specifications of Fig. IV. 1. 3. 14. 3.

(6) The steel plates to be used for the steel pole proper and its bottom cover shall be the general structural rolled steel specified in JIS-G-3101 and have a yield point of more than 30 kg/cm^2.

1. 3. 14. 3 Plating and Painting

(1) The inner and outer surfaces of the steel pole proper, the bottom cover and the nuts for pole steps shall be uniformly plated with molten zinc as specified in JIS-H-8641.

(2) The outer surfaces of that part of the steel pole which ranges from a point 50 cm above the level one-sixth of the pole height from the bottom to a point 30 cm below it shall be coated with anti-corrosive paint.

If steel poles are 7.0 m long, however, that part of them which ranges from 50 cm above the 1.2 m level from the bottom to 30 cm below it shall be coated with anti-corrosive paint.

(3) The anti-corrosive paint to be used for coating steel poles shall be tar exposy paint or equivalent or better in performance.

1. 3. 14. 4 Printing

(1) An abbreviated product name and the weight indicating symbol specified in Table IV. 1. 3. 14. 1 shall be printed at a suitable spot on the bottom cover of the steel pole in such a way that they cannot easily erased.

(2) A name plate indicating the date of manufacture, an abbreviated name of the manufacturer, and weight symbol in such a way that they cannot be easily erased shall be attached to the side of the steel pole.

(3) Red marks shall be printed at the longitudinal center of gravity of the steel pole 180° on both sides of the steel pole.

1. 3. 14. 5 Mechanical Requirements

(1) Horizontal load test

When, with its setting part fixed, the steel pole is subjected to gradual application of the horizontal loads specified in Table IV. 1. 3. 14. 3 at a point 50 cm below the top end, the steel pole shall develop no buckling nor other trouble in any part thereof.

(2) Bending resistance test

When the horizontal loads are gradually applied to the steel pole in the same way as mentioned in the preceding paragraph, its maximum bending resistance shall be more than twice the horizontal loads specified in Table IV. 1. 3. 14. 3.

(3) Step strength test

When a vertical load of 300 kg is applied to the center of the pole steps for 1 minute during attachment of accessories to the steel pole, nothing wrong shall develop with any part thereof.

(4) Through-strengh test

When a vertical load is gradually applied to the through-hole located 50 cm below the steel pole top for installing a suspending clamp after a steel pole bolt 20 mm in diameter or an equivalent is fitted into it, the through-hole shall withstand twice the design vertical load specified in Table IV. 1. 3. 14. 3.

Table IV.1.3.14.1 Kinds of Steel Poles and Standards

Type of Steel Pole	Length (m)	Top Diam. (mm)	Bottom Diam. (mm)	Thickness of Steel Plate (mm)	No. of Nuts for Pole Steps	Referential Weight (kg)	Weight Indicating Symbol
7.0-8-200	7.0	80	173	3.0	13	64	<8>
7.5-8-200	7.5	80	180	3.0	14	71	<9>
8.0-8-200	8.0	80	187	3.0	15	77	<10>
9.0-8-200	9.0	80	200	3.0	16	91	<11>
7.5-15-430	7.5	150	250	3.2	14	117	<15>
8.0-15-430	8.0	150	257	3.2	15	126	<16>

Table IV.1.3.14.2 Allowable Difference

Division	Unit	Allowable Difference
External Diameter	%	-1
Plate Thickness	mm	-0
Length	mm	+50 ~ -10

Table IV.1.3.14.3 Strenght or Steel Poles

Type of Steel Pole	Level Load		Penetrated Hole Designed Vertical Load (kg)
	Height (m) of Load Point	Designed Load (kg)	
7.0-8-200	5.30	200	4600
7.5-8-200	5.75	200	4600
8.0-8-200	6.17	200	4600
9.0-8-200	7.00	200	4600
7.5-15-430	5.75	430	5000
8.0-15-430	6.17	430	5000

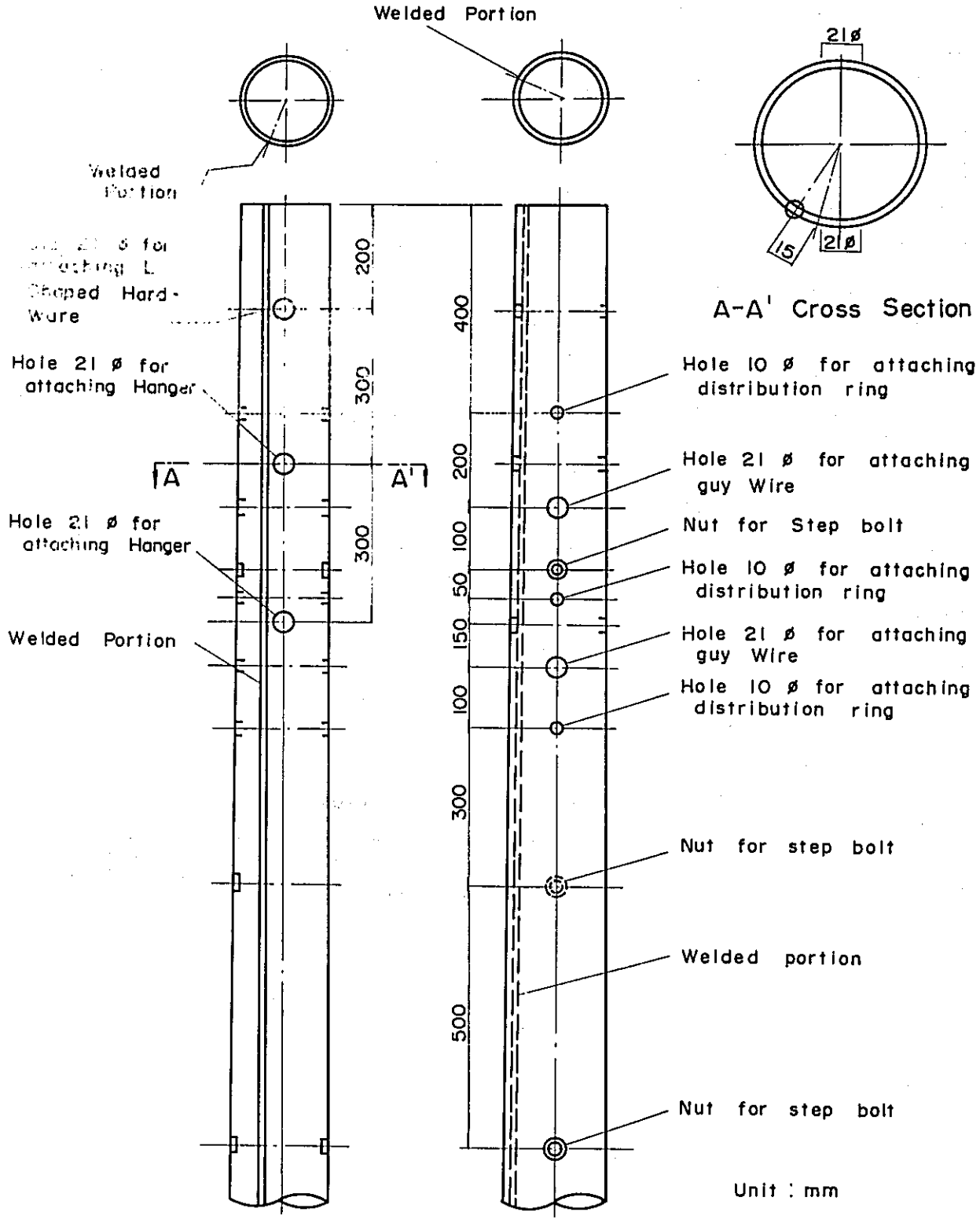


Fig. IV. 1.3.14. 1
Detailed Diagram of Steel Pole Top Portion

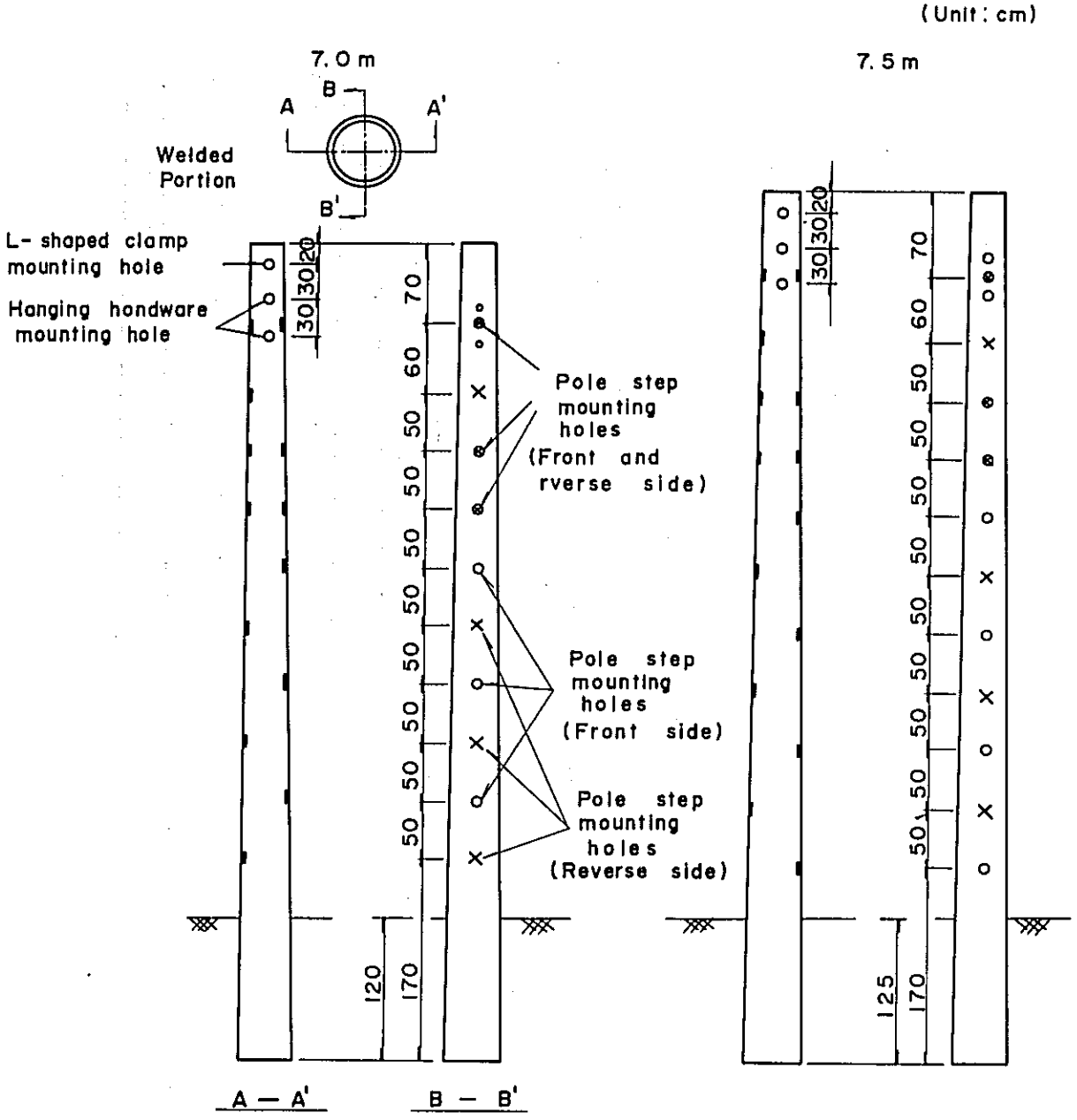


Fig. IV.1.3.14.2(1/2) Japanese Standard Pole

(Unit : cm)

