c. Life hours - 1000 hours

d. Base Type - Bayonet

C. SPEAKERS

Speakers shall be specified by the following:

1) Nominal Rated Input - 10 watts

2) Voice Coil Impedance - 16 ohms $\pm$ 15% (at 1,000 Hz)

3) Frequency Response - 400 Hz to 4,000 Hz

4) Output Sound Pressure Responce - 115 dB or more (at 690 to 760 Hz)

D. MASTS

Masts shall consist of a pole and a base.

The pole shall be approximately 110 mm in diameter and predrilled to accommodate all components such as crossing signs, flashing lights, and speakers.

The post shall be of carbon steel pipe for ordinary piping, painted in red and white applied alternatively.

E. ACCESSORIES

The Contractor shall furnish mounting hardware for crossing signs, flashing lights, speakers, and bases with anchor bolts.

2.02 LEVEL CROSSING BARRIERS

Level crossing barriers shall be capable to separate physically motorists and pedestrians from level crossings. Two types of barriers shall be employed depending on the width of the road.

A bending type (Type A) as shown on Fig 313-2 shall be employed at level crossings with a width of more than 6 m while a straight bar type (Type B) as shown on Fig. 313-3 for the closing width of 6 m or less.

Level crossing barriers shall be of a weather-proof and of anti-vibration structures as follows:

A. TYPE A

General characteristics of Type A barrier shall be as follows:

1) Power Voltage : DC 22.5 to 28 volts

2) Descending Time : 10 + 2 seconds

3) Ascending Time : 18 seconds or less

Level crossing barriers shall consist of relays, driving motors, absorbers, circuit controllers, and barriers:

1) Relays

Relays shall be of a plug-in neutral line type with three normal contacts and three reverse contacts, operated at DC 24 V.

2) Driving Motors

Driving motors shall be of removable type and be of structure that will allow readily for regular inspection of commutators.

Ratings of driving motors shall be as follows:

a. Rated Voltage : DC 24 V

b. Starting Current : 8 A or less

c. Working Current : 7 A or less

d. Slipping Current : 10 A or less

3) Circuit Controllers

Circuit controllers shall be of a removable type and shall have two normal contacts and two reverse contacts or more.

These contacts shall be capable of switching continuously a non-inductive load of 24 V DC, 2 A. Contacts shall be constructed to be energized when the arm rod is kept at horizontal or vertical positions within the range of 5 degrees from its fixed position.

4) Barrier Arms

Barrier arms shall be of wooden material.

Mounting hardware of the arm shall be furnished to accommodate the arm of approximately 6 m to 12 m in length and a counter weight thereof.

The arm top shall be capable to hold horizontally at the position of approximately 6 m above the ground surface during the opening of barriers and at the position of approximately 0.8 m during the closure of barriers

Barrier arm indicators shall be furnished on the surface of arm; the red light nearest the tip of the arm is steadily illuminated and the remaining one or two red lights flash alternately.

B. TYPE B

General characteristics of Type B barrier shall be as follows:

1) Power Voltage : DC 22.5 to 28 volts

2) Descending Time : 8 ± 2 seconds

3) Ascending Time : 10 seconds or less

Level crossing barriers shall consist of relays, driving motors, shock absorbers, circuit controllers, and barriers.

1) Relays

Relays shall be of plug-in neutral line type with three normal contacts and three reverse contacts, operated by DC 24 V.

2) Driving Motors

Driving motors shall be of readily removable and provide easy access for maintenance.

Ratings of driving motors shall be as follows:

1) Voltage : DC 24 V

2) Starting Current : 5 A or less

3) Working Current : 4 A or less

4) Slipping Current : 5 A or less

3) Circuit Controllers

Circuit controllers shall have the performance equivalent to Type A barriers.

4) Barrier Arms

Barrier arms shall be of wood material.

Mounting hardware of arm shall be furnished to accommodate arm of 6 m or less in length and a counter weight, and capable to hold the arm approximately 800 mm above the ground surface during the closure of barriers.

Barrier arm indicator shall refer to Type A barriers.

2.03 X-MARK INDICATORS

X-mark indicators shall be designed to notify engine drivers of the correct operation of level crossing barriers by displaying a X-mark light when barrier arms are completely closed.

The configuration of the indicator shall refer to Fig. 313-4.

Indicators shall consist of the following:

A. INDICATORS

Indicators shall be placed in cold rolled steel housings of weather proof and anti vibration structure to withstand local climatic conditions.

The housing shall provide with the rear cover with a safety lock.

Lamps shall be of an incandescent or candescent type with long life hours.

B. MASTS

Masts shall include a pole, a pinnacle, and a base.

The pole shall be of carbon steel tube of approximately 110 mm in diameter and predrilled to accommodate indicators, signal cables or wires, and steps instead of a ladder.

Other material shall be of cold or hot steel.

All structures shall be painted with rust proof coating.

2.04 TRAIN DETECTORS

Train detectors shall be of a high frequency track circuit.

Train detectors shall be classified into a closed circuit type (Type A) and a open circuit type (Type B).

Train detectors shall consist of control units and apparatus cases:

A. CONTROL UNITS

Control units shall be of weather-proof and anti-vibration structure.

Both types shall consist of relays, oscillators, filters, transformers, and terminal strips.

General ratings shall be as follows:

1) Type A

Type A shall be such a system that the relay is normally energized and de-energized when train occupies the controlling section; and shall meet the following ratings:

1) Voltage : DC 24 V

2) Power Consumption : Less than 5 W

3) Frequency : 14 KHz or 20 KHz

2) Type B

Type B shall be such a system that the relay is normally de-energized and energized when a train occupies the controlling section; and shall meet the following ratings.

1) Voltage : DC 24 V

2) Power Consumption : Less than 5 W

3) Frequency : 30 KHz or 40 KHz

B. APPARATUS CASE

Both types of train detectors shall be furnished with exclusive apparatus cases.

The case shall be of weather-proof and anti-vibration structure, and provide a front or side door with a safety lock.

2.05 CONTROL DEVICES

Control devices shall be capable of controlling each level crossing protection facilities according to information signals to be transmitted from track circuits, train detectors, control panels or control consoles of relay interlocking devices.

Control system of each level crossing shall comply with the Drawing.

Control devices shall consist of relays, time relay units, alarm sound oscilators, and power supplies:

A. RELAYS

Relays shall be of a plug-in type to be mounted on relay jack boards and DC 24 V shall be adopted as power source. The relays shall meet the following ratings:

1) Line Relays

Line relays shall be classified into the following:

a. For Light Loads

Relays for light loads shall be capable to control general purpose under the following ratings:

- Current : 93 mA
- Resistance : 260 ohms
- Contact : 6 (Normal/Reverse)
- Operating Time : 30 to 90 m sec.
- Releasing Time : 3 to 10 m sec.

b. For Heavy Load

Relays for heavy loads shall be capable to control level crossing barriers and flashing lights under the following ratings:

- Current : 93 mA
- Resistance : 260 ohms
- Contact : 6 (Normal), 3(Reverse)
- Operating Time : 60 to 110 ms
- Releasing Time : 3 to 10 ms

2) Slow Release Relay

Slow release relays shall be capable to control the starting time of level crossing barriers under the following ratings:

- Current : 93 mA
- Resistance : 2,700 ohms
- Contact : 2 (Normal), 2(Reverse)
- Operating Time : 150 ms
- Releasing Time : 6, 8 or 10 seconds (Adjustable)

3) Time Element Relays

Time element relays shall be capable to prevent a logical sequence from disturbance by a malfunction of track relays due to track conditions.

Ratings of time element relays shall be as follows:

- Current : 120 mA
- Resistance : 200 ohms
- Contact : 4 (Normal), 2(Reverse)
- Operating Time : 2.4 to 3.09 seconds

4) Flasher Relays

Flasher relays shall be of a silicon controlled rectifier type and close their contacts intermittently at the rate of 40 to 60 times per minute under the following ratings:

Maximum Load Current : 3 A
Contact : 1 (Normal), 2(Reverse)

B. TIME RELAY UNITS

Time relay units shall be capabl to prevent a logical sequence from disturbance by malfunction due to the time difference of relay contacts moving.

Time relay units shall be of a capacitor-resistor component.

C. ALARM SOUND OSCILLATORS

Alarm sound oscillators shall be of all electronic type and off-the-shelf type.

The following or equivalent ratings shall be complied:

Oscillation Frequency : (f_1) 750 Hz $\pm$ 15 Hz

: (f_2) 700 Hz $\pm$ 15 Hz

Modulation Frequency : 130 Hz $\pm$5 Hz

Output Sound : 80 to 115 phon (variable)

2.06 POWER SUPPLIES

Power supplies shall be furnished to maintain safe and reliable operation of level crossing protection facilities in any power failure.

Power supplies shall include a rectifier, storage batteries, and appropriate arresters:

A. RECTIFIERS

Rectifiers shall be of a silicon constant voltage type suitable for a stable DC power supply.

Ratings of rectifiers shall be equivalent to or greater than the following:

1) Input

Voltage	:	220 V
Frequency	:	50 Hz
Phase	:	Single

2) Output

Current	:	10 A
Voltage Range	:	25.8 to 28 V (Adjustable)
Accuracy of Voltage	:	± 5%

C. STORAGE BATTERIES

Storage batteries shall be of an alkaline type with a sufficient capacity to operate level crossing protection facilities at least 12 hours or 60 times of train operation in the event of AC power failure.

D. ARRESTERS

Arresters shall be capable to prevent level protection crossing facilities from extraordinary voltages such as lightning surge induced through AC power source lines and external power source lines.

Arresters shall be of a no-fuse type with a large discharge capacity.

2.07 APPARATUS CASES

Apparatus cases shall be of weather proof type to be designed without ventilation apertures and be reasonably air tight so as to prevent intrusion of dust, vermin and insects, subject to the temperature limitations of the equipment to be installed therein.

Cases shall be provided with a steel receptacle board to be equipped with relay jack-boards on its top, an inspection lamp with a bracket and foundation bolts.

Relay boards shall be pre-wired at the factory of the Manufacture in accordance with the circuit diagrams approved by the Engineer.

2.08 CONTROL PANELS

Control panels shall be capable to provide manual operation of level crossing facilities and be typically equipped with the following functional component:

1) Electric Levers: For selection of operation mode and for manual operation to start alarming

2) Push Button: For manual operation to lower level crossing barriers

c. Indication Lamp: For discerning the direction of approaching trains

Additional component may be required, if necessary.

2.09 GROUND CONNECTION FITTINGS

Ground connection fittings shall consist of grounding electrodes, grounding conductors, and markers.

Grounding electrodes shall be of a driven rod type protected against corrosion by a thick exterior of copper.

Grounding conductors shall be of thermoplastic-covered wire, 10 mm^2 in section area.

Markers shall be a concrete stake with stripped and painted marks to identify the ground connection.

PART 3: EXECUTION

3.01 GENERAL

The Contractor shall install the level crossing protection facilities in accordance with the Drawing.

The installation work on level crossing facilities shall include level crossing signals, level crossing barriers, train detectors, control devices, apparatus cases, and ground connection fittings.

3.02 LEVEL CROSSING SIGNALS

Level crossing signals shall be equipped with crossing signs, flashing lights, a speaker, and a mast.

The mast shall be erected plumb firmly on a concrete foundation to withstand local climatic conditions.

Level crossing signals shall be installed at the left side of roads facing the level crossing and its signal indications shall be visible from the distance of more than 45 m in daylight.

3.03 LEVEL CROSSING BARRIERS

Level crossing barriers shall be installed to place barrier arms more than 3 m away from the center of rails and parallel thereto.

The height of arms in the down position shall be approximately 0.8 $\pm$ 0.1 m above from the surface of pavements.

Barrier arm indicators shall be fixed on each arm with the approval of the Engineer; a steadily illuminated red light nearest the tip of the arm and one or two flashing red lights nearest the center of the arm.

3.04 TRAIN DETECTORS

The installation work of train detectors shall cover the control units, housings, masts, foundations, and ground connecting fittings.

Locations of all train detectors shall be proposed by the Contractor after due consideration of train operations, and no installation work thereon shall be commenced without the approval of the Engineer.

Type A train detectors shall be installed at alarm starting points and Type B at alarm ending points.

Control units shall be placed in the apparatus case mounted on the mast.

Masts shall be erected plumb firmly with logs or bases on concrete foundations.

The connecting cable for Type A shall be less than 20 m long and positively fixed to the rails. Should no cables be installed within the above limit, cables may be laid up to 30 m long.

The connecting cable for Type B shall be limited to a length from 3 m to 15 m long.

3.05 CONTROL DEVICES

The installation work of control devices shall include relays, time relay units, alarm sound oscillators, and power supplies.

All devices shall be installed in the exclusive apparatus case: all relays shall be attached to the jackboard fixed on the top of the case; the alarm oscillator, rectifier and arrestor on the mid-shelf; and storage batteries on the bottom.

3.06 APPARATUS CASES

The approval of the Engineer shall be required prior to the construction work of foundations.

No apparatus case shall be installed to obstruct the view of approaching trains from motorists or pedestrians; and the view of passers-by from engine drivers.

Foundations shall be constructed so that there is adequate height above surrounding ground level.

3.07 GROUND CONNECTION FITTINGS

Grounding resistances shall be less than 30 ohms. Should no resistance be kept less than the above value, it may be eased up to 50 ohms.

Grounding rods shall be installed 0.75 mm below the surface of ground and at least 1 m away from other underground cables, except in special cases that should no site conditions permit, then the clearance may be reduced to 0.5 m.

No grounding rods shall be used in common with power or communication grounding rods and the distance from rods thereof shall be more than 5 m.

END OF SECTION

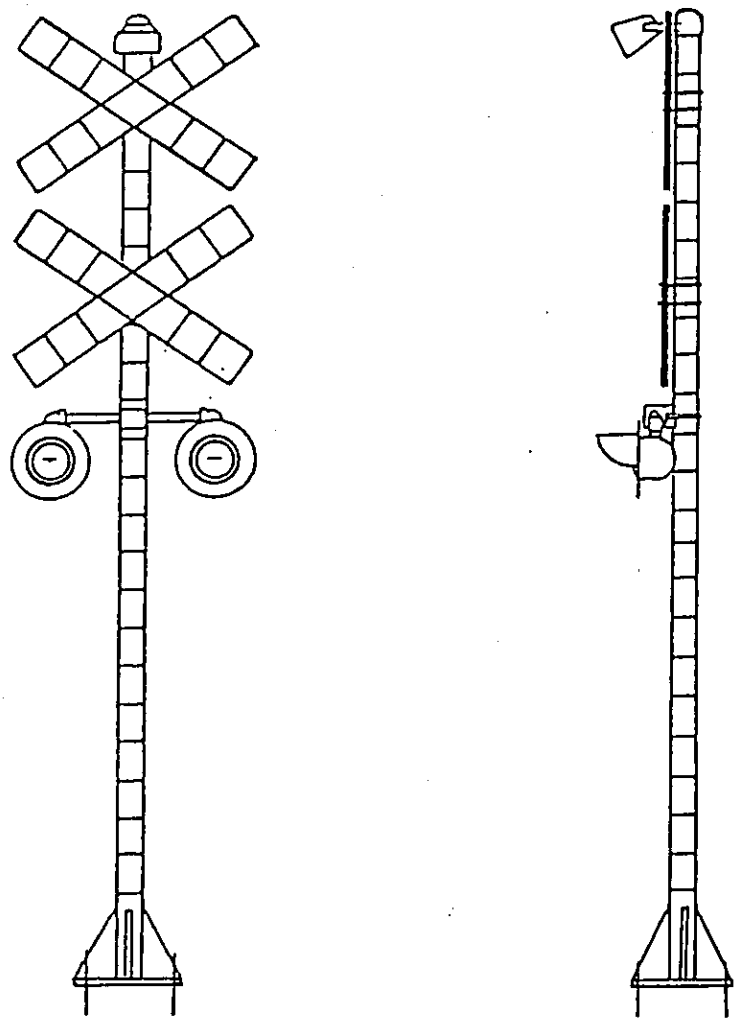

Fig.313-1 LEVEL CROSSING SIGNAL

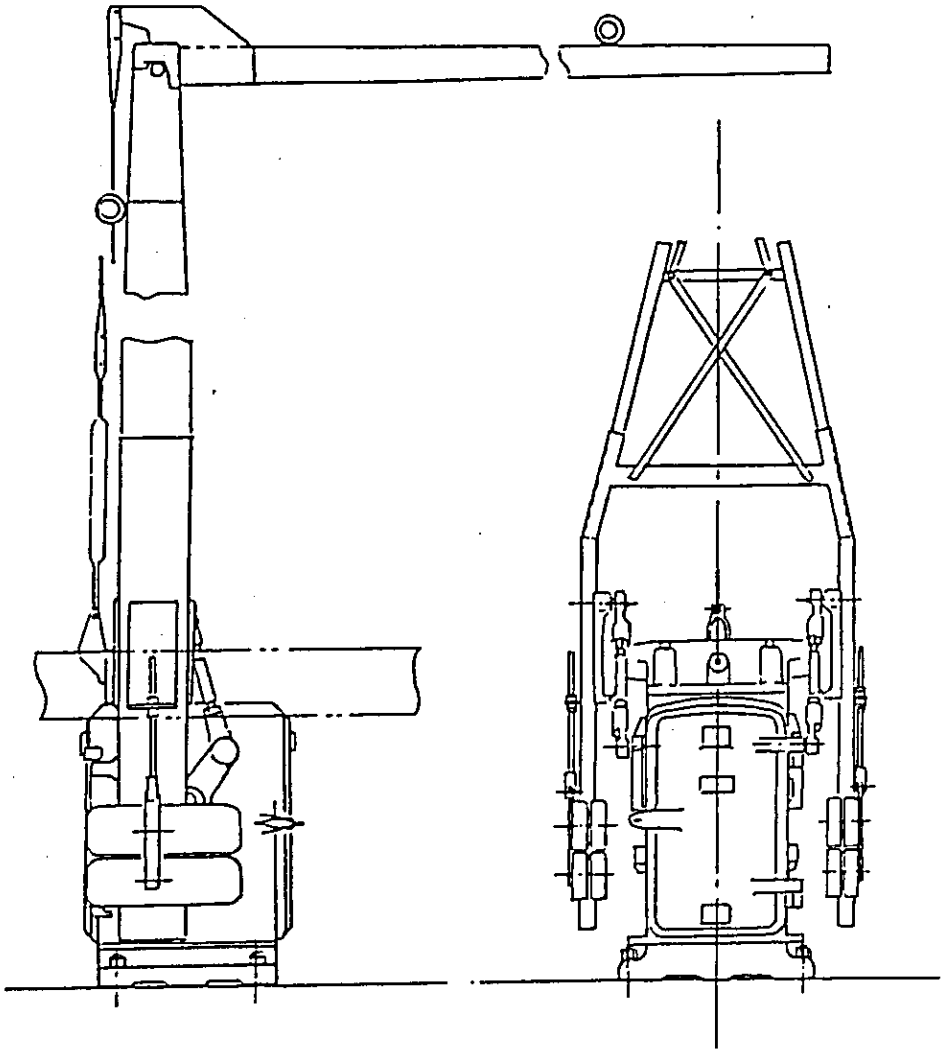

Fig.313-2 LEVEL CROSSING BARRIER
(A TYPE)