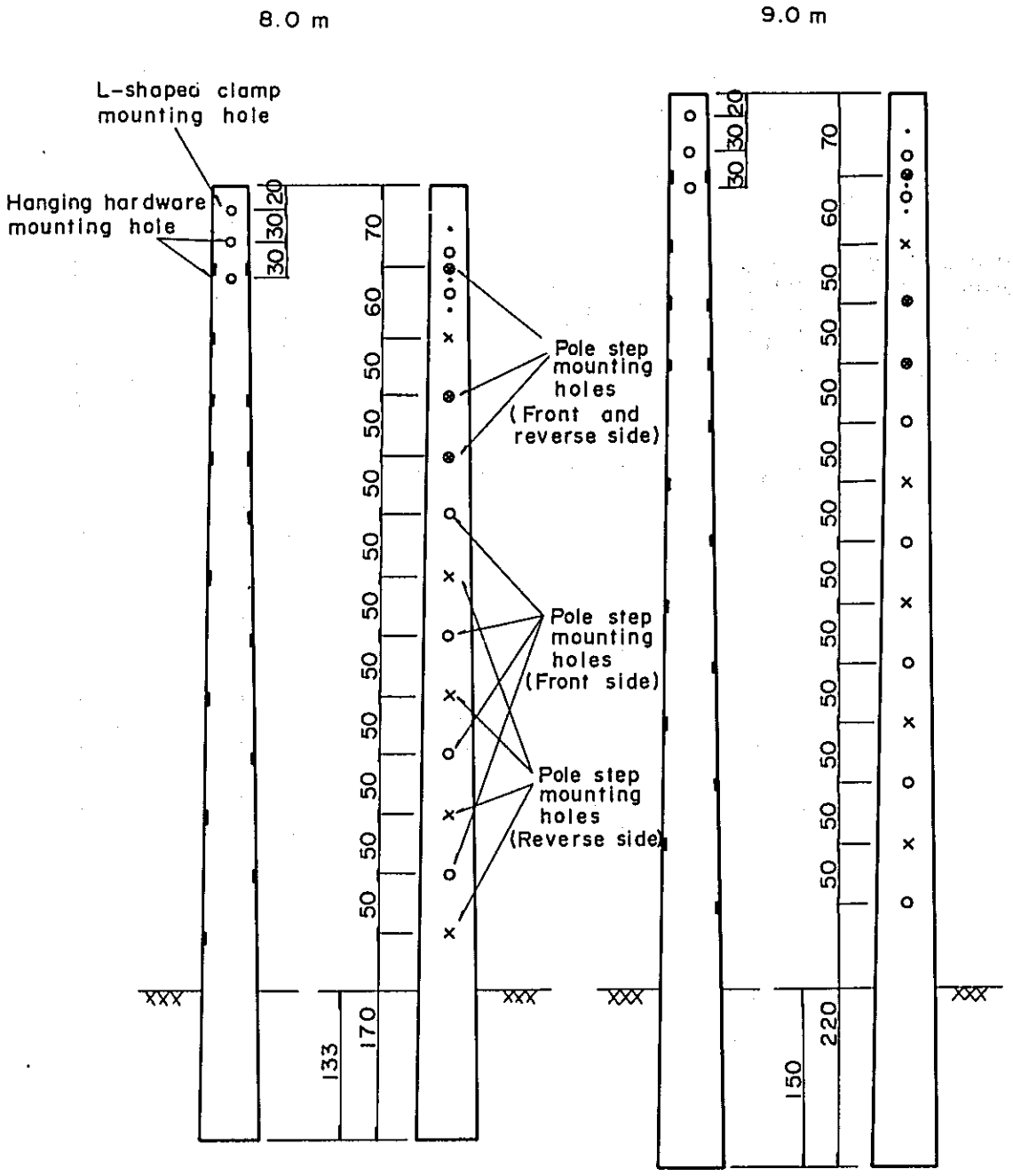
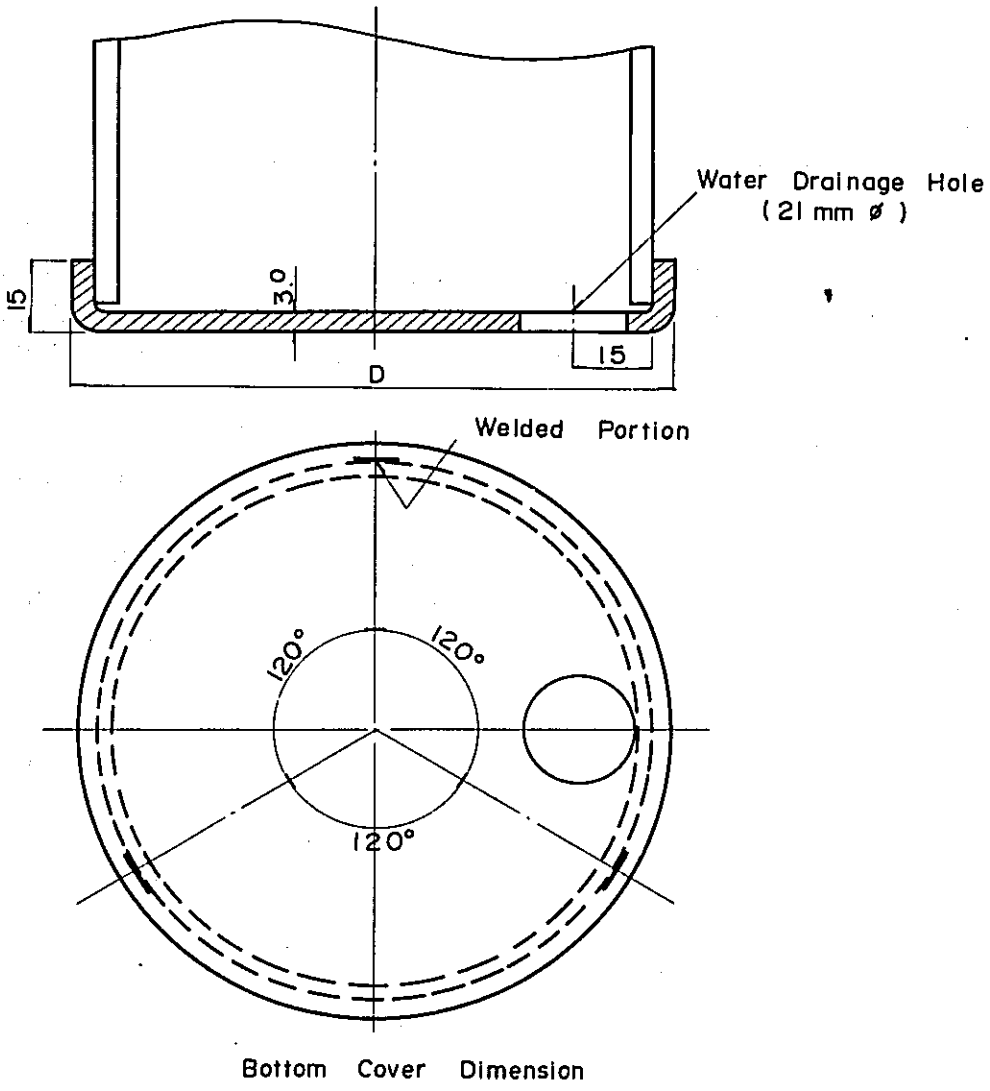


Fig. IV. I. 3.14.2 (2/2) Japanese Standard Pole



Bottom Cover Dimension

Type of Steel Pole	D
7.0 - 8 - 200	179
7.5 - 8 - 200	186
8.0 - 8 - 200	193
9.0 - 8 - 200	206
7.5 - 15 - 430	256
8.0 - 15 - 430	263

Fig. IV 1.3.14.3 Construction of Steel Pole Bottom Cover

1. 3. 15 Stay Anchor

1. 3. 15. 1 General

This section deals with stay anchors to be used for stays.

1. 3. 15. 2 Construction

(1) Stay anchors shall be used in case of installing stays in places free of buried objects underground, and shall be driven into the ground by using a stay anchor tool.
(2) Stay anchors shall be classified according to strength as specified in Table IV. 1. 3. 15. 1.
(3) Stay anchor construction and dimensions shall be as specified in Fig. IV. 1. 3. 15. 1.
(4) All surfaces of stay anchors shall be plated with molten zinc as specified in JIS-H-8641.
(5) All surfaces of stay anchors except rods, thimbles, bolts and nuts shall be coated with an anti-corrosive paint equivalent to, or better than, that specified in JIS-K-2473 for processed tar.

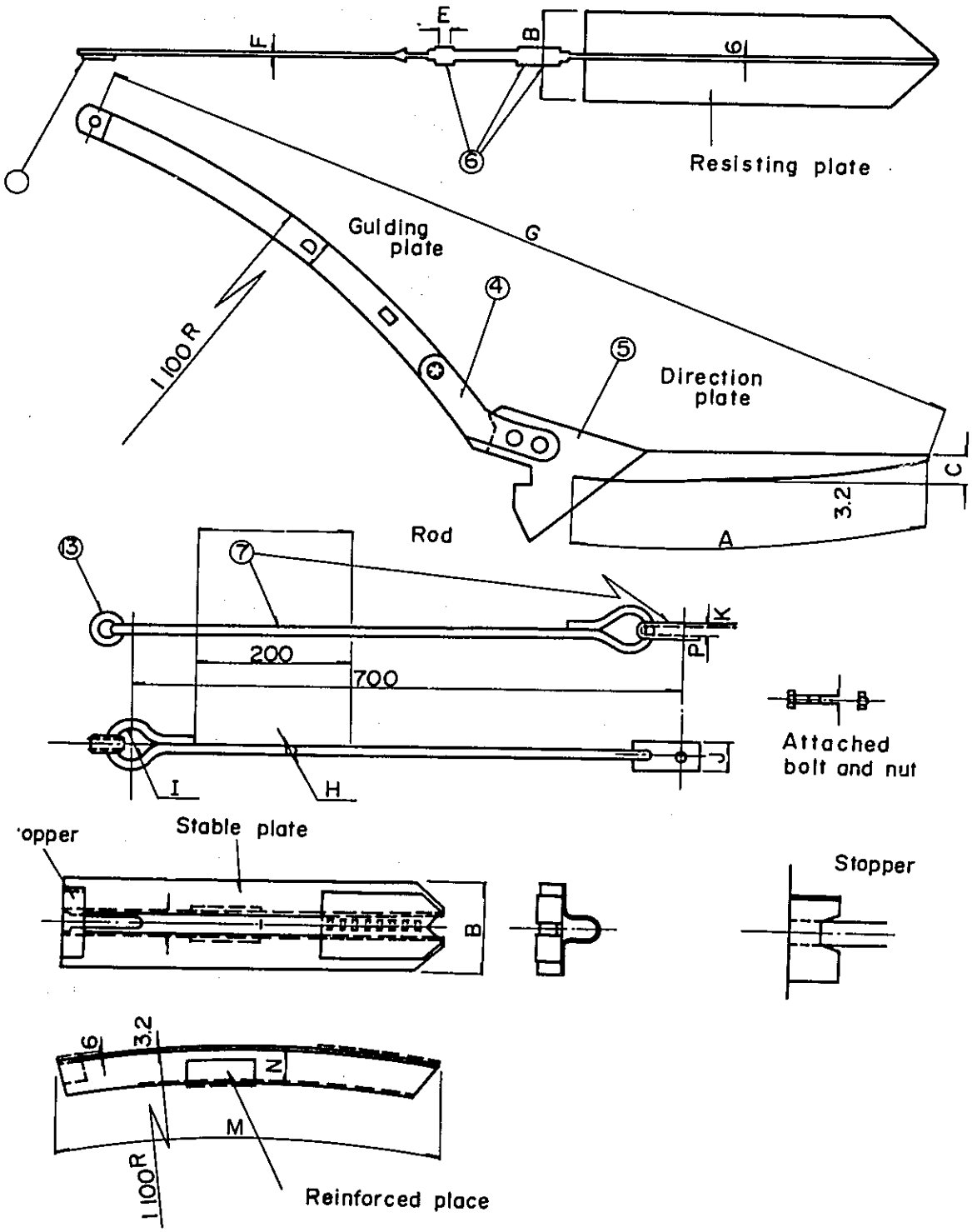
1. 3. 15. 3 Mechanical Requirements

When one half of the load specified in Table IV. 1. 3. 15. 1 is applied to stay anchors for 3 minutes as shown in Fig. IV. 1. 3. 15. 2, stay anchors shall develop no defects in their riveted and welded parts nor any other part thereof.

Table IV. 1. 3. 15. 1 Kind of Stay Anchor

Name of stay anchor	Break down load (ton)
S	5. 2
M	7. 6
L	15. 2

(Unit : mm)



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
S	450	120	33	38	13	6	1150	13	40	38	45	M12	500	46	30	
M	550	160	50	55	15	6	1260	16	50	38	6	M16	600	60	35	
L	650	200	60	65	20	9	1410	22	70	65	6	M22	700	75	40	

Fig. IV. 1. 3. 15. 1. Stay Anchor

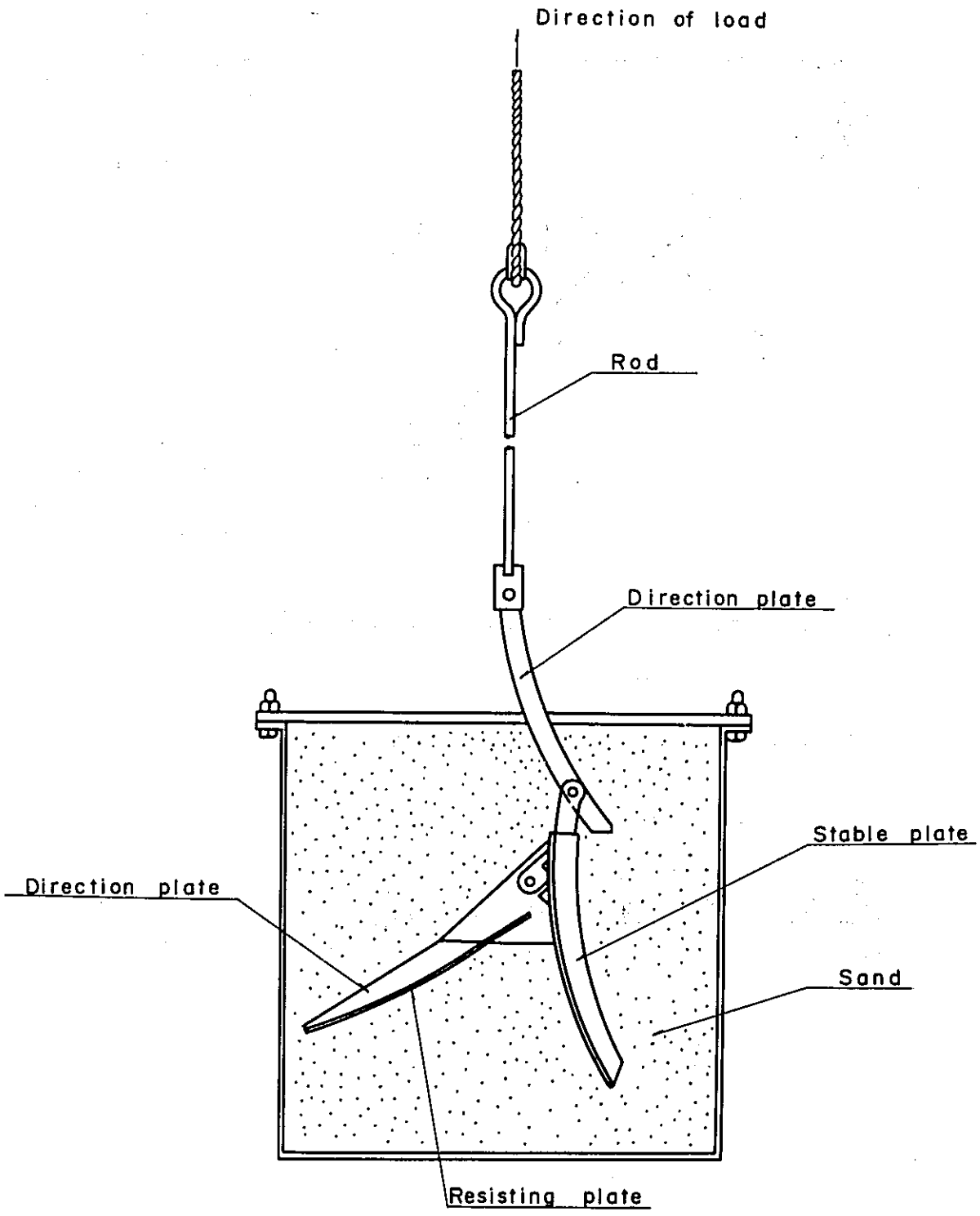


Fig. Ⅳ. 1. 3. 15. 2. Test Method for Stay Anchor

1. 3. 16 Steel Stranded Wire

1. 3. 16. 1 General

This section deals with special steel strands used as cable suspending wire, stays, etc. for aerial telephone lines.

1. 3. 16. 2 Construction

(1) A special steel strand shall be made by twisting 6 strands of the same diameter around a center strand uniformly and closely.

(2) The strands used for making a special steel strand shall be made by drawing Class 4 or Class 5 hard steel wire rod specified in JIS-G-3506 and then plating it with zinc.

(3) The strands shall be twisted right-handed, and strand length shall be 36 to 44 times as long as standard strand diameter.

(4) The kinds, composition and sizes of special steel strands shall be as specified in Table IV. 1. 3. 16. 1.

Strand diameter shall not deviate any more than 2% from the values specified therein.

(5) Strands shall be free of joints from end to end.

1. 3. 16. 3 Mechanical Requirements

The mechanical requirements for special steel strands are as shown in Table IV. 1. 3. 16. 2.

1. 3. 16. 4 Requirements for Zinc Plating

Zinc plating shall be uniform throughout all surfaces of steel strands, and meet the tests specified in Table IV. 1. 3. 16. 3.

1. 3. 16. 5 Others

(1) Steel strands shall be treated to be anti-corrosive with rope oil or other oils which are neither acid nor alkaline.

(2) Bending inside diameter shall be more than 20 times the steel strand external diameter.

(3) Steel strands shall be free of joints and their standard weights shall be as specified in Table IV. 1. 3. 16. 4.

Table IV.1.3.16.1
Kind and Composition of Steel Stranded Wires

Name	No.or Bare Wires / Standard Bare Wire Dia. ± Allowable Difference (mm)	Calculated Sectional Area (mm²)	Calculated External Diameter (mm)	Weight (g/m)		
				Standard	Max.	Min.
45 mm² Special Steel Stranded Wire	7/2.9 ± 0.10	46.24	8.7	367	390	340
35 mm² Special Steel Stranded Wire	7/2.6 ± 0.08	37.16	7.8	295	320	280
30 mm² Special Steel Stranded Wire	7/2.3 ± 0.08	29.09	6.9	231	250	210

Table IV.1.3.16.2 Strength of Steel Stranded Wire

Name	Tensile Load (kg or more)	Bare Wire			
		Tensile Load (kg or more)	Elongation (% or more)	No.of Twists (Times or more)	Standard Tensile Strength (kg/mm²)
45 mm² Special Steel Stranded Wire	5200	826	3	8	125
35 mm² Special Steel Stranded Wire	4180	664	3	9	125
30mm² Special Steel Stranded Wire	3270	519	3	10	125

Table IV.1.3.16.3 Tests on Bare Wire

Bare Wire Standard Diameter (mm)	Coating Volume Test (g/m^2 or more)	Property Test (More than 1 min.)	Uniformity Test (Times)	Winding Test	
				Tube Dia. (Double of Bare Wire Standard Diameter)	No. of Windings
2.9	150	60	3	20	6
2.6	140	50	2	15	6
2.3	140	50	2	15	6

Table IV.1.3.16.4
Standard Weight of Steel Stranded Wire

Name	Weight (kg)
45 mm^2 Special Steel Stranded Wire	400
35 mm^2 Special Steel Stranded Wire	300
30 mm^2 Special Steel Stranded Wire	200

1. 3. 17 Suspending Clamps and Bands

This section deals with suspending clamps and bands that are used for suspending CCP-AP-SS cables and SD wires from poles.

(1) Suspending clamps

a) SS cable pinch hangers

SS cable pinch hangers are used for suspending SS cables from steel poles. The SS cable pinch hanger shall consist of a main body, clamp bolt, nut, spring washer, and another spring washer for the main body.

b) SD wire hangers

SD wire hangers are used for suspending SD wires from steel poles. The SD wire hanger shall consist of a main body, clamp bolt, nut, spring washer and another spring washer for the main body.

- No. 1 SD wire hangers ..... to be used for poles
- No. 2 SD wire hangers ..... to be used for brackets

c) SS cable curved pinch hangers

These hangers are used for suspending SS cables on the inner or outer side of angle poles with an inner angle of 120° to 170°. The SS cable curved pinch hanger shall consist of a main body, supporting plate, clamp bolt, nut, spring washer and another spring washer for the main body.

d) SD wire curved hanger

These clamps are used for suspending SD wires on the inner or outer side of angle poles with an inner angle of 120° to 170°. The SD wire curved hanger shall consist of a main body, a supporting plate, clamp bolt, nut, spring washer and another spring washer for the main body.

(2) Bolts and washers

a) 12 mm bolt

The 12 mm bolt is used for installing No. 1 SD wire hanger, SS cable pinch hanger, SS cable curved pinch hanger, and L-shaped clamp to steel poles. Its length ranges from 100 mm to 360 mm at 20-mm steps.

b) 16 mm bolt

The 16 mm bolt is used for attaching stays to steel poles, and suspending SS cables from or anchoring them from angle poles. Its length ranges from 100 mm to 700 mm at 20-mm steps.

No. 2 washers shall be used for 16 mm bolts.

(3) Pole bands

a) L-43 pole band

The L-43 pole band is used for anchoring steel-cored drop wires to the T-tube of Burmese standard poles with a top end diameter of 42.7 mm. It shall consist of a band proper, hexagonal clamp bolts, nuts and washers (two each) and

two L-shaped clamps. The L-43 pole band shall meet the following mechanical requirements.

i) One L-shaped clamp can anchor two steel-cored drop wires. In this case, the safety factor shall be 2.

ii) The working adjustable range shall be 42.7 mm to 44.0 mm in diameter.

b) L-84 pole band

The L-84 pole band is used for anchoring steel-cored drop wires to the A, A4 and B tubes of Burmese standard poles with top end diameters of 71.3 mm and 89.7 mm. The L-84 pole band shall consist of a band proper, hexagonal clamp bolts, nuts and washers (two each), two L-shaped clamps. It shall meet the following mechanical requirements.

i) One L-shaped clamp can anchor two steel-cored drop wires. In this case, the safety factor shall be 2.

ii) The working adjustable range shall be 71.3 mm to 92 mm in diameter.

c) L-120 pole band

The L-120 pole band is used for anchoring steel-cored drop wires to the B4 and C tubes of Burmese standard poles with a top end diameter of 118.9 mm. It shall consist of a band proper, hexagonal clamp bolts, nuts and washers (two each) and two L-shaped clamps. It shall meet the following mechanical requirements.

i) One L-shaped clamp can anchor two steel-cored drop wires. In this case, the safety factor shall be 2.

ii) The working adjustable range shall be 118.9 mm to 122 mm in diameter.

d) S-43 pole band

The S-43 pole band is used for suspending self-supporting wires for SD wires from, or anchoring them to, the T-tube of Burmese standard poles with a top end diameter of 42.7 mm. It shall consist of a band proper, hexagonal clamp bolts, nuts and washer (two each) and M12 hexagonal bolts and nuts (two each). It shall meet the following mechanical requirements.

i) It can install an SD wire hanger and an SD wire curved hanger on both sides of the band. When two SD wires are suspended, the S-43 pole band shall be able to sufficiently bear the load.

ii) The S-43 pole band shall be able to anchor two SD wires.

iii) The working adjustable range shall be 42.7 mm to 44 mm in diameter.

In the cases of i) and ii), the safety factor shall be 2.

e) S-84 pole band

The S-84 pole band is used for suspending SS cable self-supporting wires from, and attaching anchoring stays to the A, A4 and B tubes of Burmese standard poles with top end diameters of 71.3 mm and 89.7 mm. It shall consist of

a band proper, hexagonal clamp bolts, nuts and washers (two each), and M16 flush bolts and nuts (two each). The S-84 pole band is not fitted with a thimble. It shall meet the following mechanical requirements.

i) It can install an SS cable pinch hanger and an SS cable curved pinch hanger on both sides of the band. When two SS cables are suspended, the S-84 pole band shall be able to sufficiently bear the load.

ii) The S-84 pole band shall be able to anchor one SS cable.

iii) The working adjustable range shall be 71.3 mm to 92 mm in diameter. If the working range is unadjustable, two kinds of S-84 pole bands, i. e., one for 72-mm diameter, and the other for 92-mm diameter, shall be provided. In the cases of i) and ii), the safety factor shall be 2.

f) S-120 pole band

The S-120 pole band is used for suspending SS cable self-supporting wires from, and attaching anchoring stays to, B4 and C tubes of Burmese standard poles with a top end diameter of 118.9 mm. The S-120 pole band shall consist of a band proper, hexagonal clamp bolts, nuts and washers (two each) and M16 flush bolts and nuts (two each). It shall have no thimbles. The S-120 pole band shall meet the following mechanical requirements.

i) It can install an SS cable pinch hanger and an SS cable curved pinch hanger on both sides of the band. When two SS cables are suspended, the band shall be able to sufficiently bear the load.

ii) The S-120 pole band shall be able to anchor one SS cable.

iii) The working adjustable range shall be 118.9 mm to 122 mm in diameter. In the cases of i) and ii), the safety factor shall be 2.

g) Rail pole band

This pole band is used for installing steel-cored drop wires to rail poles. It shall consist of a band proper, clamp bolts, nuts and washers (two each), M12 flush bolts and nuts (two each), and two L-shaped clamps. The pole band shall meet the following mechanical requirements.

i) One L-shaped clamp can anchor two steel-cored drop wires. In this case, the safety factor shall be 2.

h) F-band

The F-band is used for mounting struts onto Japanese standard poles with a top end diameter of 80 mm. Its working adjustable range shall be 82 mm to 102 mm in diameter.

i) No. 2 B adjustable band

This band is used for fixing riser cable protection tubes to Burmese and Japanese standard poles. Its working adjustable range shall be less than 345 mm in diameter.

j) N-stainless steel band and fastener

These are used for installing wiring rings and cable fasteners, etc., to Burmese standard poles. An N-band fastener shall be used for tightening the N-stainless steel band. The N-stainless steel band shall be more than 50 meters per roll, which may be cut to desired lengths.

1.3.18 Hardwares

(1) Strut mounting hardware

a) A-strut mounting hardware

This hardware is used for mounting struts onto Japanese standard steel poles with top end diameters of 150 mm to 180 mm. It shall consist of lap-metal fittings, bolt and nut. In case of mounting it onto an anchor pole, it can be fixed with four E-type adjustable bands.

b) B-strut mounting hardware

This hardware is used for mounting struts onto Japanese standard poles with a top end diameter of 80 mm. It shall consist of a strut mounting part, bolt, nut and a spring washer. It is used in combination with an F-band.

(2) Holding stay grip hardware

This is used for anchoring SS cables to Japanese standard poles and holding grips for end poles. It is used attached to a 16 mm bolt.

(3) SS cable separator

This is used for holding two parallel SS cables apart as required.

(4) N band #2 cable fixer

This is used for clamping riser cables with external diameters of 20 mm to 60 mm to steel poles. It is used in combination with an N-stainless steel band.

(5) Cable ring

It is used for suspending cables from strand wire at 60 cm intervals. It shall consist of a ring proper and a seat. It shall be provided with a claw which permits slip in semi-spiral directions but does not permit slip in hooked direction.

(6) Wiring ring

a) A-wiring ring

This ring is used for wiring a steel-cored drop wire on Burmese standard poles from a ready access terminal box or an SD terminal box to an L-shaped clamp. It is fastened with an N-stainless steel band.

b) B-wiring ring

This ring is used for wiring a steel-cored drop wire on Japanese standard poles from a ready access terminal box or an SD terminal box to an L-shaped clamp.

(7) Drive hook

a) 6 mm drive hook

This is used for anchoring a single steel-cored drop wire to a subscriber building.

b) 9 mm drive hook

This is used for anchoring two steel-cored drop wires to a subscriber building.

(8) C-shaped clamp

This is used for anchoring steel-cored drop wires to subscriber buildings in cases where 6 mm or 9 mm drive hook cannot be suitably screwed in.

(9) L-shaped clamp

This is used for anchoring steel-cored drop wires to poles. A 12 mm bolt is used for clamping it onto Japanese standard poles; or L-43, L-84 or L-120 pole bands are used for clamping the same onto Burmese standard poles.

(10) C-shaped wire detainer

This is used for anchoring SD wire self-supporting wires in combination with a bolt in case of Japanese standard poles, or with a band in case of Burmese standard poles.

(11) Drop wire detainer

This is used for anchoring a single steel-cored drop wire to a drive hook, C-shaped or L-shaped clamp, etc. It shall consist of a main body made of hard vinylchloride resin and a hard steel wire ring which is treated to be anti-corrosive.

(12) Wiring cleat

This is used for fixing a steel-cored drop wire under the eaves of a subscriber building or on a wall at points where it will be mainly exposed to tension. The cleat shall be installed with flush screws about 30 mm to 35 mm.

(13) Staple

This is mainly used for fixing indoor wires to wooden objects.

(14) Supporting bar for ready access terminal box

The ready access terminal box shall be so designed that it may enclose cables and self-supporting wires in the box at the same time. In case a wooden pole wire grip is used at anchor points on Japanese standard poles, the ready access terminal box cannot be installed in the correct position. In such a case, this supporting bar is ued to prevent trouble.

No. 2 SS supporting wire clamp is used for fixing this bar to a self-supporting wire.

(15) No. 2 SS supporting wire clamp

This is used to hold one each supporting bar for ready access terminal box on both sides of it when fixing the bar to an SS cable self-supporting wire. It shall consist of a main body, clamp bolt and hexagonal nut.

1. 3. 19 Wire Grips

Wire grips are broadly classified as follows according to their use:

(1) Thimble wire grips

Thimble wire grips are used for anchoring strand suspending wires and strand stay wires through bands.

(2) Wooden pole wire grips

Wooden pole wire grips are used for anchoring strand suspension wires by use of bolts. To anchor strand stay wires, both bolts and holding stay grip hardware are used.

(3) SS thimble wire grips

SS thimble wire grips are used for anchoring SS cable supporting wires through bands.

(4) SS wooden pole wire grips

SS wooden pole wire grips are used for anchoring SS cable supporting wires by use of bolts.

1. 3. 20 Protective Materials

1. 3. 20. 1 Electrical Protective Materials

Electrical protective materials shall be installed for the purpose of protecting persons who handle telephones and various kinds of devices and preventing dangers in case of contact of a telephone line with an electric line carrying high current, or an abnormally high voltage generated by lightning, etc. They shall have the function of interrupting continuous flow of the high current and voltage and discharging them into the ground in such instances.

(1) Earth clamp

This is used for connecting a bond wire or a ground wire to a suspension wire or a self-supporting wire. It shall consist of a main body, bolt, nut and a washer.