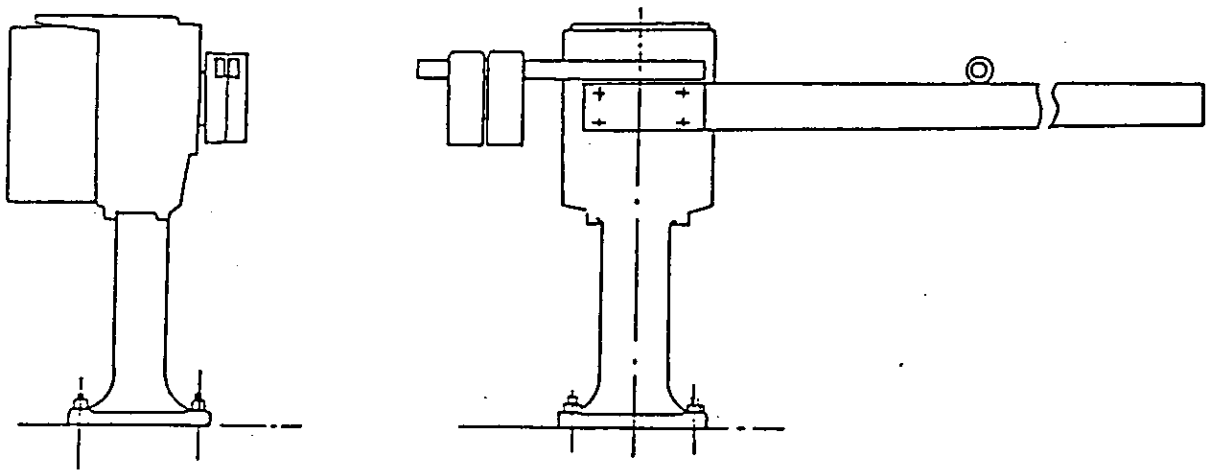

Fig.313-3 LEVEL CROSSING BARRIER
(B TYPE)

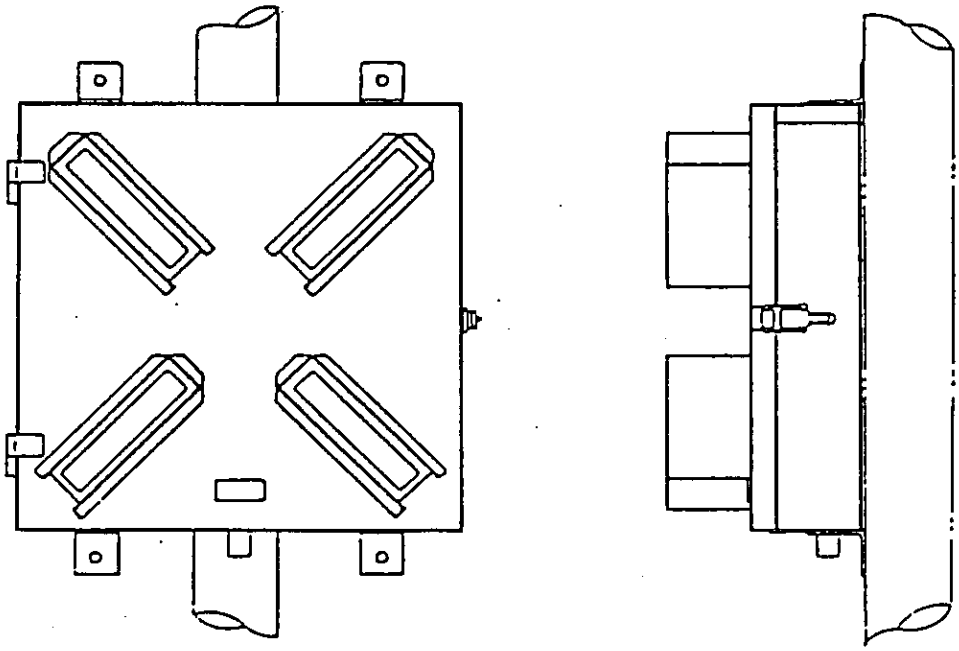

Fig.313-4 X-MARK INDICATOR

314 - AUTOMATIC TRAIN STOP SYSTEM

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314 - AUTOMATIC TRAIN STOP SYSTEM

PART 1: GENERAL

1.01 DESCRIPTION

This section covers the furnishing and installing wayside system of Automatic Train Stop System (ATS) equipped with home signals and starting signals at JIAC Station, Kota Intan Station, Jayakarta signal Station and other signal stations.

ATS shall be capable to work in conjunction with equipment equipped on electric car (hereinafter referred to on-board equipment) so that its operation shall automatically result in the application of the air brakes at designated restrictions, when engine drivers do not respond to "Cab Alarming" until the train is brought to a halt.

ATS shall consist of wayside coils and control relays.

1.02 TECHNICAL REQUIREMENTS

A. OPERATION CONCEPT

ATS operation concepts shall comply with the following:

1) To provide a function to restrict the engine driver to re-operate the train without a hault during alarming,

2) To provide a function to check the actual running speed of train,

3) To equip a recorder for data received on board and related driver's action,

4) To install as a few wayside equipment as possible.

B. CONTROL PRINCIPLE

ATS shall be of a multiplex frequency shift system which consists of a wayside device of an intermittent control system and an on-board equipment of a continuous speed check system.

The following actuation shall be required:

1) Wayside device generates a speed data according to a signal aspect,

2) The speed data transmitted from the wayside coil is memorized on a cab,

3) The speed data from the wayside equipment is checked with the actual running speed.

4) In case the actual running speed exceeds the collation speed, the ordinary or emergency brake works to a hault.

PART 2: PRODUCTS

Characteristics and ratings shall conform to this specification.

Wayside devices shall consist of wayside coils and control relays:

2.01 WAYSIDE COILS

Wayside coils shall consist of resonance circuits, with coils and condensers, molded with polyester resin and lead wires in good quality.

The base of resonance frequency shall be 140 KHz and the figure of value Q is 130 or more.

2.02 CONTROL RELAYS

Control relays shall be constructed with relays, condensers and housings thereof.

Relays shall be capable of shifting not less than 6 kinds of resonance frequencies of wayside coil so that relay contacts will change the capacities of condensers in resonance circuits under the conditions of signal indications.

Characteristics of relays shall be equivalent to the following:

1)	Voltage	:	DC 24 V
2)	Coil Resistance	:	450 ohms at 20 degrees C
3)	Contact	:	2 (Normal)
4)	Current	:	50 mA
5)	Time Element	:	0.2 to 0.6 sec, (Descending)

PART 3: EXECUTION

The Contractor shall install wayside devices after the approval of the Engineer.

The installation work of wayside devices shall include wayside coils and control relays:

3.01 WAYSIDE COILS

Location of all wayside coils shall be proposed by the Contractor and a schedule showing the positions of coils shall be provided.

Coils shall be installed at locations apart more than 2 m from rail joints.

No coils shall be installed on level crossings, trough girders, and turnouts.

No lead wires shall be jointed and any lead wire shall run in concrete troughs.

3.02 CONTROL RELAYS

Control relays shall be installed in the housing mounted to poles or concrete foundations.

Control relays may be installed on the walls where required by the Engineer.

END OF SECTION

315 - STAND-BY GENERATOR

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315 - STAND-BY GENERATOR

PART 1: GENERAL

1.01 DESCRIPTION

This section covers the furnishing and installing stand-by generators equipped at JIAC Sta. and Jayakarta Singal Sta.

The stand-by generator shall consist of an engine generator, a rectifier, a DC-AC inverter, a control panel and batteries.

Main power of 380/220 volt three phase 4 wire 50 Hz AC. power supplies for signaling systems will be provided upto line transformers by the Electric Section nearby the equipment room constructed by the Civil Section.

The configuration of power supply diagram shall be refered to Fig. 315-1.

1.02 TECHNICAL REQUIREMENTS

Stand-by generators shall be installed in equipment rooms so as to provide an electric power in case of main power failures.

Stand-by generators shall be designed to provide signaling systems with a stand-by power automatically within 40 seconds immediately after any main power failure.

During a changeover from main power to stand-by power, signaling systems except electric switch machines shall be energized with batteries.

Manual switching between the main power supply and stand-by power supply shall be provided to be controlled from the operation panel of the control console in the signal cabin.

Fuel tanks shall be dimensioned enough to ensure a minimum of 12 hours continuous running at 80% load.

PART 2: PRODUCTS

2.01 Characteristics and ratings of stand-by generators shall conform to this specification.

Stand-by generators shall consist of an engine generator, a DC-AC inverter, a rectifier and batteries:

A. ENGINE GENERATOR

The engine generator shall be dimensioned so that the normal load from the signaling equipment shall be approximately 80% of its nominal out put rating. This full load must be taken over by the engine generator not later than 10 sec. after its start.

The engine generator shall be composed of an alternator a diesel-engine generator, and control cubicle.

1) Alternator

Rating of the alternator shall be as follows:

a. Output Voltage : 220/380 V, Three Phase 4 wires

b. Rated Output : 10 KVA

c. Frequency : 50 Hz

d. Revolutions : 1500 r.p.m.

e. Power Factor : 80%

f. Exciting system : Self-excited type

2) Diesel-engine Generator

Rating of the diesel-engine generator shall be as follows:

a. Revolutions : 1500 r.p.m.

b. No. of Cylinder : Two or more

c. Starting System : Electrical

d. Lubricating System : Forced Feed Lubrication

e. Cooling System : Water-cooled Type

Fuel tanks shall be furnished by the Contractor and the capacity shall be adequate to ensure a minimum of 12 hours continuous running.

A visible indicator of fuel level shall be equipped at appropriate position.

3) Control Cubicle

Control cubicles shall be designed to disconnect automatically main power supplies and transmit an alarm be sounded in the signal cabin in case that voltage or frequency fluctuates to values beyond design tolerances.

A manually operated switch shall also be provided.

The switch shall be provided with both mechanical and electrical interlocking for the changeover operation.

The Contractor shall furnish batteries to start the engine generator.

B. DC-AC INVERTER

The DC-AC inverter shall be operable at 110 volts dc. to provide a 220 volts, single phase 50 Hz ac. for signaling systems at high efficiency.

C. RECTIFIER

The rectifier shall be of a silicon and self-cooling indoor shelf type with the following ratings:

1) Input

a.	Phase	:	Three
b.	Frequency	:	50 Hz
c.	Voltage	:	380 V
d.	Voltage Regulation	:	± 5% max.
e.	Power Factor	:	80% min.

2) Output

a.	Voltage	:	110 V
b.	Current	:	40 A
c.	Voltage Accuracy	:	+3/-0%
d.	Power Factor	:	80%min.

D. BATTERIES

Batteries shall be of an alkaline and pocket type to have sufficient capacity to provide DC power source continuously during 5 minutes in the event of main power failure.

Rating of batteries shall be as follows;

1)	Electrolytic cell	:	Synthetic resins
2)	Electrolyte	:	Caustic Potash
3)	Separator	:	Alkali, Corrosion-proof synthetic resin

E. GROUND CONNECTIONS FITTINGS

Ground connection fittings shall consist of grounding electrodes, grounding conductors, and markers which are equivalent to materials specified in the Sections 306 or 313.

PART 3: EXECUTION

3.01 GENERAL

Stand-by generators shall be installed on concrete foundations in equipment room.

The work shall consist of installing engine generator, DC-AC inverter, rectifiers, batteries, and other necessary subsidiary works as follows:

A. ENGINE GENERATOR

The foundation shall be constructed to ensure safely operation of engine generators. The dimension thereof must be approximately 1 m wide, 2 m long, and 0.5 m high.

Adequate ventilator for exhaust gas shall be installed in the cubicle.

The fuel tanks shall be installed such that refueling can be readily made without entering the equipment room. The filler caps thereof shall be equipped with padlocks.

B. PIPING

Fuel tubes and replenishing tubes to fuel tanks should be attached with polyvinyl chloride pipes steel reinforced.

Exhaust pipes shall be installed with steel conduits and an additional silencer should be attached.

C. WIRING

Connecting wires shall be installed in a wireway as follows:

1) Generator Out Put circuits : 38 mm^2

2) Excitation Circuit : 10 mm^2

3) Ignition Switch : 38 mm^2

4) DC Power Source : 10 mm^2

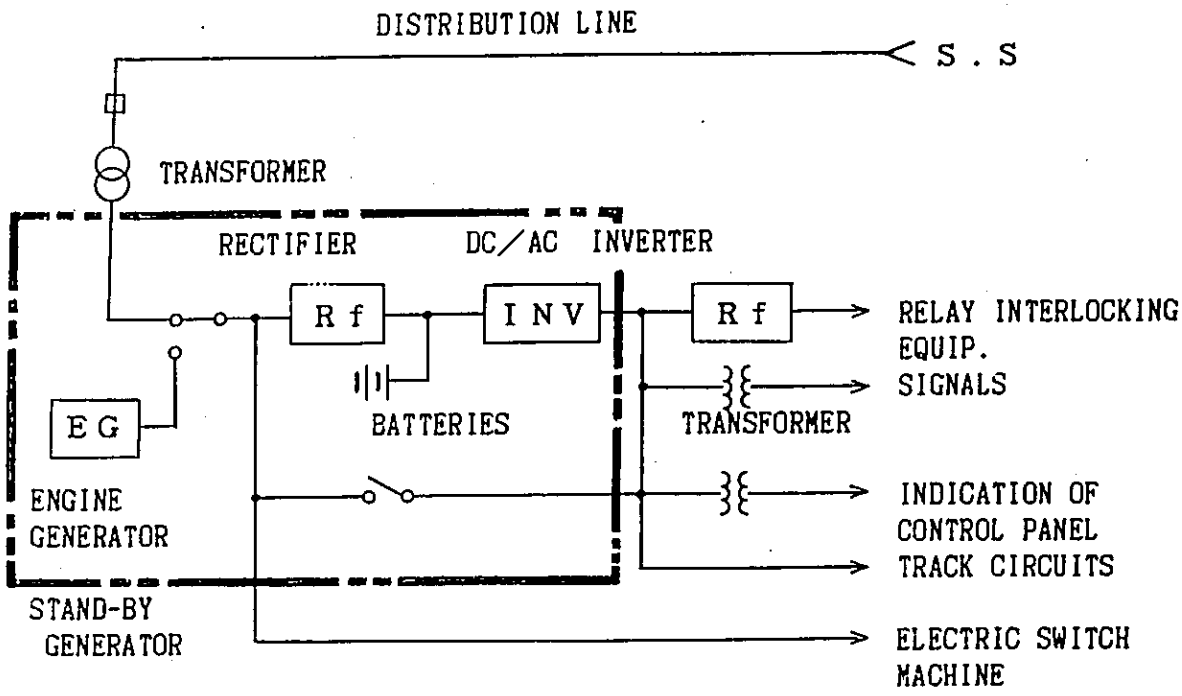
5) Control Circuit : 2 mm^2

D. GROUNDING

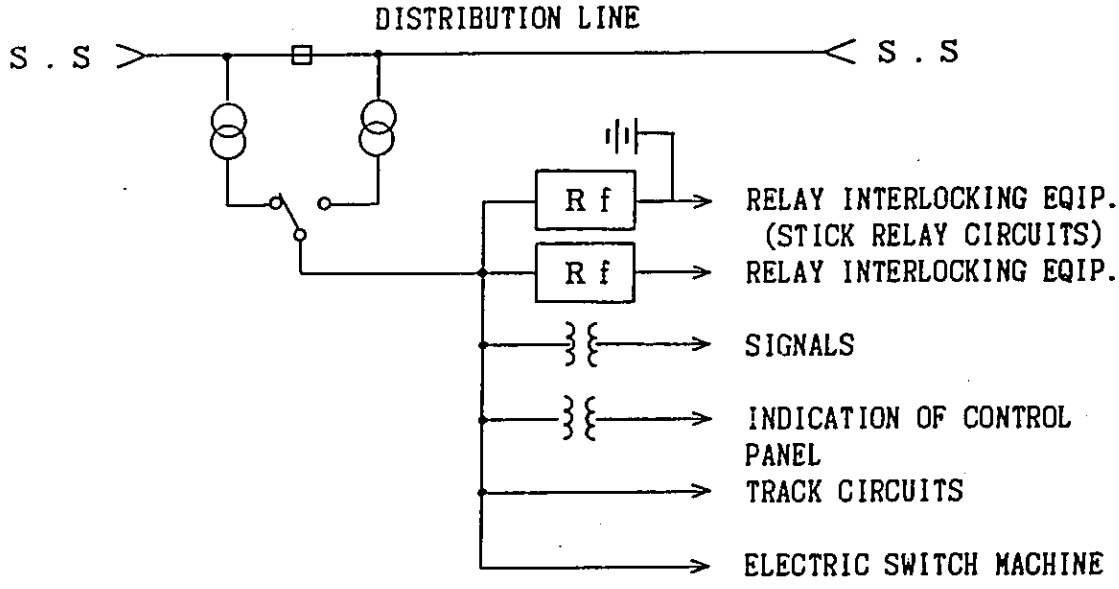
Ground connection fittings shall be installed with the engine generators and the control cubicle.