(2) Bond for alminum tape jointing

This is used for electrically bonding the aluminum shield of SS cable. It shall consisit of 2 bond propers, which are composed of connecting part and holding part, and a single lead (2.0 mm^2, 600V insulated wire) which connects them to each other.

(3) Earth bar

a) A-type earth bar

This is a metal earth bar with a diameter of 14 mm, which is used for grounding subscriber telephone protectors and line facilities. It may also be used by coupling it with B-type metal earth bar.

b) B-type earth bar

This is a metal earth bar with a diameter of 14 mm, which is used for grounding line facilities. It is used in combination with A-type metal earth bar.

(4) 2 mm² 600 V insulated wire

This is used for electrically jointing a suspension wire and a self-supporting wire, or electrically jointing a suspension wire and a self-supporting wire with the aluminum shield of an SS cable. In addition, it may also be used as an earth wire.

(5) 14 mm² 600 V insulated wire

This is used as an exchange earth lead (for exchange earth or earthing for various protective purposes).

1. 3. 20. 2 Mechanical Protection

(1) Spiral sleeve

This is used for protecting SS cables and SD wires by covering them at points where they may get close to, or cross, power lines, or come into contact with trees, structures or other obstacles. It is also used on curved pinch hanger mounting poles, etc. where cables may come into contact with poles, as well as at cable branching points and curves between poles.

After fitting the spiral sleeve around an SS cable or an SD wire, both ends of the sleeve shall be fastened with No. 2 protective PVC tape.

(2) Cable cover

This is used for preventing contact between aerial cables and power lines, or between aerial cables and other obstacles. It is classified into two types, that is, No. 1 cable cover and No. 2 cable cover.

(3) PVC wire protective cover

This is used for protecting indoor wires from power lines and other obstacles, and protecting drop wires and indoor wires at points where they run through walls. This protective cover is for double parallel conductor PVC indoor wires. It has an inside diameter of 2.5 mm, a thickness of 1.0 mm and a length of 1 m, and is to be cut to a desired length when using it.

(4) Stay guard

This is used in cases where stays are located on sidewalks so that they may come into direct contact with pedestrians. It is a yellow plastic cylinder with an inside diameter of 60 mm or more, and is to be used by cutting to a desired length.

1. 3. 21 Materials for Cable Holding

(1) Terminating sleeve holder

This is used for fixing terminating portion of a cable. This holder shall be installed under the lower cover of a terminating sleeve to receive the sleeve. The other end shall be fixed by clamping flat steel with bolts.

(2) Terminating sleeve fastener

This is used for fixing terminating portion of a cable. One end of a terminating sleeve shall be tightened and the other end of it fixed by clamping flat steel with bolts.

(3) Terminating cable fastener

This is used for clamping terminating cables to the walls of cable vault.

(4) Cable bearer

This is used for supporting cables in manholes and cable vaults. One for two cables shall be used.

In this case, a 12 mm bolt, 6 cm long, shall be used. Washer and hexagonal bolts shall be supplied.

1.3.22 Rosette

This is used for connecting indoor wires to telephone cords and, in case no subscriber telephone protectors are used, connecting drop wires to indoor wires.

1.3.23 22mm Hook Bolt

This hook bolt is used for anchoring the tie cables to the existing building of Mayangon Exchange Office.

They shall be made by processing rolled steel having a diameter of 22 mm as specified below and then placing it with molten zinc.

a) One end shall be fitted with a thimble so that 45 mm^2 steel strand can be anchored.

b) The other end shall be threaded to permit tightening with a nut.

The construction of 22 mm hook bolt is as shown in Fig. IV. 1. 3. 23. 1.

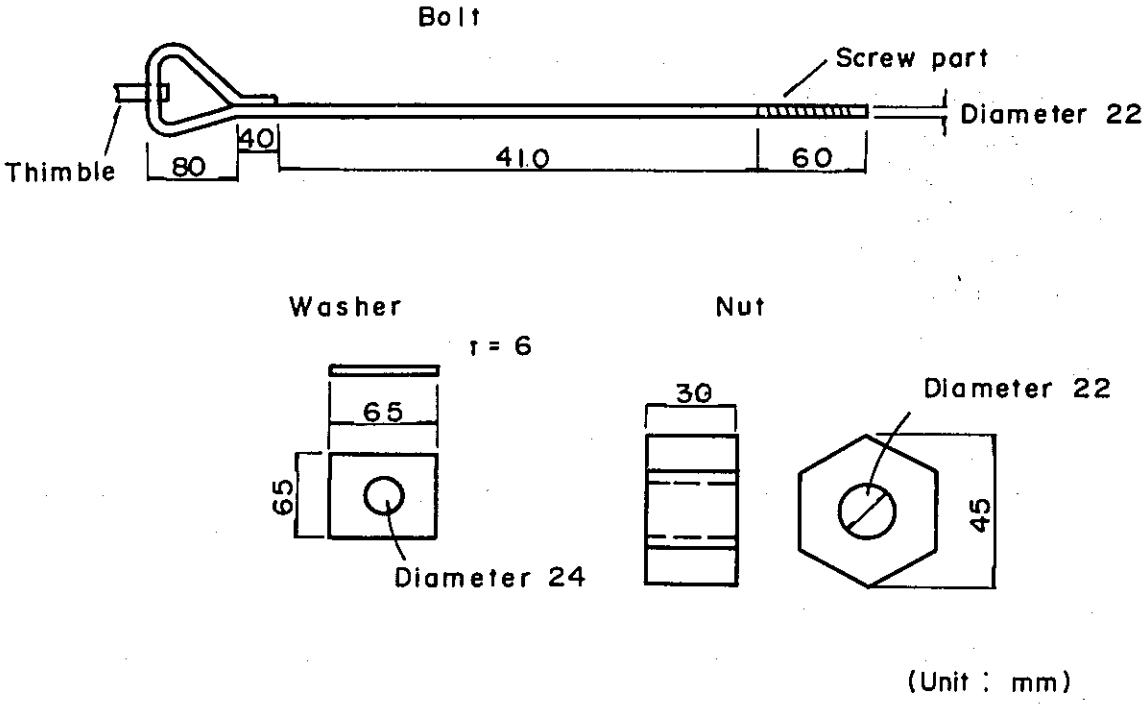


Fig. Ⅳ.1.3.23.1. Hook Bolt

1. 3. 24 CCP-AP-SS Cable Jointing Materials

(1) CCP-AP-SS cable jointing materials include PE sleeves, solder, PVC tape, sealing tape, bonding ribbon and others, but not materials for cable sheath jointing because cable sheaths are connected by using ready access terminal boxes.

The names and uses of the main jointing materials are given below.

a) PE sleeve

This is used for protecting the insulation of cable joints.

b) No. 2 solder

This is used for soldering cable joints.

c) PVC tape

This is used for taping the side cover end of ready access terminal box.

d) Sealing tape

This is used for filling the gaps between the side covers of ready access terminal box and cables.

e) Bonding tape

This is used for electrically jointing the aluminum sheaths of upper-side and lower-side cables in ready access terminal boxes.

1. 3. 25 PEF-LAP Cable Jointing Materials

(1) PEF-LAP cable jointing materials include lead sleeves, PE sleeves, putty and various kinds of tapes. The names and uses of the main jointing materials are given below.

a) Lead sleeve

This is used for joining cable sheaths at spliced parts.

b) Putty

Putty is used for keeping cable sheaths and lead sleeves airtight.

c) PE sleeve

This is used for protecting the insulation of spliced cable cores.

d) No. 2 solder

This is used for soldering jointed cable conductors.

e) Cotton tape

This is used for bundling jointed cable conductors.

f) Bonding ribbon

This is used for electrically splicing the laminated sheaths of the upper-side and lower-side cables at cable joints.

g) Polyethylene/aluminum laminated tape

This is used for splicing cable sheaths.

h) PVC tape

PVC tape is used for cable sheath splicing.

i) Adhesive rubber tape

This tape is wound around the spliced cable sheath that are raised by applying putty.

j) Spacer

This is used for holding cables in lead sleeves in position in cable branch splicing.

k) Waterproofing sheet

This is used for temporary protection of cable joints from water in case cable splicing works require two days or more.

l) Desicant

This is used in places where a temporary waterproofing method is used, and where paper insulated cables are spliced at loading points.

m) Buried cable joint part protector

This is used for protecting buried cable joints.

n) Moistureproof compound

This is used for protecting the insides of the protective cover from water, and can be easily removed when opening the cover.

o) Sandpaper

This is used for cleaning cable sheaths.

p) Cable binding cord

This is used for fixing cable joints to cable bearer in manholes.

1. 3. 26 Cable Terminating Materials

Cable terminating materials include PVC terminating sleeves, compound, PE sleeves and others. The names and uses of the main materials are given below.

a) PVC terminating sleeve

This is used for covering the joints of entrance and termination cables so that a compound may be injected into the sleeve to form a gas dam.

b) PVC terminating tube

This is used in the terminating sleeve to prevent the compound from running out.

c) PVC termination cover

This covers the top and bottom ends of the terminating sleeve.

d) Laminated tape

This is used for bonding cable sheaths with laminated sheaths to prevent gas from leaking out of the opening between them.

e) Glass cloth tape

This is used when heating laminated tape.

f) Bonding ribbon

This is used for bonding earth wires to laminated cable sheaths.

g) 2 mm^2 600 V insulated wire

This is used as lead wire for connecting the laminated sheath of an entrance cable to the ground terminal of MDF.

h) Cotton cloth tape

This is used for bundling jointed cable conductors.

i) Spacer tape

This is used to keep a bundle of cable conductors in a termination sleeve from moving to either one side.

j) Floss silk

This is inserted into the clearances of cable core units for preventing the compound from flowing into the cable.

k) PE sleeve

This is used for protecting the insulation of cable joints.

l) No. 5 compound

This is used for preventing the No. 3-A compound from running into the cable.

m) No. 3-A compound

This is used for terminated gas dam.

n) Waterproofing compound

This is used for preventing moisture from entering along terminating cables after the No. 3-A compound has hardened.

o) Hemp thread

This is used for fanning out and binding of terminating cables.

1. 3. 27 Gas Pressurization Equipment

(1) General

This section deals with the equipment and devices that are necessary for charging dry air in underground cables. The pressures mentioned in this section are relative pressures in kg/cm^2 (or g/cm^2). Flow rates are in liters per minute measured under normal atmospheric pressure.

(2) 15L dry air supply unit

This unit feeds the air compressed by an air compressor through a dehumidifying unit to produce dry compressed air, and automatically and continuously supplies dry compressed air to cables at 0.65 kg/cm^2. It has the following functions.

a) External dimensions and weight

External dimensions are less than 450 mm wide, 400 mm deep and 1,000 mm high. Weight is less than 100 kg.

b) Ambient conditions

Temperature: 3°C to 45°C

Relative humidity: 90% (3°C to 30°C)

80% (31°C to 45°C)

c) Filling flow rate

More than 15 liters per minute, which is standard pressure volume.

d) Filling pressure

0.65 ± 0.05 kg/cm^2

e) Filling air humidity

The humidity of filling air measured at standard atmospheric pressure shall be such that its dew point is below - 40°C.

f) Power supply

Single phase, AC 50 Hz, 230 V

g) Air compressor

An air compressor directly coupled to an oil-less reciprocating type motor with a rated motor output of less than 0.4 kW.

The air compressor shall have a dust filter at its intake port, and the filter shall be so designed that its elements can be easily replaced.

h) Accessories

i) Pilot lamps

In addition to the originally installed pilot lamps, five times that number shall be supplied as accessories.

ii) Air compressor dust filter elements

In addition to the originally installed dust filter elements, five times that number shall be supplied as accessories.

(3) Wall type dry air distribution equipment

This unit, to be mounted on the wall of a room where it is necessary, is connected to the dry air supply unit for distributing dry air to each cable.

The wall type dry air distribution equipment consists of a manometer, a flow meter panel (equipped with 7 flow meters) and a flow monitor panel (equipped with 7 flow monitors), and has the following functions.

a) The manometer shall be able to measure pressures from 0 to 800 g/cm^2 with a scale graduated down to 2 g/cm^2.

b) The flow meter panel has 7 float type flow meters which measure flow rates from 200 cc/minute to 1,400 cc/minute (Std. P. Vol.), and 3 additional flow meters can be easily installed.

c) The flow monitor panel has 7 flow monitors (specified in Paragraph d), and 3 additional flow monitors can be easily installed.

d) The flow monitors to be connected from the outlets of the flow meters to cable shall meet the following requirements.

i) The flow monitors shall shortcircuit their alarm terminals if the air supply rate to cables should exceed an adjusted preset level.

ii) The point at which any of the flow monitors gives an alarm shall be easily adjustable within the range of 300 to 1,000 cc/minute (Std. P. Vol.)

iii) The flow monitors shall be so designed that a shorted alarm contact can be easily separated and identified.

iv) When dry air is supplied at a rate of 1,000 cc/minute (Std. P. Vol.) after setting a flow monitor to an alarm generating level of 300 cc/minute (Std. P. Vol.), the pressure loss of the flow monitor between its inlet and outlet shall be less than 20 g/cm^2.

v) When the flow monitor is set to an alarm generating point of 600 cc/minute (Std. P. Vol.) at an ambient temperature of 20°C, and then is exposed to an ambient temperature of 30°C and 45°C, the alarm generating point shall deviate no greater than ± 15% of the point at 20°C.

(4) Alarm equipment

If the dry air supply unit gives a trouble signal, or if a flow monitor gives a signal indicating an excessive air flow to cables, the alarm unit received the signal and sounds a buzzer connected to it to warn the maintenance personnel. Its functions and accessories are as follows:

a) Power supply: DC 48 V

b) The alarm unit shall be equipped with a 20-circuit spring terminal for identifying and separating an actuated circuit out of many parallel input circuits, or be provided with one as an accessory.

c) Three buzzers shall be provided. These buzzers shall have a buzzer stop pushbutton, a relay with a self-hold circuit and a buzzer stop pilot lamp.

The buzzer shall sound to give an alarm from the alarm equipment if a DC 48 V is applied. The buzzer shall stop sounding and the buzzer stop pilot lamp shall light when the buzzer stop pushbutton is pressed. The buzzer shall have the function of automatically returning to standby condition when the alarm equipment is released to its normal condition so that the buzzer is ready for sounding at any time.