Installation work thereof shall be referred to the Section 306 or 313.

END OF SECTION



J I A C s t n , J A Y A K A R T A S . s t n



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316 - APPARATUS CASE

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316 - APPARATUS CASE

PART 1: GENERAL

1.01 DESCRIPTION

This section covers the furnishing and installing apparatus cases equipped at JIAC Sta., Kota Intan Sta., and Jayakarta Signal Sta.,

Apparatus cases shall include cases, joint boxes, foundations, and mounting hardwares:

1.02 TECHNICAL REQUIREMENTS

Apparatus cases shall be designed without ventilation apertures and be reasonably air tight so as to prevent ingress of dust, vermin, and insects, subject to the temperature limitations of the equipment to be installed therein.

Apparatus cases shall be mounted on a concrete foundation of sufficient proportions to ensure stability. Foundations shall be constructed so that there is appropriate height above surrounding ground level to prevent loose ballast, stones, and dirt.

Joint boxes shall be mounted on exclusive concrete, steel poles or on masts of other signalling system.

PART 2: PRODUCTS

Characteristics and ratings of apparatus cases shall conform to this specification.

Apparatus cases shall consist of cases, backboards, and shelves; and joint boxes:

2.01 CASES

Apparatus cases shall be of galvanized sheet steel with corrosion resistant fittings and anti-vibration structures.

Cases shall be designed to accommodate necessary on-the-shelf equipment.

Front and rear doors shall be provided and have heavy duty handles, sturdy hinges and retaining rods capable of the door opening at 90 degrees position; and screened air vent if necessary.

Both doors shall accommodate padlocks or integral locks with standard keying.

Cases shall be designed to mount with foundation bolts at four corners.

Cases shall be provided with a convenience outlet.

The Contractor shall furnish an inspection lamp with a bracket and a cord and foundation bolts.

2.02 SHELVES

Shelves shall be of either wooden or steel material. An adequate number of shelves shall be provided to mount equipment therein.

Shelving brackets may be welded to both sides of the case for easy shelf placement.

2.03 JOINT BOXES

Joint boxes shall be of polyester or steel structure to be mounted on concrete or on walls.

The boxes shall be equipped with the terminal strips to have the capacity for 40 to 120 cores.

The contractor shall furnish all terminal boxes with necessary stakes with mounting hardware.

PART 3: EXECUTION

3.01 GENERAL

The Contractor shall install apparatus cases and joint boxes after the approval of the Engineer.

The installation work of apparatus cases and joint boxes shall include cases, foundations, and stakes:

3.02 CASES AND JOINT BOXES

Location of all apparatus cases and joint boxes shall be proposed by the Contractor and a schedule showing the positions of cases shall be provided.

Apparatus cases shall be mounted horizontally on a base to ensure stability. Care shall be taken to the moving direction of doors; swing in an arc clear of the structure gauge.

The bases of apparatus cases shall be attached to form a close fit with the top of the foundation.

All joint boxes shall be firmly mounted on the poles furnished, on walls or adequate masts of other signaling facilities, with mounting hardware.

All cases and joint boxes shall be identified by painted characters showing the symbol and major mounting equipment therein.

3.03 FOUNDATIONS

The Contractor shall provide concrete pads for installation of equipment and apparatus.

Concrete pads shall be minimum 300 mm high, unless otherwise indicated, complete with necessary bolts, anchors, etc.

The Contractor shall exercize th care for selection of the appropriate location of concrete pads such that foundations will not be submerged during the period of rainy season.

END OF SECTION

317 - SIGNAL CABLE

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317 - SIGNAL CABLE

PART 1: GENERAL

1.01 DESCRIPTION

This section covers the furnishing and installing signal cables, wires and subsidiary materials such as cable troughs and bricks.

Signal cables shall be used for controlling all signaling facilities such as color light signals, shunting signals, electric switch machines, track circuits, and level crossing facilities.

Trunk cables used for block circuits between stations, distant signals, and level crossing facilities shall be laid in the underground.

Signal cables laid within station yards shall be installed in cable troughs.

1.02 TECHNICAL REQUIREMENTS

A. SIGNAL CABLES

Due consideration shall be taken as follows:

1) Voltage Fluctuation

Due care shall be taken for the fluctuation of ambient temperature or other conditions which affect electronic equipment.

Signal cable shall have appropriate impedance which keep terminal voltages of each equipment within the following range even if power source voltages or loads fluctuate:

a. For Alternating Current

Any terminal voltage shall be kept within 0.8 to 1.2 times the value of the rated voltage.

b. For Direct Current

Any terminal voltage shall be kept within 0.9 to 1.2 times the value of the rated voltage.

2) Mutual Interference

Due account shall be taken concerning arrangement and combination between cables or conductors so that no malfunctions shall be caused by the disturbance voltages caused through mutual inductances among power

feeding, receiving or lead-in cables for electronic equipment such as train detectors of level crossing facilities.

3) Spare Conductors

Spare conductors of trunk cables shall be provided with 10% spare conductors included, over and above provision for already anticipated extensions to the installation in future.

B. WIRES

Wiring shall comply with the plans approved by the Engineer and must be uniform for like apparatus throughout the entire system.

C. WIRE AND CABLE ENTRY

Wire and cable entrances to apparatus cases, housing, signals and other equipment shall be through busings, guards or specially formed entrances and shall be sealed so as to prevent ingress of dust, vermin and insects, subject to the temperature limitations of the equipment to be installed therein.

D. TERMINATIONS

Wires shall be continuous without splices between terminations. There shall be not more than two wires terminated on any one terminal.

E. LABELING

All wires and terminal designations shall be labeled with non-metallic markings.

All labeling shall be in English and warning and danger signs shall be both in English and Indonesian.

F. CABLE TROUGH

Wherever the digging of cable trenches is unavailable or uneconomic, cable troughs shall be employed.

Cable troughs shall be constructed with the common iron wires. The binding iron wires, however, may be annealed.

PART 2: PRODUCTS

Characteristics and ratings of signal cables shall meet this specification.

Signal cables shall consist of cables, wires, splicing and wiring materials, and cable troughs.

2.01 SIGNAL CABLES

Signal cables shall be classified into ground and underground cables.

These signal cables shall consist of multiple-conductor cables assembling individual insulated conductors into a tight cylindrical form under the following constitution and characteristics:

Signal cables shall be constructed to comply with a recognized National and International standards such as JIS, or this specification:

A. GROUND CABLES

Ground cables shall be designed to be suitable for laying in concrete troughs, conduits, or indoor.

Characteristics thereof shall be equivalent to the following:

1) Constitution

a. Conductor : Annealed copper wire

b. Insulation : Polyvinyl chloride

c. Inclusion : Jute or appropriate material

d. Wrapping Tape : Cloth or plastic tape

e. Internal Sheath : Polyvinyl chloride

f. External Sheath : Polyvinyl chloride

2) Characteristics

Ground cables shall be classified into two types and ratings shall be equivalent to the following:

a. Cables for Power Use

	30 mm^2	10 mm^2
- Number of Cores	2	2 or 4
- Strand/Element (Wire/mm)	19/1.4	19/0.8
- External Diameter (mm)	20.4	13.6 or 16.4
- Insulation Thickness (mm)	1.6	1.4

- Overall External Dia.(mm)	24.9	17.5 or 20.3
- Conductor Resistance at 20 deg. C (ohm/km)	0.63 or less	1.97 or less
- Dielectric Strength (volt/1 min.)	4,000	4,000
- Insulated Resistance at 20 deg. C (M-ohm.km)	60	80
at 60 deg. C (M-ohm.km)	0.2	0.3
- Approx. Weight (kg/km)	985	415 or 682
- Standard Cable Length (m)	500	500

b. Cables for General Purpose

Cables for general purpose shall be of a cross sectional area of 1.25 mm^2 and the core numbers from 2 cores to 80 cores:

	20--40 cores	80 cores
- Cross Sectional Area (mm^2)	1.25	1.25
- Strand/Element (Wire/mm)	7/0.45	7/0.45
- External Diameter (mm)	5.9 to 21.6	30.7
- Insulation Thickness (mm)	0.8	0.8
- Overall External Dia.(mm)	10 to 27	37
- Conductor Resistance at 20 deg. C (ohm/km)	17.1 or less	17.1 or less
- Dielectric Strength (volt/1 min.)	3,000	3,000
- Insulated Resistance at 20 deg. C (M-ohm.km)	100	100
at 60 deg. C (M-ohm.km)	0.4	0.4
- Approximate weight (kg/km)	110 to 1,050	2,05 0

- Standard Cable Length (m)	500	300

B. UNDERGROUND CABLES

Underground cables shall be suitable for laying in trenches, and for crossing tracks and level crossings.

Characteristics shall be equivalent to the following:

1) Constitution

Constitutions of underground cables shall be equivalent to the aforementioned ground cables, additionally have an armoured sheath of corrugated steel pipe.

2) Characteristics

Underground cable shall be classified into two types and ratings shall be equivalent to the following:

a. Cables for Power Use

Cables for power sources shall be of a cross sectional area of 30 mm^2 and/or 10 mm^2 and the core numbers of 2 or 4 as follows:

	30 mm^2	10 mm^2
- Number of cores	2	2 or 4
- Strand/Element (Wire/mm)	19/1.4	19/0.8
- External Diameter (mm)	20.4	13.6 or 16.4
- Overall External (mm)	35	27 to 30
- Conductor Resistance at 20 deg. C (ohm/km)	0.63 or less	1.97 or less
- Dielectric Strength	4,000	4,000
- Insulated Resistance at 20 deg. C (M-ohm.km)	60	80
at 60 deg. C (M-ohm.km)	0.2	0.3
- Approximately weight	1,550	800 or 1,550

- Standard Cable Length (m)	500	500

b. Cables for General Purpose

Cables for general purpose shall be of a cross sectional area of 1.25 mm^2 and the core numbers from 2 cores to 80 cores:

	2 to 20 cores	40 or less
- Cross Sectional Area (mm^2)	1.25	1.25
- Strand/Element (Wire/mm)	7/0.45	7/0.45
- External Diameter (mm)	5.9 to 15.3	21.6 or 30.7
- Insulation Thickness (mm)	0.8	0.8
- Overall External Dia. (mm)	17 to 29	38 or 48
- Conductor Resistance at 20 deg.C (ohm/km)	17.1 or less	17.1 or less
- Dielectric Strength (volt/1 min.)	3,000	3,000
- Insulated Resistance at 20 deg. C (M-ohm.km)	100	100
at 60 deg. C (M-ohm.km)	0.4	0.4
- Approximate Weight (kg/km)	320 to 948	1,630 or 2,940
- Standard Cable Length (m)	500	300

2.02 WIRES

Wires carrying "vital" signaling circuits in equipment rooms and apparatus cases shall be of thermoplastic-covered wires such as flexible stranded wires and insulated vinyl wires under the following characteristics:

The following wires are recommendable:

Kinds	Conductors	Finishing		
Nominal Cross Section (mm^2)	Strand & Element Dia. (wire/mm)	Outer Diameter (mm)	Resistance (ohm/km)	Allowable Currents (A)
0.5	20/0.18	2.2	38.6	10
0.75	30/0.18	2.8	25.8	12
1.25	50/0.18	3.1	15.5	19
2.0	37/0.26	3.4	9.51	27
10	19/0.8	6.8	1.91	66

2.03 SPLICING MATERIALS

Splicing materials shall be of encapsulating closures for signal cable connection.

Closure shall be used as a right body direct buried splice closure. Sleeves and end caps thereof shall be of tough, transparent material which withstands acids, detergents, chemicals and other harmful elements and be sturdy enough not to crack during backfilling.

The Contractor shall furnish the entire sets of splicing materials including splicing tools and accessories; injection guns, crimping tools, encapsulating compounds, grounding braid, insulation sleeves, spacers, splicing tapes, connectors, and other necessary tools and accessories.

2.04 CABLE TROUGHS

Cable troughs shall be of the concrete trough specified in the GENERAL REQUIREMENTS OF ELECTRICAL WORK.

2.05 CONDUITS

Conduits shall be of a polyvinyl chloride tube or equivalent, enough to protect cables or wires which led in cable troughs, cable racks, and equipments.

Carbon steel tubes shall be for cable laying to cross track or level crossings.

PART 3: EXECUTION

3.01 GENERAL

The Contractor shall install signal cables in accordance with the Drawings.

The installation work of signal cables shall consist of cable laying, wiring, splicing, stripping and terminating, troughing, piping, marking:

3.02 CABLE LAYING

A. INSTALLATION

Trunk cables between stations shall be laid along the lower edges of sideslopes, with their top not less than 75 cm below top of ground surface, into trenches on top of a layer stone-free soil or sand, except in elevated track section where cable ducts may be constructed by the Civil Section.

Cables within station yards shall be laid into cable troughs.

Riser or lead-in cables on structures shall be partially protected by polyethylene or steel conduit. Conduits and exposed portions of cables shall be clamped with stainless steel bands or adequate staples.

Care shall be taken to ensure that no kinking, twisting, or tangling of cables takes place.

Due account shall be taken to lay cables through handholes, manholes, and other apertures in order to ensure that no damage occurs to the insulation, particularly rubbing on other cables, or structures.

Underground cable routes shall be clearly identified by cables markers. Cable markers shall be placed at intervals of 50 m on straight routes and at changes of the route.

B. SPLICING

Any joint shall be installed with splicing tools and method approved by the Engineer.

At any location provided solely for cable jointing no isolating links shall be provided.

Not more than one joint shall be installed in any one length of cable.

Any joint installed shall be marked externally in a permanent manner with the designation and type of the cable. Joints in cable troughs shall be identified with a painted marker on the lid thereof.

Buried joints shall be clearly identified by cable joint markers.

C. STRIPPING AND TERMINATING

Caution shall be taken to ensure that stripping tools are correctly set for the thickness of sheath or insulation.

Care shall be taken to strip the sheath or the insulation from a multi-core cable or wires to avoid damaging the insulation and the conductor of individual wires.

Any conductor shall be identified with direct labeling, tags or bands fastened to the conductors in such a manner that they will not move along the conductors.

Where flexible stranded conductors are to be terminated in grub screwed type terminals, the conductors shall be fitted with a crimp type pin fitting.

D. TROUGHING

Cable troughs shall be installed so that the upper surface of the lids thereof is on a level with the ground when covered.

Where the drainage on roadbeds is obstructed due to the installation of cable troughs, adequate countermeasures therefore shall be taken.

Where cable troughs are installed at the places fulfilled with ballast, they shall be placed to keep the upper surface thereof on a level with the ballast or lower so that no replacement of ties will be obstructed.

Trench beds shall be sufficiently tamped and shaped to fit the bottom of cable troughs, and shall uniformly support throughout the entire length of troughs.

Care shall be taken to install cable troughs on shoulders of roadbeds so that no shoulders will be deformed.

E. PIPING

Wherever trunk cable routes cross, tracks, or roads, special measures with carbon steel tubes shall be provided to protect cables.

Pipes shall be crossed at right angles at such crossings and be laid with their top not less than 1 m below the bottom of sleepers or below the top of pavement surface.

F. HANDHOLES

Where cables run across tracks and level crossings, handholes shall be installed after the approval of the Engineer.

Installation work and construction materials shall be complied with the requirements prescribed in the Section on Telecommunication Work.

G. MARKING

Cable markers for underground cable shall be installed at intervals of 50 m on straight routes and at changes of the route.

Cable joint markers for under ground cable shall be planted where cables are spliced.

Cable joint markers for cables in troughs shall be marked with painted characters showing the destination and type thereof.

END OF SECTION

318 - CHANGEOVER WORK

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318 - CHANGEOVER WORK

PART 1: GENERAL

1.01 DESCRIPTION

This section covers the changeover work consisting of modifying, fabricating and replacing or removing existing signaling systems equipped at Jayakarta Kota Station and nearby Jayakarta Signal Station to be newly constructed on the Central Line.

1.02 TECHNICAL REQUIREMENTS

The changeover work shall be undertaken with a minimum investment with respect to a positive reuse of existing equipment and materials.

No existing train operations shall be interrupted during any construction work.

The Contractor shall prepare necessary printed data such as construction time, outline of the work, restricted operation time of signaling systems concerned, preparation for the work, assignment of workers, communication methods during the work, and other specially noted matters. The Contractor shall be responsible for supervision of the work throughout the periods of the work.

PART 2: PRODUCTS

Characteristics and ratings of these equipment and materials to be used for the changeover work such as signal wires with supporting structures and level crossing protection facilities shall conform to that of existing facilities.

PART 3: EXECUTION

The changeover work shall be classified into level crossing protection facilities.

The following works shall be conducted after the approval of the Engineer:

3.01 LEVEL CROSSING FACILITIES

Existing level crossing protection facilities at Jayakarta shall be modified as follows:

A. Level crossing signals and barriers shall be relocated to adequate locations due to the track addition of Cengkareng Line.