1. 3. 28 Specification of Telephone Modification

Telephone modifications shall conform to the following:

(1) The casing and handset shall be cleaned and polished; and damaged parts or parts that have large flaws shall be replaced.
(2) All telephone cords shall be replaced with new ones, and be fitted with rosettes. In case straight handset cords are used, they shall be replaced with helical cords. If the existent helical cords are cracked, twisted or otherwise damaged, they shall be replaced.
(3) Hook buttons shall be replaced with white ones.
(4) Bells shall be replaced with new ones.
(5) When replacing the hook buttons and bells, wiring shall be changed.
(6) The inside of the telephones shall be cleaned and checked.
(7) Other faulty parts and aged parts shall be replaced with equivalent or better parts.
(8) After modifications, the following specifications shall be satisfied.
   a) Conversation shall be noise-free and clear.
   b) Dial speed shall be within the range of 9.2 to 10.8 pps and make ratio within the range of 30% to 36%.
   c) Insulation resistance
   i) More than 50 M ohms across L1 and L2 (with the handset hooked on).
   ii) More than 50 M ohms across L2 and the bottom plate and more than 20 M ohms across L2 and the dial finger stop (with the handset picked up).

1. 3. 29 Public Coin Box Telephone

1. 3. 29. 1 General

Public coin box telephone is clsassified into indoor and outdoor types, both of which are automatic. The specifications of both types are as follows:

1. 3. 29. 2 Indoor Type Public Coin Box Telephone

(1) Use

For local calls only.

(2) Construction

Indoor desk type, slightly larger in size than an ordinary telephone. The casing shall made of acrylnitril butadiene styrene resin.

(3) Functions
   a) External design conditions
   i) Applicable exchange: C1 and C2 type automatic exchanges.
   ii) Maximum line resistance from the exchanges: Less than 1,500 ohms
   iii) Charge indication: Subscriber line polarity reversed at the exchanges.
   iv) Toll dialling barring: Barred at the exchanges.
   v) Dial speed: 10 pps
   vi) Coin: 50-pias coin (new coin)

b) Operation

i) When the handset is picked up and a regular coin is inserted, a DC loop circuit shall form and a dial tone audible. If a smaller coin is inserted, it shall be returned at once.

ii) When the called party answers, the current from the exchange shall flow backward to keep the coin in the coin box. (Pay call)

iii) If the current from the exchange does not flow back, the coin shall not be kept in the coin box, but the parties concerned shall talk with each other in an ordinary way and the coin shall be returned to the calling party when he hangs up. (Free call or busy)

iv) Incoming calls can be received in the same way as ordinary telephones.

(4) Specifications

a) Conversation

Shall be satisfactory in volume and articulation without noise, vibration and distortion.

b) Insulation resistance

i) Insulation resistance across L1 and L2 shall be more than 25 M ohms with the handset hooked on.

ii) Insulation resistance across L2 and the casing shall be more than 25 M ohms with the handset picked up.

iii) Insulation resistance across L2 and the dial finger stop shall be more than 25 M ohms with the handset picked up.

c) Dial

i) Dial speed shall be 9.2 to 10.8 pps.

ii) Make ratio shall be 30% to 36%.

1. 3. 29. 3 Outdoor Type Public Coin Box Telephone

(1) Use

Local calls only.

(2) Construction

Wall type with the casing made of metal and strong materials.

(3) Functions

a) External design conditions

i) Applicable exchanges: C1 and C2 type automatic exchanges.

ii) Maximum line resistance from the exchanges: Less than 1,500 ohms

iii) Charge indication: Subscriber line polarity reversed at the exchanges.

iv) Toll dialling barring: Barred at the exchanges.

v) Dial speed: 10 pps.

vi) Coin: 50-pias coin (new coin).

b) Operation

i) When the handset is picked up and a regular coin is inserted, a DC loop circuit shall be formed and a dial tone shall become audible. If a smaller coin is inserted, it shall be returned at once.

ii) When the called party answers, the current from the exchange shall flow backward to keep the coin in the coin box. (Pay call)

iii) If the current from the exchange does not flow back, the coin shall not be kept in the coin box, but the parties concerned shall talk with each other in an ordinary way and the coin shall be returned to the calling party when he hangs up. (Free call or busy)

iv) Incoming calls can be received in the same way as ordinary telephones.

(4) Specifications

a) Conversation

Shall be satisfactory in volume and articulation without noise, vibration and distortion.

b) Insulation resistance

i) Insulation resistance across L1 and L2 shall be more than 25 M ohms with the handset hooked on.

ii) Insulation resistance across L2 and the casing shall be more than 25 M ohms with the handset picked up.

iii) Insulation resistance across L2 and the dial finger stop shall be more than 25 M ohms with the handset picked up.

c) Dial

i) Dial speed shall be 9.2 to 10.8 pps.

ii) Make ratio shall be 30% to 36%.

1.3.30 Expansion Ladder Car

(1) General

This section deals with expansion ladder cars used for pole top work for aerial cable installation.

(2) Construction

An expansion ladder car is a small-sized truck (1.75-ton coach type truck) with a hydraulic expansion ladder mounted on it.

The expansion ladder consists of a hydraulic unit driven by the car engine and a double-stage expansion ladder.

(3) Performance

a) Expansion ladder

i) Platform height: More than 5.7 m above ground (Platform floor level at an elevation of 60°)

ii) Maximum tilt angle: 75° in elevation angle
iii) Effective ladder width: More than 0.35 m (Inside measurement)
iv) Horizontal swivel: 360° (Free rotation)
b) Platform
i) Floor space: More than 0.8 m × 0.65 m
ii) Dielectric strength for ladder: AC 6,600 V for 1 minute
c) Platform load capacity

Test load: 225 kg, but normally 150 kg (When the ladder is tilted to an elevation angle of 60°, expanded to a height of 5.7 m above the ground, and is subjected to a load of 225 kg on the platform, followed by repetition of ladder contraction and horizontal rotation 5 times each, nothing wrong shall be developed with any part thereof.

d) Platform expansion speed
i) Rise: 10 to 20 seconds
ii) Fall: 10 to 20 seconds
(Without load, at an elevation angle of 60°, a height of 5.7 m above the ground and an engine speed of about 1,000 rpm)
e) Ladder elevation speed
i) Rise and fall: 10 to 30 seconds (Without load at an engine speed of about 1,000 rpm from the original ladder position to an elevation angle of 75°)
f) Platform horizontal rotating speed
360° rotation in 30 to 60 seconds (Without load at an elevation angle of 60°, a height of 5.7 m above the ground and an engine speed of about 1,000 rpm)
g) Natural fall of platform
Less than 10 mm in 30 minutes (Measured at cylinder position by applying a 225 kg load on the platform at an elevation angle of 60° and a height of 5.7 m above the ground. All safety valves are closed.)
h) Overall ladder weight
Less than 700 kg (including hydraulic unit)

1. 3. 31 Cylindrical Hydraulic Auger Crane Car

(1) General

This section deals with cylindrical hydraulic auger crane cars that are used for hole digging, pole setting and pole removing in aerial cable work.

(2) Construction

A cylindrical hydraulic auger crane car is an ordinary truck mounted with an earth drill (45 cm earth drill) and a hydraulic crane. In addition, the car has a pole puller as an accessory.

a) Ordinary truck

i) Engine: Diesel

ii) Car body: Cabover, single cabin

iii) Chassis: 2.5 to 3.0 tons

iv) Tires (Rear): Double

b) Cylindrical hydraulic auger unit

The boom and the earth drill are hydraulically driven by the car engine.

c) Pole puller

This unit is driven with hydraulic hose (7.5 m) connected to the hydraulic takeout port in the car body.

(3) Performance

a) Drill

i) Drilling diameter: More than 45 cm

ii) Drilling depth: More than 3.0 m

iii) Working range: More than 5.9 m

iv) Swivel range: More than 270°

(Hole position: Distance from the center of turntable swivel axis)

b) Pole setting unit

i) Maximum lifting capacity: More than 2,000 kg; 2,500 kg in overload test value (under rated load and with use of outrigger)

ii) Maximum lifting height: More than 7.9 m (under rated load; at bottom of hook)

iii) Swivel range: More than 360°

iv) Maximum swivel speed: 1 to 2 (rpm) (under rated load)

v) Maximum lifting rope speed: More than 7.0 m/min (under rated load; at hook)

vi) Natural descent: Less than 15 mm in 5 minutes (under rated load; at elevation cylinder position)

c) Pole puller

i) Maximum pole pulling capacity: More than 7,500 kg (at 45 cm point of stroke)

ii) Stroke: 50 cm

(4) Accessories

A 35 cm earth drill shall be provided.

1. 3. 32 Test Instruments

Test instruments to be used in installation and maintenance of junction cables and subscriber cables shall be equivalent to or better than those specified by the JIS Standard.

Nomenclatures, uses and/or functions of the test instruments are given in Table IV. 1. 3. 32. 1.

1. 3. 33 Tools

Tools to be used in construction and maintenance of the outside plant shall be equivalent to or better than those specified by the JIS Standard.

Nomenclatures, uses and/or functions of the tools are given in Table IV. 1. 3. 33. 1.

Table IV.1.3.32.1 Test Instruments for Outside Plant

Item No.	Nomenclature	Description
1	Circuit tester	For measuring current, voltage, resistance, etc. of circuits (Handy utility tester).
2	Portable tester No. 3, Wheat-stone bridge type	For measuring DC resistance and for direct reading of line trouble positions (distance) by Murray's and Varley's loop methods.
3	250 V – 50 M ohm transister megger	For measuring insulation resistance within the range of 50 Mohms.
4	C-R type oscillator for voice frequency	For testing cable frequency characteristics, (adjustable within the range of 0.3 to 10 kHz.)
5	Tr-2 Type amplifier	For amplifying a tone received from the C-R type oscillator.
6	Direct reading impedance measuring set for voice frequency	For measuring cable conductor impedance within an audio frequency range by direct reading.
7	50-B type crosstalk measuring set	For measuring mutual crosstalk in cable circuits within an audio frequency range by direct reading.
8	Standard termination network for crosstalk measuring	To be used for impedance matching in measuring near-end crosstalk.

Table IV. 1.3.33.1 (1/4) Tools for Outside Plant

Item No.	Nomenclature	Description
1	Pickaxe	For digging hard ground.
2	Shovel	For digging ground.
3	Long-handle shovel	For digging cylindrical holes for installation of new poles.
4	Long-handle spoon	For removing soil from cylindrical holes for installation of new poles.
5	Hand tamper	For tampering backfilled earth after installing new poles in cylindrical holes.
6	Tent	For sheltering the jointing work in manhole.
7	Vinyl sheet	For keeping water out of cable splicing work.
8	Manhole canvas screen	For protecting workers in manhole from traffic danger. It is placed above a manhole. PTC's mark should be printed on it.
9	Safety cone	For giving warning to pedestrians and Cars. It is placed around digging areas, etc.
10	Manhole ventilator	For supplying fresh air into a manhole during work in it.
11	Portable engine generator	For generating electric power for electric soldering irons, as well as for lamps and manhole ventilators. The capacity should be 800 Watts or more at AC 100 volts.
12	Electric soldering iron (200 W)	For soldering cable conductors.
13	Electric cable drum	A drum with a socket and 30 m cabtyre cord to be carried from place to place in electric work.
14	Chisel	For cleaning the inner surface of conduits to smooth surfaces prior to running cables through them.
15	Wire brush (for 100 mm)	For removing foreign matters from conduits.
16	Mandrel (conduit tester)	For detecting bends in conduits which are beyond permissible limits, as well as breaks and other faulty parts.
17	Cable grip	This is a net-like tool to be fitted onto a cable end for pulling cable.
18	Shaft drive type winch	To be used in cable laying in conduit section. It shall be attached on the rear wheel.
19	Wire Rope Roll	For rewinding wires after cable installation.
20	Cable bender	For bending cables in manholes.

Table IV. 1.3.33.1. (2/4) Tools for Outside Plant

Item No.	Nomenclature	Description
21	Bell mouth	This is inserted into a duct mouth when pulling a cable into a conduit with an inside diameter of 90 mm, for protecting the cable from damage.
22	Cable Roller	This is used when laying underground cables. It consists of a roller mounted on a wooden base.
23	Torch lamp	To be used for plumbing work on lead sleeves and lead sheaths.
24	Lap cutter	For cutting sheaths of alpeth and laminated sheath(LAP)cable in circumferential or longitudinal directions. No. 1 and No. 2 types have different blade depth and are used according to cable sheath thickness.
25	Cable cutter	Consisting of a ratchet handle, spindle, pusher and blade, and used for cutting cables. The blade can be replaced.
26	Cable sheath cutter	For cutting cable sheaths. It shall be so made that its blade will not damage cable conductors.
27	Cable jack	For lifting and rotating cables when installing cables.
28	Tool set for underground cable jointing	A tool kit complete with all the tools necessary for underground cable jointing.
29	Tool set for aerial cable jointing	A tool kit complete with all the tools necessary for aerial cable splicing.
30	B type tool set for premises installation	A tool kit complete with all the service order tools.
31	No. 4 Head phone	This is used for communication between workers at the time of cable pair number cross checking and cutting over.
32	No. 2 cable pair checker	For cross checking cable pair numbers (Battery built-in type)
33	Loin belt	A belt for carrying tools on the waist.
34	Plier holder	To be fastened to the leather belt for holding pliers.
35	Nipper holder	To be fastened to the leather belt for holding nippers.
36	14-inch adjustable spanner	For tightening bolts and nuts.
37	8-inch pliers	For cutting or tightening iron wire.

Table IV.1.3.33.1 (3/4) Tools for Outside Plant

Item No.	Nomenclature	Description
38	No.4 Nipper	For peeling conductor insulations or cutting conductors when splicing conductors, 0.4 to 0.5 mm in diameter.
39	No.5 Nipper	For peeling conductor insulations or cutting conductors when splicing conductors, 0.65 to 0.9 mm conductors.
40	Screwdriver	For tightening screws having pluse and minus screw-head.
41	2 m measuring tape (steel tape)	For measuring cable splicing positions and sheath peeling sizes.
42	50 m measuring tape	This is used at the field survey.
43	100 m measuring rope	This is used at the field survey.
44	Height measuring rod	For measuring cable height above the ground.
45	Working platform	This is used for the work at pole top. The platform can be installed at any position on pole.
46	Safety belt	To be worn by workers when working at high places.
47	Earth bar driving tool	A tool for driving an earth bar until its head is 50 cm underground.
48	Anchor driving tool	For driving anchors.
49	Lever Block (1.5 ton)	For pulling steel strands. (Consisting of a main body, holding wire and sub-vice.)
50	Stay rod vice	This is used in combination with the lever block for tightening stays.
51	SS cable vice	This is used in combination with the lever block for holding SS cable self-supporting wires in installing SS cables.
52	SD wire vice	This is used in installing SD wire.
53	Bolt clipper	For cutting steel strands.
54	No. 2 Metal pulley	With the rolling wheel covered with neoprene film, this is used in installing cables and SD wires.
55	No. 4 Metal pulley	This is used in installing cables and SD wires, particularly where they begin and end and curve.
56	Curve pulley arm	This arm is installed on the outside of angle poles for mounting No.4 metal pulleys apart from the pole.

Table IV.1.3.33.1 (4/4) Tools for Outside Plant

Item No.	Nomenclature	Description
57	Pulley hanger	This is used in combination with the No. 2 or No. 4 metal pulley.
58	Shackle	For connecting a cable grip to the No. 1 cable unstrander.
59	No. 1 Cable unstrander	For preventing the twist of cables and SD wires when installing them.
60	Anti-twisting device	This is installed between cable grip and cable unstrander to prevent SS cables from being twisted at the time of installation.
61	Folding ladder	A ladder for pole top work which can be folded into three parts.
62	Protective sheet for pole installtion	For protecting workers from electric shock in case the pole top contacts a power line (to be wound on the top of a pole).
63	12 mm hemp rope	This is used in cable and SD wire installation, etc.
64	Metal cap holder	For holding the No. 6 valve installed on the lead sleeve.
65	Cable sheath drill	For making a hole on lead sleeve to install the gas valve.
66	No. 5 gas valve chuck	A joint for No. 5 valve used for measuring cable gas pressure.
67	No. 6 gas valve chuck	A joint for No. 6 valve for measuring cable gas pressure.
68	No. 4 manometer	A portable mercury manometer for accurate measurement of gas pressure.
69	Portable pressure gauge	For simple measurement of gas pressure.

CHAPTER 2 MATERIALS LIST

2. 1 Mayangon Exchange Office

Materials necessary for construction of outside plant for Mayangon Exchange Office are shown in Table IV. 2. 1. 1, and Table IV. 2. 1. 2. Table IV. 2. 1. 3 presents a list of cable pieces for underground lines.

2. 2 Maymyo Exchange Office

Materials necessary for construction of outside plant for Maymyo Exchange Office are shown in Table IV. 2. 2. 1.

2. 3 Materials for Training

Table IV. 2 3. 1 presents a list of materials for training on outside plant facilities.

Table IV. 2. 1. 1.

Material List for Junction Cable

I. Cable

Item No.	Item	Unit	Quantity			Remarks
			Construction	Maintenance	Total	
1	0.9 —400 PEF – LAP Cable	m	4.019	125	4.144	refer to List of cable pieces
2	0.9 —400 PEF – LAP (armoured) 〃	〃	2.924	125	3.049	〃
3	0.5 —400 terminating cable	〃	30	—	30	including quantity for subscrber cable termination

II. Laading Coil

Item No.	Item	Unit	Quantity			Remarks
			Construction	Maintenance	Total	
1	88mH — 400 P. Loading coil	pcs	4	—	4	

III. Jointing Materials

Item No.	Item	Unit	Quantity			Remarks
			Construction	Maintenance	Total	
1	Cable terminating materials (0.9 – 400)	pcs	2	—	2	
2	Cable jointing materials in manhole (0.9 – 400)	〃	22	17	39	
3	Coil jointing materials in manhole (0.9 – 400)	〃	4	1	5	
4	Cable jointing materials in buried section(0.9 – 400)	〃	8	1	9	
5	Buried cable joint Part protector	〃	8	2	10	

Table IV. 2.1.2 (1/14) Material List for Outside Plant in Mayangon

I. Cable & Wires

1. Underground Cable

Item No.	Item	Unit	Quantity			Remarks
			Construction	Maintenance	Total	
1-1	0.4-400 PEF-LAP armoured	m	1,764	100	1,864	refer to list of cable pieces
1-2	0.4-600 "	"	1,692	100	1,792	"
1-3	0.4-800 "	"	1,213	100	1,313	"
1-4	0.4-1000 "	"	431	100	531	"
1-5	0.5-400 "	"	2,762	100	2,862	"
1-6	0.5-600 "	"	379	100	479	"
1-7	0.9-400 "	"	4,713	—	4,713	"
1-8	0.4-30 CCP-JF armoured	"	250	50	300	"

2. Terminating Cable

Item No	Item	Unit	Quantity			Remarks
			Construction	Maintenance	Total	
2-1	0.4-400 terminating cable	m	70	—	70	
2-2	0.4-600 "	"	50	—	50	

3. CST Riser Cable

Item No	Item	Unit	Quantity			Remarks
			Construction	Maintenance	Total	
3-1	0.4-400 CST riser cable (20m)	pcs	4	—	4	refer to list of cable pieces
3-2	" (30m)	"	5	—	5	"
3-3	" (40m)	"	2	—	2	"
3-4	" (50m)	"	5	—	5	"
3-5	" (60m)	"	1	1	2	"

Table IV. 2. 1. 2 (2/14) Material List for Outside Plant in Mayangon

4. Aerial Cable

Item No.	Item	Unit	Quantity			Remarks
			Construction	Maintenance	Total	
4-1	0.4-1400 PEF-LAP cable	m	35	—	35	
4-2	0.4-30 CCP-AP-SS cable	"	15,050	950	16,000	
4-3	0.4-50 〃	"	10,100	400	10,500	
4-4	0.4-100 〃	"	7,350	150	7,500	
4-5	0.4-200 〃	"	4,600	400	5,000	
4-6	0.5-30 〃	"	4,400	600	5,000	
4-7	0.5-50 〃	"	2,250	250	2,500	
4-8	0.5-100 〃	"	2,300	200	2,500	
4-9	0.5-200 〃	"	3,500	500	4,000	
4-10	0.65-30 〃	"	3,000	500	3,500	
4-11	0.65-100 〃	"	4,300	200	4,500	
4-12	0.9-30 〃	"	1,600	400	2,000	
4-13	0.9-50 〃	"	2,600	400	3,000	

5. SD Wire

Item No	Item	Unit	Quantity			Remarks
			Construction	Maintenance	Total	
5-1	2 SD wire	m	2,200	800	3,000	
5-2	6 SD wire	"	25,000	3,000	28,000	

Table IV. 2. 1. 2 (3/4) Material List for Outside Plant in Mayangon

6. Other Wire

Item No	Item	Unit	Quantity			Remarks
			Construction	Maintenance	Total	
6-1	0.5-2 jumper wire	m	5,400	600	6,000	including quantity for junction cable
6-2	Drop wire	"	52,000	40,000	92,000	
6-3	Indoor wire	"	18,000	13,000	31,000	
6-4	30mm^2 Special steel stranded wire	kg	1,400	100	1,500	
6-5	35mm^2 " "	"	60	20	80	
6-6	45mm^2 " "	"	150	30	180	
6-7	14mm^2 600 V Insulated wire	m	130	20	150	
6-8	2mm^2 600 V "	"	300	100	400	

II. Cable Jointing Materials

1. Cable Terminating Materials

Item No.	Item	Unit	Quantity			Remarks
			Construction	Maintenance	Total	
1-1	0.4-1000 PEF-LAP cable	set	2	—	2	
1-2	0.4-1400 "	"	4	—	4	
1-3	0.5-600 "	"	1	—	1	
1-4	0.9-400 "	"	1	—	1	

Table IV. 2.1.2 (4/14) Material List for Outside Plant in Mayangon

2. Underground Cable Jointing Materials

Item No	Item	Unit	Quantity			Remarks
			Construction	Maintenance	Total	
2-1	0.4-400 PEF-LAP cable (armoured)	set	7	1	8	
2-2	0.4-600 "	"	7	1	8	
2-3	0.4-800 "	"	5	1	6	
2-4	0.4-1000 "	"	4	1	5	
2-5	0.5-400 "	"	12	2	14	
2-6	0.5-600 "	"	2	—	2	
2-7	0.9-400 "	"	19	2	21	
2-8	Buried cable joint part protector	"	49	8	57	including moisture-proof compound

3. Aerial Cable Jointing Materials

Item No	Item	Unit	Quantity			Remarks
			Construction	Maintenance	Total	
3-1	0.4-30 CCP-AP-SS cable	set	33	3	36	
3-2	0.4-50 "	"	36	4	40	
3-3	0.4-100 "	"	42	4	46	
3-4	0.4-200 "	"	31	3	34	
3-5	0.5-30 "	"	8	1	9	
3-6	0.5-50 "	"	7	1	8	
3-7	0.5-100 "	"	7	1	8	
3-8	0.5-200 "	"	13	1	14	
3-9	0.65-30 "	"	6	1	7	
3-10	0.65-100 "	"	13	1	14	
3-11	0.9-30 "	"	4	1	5	
3-12	0.9-50 "	"	6	1	7	

Table IV. 2.1.2 (5/14) Material List for Outside Plant in Mayangon

Ⅲ. Terminal Boxes

1. Ready Access Terminal Box

Item No.	Item	Unit	Quantity			Remarks
			Construction	Maintenance	Total	
1-1	200 straight type	set	568	152	720	
1-2	200 single branch type	"	49	2	51	
1-3	200 both branch type	"	2	—	2	
1-4	400 straight type	"	8	—	8	
1-5	400 single branch type	"	8	—	8	
1-6	400 both branch type	"	1	1	2	
1-7	Single side cover (200 type)	"	—	20	20	
1-8	Branch side cover (200 type)	"	—	10	10	
1-9	Single side cover (400 type)	"	—	2	2	
1-10	Branch side cover (400 type)	"	—	2	2	

2. Other Terminals

Item No.	Item	Unit	Quantity			Remarks
			Construction	Maintenance	Total	
2-1	10cct terminal block; 2-A type	pcs	34	2	36	
2-2	SD terminal box	set	272	88	360	
2-3	4 pair tarminal block	pcs	416	184	600	
2-4	CCP connector	"	2,000	2,000	4,000	

Table IV. 2.1.2 (6/14) Material List for Outside Plant in Mayangon

IV. Steel Tubular Pole

Item No.	Item	Unit	Quantity			Remarks
			Construction	Maintenance	Total	
1	7.0 - 200	pcs	115	5	120	
2	7.5 - 200	"	483	22	505	
3	7.5 - 430	"	4	1	5	
4	8.0 - 200	"	196	14	210	
5	8.0 - 430	"	5	-	5	
6	9.0 - 200	"	17	3	20	

V. Other Materials for Underground Cable Installation

Item No	Item	Unit	Quantity			Remarks
			Construction	Maintenance	Total	
1	100mm steel pipe	pcs	65	10	75	pipe length is 5.5m
2	Cable bearer	"	140	10	150	
3	Terminating sleeve fastener	"	12	-	12	including nuts
4	Terminating sleeve holder	"	8	-	8	"
5	Other necessary accessories	set	1	-	1	

Table IV. 2.1.2 (7/14) Material List for Outside Plant in Mayangon

VI. Accessories for Aerial Facilities

Item No.	Item	Unit	Quantity			Remarks
			Construction	Maintenance	Total	
1	22mm hook bolt	pcs	2	—	2	
2	S type stay anchor	set	739	41	780	
3	M type 〃	〃	3	1	4	
4	Stay guard	pcs	350	50	400	Length is 2.0m
5	SS cable pinch hanger	〃	900	200	1100	
6	No.1 SD wire hanger	〃	370	130	500	
7	SS cable curved pinch Hanger	〃	300	50	350	
8	SD wire curved hanger	〃	70	30	100	
9	12mm bolt	〃	500	100	600	
10	16 mm 〃	〃	300	50	350	
11	20mm 〃	〃	11	9	20	
12	L-43 pole band	〃	0	10	10	
13	L-84 〃	〃	400	250	650	
14	L-120 〃	〃	20	20	40	
15	S 43 〃	〃	5	2	7	
16	S 84 〃	〃	1600	100	1700	
17	S 120 〃	〃	5	2	7	
18	Rail pole band	〃	40	5	45	
19	F band	〃	60	10	70	
20	No.2-B adjustable band	〃	34	1	35	

Table IV. 2. 1. 2 (8/14) Material List for Outside Plant in Mayangon

Item No.	Item	Unit	Quantity			Remarks
			Construction	Maintenance	Total	
21	N stainless band	m	2,500	500	3,000	
22	N stainless band fastener	pcs	1,500	200	1,700	
23	B strut mounting hardware	"	33	2	35	
24	Holding stay grip hardware	"	350	70	420	
25	SS cable separator	"	50	10	60	
26	A wiring ring	"	2,100	400	2,500	
27	B "	"	900	200	1,100	
28	6mm drive hook	"	2,000	400	2,400	
29	9mm "	"	800	150	950	
30	C-shaped clamp	"	500	100	600	
31	L- "	"	1,500	500	2,000	
32	C-shaped wire detainer	"	340	60	400	
33	Drop wire detainer	"	2,500	1,500	4,000	
34	No.1 thimble grip for 30mm^2 stranded wire	"	900	200	1,100	
35	" 35 mm^2 "	"	30	10	40	
36	" 45 mm^2 "	"	30	10	40	
37	S.S cable thimble grip for 7/1.6 supporting wire	"	90	20	110	
38	" for 7/1.8 "	"	30	10	40	
39	" for 7/2.0 "	"	10	5	15	
40	No.1 wooden pole grip for 30mm^2 stranded wire	"	600	100	700	

Table IV. 2.1.2 (9/14) Material List for Outside Plant in Mayangon

Item No.	Item	Unit	Quantity			Remarks
			Construction	Maintenance	Total	
41	No. 1 wooden pole grip for 35mm² stranded wire	pcs	10	5	15	
42	for 45mm² "	"	30	10	40	
43	S.S cable wooden pole grip for 7/1.6 supporting wire	"	130	20	150	
44	for 7/1.8 "	"	50	10	60	
45	for 7/2.0 "	"	20	5	25	
46	A type earth bar	"	61	9	70	
47	B "	"	122	18	140	
48	Pole step	"	3,875	225	4,100	
49	Cable cover	"	200	15	215	
50	Other necessary accessories	set	1	—	1	