B. Alarm control circuits shall be modified to control the train operations complexed with existing trains on the Central Line and on Cengkareng Line.

Existing AF track circuit for controlling the northern-bound trains to Jayakarta Kota Sta. shall be removed, and train detectors to operate the control device in accordance with the movements of trains on Cengkareng Line.

C. The control logic shall be modified to meet the new alarm control requirements, which need the rearrangement of connecting wires and new control relays.

END OF SECTION

319 - TELEPHONE SYSTEM

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319 - TELEPHONE SYSTEM

PART 1: GENERAL

1.01 DESCRIPTION

This section covers the requirements for the telephone system required for train operation, maintenance, and administration of the new Railway Line.

This work shall consist of furnishing and installing telephone system, access wiring and cabling, piping, and of related works required to complete the telephone system plus spare parts.

Location, line, grades, size/type, etc. of work shall be based on the drawings and these specifications.

The work under this section shall include related testing required to complete the telephone system.

1.02 SYSTEM DESCRIPTION

The telephone system consists of the following equipment:

1) Automatic Telephones
2) Train Operation and Electric Power Dispatching Telephones
3) Direct Line Telephones
4) Portable Telephones

1.03 REFERENCES

Related work in other sections:

Section 301	GENERAL REQUIREMENTS
Section 323	TELECOMMUNICATION CABLE SYSTEM

PART 2: PRODUCT

Characteristics and ratings of equipment shall not be less than, or exceed as the case may be, those requirements indicated on the drawings or in the specifications.

2.01 AUTOMATIC TELEPHONES

A. NEW SUBSCRIBERS:

Automatic telephone system shall be provided for new subscribers as follows:

Station	Number of New Subscribers	Exchange to be Connected
Airport Station	7	Jakarta Kota UH-200
A Signal Station	1	Jakarta Kota UH-200
B Signal Station	1	Jakarta Kota UH-200
Kota-Intan Station	4	Jakarta Kota UH-200

B. AUTOMATIC TELEPHONE SET

Automatic telephone sets shall be provided for new subscribers. The automatic telephone sets shall have the function and characteristics matching the existing Philips UH-200 exchange equipment.

The subscriber line relay units required within the UH-200 exchange equipment in order to accommodate the Automatic Telephone Set has been already prepared.

Standard transmission loss between exchange and subscriber telephone set shall not be more than 13 dB.

C. PERFORMANCE

1) Dialing speed : 10 ±1 impulse/second

2) Dial impulse make ratio : 33 ±3%

3) Sensitivity of receiving unit : 71 dB ±5 dB at 1 kHz

4) Sensitivity of transmitting unit:-52 dB +6 dB at 1 kHz

2.02 TRAIN OPERATION AND ELECTRIC POWER DISPATCHING TELEPHONES

The train operation dispatching system shall be provided for dispatching order and means of communication between station to station and Manggarai Operation Centre.

The electric power dispatching telephone system shall be provided for dispatching orders and communication between the substations and the Manggarai Operation Centre.

A. SYSTEM COMPOSITION

The system shall be composed of a master unit and slave units. The master unit shall be capable of making general call and selective calls to the slave units.

The slave units shall be able to call the master unit and other slave units within the system.

Transmission line between Jakarta Kota and Manggarai Operation Centre shall use Optical Fiber PCM Cable Carrier System provided by other project.

B. CIRCUIT COMPOSITION

1) The circuit attenuation, including the branch attenuation, at 1,000 Hz will be 20 dB or less for individual selective calls and 40 dB or less for general calls.

   a. Individual Selective Calls:

      (Circuit Attenuation) + (Branch Attenuation per Telephone x n) : max. 20 dB.

   b. General Calls:

      (Circuit Attenuation) + (Attenuation per Telephone when Receiver is Picked UP x n) : max. 40 dB.
      where: "n" is the number of telephones connected on the same circuit.

2) Care shall be taken to provide impedance matching whenever branch circuits are made to the master unit.

3) The maximum number of telephone sets that can be connected on one circuit shall be 20.

C. PERFORMANCE

1) Selective Calling Method: Frequency selective calling

2) Master Unit:

   a. Selective Key/Button shall have the following functions:

      . General call
      . Individual selective calling (for 20 selective calls)

   b. A lamp shall be provided to indicate calls from slave units. Calls from slave units shall also be indicated by bell or buzzer.

   c. The telephones shall be the desk type consisting of the telephone set and the monitoring device.

   d. Working voltage: Local battery, DC 6V

3) Slave Units:

a. Calls shall be indicated by bell or buzzer.

b. The units shall be of the desk type; and at Substations, the units shall be housed in exterior boxes.

c. Power source: Local battery, DC 6V.

2.03 DIRECT LINE TELEPHONE

Direct Line Telephones shall be installed at stations on the New Railway Line for the Message Block as Follows:

Airport Station	-	A Signal Station
A Signal Station	-	B Signal Station
B Signal Station	-	Kota-Intan Station
Kota-Intan Station	-	Jayakarta Signal Sta.
Jayakarta Signal Station	-	Gambir Station

A tape recorder shall be provided with each direct line telephone; and shall be connected with the telephone circuit to record communications when the telephone is only used for substitute blocking (telephone blocking) between neighbouring stations.

A. SYSTEM REQUIREMENT

1) The telephone sets used in this system shall be the Magneto Telephones.

2) Circuit Composition: The circuit attenuation shall be 20 dB or less at 1,000 Hz.

3) The circuits for this telephone system for the six stations shall be provided with Telecommunication Cable System.

B. PERFORMANCE

1) Direct Line Telephone

a) The desk type Magneto telephone shall be capable of being used in the message blocks.

b) Power source: Local battery, DC 3V.

2) Tape Recorder

a)	Track form	:	Monaural
b)	Tape type	:	Cassette
c)	Tape speed	:	4.75 cm/sec
d)	Frequency range	:	100 to 8000 Hz
e)	Power source	:	AC 220 V, 50 Hz; or DC 9 V (1.5 V dry battery x 6)

2.04 PORTABLE TELEPHONES

Terminal boxes shall be provided at intervals of 500 meters installation of the telecommunication cables for the New Railway Line. By connecting the portable telephones to the terminal boxes, Connections will be made to the Message Block and it will be possible to communicate with the adjacent stations.

The telephone sets used for the portable telephone system shall be of the magneto telephone with a carrying case.

Circuit composition: The circuit attenuation shall be 20 dB or less at 1,000 Hz.

Total number of telephone sets to be provided : 20 sets.

A. PERFORMANCE:

1) Portable magneto telephone shall be provided with a leather (or equivalent) carrying case.

2) Connections to the terminal boxes shall be simple.

3) Power source: Local battery, DC 3 V or DC 6 V.

2.05 SPARE PARTS

A. Number of Spare telephone sets shall be required for each system as follows:

1) Automatic telephone sets: 3 sets.

2) Slave units for Selective Calling Telephone System: 2 sets

3) Desk Type Magneto Telephone Sets: 2 sets.

B. Master unit for Selective Calling Telephone System:

1) Lamps: 3 each of working lamps.

2) Fuses: 3 each of working fuses.

C. One unit of rosette each shall be provided per telephone set, except for the portable telephones.

PART 3. EXECUTION

The final location of the subscriber telephone instruments will be instructed by the Engineer.

Interior telephones shall be connected to the terminals (rosettes) provided at least 30 cm above the finish floor level on the wall with screws where it will be away from sprinkled water and dust.

Exterior type telephones shall be housed in boxes where it will be sheltered from the elements, and extreme care shall be exercised to keep it well insulated.

Interior wiring shall be made with vinyl insulated wires protected by wire protectors or conduits.

Local batteries shall be housed in protection boxes, and vinyl insulated wires shall be used between telephone sets and terminal plates.

After installation, tests shall be performed to ensure that the telephones are in good working order.

END OF SECTION

320 - PUBLIC ADDRESS SYSTEM

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320 - PUBLIC ADDRESS SYSTEM

PART 1: GENERAL

1.01 GENERAL DESCRIPTION

This section covers the Public Address System installed at the stations, and provides for information announcement for passengers through microphones, background music cast, and approach/departure announcement.

This work shall consist of furnishing and installing the Public Address system and access wiring/cabling and related work required to complete the public address system as shown on the drawings and in accordance with these specifications.

The work under this section shall include related testing required to complete the public address system.

1.02 SYSTEM DESCRIPTION

Public Address Systems installed at airport terminal station and Kota-Intan station shall provide:

1) Announcement by the platform microphones
2) Announcement from the office room microphone,
3) Automatic (departure/approach) announcement, and
4) Background music casting

The Public Address system shall consist of master public address equipment, operating panels, microphone boxes, and speakers.

Castings shall cover three areas: east-bound platform, west-bound platform, and concourse. Each operating panel shall be capable to select either general announcement or individual selective announcement over the above areas. Microphone boxes shall be capable to select any platform to be announced.

In case of amplifier failure, alternative amplifier shall take over the failed one by operation of a selector switch.

1.03 REFERENCES

Related work in other sections:

Section 301	GENERAL REQUIREMENTS FOR ELECTRICAL WORK
Section 323	TELECOMMUNICATION CABLE SYSTEM

PART 2. PRODUCT

Characteristic and rating of equipment shall not be less than or exceed as the case may be, those requirement indicated on the drawings or in the specification.

2.01 MASTER PUBLIC ADDRESS EQUIPMENT

This equipment shall be capable of providing information announcements for passengers through microphone boxes and/or an operation panel and automatic announcements of train arrival and departure which are actuated by starting signals.

A. TYPE AND RATING

Type	:	Desk top type
Power source	:	AC 220 V, 50 Hz
Rated output	:	30 W x 3
Number of output circuit	:	3

B. COMPOSITION

The equipment shall consist of a sound source unit (files of announcement), a sound source control unit, a monitor unit, a power amplifier unit, an output control unit, an input control unit, a standby switching unit, and a terminal connection board. The block diagram of the system shall refer to Fig. 320-1.

C. FUNCTION

1) Sound Source Unit (files of announcement)

- shall provide outputs of announcement signals and various sound sources (like departure bell) actuated by start signals.

2) Sound Source Control Unit

- shall transmit start signals to the sound source unit which are timed by settings of timers after external signals (approach/departure) have been received.

3) Monitor Unit

- shall monitor outputs of power amplifiers, and conditions of control power by an selector switch.

4) Power Amplifier Unit

- shall receive voice signals and various sound source signals at 0 dB reference, and transmit amplified outputs to speaker lines with 100 V or 70 V.

5) Output Control Unit

- shall connect amplifier output to desired broadcasting area by selector switch or external start signals.

6) Input Control Unit

- shall amplify microphone signals up to 0 dB level, compare its priority with other signals, and transmit the signals to power amplifiers through mixing circuits.

7) Standby Switching Unit

- shall switch input and output circuits from current amplifier to standby amplifier if the current one failed.

8) Terminal Connection Board

- shall connect lines, control lines, output lines, and voice input/output lines.

D. PERFORMANCE

1) Sound Source Unit

Number of Announcement System	:	2
Number of Starting Signal Circuit	:	4
Announcement Time	:	10 sec/one announcement max.
Memory Capacity of Basic Sentence	:	33 sec max.

2) Sound Source Control Unit

Number of Signal Input Circuits	:	4 (No-voltage contact)
Timer Setting Range	:	1 - 100 sec. ±10%

Number of Information Output Circuits

Sound Source Start Signal	:	4
Amplifier Start Signal	:	2

3) Monitor Unit

Monitor Output	:	1 W
Meter	:	Capable of checking output power power source

4) Power Amplifier Unit

Input Level	:	0 dB
Input Impedance	:	50 kilo-ohms
Rated Output	:	30 W
Load Impedance	:	100 V line; 330 ohms, 70 V line; 170 ohms
Frequency Response	:	±3 dB at 100 - 10,000 Hz (1000 Hz reference)
Distortion	:	Less than 5% under the rated output (at 1000 Hz)
S/N Ratio	:	Not less than 70 dB
Power Source	:	AC 220 V 50 Hz or DC 24 V
Chime	:	4 tone electric sound

5) Output Control Unit

Number of Output Circuits	:	3 circuits
Control Circuits	:	4 types
Indication	:	3 ON AIR indications

6) Input Control Unit

Microphone Input Level	:	-54 dB 600 ohms balanced, 3 systems
Sound Source Input Level	:	-9 dB 600 ohms balanced, 2 systems
Line Input Level	:	-10 dB 50 kilo-ohms unbalanced, 1 system
Microphone Amplifier Output	:	0 dB 600 ohms unbalanced

Priority:
1. Microphone box
2. Operating panel
3. Automatic announcement
4. Background music

7) Standby Switching Unit

Switching control : 1 circuit and reset
Standby amplifier input/output line: 1 circuit

8) Overall

a. Temperature rise:

After continuous operation for 8 hours at

. Transformer cores	:	Lower than 55 degrees C
. Power transistors	:	Lower than 55 degrees C
. Others	:	Lower than 50 degrees C

b. Insulation resistance:

More than 10 Mega ohms between the rock and the AC input terminals with DC 500 V resistance tester.

c. Voltage Withstand:

No defects shall be shown after applying AC 1000 V 50Hz for one minute between the rock and AC input terminals.

E. SPARE PARTS

Cord		:	2.5 meters
Fuses	1A / 5A	:	10
Fuses	2A	:	5
Fuses	3A	:	4
Fuses	5A	:	1
Relay (output control unit)		:	1

2.02 OPERATING PANELS, MICROPHONE BOXES, AND SPEAKERS

Operating Panels, Microphone Boxes, and Speakers shall be used in combination with Master Public Address Equipment.

A. PERFORMANCE:

1) Operating Panel

. Type	:	Desk top
. Number of control circuit	:	3 circuits
. Input circuit level	:	Mic ... -10 dBm Aux. ... -30 dBm
. Output impedance	:	600 ohms
. Power source	:	DC 24 V

2) Microphone Box

. Type	:	Wall mounting
. Circuit number	:	2 circuits
. Microphone	:	Dynamic microphone Directivity ...Unity Output impedance... 600 ohm ± 30%

3) Trumpet Speaker

. Power input rated	:	10 watts
. Impedance	:	1 k, 1.5 k, 2 k, 2.5 kilo-ohms
. Frequency range	:	350 - 5000 Hz, -20 dB

4) Dynamic Speaker

. Form	:	Core type
. Input power	:	3 watts
. Impedance	:	3.3 k, 5 k, 10 k, ohms
. Frequency range	:	100 - 8000 Hz, -20 dB

PART 3: EXECUTION

The Contractors shall be responsible for the determination of the location and quantity of speakers under the circumstance of each station.

On wirings between main equipment, operation panels, microphone boxes, and speakers, the contractor shall select the most appropriate wiring routes and wiring methods as matched with the buildings.

Power source of the master public address equipment shall be supplied in AC 220 V from the nearest panelboard.

END OF SECTION

321 - ELECTRIC CLOCK SYSTEM

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321 - ELECTRIC CLOCK SYSTEM

PART 1: GENERAL

1.01 DESCRIPTION

This section covers the electric clock system installed at every station to secure accuracy of operation time and passenger service.

This work shall consist of furnishing and installing a master clock, slave clock and access wiring/cabling and related work required to complete the electric clock system as shown on the drawing and in accordance with these specifications.

The work under this section shall include related testing required to complete the electric clock system.

1.02 SYSTEM DESCRIPTION

The electric clock system shall consist of a master clock and slave clocks. The master clock shall be installed at Airport Terminal Station and slave clocks at each station.

The master clock shall use a crystal resonator, shall demultiply the output from a highly stable and accurate crystal oscillator, and shall transmit 30 seconds clock pulses to drive slave clocks.

1.03 REFERENCES

Related work in other Sections:

Section 301	GENERAL REQUIREMENTS FOR ELECTRICAL WORK
Section 323	TELECOMMUNICATION CABLE SYSTEM

PART 2: PRODUCTS

Characteristics and ratings of equipment shall not be less than, or exceed as the case may be, the requirements indicated on the drawing or in the specification.

2.01 MASTER CLOCK

Master clock shall be used in combination with slave clocks.

A. RATINGS

Power Source :	AC 220 V, 1 A
Output Signal:	DC 24 V, 30 seconds polarized signal for 5 circuits

		Height	Width	Depth
Dimension : Approx.		2000 mm	600 mm	400 mm

B. COMPOSITION

The clock shall consist of a master clock, a slave clock operation unit, switching unit, a slave clock adjusting unit, a monitor clock unit, a battery charger, and a battery unit.

C. FUNCTION

The master clock shall demultiply the signal from a highly stable and accurate crystal oscillator and transmit 30 second clock pulses to drive slave clocks.

The master clock shall be capable of simultaneous adjustment of clocks over all systems or by system separately from the monitor clock. Also, the battery charger and the battery shall be used at floated charging manner to provide continuous operation even at power failure.

D. PERFORMANCE

Basic Frequency	:	4915.2 kHz
Accuracy	:	+0.7 sec/week
Output Signal	:	DC 24 V, 30 seconds polarized pulse
Number of Slave Clock Driven	:	30 set/1 circuit
Indication Second	:	with second hand
Correction of Second	:	Forward, back and stop by push button
Power Source	:	AC 220 V 50 Hz lo
Stand-by Power	:	DC 24 V batteries 36 AH

E. SPARE PARTS

Alarm Fuse	:	100%
Relay Unit	:	One for each type

2.02 RELAY SLAVE CLOCK

For long distance transmission, the relay slave clock shall receive control signals from the master clock and shall relay controls to slave clocks.

A. COMPOSITION

The clock shall consist of a relay unit, a line control unit, a line monitor unit, and a pilot unit.

B. FUNCTION

The clock shall receive the polarized reversing signals from the master clock and transmits signals at 30 seconds interval at every 0 and 30 second of a minute through a relay circuit.

C. PERFORMANCE

Received Relay Signal Level	:	15 to 24 V
Output Power	:	DC 24 V
Power Source	:	AC 220 V
Input Impedance	:	Not less than 1 kilo-ohm.

2.03 SLAVE CLOCK

Slave clocks shall be used in combination with the master clock or the relay slave clock.

A. TYPE AND RATING

Form: (1) Wall mounted, single face type : o300 mm

(2) Ceiling hung, double face type : o600 mm

Minimum Working Voltage	:	DC 10 V
DC Resistance	:	2000 ohms for 300 mm type
	:	1500 ohms for 600 mm type
Operating Voltage	:	DC 24 V polarized pulse 30 seconds interval

PART 3: EXECUTION

The master clock shall be fixed firmly after leveling.

The master clock shall be installed in the signal/telecom. equipment room of signal cabin, and power shall be received from a panelboard in the signal/telecom. room.

The Contractor shall be responsible for determination of the number and location of slave clocks as approved by the Engineer.

Conduits or protective material with wires for slave clocks shall be installed under concealed or exposed method of suite a building/structure.

END OF SECTION

322 - CABLE CARRIER SYSTEM

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322 - CABLE CARRIER SYSTEM

PART 1: GENERAL

1.01 DESCRIPTION

This section covers the cable carrier system which utilizes a non-loaded communication cable as transmission line including a 30-CH carrier circuit with the Time Division Multiplex Pulse Code Modulation (PCM) system.

This work shall consist of furnishing and installing PCM cable carrier system, access wiring/cabling and related work required to complete the PCM cable carrier system as shown on the drawings and in accordance with these specification.

The work under this section shall include related testing required to complete the cable carrier system.

1.02 SYSTEM DESCRIPTION

The cable carrier equipment shall be installed in order to relieve transmission loss on the communication circuits between Air Port Terminal Station and Jakarta-Kota station.

The system shall consist of PCM Multiplex Terminal Equipment and PCM Line Repeater Equipment.

PCM Multiplex Terminal Equipment shall be installed at Airport Terminal Station and Jakarta-Kota station, and a communication cable shall be used for transmission line and repeaters shall be installed to relieve the transmission loss.

One system (30 channels) of PCM Cable Carrier system shall be installed and shall be provided for automatic telephone subscriber circuits, substation control circuits and Telex circuits.

At present, 8 automatic telephone subscriber circuits and 7 spare circuits, 15 circuits in total, are planned.

The loading of the actual channel shall be subject to review and approval by the PJKA.

1.03 REFERENCES

Related work in other Sections.

Section 301 GENERAL REQUIREMENTS

PART 2: PRODUCTS

Characteristics and ratings of equipment shall not be less than, or exceed as the case may be, the requirements indicated on the drawing or in the specification.

2.01 PCM MULTIPLEX TERMINAL EQUIPMENT

PCM multiplex terminal equipment multiplexes 30 channel voice signals and related exchange signals by the PCM method, converting them to one 2048 kb/s digital signal, and is also capable of performing this process in reverse.

A. PERFORMANCE

1)	Modulation method	:	Pulse code modulation
2)	Number of channels	:	30
3)	Sampling rate	:	8 k bit/s
4)	Gross binary bit rate	:	2,048 k bit/s ± 50 ppm
5)	Encording	:	8 bits 256 quantizing steps
6)	Compounding	:	A = 87.6 with 13 segments
7)	Interface of voice frequency		
	a) Termination	:	2 wire/4 wire
	b) Input/output levels	:	CCITT Rec. G232, L
	c) Impedance	:	600 ohms, balanced
8)	Interface at high frequency		
	a) Impedance	:	120 ohms balanced
	b) Code format	:	HDB-3
	c) Pulse amplitude	:	2.37 Vo-p ±10%
9)	Signalling interface	:	DC-loop, ringer fox automatic telephone
10)	Performance characteristics at voice frequencies	:	CCITT Rec. G.712

2.02 LINE TERMINAL EQUIPMENT

The Line Terminal Equipment transmit signals from PCM Multiplex Equipment to transmission lines, and also performs a number of other functions such as power feeding to line repeaters, fault location, communication by orderwire for maintenance, and testing between line repeater station and between any line repeater station and the terminal office.

A. PERFORMANCE

1)	Bit rate	:	2048 kb/s
2)	Line interface		
	a) Impedance	:	Nominal 120 ohms, balanced
	b) Line code format	:	HDB-3
	c) Output pulse	:	3Vo-p ±10%
3)	Power requirement voltage	:	-36 V to -72 VDC
4)	Power feeding current	:	48 mA DC
5)	Order wire	:	2-wire voice order-wire with 16 Hz ringing signal for calling

2.03 LINE REPEATER EQUIPMENT

The line repeater equipment shall be housed in a watertight container shaped for installation in a manhole or wall mounted type. The repeater housing and stub cable shall be waterproof and a gas test fitting shall be provided.

A. PERFORMAQNCE

1)	Automatic equalization	:	8 dB to 42 dB/1024 kHz
2)	Supervisory filters	:	24 frequencies or 18 frequencies
3)	Power consumption	:	48 mA
4)	Housing		
	a) Mounting	:	Pole, buried or manhole
	b) Capacity	:	6 or 12 systems

PART 3: EXECUTION

The Terminal Equipment shall be installed at level by using wooden cradles and alike and be fixed firmly using anchor bolts.

The contractor shall install repeaters of indoor and outdoor type in an appropriate method as required respectively. When installing outdoor type repeaters, as a rule, they shall be installed in a manhole at banked railway sections and in a duct as elevated railway sections, and they shall be protected in a manner as appropriate at the sites.

The necessary wiring within the PCM cable carrier equipment shall be provided.

Termination of the cable shall be processed securely by using soldering, wrapping tool or alike, as approved.

END OF SECTION

323 - TELECOMMUNICATION CABLE SYSTEM

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323 - TELECOMMUNICATION CABLE SYSTEM

PART 1: GENERAL

1.01 DESCRIPTION

This section covers the Telecommunication Cable System which forms a communication line required for train operations, maintenance, and administration of the New Railway Line for Cengkareng Airport.

This work shall consist of furnishing, installing, splicing and terminating of telecommunication cable among each station premises and between Airport and Jayakarta station, and it shall also include installation work of terminal boxes and other related work.

The number of cable pairs shall be calculated according to the kind of circuits contained, number of circuits, number of pairs for each circuit, and spare pairs. Accordingly, the number of pairs shall be determined according to the circuits actually required

1.02 REFERENCES

Related work in other Sections:

Section 301	GENERAL REQUIREMENTS
Section 320	PUBLIC ADDRESS SYSTEM
Section 321	ELECTRIC CLOCK SYSTEM
Section 322	CABLE CARRIER SYSTEM

1.03 SYSTEM DESCRIPTION

The Telecommunication Cable System shall consist of a main cable which contain communication circuits for the New Railway Line, branch cables for connection of wayside portable telephones, local cables, and other related installations.

A. LOCATION AND CABLE ROUTE

The main cable shall be installed along the railway from Airport Terminal station to Jayakarta through Jayakarta-Kota. The type and installing route of the call shall be as shown on the drawings. For wayside terminal boxes installed at 500 m interval along the railway shall be connected with the main cables with branch cables.

B. COMMUNICATION CIRCUITS IN THE CABLE SYSTEM

The cable system shall contain the following communication circuits.

1) Automatic telephone line
2) direct telephone line
3) Train dispatching telephone line
4) Electric power dispatching line
5) Substation control line
6) Electric clock line
7) PCM cable carrier system line
8) Signal block line

C. BASIC CONCEPT OF TELECOMMUNICATION CABLE SYSTEM

1) Telecommunication Cable:

The specification for the telecommunication cable are specified in Subsection 2.01 TELECOMMUNICATION CABLE herein. When cable of different type are proposed for use, they shall have similar characteristic or exceed the requirement, and shall be approved by the PJKA.

2) Cable Installation Method:

The main cable shall be of direct burial corrugated type and shall be buried directly at shoulder of the railway in banked section and installed in a cable duct in elevated section. At the site where burying is difficult, the cable shall be installed in a concrete trough.

3) Wayside Telephone Terminal Boxes (T.B.)

Terminal boxes shall be provided at 500 meter spacing between stations along railway line from Airport Station to Jayakarta, and shall provide for the safety of train operation, maintenance of railway system, and the means of communication at emergency. 10P cable shall be branched off from the main cable.

4) Distribution Boxes:

a. Distribution boxes shall be installed at each station, signal cabin, and terminal board shall be also installed at the Jakarta-Kota station.

b. Protective devices consisting of a fuse and arrester shall be provided for the circuits connected to communication equipment within Distribution Boxes.

Circuits not connected to any equipment shall be through-connected using jumpers.

5) Interface with Substation Equipment

a. 10P cable shall be branched off from connecting point of main cable at the adjacent substation.

b. A Distribution Box shall be provided at each substation and protective devices shall be provided for the remote control circuits, and this is the interface point between power and communication facilities.

PART 2: PRODUCT

Characteristics of cables and terminal box shall not be less than or exceed as the case may be, those requirement indicated on the drawing or in the specification.

2.01 TELECOMMUNICATION CABLE

This specification covers the construction, electrical characteristics and packing of color coded polyethylene insulated, polyethylene sheathed or corrugated sheathed telephone cable with 0.9 mm conductors. The telecom cable shall be, to the maximum extent, procured from a local manufacturer. Products manufactured out-of-country shall be subject to approval by the Engineer.

A. SYMBOLS

S 9002 - B

Sheath : B = Polyethylene sheath,
BD = Polyethylen sheath with self-supporting type
C = Corrugated sheath

Number of Pairs : 002 = 2P, 006 = 6P, 010 = 10P,
020 = 20P, 030 = 30P, 040 = 40P

Nominal Diameter of Conductor : 9 = 0.9 mm

Composition of Conductor : U = Unit type,
S = Small pair type

B. TYPE AND STRUCTURE

Type and structure of the telecom cable shall be as shown on Table 323-1

C. CONSTRUCTION

1) Conductor

Each conductor shall be annealed copper conforming to the requirement of ASTM-83. The diameter shall be 0.9 mm $\pm$0.02 mm.

2) Conductor Insulation

Each conductor shall be insulated with colored polyethylene with a nominal thickness of 0.35 mm.

3) Quadding

Four insulated conductors shall be uniformly twisted together to form a compact and symmetrical quad.

4) Quad Code

Conductor insulation in a basic unit shall be colored in accordance with the requirements of Table 323-2. This requirements may be altered as approved by PJKA in writing.

5) Cable Core

a. Unit Composition

Cable quad core shall be arranged as on Fig. 323-1 and form a unit. Five quads shall be stranded into a 10-pair unit with a tape whipping. Each unit shall be screened with suitable tape and bound with stretched polyethylene tape whipping in accordance with the requirements of Table 323-3. This requirements may be altered with the written approval of the PJKA.

b. Cable Composition

Suitable number of 10-pair units shall be stranded into a compact and symmetrical cable core as shown on Fig. 323-2. A suitable number of plastic fillers may be applied to make the cable core cylindrical.

6) Cable Core Wrappings

a. Non-hydroscopic tape shall be used as cable core wrapping, helically and/or longitudinally applied with an overlap. Suitable binder may be incorporated if necessary.

b. The core wrapping prevents the melting of the conductor insulation during the sheathing process.

7) Identification Marks

Identification marks shall be embossed or printed along the cable sheath or by using an identification tape.

8) Electric Screen

a. A layer of aluminium approximately 0.2 mm thick shall be used as an electric screen and moisture barrier.

b. The aluminium shall be applied longitudinally over the wrapped cable core with an overlap.

c. The electronic screen shall consist of a plain and one-sided polyethylene coated almuninium tape. The polyethylenes coating shall be on the outer side of the core.

d. Unit Screen

The cable will be used for not only the voice-frequency telephone circuits but also the PCM system, telegraph circuits. Therefore, the screen tape shall be applied over each unit in order to reduce the cross-talk of the circuits between the different units. Usually aluminium coated plastic (Myler) tape shall be used for this purpose. The manufacturers may offer other screen method such as compartmental screen (2-screen, etc.).

9) Sheath

a. PE Sheath Cable

Black polyethylene sheath shall be extruded over the screened core or identification tape.

Polyethylene sheath shall adhere tightly to the aluminum tape.

The mean value of the sheath thickness shall be not less than 90% of the nominal value given in Table 323-1.

b. Corrugated Metallic Cable

Inner sheath shall be covered with concentric black polyethylene over the identification tape or screened core. The thickness of the polyethylen coating shall be as shown on Table 323-1.

A 0.4 mm thick steel tape or a tape with similar characteristics shall be applied longitudinally over the inner sheath, and after fusing of the sheath, corrugations shall be formed on to the cable.

The outer sheath shall be applied over the corrugated sheath for protection against moisture and wrapped with black ploye thylene concentrically. The minimum thickness of the polyethylene sheath shall be 1.5 mm.

The mean value of the sheath thickness shall be not less than 90% of the nominal value shown on Table 323-1.

D. ELECTRICAL CHARACTERISTICS

The electrical characteristics of the cable shall be as follows:

1)	Conductor resistance	:	Not more than 29.0 ohms/km
2)	Dielectric strength	:	DC 500 V or AC 350 V for one minute
3)	Insulation resistance	:	Not less than 5,000 M ohms/km
4)	Average mutual capacitance of the pairs at 1 kHz	:	Not more than 55 nF/km
5)	Capacitance unbalance between side-to-side in the same quad at 1 kHz	:	Maximum value - not more than 800 pF/500 m Mean value - not more than 150 pF/500 m

The measurements taken at 20 degrees C.

E. PACKAGING

1) Both ends of the cable shall be sealed by a suitable method to prevent the entrance of moisture.

2) The direction of rotation of the color scheme shall be shown by marking the clockwise and anti-clockwise ends with red and blue bands, respectively.

3) Each length of cable shall be packed on one drum so as to prevent the cable from damage during storage and transportation.

4) On each drum, the type and the length of cable, weight, rolling mark, and other particulars shall be plainly marked.

F. GAS PRESSURE TEST

In order to check the reliability of the polyethylene sheath, the cables shall be tested by gas pressure. After sealing both ends of the cable, gas shall be injected into the cable to a minimum pressure of 1 kg/cm^2. After equalization of pressure throughout the length of the cable, the gas shall be shut off. Twelve hours after the

supply of gas, the gas pressure shall not decrease by more than 100 g/cm^2. The cable shall be delivered under gas pressure of minimum 600 g/cm^2 at 20 degrees C.

G. REQUIREMENTS OF POLYETHYLENE

To guarantee the long life of cables, the polyethylene material shall be tested by suitable methods.

Table 1. NOMINAL VALUE OF SHEATH THICKNESS

Item \ Type (Number of Pairs)		S9002-B	S9006-B	U9010-B	U9020-B	S9006-C	U9010-C	U9020-C	U9030-C	U9040-C	U9010-BD
		2	6	10	20	6	10	20	30	40	10
Nominal Diametres and Tolerance (mm)		0.9 ± 0.02									
Insulator Thickness	Polyethylene (mm)	0.35 ± 10 %									
Quad Arrangement	Central Layer	1	3	—	—	3	—	—	—	—	—
Unit Arrangement	Central Layer	—	—	1	2	—	1	2	3	4	1
Polyethylene Sheath	Standard Thickness (mm)	1.5			1.8	1.5	1.8				1.5
	Approx. Overall Dia. (mm)	10	14	15	23	—	—	—	—	—	15
Corrgated Sheath	Inside Sheath: Standard PE Thickness (mm)	—	—	—	—	1.5	1.8				—
	Corrgation: Thickness of Steel Armour Tape (mm)	—	—	—	—	0.3	0.4				—
	Outside Seath: Standard PE Thickness (mm)	—	—	—	—	2.0	2.0				—
	Applox. Overall Dia. (mm)	—	—	—	—	22	24		38		—
Self-Supporting Type	Support messenger Wire (number/mm)	—	—	—	—	—	—	—	—	—	7/2.0
Standard Cable Length (m)		500									

Table 2. COLOUR COODING OF CONDUCTORS

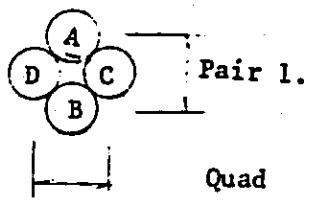
Quad Number	Pair 1.		Pair 2.		Remarks
	A	B	C	D	
1	Blue	White	Brown	Black	
2	Yellow	"	"	"	
3	Green	"	"	"	
4	Red	"	"	"	
5	Violet	"	"	"	

Table 3. COLOUR OF WHIPPING TAPE

Unit whippings	
Unit No.	Colour of Whipping
1	Blue
2	Yellow
3	Green
4	Red
5	Violet

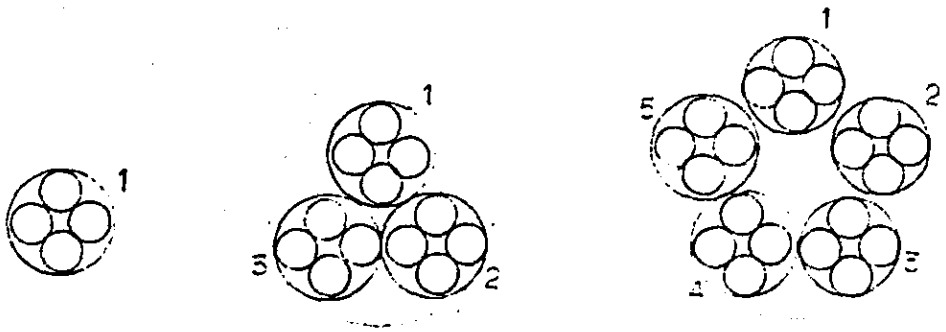


Fig. 1. QUAD AND UNIT COMPOSITION

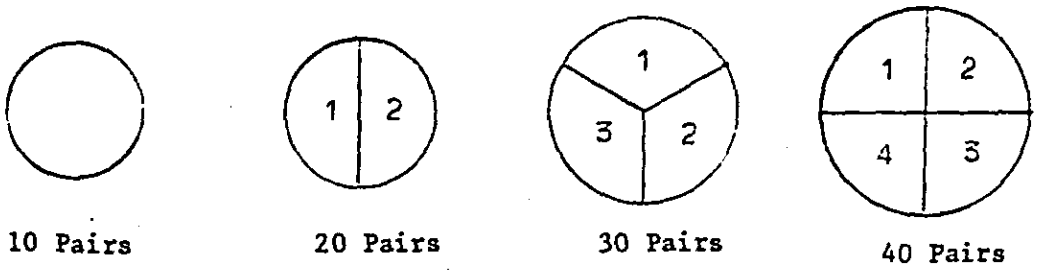


Fig. 2. CABLE UNIT CORE COMPOSITION

2.02. DISTRIBUTION BOX

Distribution boxes shall be installed in the Signal Telecommunication Device Room, or at stations and shall be used for connecting communication cable or cables with the equipment.