VII. Premises

Item No.	Item	Unit	Quantity			Remarks
			Construction	Maintenance	Total	
1	Modification of telephone set	set	1,500	150	1,650	
2	Indoor type public coin box telephone	"	9	1	10	
3	Outdoor type public coin box telephone	"	6	1	7	
4	PVC Wire protector	pcs	450	50	500	Length is 1.0m
5	Wire protector	"	200	100	300	"
6	Rosette	"	900	650	1,550	

Table IV. 2.1.2 (10/14)

Material List for Outside Plant in Mayangon

VIII. Gas Pressurization Equipment

Item No.	Item	Unit	Quantity			Remarks
			Construction	Maintenance	Total	
1	15-L Dry-air Supply Equipment	set	1	—	1	
2	Wall Type Dry-air Distribution Equipment	"	1	—	1	
3	Alarm Equipment	"	1	—	1	
4	No. 3 Gas Pipe Connector	pcs	5	2	7	
5	Gas Pipe	set	1	—	1	6mm & 16mm
6	Other Necessary Accessories	"	1	—	1	

IX. Construction Vehicles

Item No.	Item	Unit	Quantity			Remarks
			Construction	Mainenance	Total	
1	Expansion Ladder Car	car	2	—	2	
2	Cylindrical Hydaulic Auger Crane Car	"	1	—	1	

X. Test Instruments

Item No.	Item	Unit	Quantity			Remarks
			Construction	Mainenance	Total	
1	Circuit Tester	set	3	—	3	
2	Portable Tester No. 3 Wheatsone Bridge Type	"	2	—	2	
3	250V - 50M Ohm Transister Megger	"	2	—	2	
4	C-R Type Oscillator for Voice Freguency	"	1	—	1	
5	Tr-2 Type Amplifier	"	1	—	1	
6	Direct Reading Impedance Measuring set for Voice Freguency	"	1	—	1	
7	50-B Type Crosstalk Measuring set	"	1	—	1	
8	Standard Termination Network for Crosstalk Measuring	"	1	—	1	

Table IV. 2. 1. 2 (11/14)

Material List for Outside Plant in Mayangon

XI. Tools

Item No.	Item	Unit	Quantity			Remarks
			Construction	Maintenance	Total	
1	Pickaxe	pcs	40	—	40	
2	Shovel	〃	40	—	40	
3.	Long Handle Shovel	〃	10	—	10	
4.	Long Handle Spoon	〃	10	—	10	
5.	Hand Tamper	〃	3	—	3	
6.	Tent	sheet	5	—	5	
7.	Vinyl Sheet	〃	20	—	20	
8.	Manhole Canvas Screen	set	5	—	5	
9.	Safty Corn	pcs	20	—	20	
10.	Manhole Ventilator	set	2	—	2	
11.	Portable Engine Generator (800W)	〃	5	—	5	
12.	Electric Soldering Iron (200W)	〃	5	—	5	
13.	Electric Cable Drum	〃	5	—	5	
14.	Chisel	pcs	2	—	2	
15.	Wire Brush	〃	2	—	2	
16.	Mandrel	〃	2	—	2	
17.	Cable Grip	〃	2	—	2	
18.	Shaft Drive Type Winch	set	1	—	1	
19.	Wire Rope Roll	〃	1	—	1	
20.	Cable Bender	〃	2	—	2	

Table IV 2.1.2 (12/14)

Material List for Outside Plant in Mayangon

Item No.	Item	Unit	Quantity			Remarks
			Construction	Maintenance	Total	
21.	Bellmouth	pcs	1	—	1	
22.	Cable Roller	〃	20	—	20	
23.	Torch Lamp	set	5	—	5	
24.	Lap Cutter	pcs	10	—	10	
25.	Cable Cutter	〃	3	—	3	
26.	Cable Sheath Cutter	〃	5	—	5	
27.	Cable Jack	set	3	—	3	
28.	Tool Set for Underground Cable Jointing	〃	5	—	5	
29.	Tool Set for Aerial Cable Jointing	〃	6	—	6	
30.	B type Tool Set for Premises Installation	〃	6	—	6	
31.	No.4 Head Phone	〃	20	—	20	
32.	No.2 Cable Pair Checker	〃	4	—	4	
33.	Loin Belt	pcs	20	—	20	
34.	Plier Holder	〃	20	—	20	
35.	Nipper Holder	〃	20	—	20	
36.	14-Inch Adjustable Spanner	〃	20	—	20	
37.	8-Inch Plier	〃	20	—	20	
38.	No.4 Nipper	〃	40	—	40	
39.	No.5 Nipper	〃	40	—	40	
40.	SD Plier	〃	6	—	6	

Table IV 2.1.2. (13/14)

Material List for Outside Plant in Mayangon

Item No.	Item	Unit	Quantity			Remarks
			Construction	Maintenance	Total	
41.	Screw .Driver	pcs	20	—	20	
42.	2m Measuring Tape (Steel Type)	"	10	—	10	
43.	50m Measuring Tape	"	5	—	5	
44.	100m Measuring Rope	"	2	—	2	
45.	Height Measuring Rod	"	1	—	1	
46.	Working Platform	set	5	—	5	
47.	Safety Belt	pcs	20	—	20	
48.	Earth Bar Driving Tool	set	5	—	5	
49.	Anchor Driving Tool	"	2	—	2	
50.	Lever Block (1.5t)	"	6	—	6	
51.	Stay Rod Vice	"	2	—	2	
52.	SS Cable Vice	"	4	—	4	
53.	SD Wire Vice	"	3	—	3	
54.	Bolt Clipper	"	2	—	2	
55.	No.2 Metal Pulley	pcs	15	—	15	
56.	No.4 Metal Pulley	"	6	—	6	
57.	Curve Pulley-Arm	"	6	—	6	
58.	Pulley Hanger	"	15	—	15	
59.	Shackle	"	20	—	20	
60.	No.1 Cable Unstrander	"	2	—	2	

Table IV. 2.1.2. (14/14)
Material List for Outside Plant in Mayangon

Item No.	Item	Unit	Quantity			Remarks
			Construction	Maintenance	Total	
61.	Anti Twisting Device	pcs	2	—	2	
62.	Folding Ladder	set	5	—	5	
63.	Protec tive Sheet for Pole Installation	sheet	15	—	15	
64.	12mm Hemp Rope	m	1.000	—	1.000	
65.	Metal Cap Holder	pcs	2	—	2	
66.	Cable Sheath Drill	"	2	—	2	
67	No.5 Gas Valve Chuck	"	3	—	3	
68.	No.6 Gas Valve Chuck	"	3	—	3	
69.	No.4 Manometer	set	2	—	2	
70.	Portable Pressure Gauge	"	2.	—	2	

Table Ⅳ.2.1.3 (1/12) List of Cable Pieces

0.9-400 PEF-LAP Cable (Junction Cable)

Name of cable	Section	Length of cable piece (m)	Cable drum number	Remarks
Junction	Hanthawaddy Ex. office ~ No. 574 MH	214	No. 1	
〃	No. 574 MH ~ No. 577 〃	212	〃 2	
〃	No. 577 〃 ~ No. 580 〃	212	〃 3	
〃	No. 580 〃 ~ No. 583 〃	213	〃 4	
〃	No. 583 〃 ~ No. 586 〃	198	〃 5	
〃	No. 586 〃 ~ No. 589 〃	213	〃 6	
〃	No. 589 〃 ~ No. 592 〃	213	〃 7	
〃	No. 592 〃 ~ No. 595 〃	195	〃 8	
〃	No. 595 〃 ~ No. 633 〃	214	〃 9	
〃	No. 633 〃 ~ No. 635 〃	243	〃 10	
〃	No. 635 〃 ~ No. 637 〃	245	〃 11	
〃	No. 637 〃 ~ No. 639 〃	181	〃 12	
〃	No. 639 〃 ~ No. 641 〃	187	〃 13	
〃	No. 641 〃 ~ No. 644 〃	184	〃 14	
〃	No. 644 〃 ~ No. 647 〃	212	〃 15	
〃	No. 647 〃 ~ No. 649 〃	151	〃 16	
〃	No. 649 〃 ~ No. 651 〃	243	〃 17	
〃	No. 651 〃 ~ No. 653 〃	245	〃 18	
〃	No. 653 〃 ~ No. 655 〃	244	〃 19	
	Maintenance	125	〃 20	
Total		4,144		

Table Ⅳ.2.1.3 (2/12) List of Cable Pieces

0.9-400 PEF-LAP Armoured Cable (Junction Cable)

Name of cable	Section		Length of cable piece (m)	Cable drum number	Remarks
Junction	No. 655 MH	~ Existing L_3 coil MH	115	No. 1	
〃	Existing L_3 coil MH	~ L_2 S_8 jointing point	231	〃 2	
〃	L_2 S_8 jointing point	~ New No. 4 MH	231	〃 3	
〃	New No. 4 MH	~ L_3 S_1 jointing point	238	〃 4	
〃	L_3 S_1 jointing point	~ L_3 S_2 〃	230	〃 5	
〃	L_3 S_2 〃	~ L_3 S_3 〃	233	〃 6	
〃	L_3 S_3 〃	~ L_3 S_4 〃	230	〃 7	
〃	L_3 S_4 〃	~ Existing L_4 coil MH	232	〃 8	
〃	Existing L_4 coil MH	~ L_3 S_6 jointing point	241	〃 9	
〃	L_3 S_6 jointing point	~ L_3 S_7 〃	211	〃 10	
〃	L_3 S_7 〃	~ New No. 3 MH	231	〃 11	
〃	New No.3 MH (L_4 coil)	~ New No.2 MH L_4 S_1 (jointing point)	119	〃 12	
〃	New No.2MH L_4 S_1 (jointing point)	~ L_4 S_2 jointing point	168	〃 13	
〃	L_4 S_2 jointing point	~ Mayangon Ex. office	214	〃 14	
	Maintenance		125	〃 15	
Total			3,049		

Table IV.2.1.3 (3/12) List of Cable Pieces

0.4-400 PEF-LAP Armoured Cable

Name of cable	Section	Length of cable piece (m)	Cable drum number	Remarks
D	DS3 jointing point ~ DS4 jointing point	126	No. 1	
〃	DS4 〃 ~ DS5 〃	230	〃 2	
〃	DS5 〃 ~ DS6 〃	210	〃 3	
〃	DS6 〃 ~ DS7 〃	240	〃 4	
〃	DS7 〃 ~ DS8 〃	230	〃 5	
〃	DS8 〃 ~ DS9 〃	230	〃 6	
〃	DS9 〃 ~ DS10 〃	202	〃 7	
〃	DS3 〃 ~ DS3-1 〃	94	〃 1	
A	AS5 〃 ~ AS5-1 〃	202	〃 8	
	Maintenance	100	〃 9	
Total		1,864		

Table Ⅳ.2.1.3 (4/12) List of Cable Pieces

0.4-600 PEF-LAP Armoured Cable

Name of cable	Section	Length of cable piece (m)	Cable drum number	Remarks
A	A S6 Jointing point ~ A S7 Jointing point	253	No. 1	
〃	A S7 〃 ~ A S8 〃	252	〃 2	
〃	A S8 〃 ~ A S9 〃	277	〃 3	
〃	A S9 〃 ~ A S10 〃	229	〃 4	
〃	A S10 〃 ~ A S11 〃	252	〃 5	
〃	A S11 〃 ~ A S12 〃	247	〃 6	
〃	A S12 〃 ~ A S13 〃	182	〃 7	
	Maintenance	100	〃 8	
Total		1,792		

Table IV.2.1.3 (5/12) List of Cable Pieces

0.4-800 PEF-LAP Armoured Cable

Name of cable	Section	Length of cable piece (m)	Cable drum number	Remarks
A	A S1 Jointing point ~ A S2 Jointing point	205	No. 1	
〃	A S2 〃 ~ A S3 〃	252	〃 2	
〃	A S3 〃 ~ A S4 〃	252	〃 3	
〃	A S4 〃 ~ A S5 〃	252	〃 4	
〃	A S5 〃 ~ A S6 〃	252	〃 5	
	Maintenance	100	〃 6	
Total		1,313		

Table IV.2.1.3 (6/12) List of Cable Pieces

0.4-1.000 PEF-LAP Armoured Cable

Name of cable	Section	Length of cable piece (m)	Cable drum number	Remarks
D	Ex. office ~ DS2 jointing point	261	No. 1	including A cable
〃	DS2 jointing point ~ New No. 2 MH	170	〃 2	
〃	Maintenance	100	〃 3	
Total		531		

Table Ⅳ.2.1.3 (7/12) List of Cable Pieces

0.5-400 PEF-LAP Armoured Cable

Name of cable	Section	Length of cable piece (m)	Cable drum number	Remarks
C	New No. 2 M H ～ C S 3 jointing point	286	No. 1	
〃	C S 3 jointing point ～ C S 4 〃	252	〃 2	
〃	C S 4 〃 ～ C S 5 〃	252	〃 3	
〃	C S 5 〃 ～ C S 6 〃	252	〃 4	
〃	C S 6 〃 ～ C S 7 〃	252	〃 5	
〃	C S 7 〃 ～ C S 8 〃	254	〃 6	
〃	C S 8 〃 ～ C S 9 〃	252	〃 7	
〃	C S 9 〃 ～ C S 10 〃	252	〃 8	
〃	C S 10 〃 ～ C S 11 〃	252	〃 9	
〃	C S 11 〃 ～ C S 12 〃	254	〃 10	
〃	C S 12 〃 ～ C S 14 〃	204	〃 11	
	Maintenance	100	〃 12	
Total		2,862		

Table Ⅳ.2.1.3 (8/12) List of Cable Pieces

0.5-600 PEF-LAP Armoured Cable

Name of cable	Section	Length of cable piece (m)	Cable drum number	Remarks
C	Ex. office ～ CS1 jointing point	211	No. 1	
〃	CS1 jointing point ～ New No. 2 MH	168	〃 2	
	Maintenance	100	〃 3	
Total		479		