A. TYPES OF DISTRIBUTION BOXES

The types of distribution boxes shall be as shown on Table 323-4.

Table 323-4 Type of Distribution Boxes

Location	Mounting Method	Components	Terminal Capacity
Indoor	Wall Mounting	Terminal, protective devices for telecommunication equipment	10P 20P 30P 60P 100P
Outdoor	Pole Mounting	Terminal, protective device for telecommunication equipment Protective device for substation control line	10P

NOTES:

a. The size and capacity of distribution boxes shall be determined after reviewing the communication network and circuitry, allowing for ample box size.

b. Distribution boxes at substations shall have as minimum space for the capacity to include protective device, 6 communication circuits, and 4 substation control circuits.

c. Protective devices for substation control circuits shall be installed at the following substations:

Cengkareng SS: 4 circuits
Kapuk SS : 4 circuits
Jakarta SS : 4 circuits

B. CONSTRUCTION

1) The cabinets shall be constructed of sheet steel, of material, thickness of adequate strength, and shall be painted after substrate has been treated for corrosion.

2) Outdoor boxes shall be double-layer construction, and shall be waterproof.

3) Cable ports shall be provided at the bottom of the box.

4) Outdoor distribution boxes shall be constructed to be capable of being padlocked.

C. TERMINALS

The terminals shall be the communication type with high insulation values.

D. PROTECTIVE DEVICE

1) For Communication Circuits

The protective device shall consist of a fuse and vacuum arrester.

The arrester shall be 2- or 3-pole type with discharge value of 230 V to 350 V AC.

2) For Remote Control Circuits

The protective device shall consist of an insulating transfer, vacuum arrester, and varister.

The arresters shall be of the 3-pole type with a discharge value of 210 V AC $\pm$50 V.

3) For Interlocking Breaker Circuits

The protective device shall consist of a vacuum arrester and fuse.

The arresters shall be of the 5-pole type with a discharge value of 490 AC $\pm$50V.

2.03 TERMINAL BOXES

Terminal boxes shall be provided with circuit wiring branched off the communication cable, and by connecting portable telephones to the terminals conversation can be made with necessary parties.

A. COMPOSITION

1) The boxes shall be mounted on poles or walls.

2) The boxes shall be treated for corrosion resistant and shall be of waterproof construction.

3) The cable outlets shall be provided at the bottom of the boxes.

4) The boxes shall be provided with terminals which permit easy connection of portable telephones.

B. THE NUMBER OF TERMINALS TO BE PROVIDED

1) Terminals for 10 circuits shall be provided.

2) The circuits shall be 5 of the T-type branch, and 2 of the PI-Figure-type branch (for relay purposes).

2.04 OUTDOOR TYPE TELEPHONE BOX

Outdoor type telephone boxes shall contain telephone sets at station yard or at substations and there shall be two types, i.e. wall mounted type and pole mounted type.

A. COMPOSITION

1) The box shall be mounted on the poles or walls.

2) The box shall be treated for corrosion resistant and shall be of waterproof construction.

3) The cable outlets shall be provided at the bottom of the boxes.

4) The boxes shall be provided with terminal for telephone set.

2.05 SPARE PARTS AND ACCESSORIES

A. DISTRIBUTION BOX

General Use at Stations:

1) Vacuum arrester : 50% of numbers in use

2) Fuse : 100% of numbers in use

For Substations

1) Vacuum Arresters: 50% of numbers in use

2) Varister : 50% of numbers in use

3) Transformer : 25% of numbers in use

B. FOR TERMINAL BOXES

Complete units : 5 each

PART 3: EXECUTION

3.01 INSTALLATION OF TELECOMMUNICATION CABLE

A. Laying of the main cable shall usually be made according to standard method of direct burying (at 0.8 m depth) at banked sections; and the cable shall be protected in concrete troughs or conduits at places where burying is difficult or at the level crossings.

The cable shall be laid in a cable duct at elevated sections. Hand halls shall be provided with the conduit if required.

B. Local cables shall be installed in troughs; where the troughs are provided under signalling work, the cables shall be installed with signal cables in the same troughs.

C. A protective conduit shall be provided on the cable at risers and down cables on the pier and at distribution boxes.

D. All cabling shall be provided with suitable tags or labels to indicate the circuits on which they are used the terminal to which they are connected.

E. One end of the cable sheath shall be grounded. Grounding may be jointly made with the metal cabinet of the distribution boxes.

F. The Contractor shall prepare his cable installation plan after making a site survey.

3.02 SPLICING OF COMMUNICATION CABLES

A. Splicing of communication cables shall either be straight splice, branch splice, flexible splice, or termination.

B. Cable splice shall be made by the resin method MGE Sleeve method, or other splicing methods which have similar or better qualities.

C. The resin method of performing straight or branch splice consists of adhesion by heat fusion of aluminium tape to the cable sheath and forming the splice with epoxy resin.

D. The MGE Sleeve method of performing straight or branch splice consist of heat constructibility sleeve, adhesion by heat fusion of aluminium tape to the cable sheath and forming the splice with polyurethane resin.

E. The flexible splice and termination of cables consists of protecting the cable from water intrusion and humidity. Conductors shall be spliced by the stranded-solder method or other method which given equal or better connection.

3.03 DISTRIBUTION BOXES

A. GENERAL USE DISTRIBUTION BOXES

1) The distribution boxes shall be securely fastened at walls in the signal/telecom. device room or office room.

2) Protective devices shall be grounded. Grounding of protective devices shall be provided separately from the grounding of other telecom. equipment.

B. DISTRIBUTION BOXES FOR SUBSTATIONS

1) Distribution boxes at substations shall be mounted on concrete poles or other suitable mounts.

2) The remote control circuits at substations shall be terminated with protective devices.

3) The ground rod for the protective devices at substations shall be installed a sufficient distance away from the substation.

4) The distribution box cabinet grounding may be grounded in common with the substation facilities.

3.04 TERMINAL BOXES

Terminal boxes shall be securely fastened on the concrete telecom. poles or side wall of the elevated sections.

The cables to the terminal boxes shall be protected with flexible pipe securely fixed to the box.

Installation details of the terminal boxes shall be in accordance with the drawing.

3.05 WIRING AND GROUNDING

A. The wiring in the distribution boxes shall be made with jumper wires.

B. Within the distribution box grounding terminals shall be provided.

C. Grounding resistance required for the various facilities shall be as shown on Table 323-5.

Table 323-5 Grounding Resistance

Equipment	Purpose	Grounding Resistance
Distirbution Box Cabinet	Safety and protection	Less than 100 ohm
Equipment Cabinet	Ditto	Less than 100 ohm
Vacuum Surge Arrester	Ditto	Less than 50 ohm
Air-gap Surge Arrester	Ditto	Less than 50 ohm
Suspended Cable Messenger	Ditto	Less than 100 ohm

D. INSTALLATION REQUIREMENT FOR GROUNDING

1) Separation between different groundings shall be more than 5 metres.

2) The top of the earth rod shall be buried not less than 0.75 metre from the ground surface.

3) The earthing wire shall be buried at the same depth as the top of the earth rod.

4) Connection between earth electrode and earthing wire shall be attached by brazing, welding or clamping.

5) A marker shall be installed at each grounding point, and shall be indicated on the as-built drawings for record purpose.

END OF SECTION

324 - TRAIN BOARDING INFORMATION EQUIPMENT

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324 - TRAIN BOARDING INFORMATION EQUIPMENT

PART 1: GENERAL

1.01 DESCRIPTION

This section covers the train boarding information system for passenger services to indicate destination and departure time of a train.

This work shall consist of furnishing and installing the information equipment including indication panels, operation panels, access wiring/cabling and related work required to complete the train boarding information system at the locations as shown on the drawing and in accordance with these specifications.

The work under this section shall include related testing required to complete the system.

1.02 SYSTEM DESCRIPTION

The system shall consist of indication panels and an operation panel with micro-computer, and shall indicate destination and departure time of a train through the operation panel. Train operation diagram shall be programmed on memories of the micro-computer.

1.03 REFERENCES

Related work in other Sections:

Section 301 GENERAL REQUIREMENTS FOR ELECTRICAL WORK

Section 302 COMMON PRODUCTS AND EXECUTION

Section 323 TELECOMMUNICATION CABLES

PART 2: PRODUCTS

Characteristics and ratings of the equipment shall not be less than, or exceed as the case may be, the requirements indicated on the drawings or in the specifications.

2.01 INDICATION PANELS

A. Indicator for times and destinations shall be a flap revolution type, shall be provided within aluminum extrusion panel made body with clear acrylic resin panel window hinged with the body. Each panel and window shall be sealed dust tight.

B. Characters on the flaps for indication or elsewhere shall be white and printed on the black background. The Contractor may conform to manufacturer's standard for type of characters, colors or other finishes, which are subject to approval of PJKA.

C. The indication panel shall be incorporated with the following:

1) Stabilization power supply section: 1 completed set

2) Semiconductor control section : 1 -Do-

3) Input/output terminal section : 1 -Do-

D. Weight and power demand per one unit of the panel shall be as follows:

1) Weight : 150 kg or less

2) Power demand : 100 VA or less

E. Voltage Fluctuation : 220 V $\pm$ 10%

2.02 OPERATION PANELS

A. Operation panels shall be made by 1.6 mm thick steel plate and shall be finished with melamine printing.

B. Operation panels shall be incorporated with the following function switches:

1) Power switch - to switch on/off for input power

2) Reverse switch - to reverse the indications

3) Step switch - to forward the indications

4) Eraser switch - to clear the indications

5) Setting switch - to set train type, boarding platform number, to departure time and destination

6) Memory switch - to memorize new train operation diagram

C. Performance

1) Input voltage : AC 220 V 60 Hz

2) Weight : 50 kg or less

3) Power demand : 100 VA or less

PART 3: EXECUTION

Indication panels shall be installed rigidly at the gates of the stations with support fittings and shall be located at readily visible locations for passengers' convenience.

Operation panels shall be installed at readily visible locations of the indication panel for a operator with approval of PJKA.

Conduits or protective materials with access wires for the equipment shall be installed under concealed or exposed method to suit to the building struture

END OF SECTION

PART E

BILL OF QUANTITIES

SCOPE AND MEASUREMENT

SCOPE AND MEASUREMENT

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SCOPE AND MEASUREMENT

1. SCOPE OF WORK

1.01 GENERAL

A. The scope of work under this Contract Package III includes the furnishing of all labor, supervision, tools and equipment, technical and professional services, materials, supplies and articles necessary for the construction of approximately 20 kilometers of railway electric system for a single track railway services as referred to "Cengkareng Airport Line" as part of Perusahaan Jawatan Kereta Api (PJKA) network.

The work consists of furnishing and installing the electrical facilities for the new railway system including substations, traction and utility power distribution lines, signalling and telecommunications system.

B. Each system includes:

- power supply system consisting of three substations including power receiving, transformation, distribution and control equipment for DC 1500 V and AC 3 phase, 6 kV power supply with related work as shown or specified.

- power distribution system consisting of overhead catenary and feeder lines for DC 1500 V traction power distribution, AC 6 kV utility power distribution line, lightning protection system, and low voltage power service equipment including supporting structures with related work as shown or specified.

- signalling system consisting of relay interlocked signalling system including relay interlocking devices colour light signals, shunting signals, electric switch machines and track circuits; and level crossing protection system including warning signals, protection barriers, X-mark indicators and control equipment; with related work as shown or specified.

- telecommunications system consisting of telephones including dispatching, direct line, portable and automatic telephones; public address, electric clock, cable carrier and train boarding information equipment; with related work as shown or specified.

C. For convenience in reference and control, the total work under this Contract is subdivided into major categories and groups as follows:

Groups under Package III Electrical Work:

(1) Substations

(2) Overhead Contact System

(3) Power Distribution Lines

(4) Signalling System

(5) Telecommunications System

1.02 WORK NOT INCLUDED

The following works will not be included, but not be limited to:

- civil work for railbed and site preparation of substations;

- architectural work including interior electrical utilization equipment excluding signal and telecom equipment;

- installation of insulated rail joints;

- electrical and architectural work for Manggarai Operation Centre Building excluding substation remote control equipment for the New Railway Line.

2. MEASUREMENT FOR PAYMENT

2.01 GENERAL

This section defines how pay items, enumerated in Bill of Quantities, are measured for payment. All lump sum items may be paid based on progress payment.

Abbreviations:

The following abbreviations have been used in the Bill of Quantities:

Abbreviation	Full Meaning
C.M.	cubic meter
S.M.	square meter
L.M.	lineal meter
No.	number
M.T.	metric ton
S	set
P	place
L.S.	lump sum

Work shall be measured net.

Item No.	Title and Description for Scope and Measurement

GROUP 1: SUBSTATIONS

Cengkareng Substation

1.01 **PRESTRESSED CONCRETE PILE** - shall consist of providing and installing the prestressed concrete pile of the type and in the size and depth indicated; placed at the locations and to the lines, grades, details and extent shown on the drawings; and shall include:

* Prestressed Concrete Pile, 350 mm Diameter

- shall be measured by the lineal meters of pile of the type and size placed in the completed work, and based upon dimensions taken at the theoretical centerline of the pile.

1.02 **CONCRETE FOUNDATIONS** - shall consist of furnishing of concrete for reinforced concrete structures; and shall include conveying, placing, consolidating, finishing and curing the concrete in place; and falsework, formwork, construction joint treatment, and related materials, work and operations.

- shall be measured by the cubic meters of concrete for the respective structures of the types and sizes indicated and at the loctions in the completed work.

1.03 **SUBSTATION EQUIPMENT** - shall consist of furnishing and installing the substation equipment; shall include cable terminations, furnishing spare parts, test, and related work to complete substation; and shall apply to:

a. 20 kV Cubicle
b. DC Transforming Equipment - consisting of rectifier's transformer, silicone rectifier, series reactor and filter cubicle;
c. DC Feeder Cubicle
d. 6 kV Distribution Equipment - consisting of distribution transformer and 6 kV cubicle;
e. Local Power Equipment
f. Remote control Panel

- shall be measured as a lump sum item for providing respective substation equipment in the completed work.

Item No.	Title and Description for Scope and Measurement
1.04	**POWER CABLES** - shall consist of furnishing and installing power cables, spacers and flexible pipes to complete the system and shall apply to: a. 22 kV CV 1-core 150 mm^2 b. 3.3 kV CV 1-core 300 mm^2 c. 3.3 kV CV 1-core 25 mm^2 d. 6.6 kV CV 1-core 35 mm^2 - shall be measured by lineal meters of power cables of the respective type placed in the completed work.
1.05	**CONTROL CABLES** - shall consist of furnishing and installing CVV, CVVS and PV cables, including terminations, and conduit tubes to complete the system. - shall be measured by lineal meters of control cables of the respective type placed in the completed work.
1.06	**GROUNDING DEVICES** - shall consist of furnishing and installing ground wires, ground rods including terminations, splices, related terminal end connections and accessories; and also including excavation, trenching, bedding, backfilling, compaction and the testing of ground resistance to complete the grounding system. - shall be measured as a lump sum item for providing the respective miscellaneous devices in the complete substations.
1.07	**MISCELLANEOUS DEVICES** - shall consist of furnishing and installing gravel paving, outdoor lights including piping and wiring, fencing; and also including excavation, trenching, bedding, backfilling, compaction and disposal of surplus excavation to complete the work. - shall be measured as a lump sum item for providing the respective miscellaneous devices in the completed substations.

Item No.	Title and Description for Scope and Measurement

Kapuk Substation

1.08 **PRESTRESSED CONCRETE PILE** - shall consist of providing and installing the prestressed concrete pile of the type and in the size and depth indicated; placed at the locations and to the lines, grades, details and extent shown on the drawings; and shall include:

* Prestressed Concrete Pile, 350 mm Diameter

- shall be measured by the lineal meters of pile of the type and size placed in the completed work, and based upon dimensions taken at the theoretical centerline the pile.

1.09 **CONCRETE FOUNDATIONS** - shall consist of furnishing of concrete for reinforced concrete structures; and shall include conveying, placing, consolidating, finishing and curing the concrete in place; and falsework, formwork, construction joint treatment, and related materials, work and operations.

- shall be measured by the cubic meters of concrete for the respective structures of the types and sizes indicated and at the locations in the completed work.

1.10 **SUBSTATION EQUIPMENT** - shall consist of furnishing and installing the substation equipment; shall include cable terminations, furnishing spare parts, test, and related work to complete substation; and shall apply to:

a. 20 kV Cubicle
b. DC Transforming Equipment - consisting of rectifier's transformer, silicone rectifier, series reactor and filter cubicle;
c. DC Feeder Cubicle
d. 6 kV Distribution Equipment - consisting of 6kV cubicle;
e. Local Power Equipment
f. Remote Control Panel

- shall be measured as a lump sum item for providing the respective equipment for the substation in the completed work.

Item No.	Title and Description for Scope and Measurement
1.11	**POWER CABLES** - shall consist of furnishing and installing power cables, spacers and flexible pipes to complete the system and shall apply to: a. 22 kV CV 1-core 150 mm^2 b. 3.3 kV CV 1-core 300 mm^2 c. 3.3 kV CV 1-core 25 mm^2 - shall be measured by lineal metes of power cables of the respective type placed in the completed work.
1.12	**CONTROL CABLES** - shall consist of furnishing and installing CVV, CVVS and PV cables, including terminations, and conduit tubes to complete the system. - shall be measured by lineal meters of control cables of the respective type placed in the completed work.
1.13	**GROUNDING DEVICES** - shall consist of furnishing and installing ground wires, ground rods including terminations, splices, related termial end connections and accessories; and also including excavation, trenching, bedding, backfilling, compaction and the testing of ground resistance to complete the grounding system. - shall be measured as a lump sum item for providing the respective miscellaneous devices in the complete substations.
1.14	**MISCELLANEOUS DEVICES** - shall consist of furnishing and installing gravel paving, outdoor lights including piping and wiring, fencing; and also including excavation, trenching, bedding, backfilling, compaction and disposal of surplus excavation to complete the work. - shall be measured as a lump sum item for providing the respective miscellaneous devices in the completed substations.

Item No.	Title and Description for Scope and Measurement

Jakarta Kota Substation

1.15 **PRESTRESSED CONCRETE PILE** -shall consist of provididng and installing the prestressed concrete pile of the type and in the size and depth indicated; placed at the locations and to the lines, grades, details and extent shown on the drawings; and shall include:

* Prestressed Concrete Pile, 350 mm Diameter

- shall be measured by the lineal meters of pile of the type and size placed in the completed work, and based upon dimensions taken at the theoretical centerline of the pile.

1.16 **CONCRETE FOUNDATIONS** - shall consist of furnishing of concrete for reinforced concrete structures; and shall include conveying, placing, consolidating, finishing and curing the concrete in place; and falsework, formwork, construction joint treatment, and related materials, work and operations.

- shall be measured by the cubic meters of concrete for the respective structures of the types and sizes indicated and the locations in the completed work.

1.17 **SUBSTATION EQUIPMENT** - shall consist of furnishing and installing the substation equipment for the new railway line, and replacing the existing 20 kV cubicle and local power equipment for the Central Line; shall include cable terminations, furnishing spare parts, test, related work to complete substation, and disposition of old equipment to the location as directed by the Engineer; and shall apply to:

a. 20 kV Cubicle (replacement) - including removal of existing power receiving cables;
b. DC Transforming Equipment - consisting of rectifier's transformer, silicone rectifier, series reactor and filter cubicle;
c. DC Feeder Cubicle - including installation of linked breaking device and modification of existing linked breaking system;
d. 6 kV Distribution Equipment - consisting of distribution transformer and 6 kV cubicle;
e. Local Power Equipment (replacement)
f. Remote Control Panel (modification) - consisting of modification of existing linked breaking system;

- shall be measured as a lump sum on each item for providing the respective substation equipment in the completed work.

Item No.	Title and Description for Scope and Measurement
1.18	**POWER CABLES** - shall consist of furnishing and installing power cables, spacers and flexible pipes to complete the system and shall appply to the following, exclusive of Item d as specifically required for the temporary work including subsequent restoration work: a. 22 kV CV 1-core 150 mm^2 b. 3.3 kV CV 1-core 300 mm^2 c. 6.6 kV CV 1-core 35 mm^2 d. 3.3 kV CV 1-core 300 mm^2 (for Temporary Work) - shall be measured by lineal meters of power cables of the respective type placed in the completed work with exception of Item d which shall be measured as a lump sum item for the temporary work.
1.19	**CONTROL CABLES** - shall consist of furnishing and installing CVV, CVVS and PV cables, including terminations, and conduit tubes to complete the system. - shall be measured by lineal meters of control cables of the respective type placed in the completed work.
1.20	**GROUNDING DEVICES** - shall consist of furnishing and installing ground wires, ground rods including terminations, splices, related terminal end connections and accessories; and also including excavation, trenching, bedding, backfilling, compaction and the testing of ground resistance to complete the ground system. - shall be measured as a lump sum item for providing the respective miscellaneous devices in the complete substations.
1.21	**MISCELLANEOUS DEVICES** - shall consist of furnishing and installing gravel paving, outdoor lights including piping and wiring, fencing; and also including excavation, trenching, bedding, backfilling, compaction and disposal of surplus excavation to complete the work. - shall be measured as a lump sum item for provididng the respective miscellaneous devices in the completed substations.

Item No.	Title and Description for Scope and Measurement
	Manggarai Center
1.22	**REMOTE SUPERVISORY CONTROL PANEL** - shall consist of furnishing and installing remote supervisory control panels for the new railway line substations and modification of existing control panel for Jakarta Kota substation of the Central Line; and shall include related tests and work to complete the control center. - shall be measured as a lump sum item for providing the respective control center equipment in the completed work.
1.23	**CONTROL CABLES** - shall consist of furnishing and installing CVV, CVVS and PV cables, including terminations, and conduit tubes to complete the system. - shall be measured by lineal meters of control cables of the respective type placed in the completed work.
	Duri Substation
1.24	**LINKED BREAKING DEVICE** - shall consist of furnishing and installing linked breaking device and related control cables including terminations, connections, tests and modification of linked breaking system to complete the substation system. - shall be measured as a lump sum item for providing the respective equipment in the completed work.
	Gambir Substation
1.25	**LINKED BREAKING DEVICE** - shall consist of furnishing and installing linked breaking device and related control cables including terminations, connections, tests and modification of linked breaking system to complete the substation system. - shall be measured as a lump sum item for provididng the respective equipment in the completed work.
	TOOLS AND INSTRUMENTS
1.26	**TOOLS AND INSTRUMENTS** - shall consist of furnishing tools and measuring instruments required for maintenance of substation equipment: - shall be measured as a lump sum item for providing the respective devices.

Item No.	Title and Description for Scope and Measurement

GROUP 2: OVERHEAD CONTACT SYSTEM

2.01 **SUPPORTING STRUCTURES** - shall consist of furnishing and installing concrete poles including foundations, guys, beams, cross arms to complete the supporting structures; and also including excavation, backfilling, compaction and disposal of surplus excavation to complete the supporting structures.

- shall be measured by count of set of the concrete poles installed in the completed work.

2.02 **OVERHEAD CATENARIES** - shall consist of furnishing and installing messenger wires and trolley wires including pull offs, steady braces, automatic tensioning devices, air sections, air joints and section insulators to complete the overhead catenaries.

- shall be measured by lineal meters of overhead catenaries installed in the completed work.

2.03 **FEEDER WIRES** - shall consist of furnishing and installing feeder wires including return circuit wires, feeding branches, cables and concrete troughs; and also including excavations, trenching, bedding, backfilling, compaction and disposal of surplus excavation to complete the feeding system.

- shall be measured by lineal meters of feeder wires installed in the complleted work.

2.04 **MISCELLANEOUS DEVICES** - shall consist of furnishing and installing lightning arresters, grounding devices, wire caution marker devices for level crossing, and also test and mesurement shall be included to complete the overhead contact system.

- shall be measured as a lump sum item for miscellaneous devices installed in the completed work.

Item No.	Title and Description for Scope and Measurement
2.05	**REFORMATION WORK IN JAYAKARTA** - shall consist of furnishing and installing concrete poles including foundations, beams, guys, overhead catenaries, feeder branches, pull offs, steady braces, automatic tensioning devices and section insulators; and also including shifting of overhead catenaries and removal of the existing steel masts, beams, overhead catenaries, pull offs, automatic tensioning devices; and also includng excavation, backfilling, compaction and disposal of surplus excavation, and related tests and measurements to complete the reformation work of the overhead contact system in Jayakarta. - shall be measured as a lump sum item for providing respective products and materials in the reformation work of overhead contact system in Jayakarta.

Item No.	Title and Description for Scope and Measurement

GROUP 3: POWER DISTRIBUTION LINES

3.01 **OVERHEAD DISTRIBUTION LINES** - shall consist of furnishing and installing OE wires including cross arms, suspension insulators, LP insulators, guys, and hardware to complete the overhead distribution lines.

- shall be measured by lineal meters of wires installed in the completed work.

3.02 **OVERHEAD GROUND WIRES** - shall consist of furnishing and installing steel wires including suspension insulators, spliced arms, guys, grounding devices; and also including excavation, trenching, bedding, backfilling, compaction and disposal of surplus excavation for underground ground wires and measurements to complete the overhead ground wire system.

- shall be measured by lineal meters of wires installed in the comleted work.

3.03 **POWER CABLES** - shall consist of furnishing and installing 6.6 kV CV cables including terminators, messenger wires, cable trays, flexible pipes, manholes, ground fault detectors, ground devices, 600V NYY cables, concrete troughs; and also including excavation, trenching, bedding, backfilling, compaction and disposal of surplus excavation and related tests and measurements to complete the system.

- shall be measured by lineal meters of cables installed in the completed work.

3.04 **DISTRIBUTION EQUIPMENT** - shall consist of furnishing and installing lightning arresters, transformers, drop wires for transformers, primary cutouts, inspection stands, pole switches, service drop wires, concrete poles, grounding devices; and also including excavation, trenching, bedding, backfilling, compaction and disposal of surplus excavation and related tests and measurements to complete the system.

- shall be measured as a lump sum item for providing the respective distribution equipment in the completed work.

Item No.	Title and Description for Scope and Measurement
3.05	**POWER DISTRIBUTION CUBICLES** - shall consist of furnishing and installing power distribution cubicles, transformers and grounding devices; and also including excavation, trenching, bedding, backfilling, compaction and disposal of surplus excavation for ground devices, and related tests and measurements to complete the system. - shall be measured as a lump sum item for providing the respective power distribution cubicles in the completed work.

Item No.	Title and Desription for Scope and Measurement

GROUP 4: SIGNALLING SYSTEM

4.01 **RELAY INTERLOCKING DEVICE** - shall consist of furnishing and installing the control panel, relay board, terminal board, instrument rack, electric power distribution panel, signalling transformer, rectifier, battery, wiring, grounding and related works to complete Relay Interlocking System; and shall apply to:

a. 4 Routes
b. 10 Routes or less

- shall be measured by the set in respective type/size of the device placed at the loctions in the completed work.

4.02 **COLOUR LIGHT SIGNAL** - shall consist of furnishing and installing the signal head and related accessories to complete the colour light signals; and shall apply to:

a. 2 ASPECTS
b. 3 ASPECTS

- shall be measured by the set in respective type of the signals placed at the locations in the completed work.

4.03 **SHUNTING SIGNAL** - shall consist of furnishing and installing the signal head and related accessories to complete the shunting signals; and shall apply to:

a. TYPE A
b. TYPE B

- shall be measured by the set in respective type of the signals placed in the completed work.

4.04 **EMERGENCY SIGNAL** - shall consist of furnishing and installing the signal head and related accessories to complete the emergency signals:

- shall be measured by the set of the signals placed in the completed work.

Item No.	Title and Description for Scope and Measurement
4.05	**SIGNAL MAST** - shall consist of furnishing and installing the masts and concrete bases and related works of excavation, backfill, compaction and disposal of surplus excavation; and other related works to complete the signal mast assemblies: - shall be measured by the set of the signal masts placed in the completed work.
4.06	**MARKER** - shall consist of furnishing and installing each type of the Signs and related works including excavation, backfill, compaction and disposal of surplus excavation; and shall apply to: a. RESTRICTED SPEED RELEASE MARKER b. SHUNTING LIMIT MARKER c. CAR STOP MARKER - shall be measured by count of the individual number of units for the respective type of the signs palced in the completed work.
4.07	**ELECTRIC SWITCH MACHINE** - shall consist of furnishing and installing the switch machine, accessories, and related works: - shall be measured by the set of the machine placed in the completed work.
4.08	**TRACK CIRCUITS** - shall consist of furnishing and installing transformer, resistor, feeder and receiver, relay and bonds; and related works to complete track circuit; and shall apply to: a. TYPE A, SINGLE TRACK b. TYPE A, DOUBLE TRACK c. TYPE B, DIVIDED FREQUENCY d. TYPE B, COMMERCIAL FREQUENCY - shall be measured by the set in respective type of the track circuits placed in the completed work.

Item No.	Title and Description for Scope and Measurement
4.09	**LEVEL CROSSING EQUIPMENT** - shall consist of furnishing and installing level crossing signal, level crossing barrier, train detector X-mark indicator and control device including pole/mast, accessories, concrete base, grounding, excavation, backfill, compaction and disposal of surplus excavation; and related works to complete level crossing protection system; and shall apply to: a. LEVEL CROSSING SIGNAL b. LEVEL CROSSING BARRIER, TYPE A c. - Do - TYPE B d. X - MARK INDICATOR e. TRAIN DETECTOR f. CONTROL DEVICE - shall be measured by count of the individual number of units for various equipment of level crossing placed in the completed work.
4.10	**ATS WAYSIDE DEVICE** - shall consist of furnishing and installing the ground device including wayside coil, control relay and accessories; and related works to complete ATS Wayside System: - shall be measured by count of the set placed in the completed work.
4.11	**STAND-BY GENERATOR** - shall consist of furnishing and installing the stand-by generator set including rectifier, inverter, batteries, control cubicle, fuel tank, access pipes, wires/cables, concrete bed, accessories; and related works to complete generating system: - shall be measured by count of the set of generator placed in the completed work.
4.12	**APPARATUS CASE** - shall consist of furnishing and installing apparatus case for signals and level crossing equipment with accesories; and related works including concrete base, excavation, backfill, compaction and disposal of surplus excavation to complete the system: - shall be measured by count of the set placed in the completed work.

Item No.	Title and Description for Scope and Measurement
4.13	**SIGNAL CABLES** - shall consist of furnishing and installing signal cables and troughs, including terminal boxs, terminations, splices and related terminal end connections and accessories; and also including excavation, trenching, bedding, backfill, compaction and disposal of surplus excavation for direct burial cables and troughs; to complete the system; and shall apply to: a. GENERAL TYPE CABLE b. DIRECT BURIAL TYPE CABLE c. TROUGH - shall be measured by lineal meters of signal cables and troughs of the respective type placed in the completed work.
4.14	**IMPROVEMENT OF EXISTING LEVEL CROSSING EQUIPMENT** - shall consist of the following work items and related testing, connection changes of control cables and wires; furnishing, installing and removing of control cables, relays and concrete bases of the level crossing equipment; and excavation, trenching, bedding, backfill, compaction and disposal of surplus excavation; and shall include: * relocation of level crossing signals and barriers and * removal of Audio Frequency (AF) track circuit devices and * installation of level corossing control devices and X-mark indicators: - shall be considered as a lump sum item for providing the respective works complete in place.

Item No.	Title and Description for Scope and Measurement

GROUP 5: TELECOMMUNICATIONS SYSTEM

5.01 **TELEPHONES** - shall comprise various types of telephone with access wirings and conduits; and shall consist of furnishing and installing the telephone sets and related accessories; and shall apply to:

a. AUTOMATIC TELEPHONE
b. DISPATCHING TELEPHONE
c. DIRECT LINE TELEPHONE
d. PORTABLE TELEPHONE

- shall be measured by count of the set placed in the completed work.

5.02 **PUBLIC ADDRESS EQUIPMENT** - shall comprise various public address equipment with access wiring and conduits; and shall consist of furnishing and installing the public address equipment and related accessories; and shall apply to:

a. MASTER EQUIPMENT
b. OPERATION PANEL
c. DYNAMIC TYPE SPEAKER
d. TRUMPET TYPE SPEAKER
e. MICROPHONE BOX

- shall be measured by count of the individual number of units placed in the completed work.

5.03 **ELECTRIC CLOCKS** - shall comprise various types of electric clock with access wiring and conduits; and shall consist of furnishing and installing each type or size of the clock with fittings, and related works to complete electric clock system; and shall apply to:

a. MASTER CLOCK
b. RELAY SLAVE CLOCK
c. SLAVE CLOCK, SINGLE FACE 300 mm Diameter
d. - Do - , DOUBLE FACES 600 mm Diameter

- shall be measured by count of the individual number of the units placed in the completed work.

Item No.	Title and Description for Scope and Measurement
5.04	**CABLE CARRIER EQUIPMENT** - shall comprise various types of cable carrier equipment with access wiring and conduits; and shall consist of furnishing and installing each type of the equipment with fittings, and related works to complete the cable carrier system; and outdoor type line repeater equipment shall also include access manholes and related excavation, backfill, compaction and disposal of surplus excavation; and shall apply to: a. TERMINAL EQUIPMENT b. LINE REPEATER EQUIPMENT, INDOOR TYPE c. - Do - , OUTDOOR TYPE - shall be measured by count of the individual number of the units placed in the completed work.
5.05	**DIRECT BURIAL MAIN TELECOM CABLE** (30 pairs up to 40 pairs) - shall consist of furnishing and installing the cables, protective conduits, splicings, terminatings and related connections to the distribution boxes/equipment, excavation, bedding, backfill, compaction and disposal of surplus excavation: - shall be measured by lineal meters of the cable placed in the completed work.
5.06	**MAIN TELECOM CABLE** (30 pairs up to 40 pairs, within Duct) - shall consist of furnishing and installing the cables, protective conduits, splicings, terminatings and related connections to the distribution boxes/equipment: - shall be measured by lineal meters of the cable placed in the completed work.
5.07	**TELECOM BRANCH CABLE** (10 pairs) - shall consist of furnishing and installing the cables, protective conduits, splicings, terminatings, and related connections to the terminal boxes, excavation, bedding, backfill, compaction and disposal of surplus excavation: - shall be measured by lineal meters of the cable placed in the completed work.
5.08	**LOCAL TELECOM CABLE** (2 pairs up to 20 pairs) - shall consist of furnishing and installing the cables, protective conduits, splicings, terminatings and related connections to the distribution boxes/equipment: - shall be measured by lineal meters of the cables placed in the completed work.