Table IV.2.1.3 (9/12) List of Cable Pieces

0.9-400 PEF-LAP Armoured Cable

Name of cable	Section	Length of cable piece (m)	Cable drum number	Remarks
B	Ex. office ~ BS1 jointing point	251	NO. 1	
〃	BS1 jointing point ~ BS2 〃	252	〃 2	
〃	BS2 〃 ~ BS3 〃	252	〃 3	
〃	BS3 〃 ~ BS4 〃	252	〃 4	
〃	BS4 〃 ~ BS5 〃	254	〃 5	
〃	BS5 〃 ~ BS6 〃	252	〃 6	
〃	BS6 〃 ~ BS7 〃	256	〃 7	
〃	BS7 〃 ~ BS8 〃	254	〃 8	
〃	BS8 〃 ~ BS9 〃	254	〃 9	
〃	BS9 〃 ~ BS10 〃	252	〃 10	
〃	BS10 〃 ~ BS11 〃	252	〃 11	
〃	BS11 〃 ~ BS12 〃	252	〃 12	
〃	BS12 〃 ~ BS13 〃	252	〃 13	
〃	BS13 〃 ~ BS14 〃	254	〃 14	
〃	BS14 〃 ~ BS15 〃	252	〃 15	
〃	BS15 〃 ~ BS16 〃	252	〃 16	
〃	BS16 〃 ~ BS17 〃	252	〃 17	
〃	BS17 〃 ~ BS18 〃	254	〃 18	
〃	BS18 〃 ~ BS19 〃	164	〃 19	
Total		4,713		

Table IV.2.1.3 (10/12) List of Cable Pieces

0.4-1.400 PEF-LAP Cable

Name of cable	Section	Length of cable piece (m)	Cable drum number	Remarks
Tie cable	Pole ~ Pole	35	No. 1	Mayangon Ex. office
Total		35		

Table Ⅳ.2.1.3 (11/12) List of Cable Pieces

0.4−400 CST with Dam and Gas Valve Armoured Cable

Name of cable	Section			Length of cable piece (m)	Cable drum number	Remarks
A	A S 1 Jointing point	～	Pole	50		
〃	A S 5-1 〃	～	Pole	20		
〃	A S 6 〃	～	Pole	40		
〃	A S 9 〃	～	Pole	20		
〃	A S 13 〃	～	Pole	30		
〃	A S 13 〃	～	Pole	30		
B	B S 6 〃	～	Pole	50		
〃	B S 15 〃	～	Pole	50		
〃	B S 19 〃	～	Pole	20		
C	New No. 2 M H	～	Pole	50		
〃	C S 13 jointing point	～	Pole	30		
〃	C S 14 〃	～	Pole	40		
D	New No. 2 M H	～	Pole	60		
〃	D S 3-1 jointing point	～	Pole	30		
〃	New No. 2 M H	～	Pole	20		
〃	D S 10 jointing point	～	Pole	30		
〃	D S 10 〃	～	Pole	50		

Table Ⅳ.2.1.3 ($^{12}/_{12}$) List of Cable Pieces

0.4-30 CCP-JF Armoured Cable

Name of cable	Section	Length of cable piece (m)	Cable drum number	Remarks
	Pole ～ President's house	300	NO. 1	
Total		300		

Table IV.2.2.1 (1/8)

Material List for Outside Plant in Maymyo

I. Cable & Wires

1. Aerial Cable

Item No.	Item	Unit	Quantity			Remarks
			Construction	Maintenance	Total	
1	0.4 - 30 CCP - AP - SS Cable	m	11,000	500	11,500	
2	0.4 - 50 "	"	5,500	500	6,000	
3	0.4 - 100 "	"	2,050	450	2,500	
4	0.4 - 200 "	"	3,300	200	3,500	
5	0.5 - 30 "	"	6,800	700	7,500	
6	0.5 - 50 "	"	2,150	350	2,500	

2. SD Wire

Item No.	Item	Unit	Quantity			Remarks
			Construction	Maintenance	Total	
1	2SD Wire	m	2,050	950	3,000	
2	6SD Wire	"	10,700	800	11,500	

3. Other Wires

Item No.	Item	Unit	Quantity			Remarks
			Construction	Maintenance	Total	
1	Drop Wire	m	11,600	10,000	21,600	
2	Indoor Wire	"	3,000	3,000	6,000	
3	30 mm^2 Special Steel Stranded Wire	Kg	650	50	700	
4	35 mm^2 "	"	90	20	110	
5	14 mm^2 600 V Insulated Wire	m	160	20	180	
6	2 mm^2 600 V Insulated Wire	"	200	50	250	

Table IV. 2. 2. 1 (2/8)

Material List for Outside Plant in Maymyo

II. Cable Jointing Materials

Item NO	Item	Unit	Quantity			Remarks
			Construction	Maintenance	Total	
1.	0.4 — 30 ccp-AP-SS cable	set	22	8	30	
2.	0.4 — 50 ,	,	17	5	22	
3.	0.4 — 100 ,	,	8	3	11	
4.	0.4 — 200 ,	,	21	7	28	
5.	0.5 — 30 ,	,	15	5	20	
6.	0.5 — 50 ,	,	7	2	9	

III. Terminal Boxes

1. Ready Access Terminal Box

Item NO	Item	Unit	Quantity			Remarks
			Construction	Maintenance	Total	
1.1	200 straight type	set	275	125	400	
1.2	200 single branch type	,	24	1	25	
1.3	Single side cover (200 type)	,	—	10	10	
1.4	Branch side cover (200 type)	,	—	5	5	

2. Other Terminals

Item NO.	Item	Unit	Quantity			Remarks
			Construction	Maintenance	Total	
2.1	10 cct terminal block 2-A type	pcs	3	—	3	
2.2	SD terminal box	set	80	30	110	
2.3	4 Pair terminal block	pcs	100	150	250	
2.4	CCP connector	,	400	400	800	
2.5	Pole mounted protector	,	3	—	3	

Table IV.2.2.1 (3/8)

Material List for Outside Plant in Maymyo

IV. Steel Tubular Pole

Item No.	Item	Unit	Quantity			Remarks
			Construction	Maintenance	Total	
1	7.0 - 200	pcs	10	-	10	
2	7.5 - 200	"	224	16	240	
3	7.5 - 430	"	5	-	5	
4	8.0 - 200	"	161	9	170	
5	9.0 - 200	"	4	1	5	

V. Accessories For Aerial Facilities

Item No	Item	Unit	Quantity			Remarks
			Construction	Maintenance	Total	
1	S Type Stay Anchor	set	313	27	340	
2	M Type Stay Anchor	"	5	-	5	
3	Stay Guard	pcs	100	20	120	Length is 2.0m
4	SS Cable Pinch Hanger	"	500	100	600	
5	No.1 SD Wire Hanger	"	200	40	240	
6	SS Cable Curved Pinch Hanger	"	120	20	140	
7	12 mm Bolt	"	300	60	360	
8	16 mm "	"	200	40	240	
9	20mm "	"	10	2	12	
10	L - 43 Pole Band	"	5	5	10	
11	L - 84 "	"	300	150	450	
12	L - 120 "	"	5	5	10	

Table IV. 2. 2. 1 (4/8)

Material List for Outside Plant in Maymyo

Item No.	Item	Unit	Quantity			Remarks
			Construction	Maintenance	Total	
13	S-43	pcs	15	10	25	
14	S-84	〃	750	50	800	
15	S-120	〃	50	5	55	
16	Rail-Pole Band	〃	50	5	55	
17	F Band	〃	10	2	12	
18	N Stainless band	m	500	100	600	
19	N Stainless Band Fastener	pcs	350	50	400	
20	B Strut Mounting Hardware	〃	7	3	10	
21	Holding Stay Grip Hardware	〃	250	50	300	
22	SS Cable Separator	〃	4	1	5	
23	A Wiring Ring	〃	450	90	540	
24	B 〃	〃	150	30	180	
25	6mm Drive Hook	〃	400	80	480	
26	9mm 〃	〃	200	40	240	
27	C-Shaped Clamp	〃	50	20	70	
28	L-Shaped Clamp	〃	300	60	360	
29	C-Shaped Wire Detainer	〃	100	20	120	
30	Drop Wire Detainer	〃	200	440	600	
31	No.1 Thimble Grip for 30mm^2 Stranded Wire.	〃	420	80	500	
32	SScable Thimble Grip for 7/1.6 Supporting Wire.	〃	60	20	80	

Table IV. 2. 2.1 (5/8)

Material List for Outside Plant in Maymyo

Item No.	Item	Unit	Quantity			Remarks
			Construction	Maintenance	Total	
33	SS Cable Thimble Grip for 7/1.8 Supporting Wire	pcs	10	2	12	
34	SS Thimble Grip for 7/2.0 〃	〃	5	2	7	
35	No.1 Wooden Pole Grip for 30mm^2 Stranded Wire	〃	280	70	350	
36	for 35mm^2 〃	〃	70	30	100	
37	SS Cable Wooden Pole Grip for 7/1.6 Supporting Wire	〃	60	20	80	
38	for 7/1.8 〃	〃	10	2	12	
39	for 7/2.0 〃	〃	50	15	65	
40	A Type Earth Bar	〃	210	160	370	
41	B Type Earth Bar	〃	125	25	150	
42	Pole Step	〃	2,220	100	2,320	
43	Cable Cover	〃	100	20	120	
44	Other Necessary Accessories	set	1	—	1	

Ⅵ. Premises

Item No.	Item	Unit	Quantity			Remarks
			Construction	Maintenance	Total	
1	Modification of Telephone Set	set	150	200	350	
2	Indoor Type Public Coin Box Telephone Set	〃	4	1	5	
3	Outdoor Type Public Coin Box Telephone Set	〃	2	1	3	
4	PVC Wire Protector	pcs	450	50	500	Length is 1.0 m
5	Wire Protector	〃	200	100	300	Length is 1.0 m
6	No.4 Subscriber Telephone Protector	set	160	150	310	

Table IV. 2.2.1 (6/8)

Material List for Outside Plant in Maymyo

VII. Construction Vehicles

Item NO.	Item	Unit	Quantity			Remarks
			Construction	Maintenance	Total	
1.	Expansion Ladder Car	car	1	—	1	
2.	Cylindrical Hydraulic Auger Crane Car	"	1	—	1	

VIII. Test Instruments

Item NO.	Item	Unit	Quantity			Remarks
			Construction	Maintenance	Total	
1.	Circuit tester	set	2	—	2	
2.	Portable tester NO.3 Wheatstone bridge type	"	1	—	1	
3.	250V – 50M ohm transister megger	"	1	—	1	

IX. Tools

Item NO.	Item	Unit	Quantity			Remarks
			Construction	Maintenance	Total	
1.	Pickaxe	pcs	10	—	10	
2.	Shovel	"	10	—	10	
3.	Long Handle Shovel	"	5	—	5	
4.	Long Handle Spoon	"	5	—	5	
5.	Hand Tamper	"	2	—	2	
6.	Vinyl Sheet	"	5	—	5	
7.	Portable Engine Generator (800W)	set	3	—	3	
8.	Electric Soldering Iron (200W)	"	3	—	3	
9.	Electric Cable Drum	"	3	—	3	

Table IV. 2. 2. 1 (7/8)

Material List for Outside Plant in Maymyo

Item NO	I t e m	Unit	Quantity			Remarks
			Construction	Maintenance	Total	
10.	Lap cutter	pcs	5	—	5	
11.	Cable Sheath Cutter	"	5	—	5	
12.	Cable Jack	set	2	—	2	
13.	Tool Set for Aerial Cable Jointing	"	5	—	5	
14.	B type Tool Set for Premises Installation	"	4	—	4	
15.	NO.4 Head Phone	"	10	—	10	
16.	NO.2 Cable Checker	"	2	—	2	
17.	Loin Belt	pcs	10	—	10	
18.	Plier Holder	"	10	—	10	
19.	Nipper Holder	"	10	—	10	
20.	14-Inch Adjustable Spanner	"	5	—	5	
21.	8-Inch Plier	"	15	—	15	
22.	NO.4 Nipper	"	20	—	20	
23.	NO.5 Nipper	"	20	—	20	
24.	SD Plier	"	4	—	4	
25.	Screw driver	"	10	—	10	
26.	2m measuring tape (steel type)	"	10	—	10	
27.	50m measuring tape	"	3	—	3	
28.	100m measuring rope	"	2	—	2	
29.	Hight measuring rod	"	1	—	1	
30.	Working Platform	set	5	—	5	

Table IV. 2.2.1 (8/8)

Material List for Outside Plant in Maymyo

Item NO.	Item	Unit	Quantity			Remarks
			Construction	Maintenance	Total	
31.	Safty Belt	set	15	—	15	
32.	Earth Bar Driving Tool	〃	3	—	3	
33.	Anchor Driving Tool	〃	2	—	2	
34.	Lever Block (1.5t)	〃	6	—	6	
35.	Stay Rod Vice	〃	2	—	2	
36.	SS Cable Vice	〃	4	—	4	
37.	SD Wire Vice	〃	2	—	2	
30.	NO.2 Metal Pulley	〃	10	—	10	
39.	NO.4 Metal Pulley	〃	4	—	4	
40.	Curve Pulley-Arm	〃	4	—	4	
41.	Pulley Hanger	〃	10	—	10	
42.	Shackle	〃	10	—	10	
43.	NO.1 Cable Unstrander	〃	2	—	2	
44.	Anti Twisting Device	〃	2	—	2	
43.	Folding Ladder	〃	5	—	5	
46.	Protective Sheet for Pole Installation	〃	10	—	10	
47.	12mm Hemp Rope	m	500	—	500	

Table IV.2.3.1 Material List for Training (Outside plant)

Item	Unit	Quantity	Remarks
Cable and wire			
0.4-600 PEF-LAP armoured cable	m	100	
0.4-400 terminating cable	m	10	
0.4-50 CCP-AP-SS cable	m	100	
6SD wire	m	200	
Drop wire	m	200	
Indoor wire	m	200	
Jointing Materials and Buried Cable Jointing Part Protector			
0.4-600 PEF-LAP armoured cable terminating material	pcs	1	
0.4-600 armoured cable jointing material	pcs	60	
Buried cable jointing part protector	pcs	2	including water proof compound
0.4-50 CCP-SS-Cable jointing material	pcs	60	
200 straight type ready access terminal box	pcs	10	
200 single branch type ready access terminal box	pcs	5	
SD wire terminal box	pcs	10	
4 pair terminal block	pcs	20	
Stranded wire and Stay anchor			
30 special steel stranded wire	kg	30	
S type stay anchor	pcs	3	
Other necessary materials			
Other necessary materials including accessories for aerial facilities	set	1