Item No.	Title and Description for Scope and Measurement
5.09	**OVERHEAD TELECOM CABLE** - shall consist of furnishing and installing the cables, protective conduits, splicings, terminatings, fittings and related connections: - shall be measured by lineal meters of the cable placed in the completed work.
5.10	**TELECOM DUCTS** - shall consist of furnishing and installing pipes/conduits and/or precast concrete troughs of the type or size at the locations indicated, trenching, bedding, backfill, compaction and disposal of surplus excavation; and shall apply to: a. PIPE b. TROUGH - shall be measured by lineal meters of each type of the duct placed in the completed work.
5.11	**HANDHOLE** - shall consist of a complete handhole assembly as size indicated; and shall include frame cover, aggregate subbase, excavation, backfill, compaction and disposal of surplus excavation: - shall be measured by count of the individual number of units of the handhole placed in the completed work.
5.12	**DISTRIBUTION BOX** - shall consist of furnishing and installing the boxes, access conduits and fittings; and also concrete short poles and related excavation, backfill, compaction and disposlal of surplus excavation shall be included for the outdoor type boxes; and shall apply to: a. INDOOR TYPE, up to 20p b. - Do - , up to 100p c. OUTDOOR TYPE, 10p - shall be measured by count of the individual number of the boxes placed in the completed work.

Item No.	Title and Description for Scope and Measurement
5.13	**TERMINAL BOX AND OUTDOOR TYPE TELEPHONE BOX** - shall consist of furnishing and installing the boxes, access conduits and fittings; and also concrete short poles and related excavation, backfill, compaction and disposal of surplus excavation shall be included for the pole mounted outdoor type telephone boxes; and shall apply to: a. POLE MOUNTED TYPE b. WALL MOUNTED TYPE - shall be measured by count of the individual number of the boxes placed in the completed work.
5.14	**TRAIN BOARDING INFORMATION EQUIPMENT** - shall consist of furnishing and installing the operation panels and indication panels including access wires/cables, conduits and fittings; and related works to complete the system; and shall apply to: a. OPERATION PANEL b. INDICATION PANEL - shall be measured by count of the individual number of each type for the units placed in the completed work:

END OF SCOPE AND MEASUREMENT

BILL OF QUANTITIES

BIDDER: _____

DATE: _____

SIGNATURE: _____

GENERAL SUMMARY

		AMOUNT, RP.
1.	SUBSTATIONS	_____
2.	OVERHEAD CONTACT SYSTEM	_____
3.	POWER DISTRIBUTION LINES	_____
4.	SIGNALLING SYSTEM	_____
5.	TELECOMMUNICATION SYSTEM	_____
	TOTAL	_____

BILL OF QUANTITIES

BIDDER: _____

DATE: _____

SIGNATURE: _____

1. SUBSTATIONS

PAY ITEM No.	REF. SPEC. NO.	DESCRIPTION OF ITEM	ESTIMATED QUANTITY	UNIT	UNIT PRICE		AMOUNT		
					L.C. RP.	F.C. US$	L.C. RP.	F.C. US$	TOTAL RP.
1.01	008,303	PRESTRESSED CONCRETE PILE	1,216	L.M.					
1.02	004,012 019,021 303	CONCRETE FOUNDATIONS	505	C.M.					
1.03	303,303	SUBSTATION EQUIPMENT							
a.		20 KV CUBICLE	1	L.S.					
b.		DC TRANSFORMING EQUIPMENT	1	L.S.					
c.		DC FEEDER CUBICLE	1	L.S.					
d.		6 KV DISTRIBUTION EQUIPMENT	1	L.S.					
e.		LOCAL POWER EQUIPMENT	1	L.S.					
f.		REMOTE CONTROL PANEL	1	L.S.					
1.04	005,302 303	POWER CABLES							
a.		22 KV CV 1 - CORE 150 mm^2	500	L.M.					
b.		3.3 KV CV 1 - CORE 300mm^2	400	L.M.					
c.		3.3 KV CV 1 - CORE 25 mm^2	150	L.M.					
d.		6.6 KV CV 1 - CORE 35 mm^2	100	L.M.					
1.05	005,302 303	CONTROL CABLE	4,400	L.M.					
1.06	004,005 302,303	GROUNING DEVICES	1	L.S.					
1.07	303	MISCELLANEOUS DEVICES	1	L.S.					
1.08	008,303	PRESTRESSED CONCRETE PILE	600	L.M.					
1.09	004,012 019,021 303	CONCRETE FOUNDATIONS	280	C.M.					

BILL OF QUANTITIES

BIDDER: _____

DATE: _____

SIGNATURE: _____

1. SUBSTATIONS

PAY ITEM No.	REF. SPEC. NO.	DESCRIPTION OF ITEM	ESTIMATED QUANTITY	UNIT	UNIT PRICE		AMOUNT		
					L.C. RP.	F.C. US$	L.C. RP.	F.C. US$	TOTAL RP.
1.10	303	SUBSTATION EQUIPMENT							
a.		20 KV CUBICLE	1	L.S.					
b.		DC TRANSFORMING EQUIPMENT	1	L.S.					
c.		DC FEEDER CUBICLE	1	L.S.					
d.		6 KV DISTRIBUTION EQUIPMENT	1	L.S.					
e.		LOCAL POWER EQUIPMENT	1	L.S.					
f.		REMOTE CONTROL PANEL	1	L.S.					
1.11	005,302 303	POWER CABLES							
a.		22 KV CV 1 - CORE 150 mm^2	200	L.M.					
b.		3.3 KV CV 1 - CORE 300mm^2	150	L.M.					
c.		3.3 KV CV 1 - CORE 25 mm^2	100	L.M.					
1.12	005,302 303	CONTROL CABLES	2,800	L.M.					
1.13	004,005 302,303	GROUNDING DEVICES	1	L.S.					
1.14	303	MISCELLANEOUS DEVICES	1	L.S.					
1.15	008,303	PRESTRESSED CONCRETE PILE	390	L.M.					
1.16	004,012 019,021 303	CONCRETE FOUNDATIONS	295	C.M.					
1.17	303	SUBSTATION EQUIPMENT							
a.		20 KV CUBICLE (REPLACEMENT)	1	L.S.					

BILL OF QUANTITIES

BIDDER: _____

DATE: _____

SIGNATURE: _____

1. SUBSTATIONS

PAY ITEM No.	REF. SPEC. NO.	DESCRIPTION OF ITEM	ESTIMATED QUANTITY	UNIT	UNIT PRICE		AMOUNT		
					L.C. RP.	F.C. US$	L.C. RP.	F.C. US$	TOTAL RP.
b.		DC TRANSFORMING EQUIPMENT	1	L.S.					
c.		DC FEEDER CUBICLE	1	L.S.					
d.		6 KV DISTRIBUTION EQUIPMENT	1	L.S.					
e.		LOCAL POWER EQUIPMENT (REPLACEMENT)	1	L.S.					
f.		REMOTE CONTROL PANEL (MODIFICATION)	1	L.S.					
1.18	005,302 303	POWER CABLES							
a.		22 KV CV 1 - CORE 150 mm^2	700	L.M.					
b.		3.3 KV CV 1 - CORE 300mm^2	200	L.M.					
c.		6.6 KV CV 1 - CORE 35 mm^2	100	L.M.					
d.		3.3 KV CV 1 - CORE 300mm^2 (FOR TEMPORARY WORK)	1	L.S.					
1.19	005,302 303	CONTROL CABLES	5,200	L.M.					
1.20	004,005 302,303	GROUNDING DEVICES	1	L.S.					
1.21	303	MISCELLANEOUS DEVICES	1	L.S.					
1.22	303	REMOTE SUPERVISORY CONTROL PANEL	1	L.S.					
1.23	005,302 303	CONTROL CABLES	200	L.M.					
1.24	303	LINKED BREAKING DEVICE	1	L.S.					

BILL OF QUANTITIES

BIDDER: _____

DATE: _____

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1. SUBSTATIONS

PAY ITEM No.	REF. SPEC. NO.	DESCRIPTION OF ITEN	ESTIMATED QUANTITY	UNIT	UNIT PRICE		AMOUNT		
					L.C. RP.	F.C. US$	L.C. RP.	F.C. US$	TOTAL RP.
1.25	303	LINKED BREAKING DEVICE	1	L.S.					
1.26	303	TOOLS AND INSTRUMENTS	1	L.S.					
		TOTAL OF SUBSTATIONS							

BILL OF QUANTITIES

BIDDER: _____

DATE: _____

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2. OVERHEAD CONTACT SYSTEM

PAY ITEM No.	REF. SPEC. NO.	DESCRIPTION OF ITEM	ESTIMATED QUANTITY	UNIT	UNIT PRICE		AMOUNT		
					L.C. RP.	F.C. US$	L.C. RP.	F.C. US$	TOTAL RP.
2.01	004,012 019,021 022,304	SUPPORTING STRUCTURES	422	S					
2.02	304	OVERHEAD CATENARIES	26,200	L.M.					
2.03	005,302 304	FEEDER WIRES	37,200	L.M.					
2.04	004,302 304	MISCELLANEOUS DEVICES	1	L.S.					
2.05	004,302 304	REFORMATION WORK IN JAYAKARTA	1	L.S.					
		TOTAL OF OVERHEAD CONTACT SYSTEM							

BILL OF QUANTITIES

BIDDER: _____

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3. POWER DISTRIBUTION LINES

PAY ITEM No.	REF. SPEC. NO.	DESCRIPTION OF ITEM	ESTIMATED QUANTITY	UNIT	UNIT PRICE		AMOUNT		
					L.C. RP.	F.C. US$	L.C. RP.	F.C. US$	TOTAL RP.
3.01	004,302 305	OVERHEAD DISTRIBUTION LINES	58,455	L.M.					
3.02	004,302 305	OVERHEAD GROUND WIRES	22,280	L.M.					
3.03	004,005 302,305	POWER CABLES -							
a.		6.6 KV CV CABLES	2,979	L.M.					
b.		600 V NYY CABLES	240	L.M.					
3.04	302,305	DISTRIBUTION EQUIPMENT	1	L.S.					
3.05	302,305	POWER DISTRIBUTION CUBICLES	1	L.S.					
		TOTAL OF POWER DISTRIBUTION LINES							

BILL OF QUANTITIES

BIDDER: _____

DATE: _____

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4. SIGNALLING SYSTEM AND SAFETY FACILITIES

PAY ITEM No.	REF. SPEC. NO.	DESCRIPTION OF ITEM	ESTIMATED QUANTITY	UNIT	UNIT PRICE		AMOUNT		
					L.C. RP.	F.C. US$	L.C. RP.	F.C. US$	TOTAL RP.
4.01	306	RELAY INTERLOCKING DEVICES -							
a.		4 ROUTE OR LESS	3	S					
b.		10 ROUTE OR LESS	2	S					
4.02	307	COLOUR LIGHT SIGNALS							
a.		2 ASPECTS	30	S					
b.		3 ASPECTS	4	S					
4.03	308	SHUNTING SIGNALS -							
a.		TYPE A	2	S					
b.		TYPE B	2	S					
4.04	309	EMERGENCY SIGNAL	20	S					
4.05	004,022 307	SIGNAL MAST	35	S					
4.06	004,022 310	MARKERS -							
a.		RESTRICTED SPEED RELEASE MARKER	4	No.					
b.		SHUNTING LIMIT MARKER	1	No.					
c.		CAR STOP MARKER	3	No.					
4.07	311	ELECTRIC SWITCH MACHINE	20	S					
4.08	312	TRACK CIRCUITS -							
a.		TYPE A SINGLE TRACK	12	S					
b.		- DO - DOUBLE TRACK	24	S					

BILL OF QUANTITIES

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DATE: _____

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4. SIGNALLING SYSTEM AND SAFETY FACILITIES

PAY ITEM No.	REF. SPEC. NO.	DESCRIPTION OF ITEM	ESTIMATED QUANTITY	UNIT	UNIT PRICE		AMOUNT		
					L.C. RP.	F.C. US$	L.C. RP.	F.C. US$	TOTAL RP.
c.		TYPE B DIVIDED FREQUENCY	4	S					
d.		- DO - COMMERCIAL FREQUENCY	1	S					
4.09	004,022 313	LEVEL CROSSING EQUIPMENT-							
a.		CROSSING SIGNAL	30	No.					
b.		CROSSING BARRIER, A TYPE	22	No.					
c.		- DO - , B TYPE	14	No.					
d.		X-MARK INDICATOR	28	No.					
e.		TRAIN DETECTOR	35	No.					
f.		CONTROL DEVICE	15	No.					
4.10	314	ATS WAYSIDE DEVICE	47	S					
4.11	315	STAND -BY GENERATOR	2	S					
4.12	316	APPARATUS CASE	20	S					
4.13	005,317	SIGNAL CABLES -							
a.		GENERAL TYPE CABLE	25,500	L.M.					
b.		DIRECT BURIAL TYPE CABLE	17,800	L.M.					
c.		TROUGH	8,100	L.M.					
4.14	318	IMPROVEMENT OF EXISTING LEVEL CROSSING EQUIPMENT	1	L.S.					
		TOTAL OF SIGNALLING SYSTEM AND SAFETY FACILITIES							

BILL OF QUANTITIES

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DATE: _____

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5. TELECOMMUNICATION SYSTEM

PAY ITEM No.	REF. SPEC. NO.	DESCRIPTION OF ITEM	ESTIMATED QUANTITY	UNIT	UNIT PRICE		AMOUNT		
					L.C. RP.	F.C. US$	L.C. RP.	F.C. US$	TOTAL RP.
5.01	319	TELEPHONE -							
a.		AUTOMATIC TELEPHONE	17	S					
b.		DISPATCHING TELEPHONE	10	S					
c.		DIRECT LINE TELEPHONE	23	S					
d.		PORTABLE TELEPHONE	20	S					
5.02	320	PUBLIC ADDRESS EQUIPMENT -							
a.		MASTER EQUIPMENT	2	No.					
b.		OPERATION PANEL	5	No.					
c.		DYNAMIC TYPE SPEAKER	2	No.					
d.		TRUMPET TYPE SPEAKER	10	No.					
e.		MICROPHONE BOX	8	No.					
5.03	321	ELECTRIC CLOCK -							
a.		MASTER CLOCK	1	No.					
b.		RELAY SLAVE CLOCK	3	No.					
c.		SLAVE CLOCK SINGLE FACE 300 MM DIAMETER	16	No.					
d.		SLAVE CLOCK DOUBLE FACE 600 MM DIAMETER	5	No.					
5.04	322	CABLE CARRIER EQUIPMENT -							
a.		TERMINAL EQUIPMENT	2	No.					
b.		LINE REPEATER EQUIPMENT, INDOOR TYPE	3	No.					

BILL OF QUANTITIES

BIDDER: _____

DATE: _____

SIGNATURE: _____

5. TELECOMMUNICATION SYSTEM

PAY ITEM No.	REF. SPEC. NO.	DESCRIPTION OF ITEM	ESTIMATED QUANTITY	UNIT	UNIT PRICE		AMOUNT		
					L.C. RP.	F.C. US$	L.C. RP.	F.C. US$	TOTAL RP.
c.		LINE REPEATER EQUIPMENT, OUTDOOR TYPE	6	No.					
5.05	005,323	DIRECT BURIAL MAIN TELE-COM CABLE (30 PAIRS UP TO 40 PAIRS)	12,800	L.M.					
5.06	323	MAIN TELECOM CABLE (30 PAIRS UP TO 40 PAIRS, WITH-IN DUCT)	9,000	L.M.					
5.07	323	TELECOM BRANCH CABLE (10 PAIRS)	800	L.M.					
5.08	323	LOCAL TELECOM CABLE (2 PAIRS UP TO 20 PAIRS)	6,000	L.M.					
5.09	323	OVERHEAD TELECOM CABLE	3,800	L.M.					
5.10	005,323	TELECOM DUCTS (TROUGH)	210	L.M.					
5.11	004,302	HANDHOLE	29	No.					
5.12	004,323	DISTRIBUTION BOXES -							
a.		INDOOR TYPE, UP TO 20 P	5	No.					
b.		INDOOR TYPE, UP TO 100 P	6	No.					
c.		OUTDOOR TYPE, UP TO 10 P	2	No.					
5.13	004,323	TERMINAL BOX AND OUTDOOR TYPE TELEPHONE BOX -							
a.		POLE MOUNTING TYPE	31	No.					
b.		WALL MOUNTING TYPE	11	No.					

BILL OF QUANTITIES

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5. TELECOMMUNICATION SYSTEM

PAY ITEM No.	REF. SPEC. NO.	DESCRIPTION OF ITEM	ESTIMATED QUANTITY	UNIT	UNIT PRICE		AMOUNT		
					L.C. RP.	F.C. US$	L.C. RP.	F.C. US$	TOTAL RP.
5.14	324	TRAIN BOARDING INFORMATION EQUIPMENT -							
a.		OPERATION PANEL	2	No.					
b.		INDICATION PANEL	4	No.					
		TOTAL OF TELECOMMUNICATION SYSTEM