Table 2-3-5 Details of 33 kV Transmission Equipment and Materials

Item	Quantity	Specifications
(1) Pole-mounted transformers	4 units	(Area A-1:1 unit, Area A-2:3 units)
1) Type		Oil-insulated; outdoor type
2) Phase; transformation ratio		Single phase; 33,000/240 V
3) Capacity		25 kVA
(2) Pole-mounted transformers	11 units	(Area A-1:4 units, Area A-2:7 units)
1) Type		Oil-insulated; outdoor type
2) Phase; transformation ratio		3 phase; 33,000/415-240 V
3) Capacity		50 kVA
(3) Pole-mounted transformers	20 units	(Area A-1:9 units, Area A-2:2 units, Area B:5 units, Area C:4 units)
1) Type		Oil-insulated; outdoor type
2) Phase; transformation ratio		3 phase; 33,000/415-240 V
3) Capacity		100 kVA
(4) Pole-mounted transformers	11 units	(Area A-1:4 units, Area A-2:5 units, Area B:1 unit, Area C:1 unit)
1) Type		Oil-insulated, outdoor type
2) Phase; transformation ratio		3 phase; 33,000/415-240 V
3) Capacity		200 kVA
(5) Bare cable for overhead transmission lines	691 km	(Area A-1:318 km, Area A-2:152 km, Area B:107 km, Area C:114 km)
1) Type		AAAC
2) Size		95 mm^2
(6) Overead grounding conductor	5,700 m	(Area A-1:2,200 m, Area A-2:2,100 m, Area B:800 m, Area C:600 m)
1) Type		Fused-zinc plated steel wire
2) Size		55 mm^2
(7) Insulators	5,364 pieces	(Area A-1:2,421 pieces, Area A-2:1,251 pieces, Area B:603 pieces, Area C:1,089 pieces)
1) Type		33 kV suspension insulator
(8) Insulators	6,270 pieces	(Area A-1:2,937 pieces, Area A-2:1,368 pieces, Area B:867 pieces, Area C:1,098 pieces)
1) Type		33 kV pin insulator
(9) Cut-out switches	138 units	(Area A-1:54 units, Area A-2:51 units, Area B:18 units, Area C:15 units)
1) Type		Outdoor type; with fuse
2) Rated current		100 A
3) Rated voltage		36 kV
4) Breaking current		8 kA
(10) Load-break switches	17 units	(Area A-1:9 units, Area A-2:5 units, Area B:1 unit, Area C:2 units)
1) Type		Hand-operated type
2) Rated current		630 A
3) Rated voltage		33 kV
4) Allowable short-circuit current		16 kA
(11) Surge arresters	189 units	(Area A-1:81 units, Area A-2:66 units, Area B:21 units, Area C:21 units)
1) Type		Outdoor, gapless type
2) Discharge voltage		5 kA
3) Rated voltage		33 kV
(12) Pole-mounting metalware and others	one set	Pole-mounting metalware; conductor connecting sleeve; clamp; grounding TV wire; other materials

Table 2-3-6 Details of Maintenance Vehicles

Item	Quantity	Specifications
(1) Trucks with three ton crane	2 units	
1) Crane capacity		Approx. 3 tons x 3.45 m = approx. 10 ton-m
2) Hoisting capacity		Approx. 3 tons

(5) Substation Construction Plan

In the Project, the Japanese side will be responsible for the extension of the Njeru Substation, construction of the new Kayunga Substation, voltage regulator installation at the Hoima Substation and voltage regulator installation at Wabigalo. Special attention will be paid to the following issues in conducting the work.

1) Basic Issues

As in the case of the procurement of the 33 kV transmission equipment and materials [see 2.3.2-(4)-1)], special attention will be paid to ensure the ease and safety of equipment operation and maintenance. Outdoor type enclosed switchgears will be used at all four sites to reduce the installation period.

2) Step Voltage Regulator (Autotransformer) Capacity

The required step voltage regulator capacity is calculated by multiplying the total transformer capacity on the load side by the factor which takes the demand rate. This factor is 0.85 based on the past performance of step voltage regulators in Uganda.

(a) Step Voltage Regulator at Hoima Substation

Given the total capacity of the transformers to be connected to the step voltage regulator at the Hoima Substation as listed below, the capacity of the planned step voltage regulator is set at 5 MVA to approximate the required capacity.

Area	Transformer Capacity	Remarks
Hoima Substation	1.0 MVA	
Masindi Substation	2.5 MVA	
Kinyala Substation	1.0 MVA	
Project Site (Area C)	0.6 MVA	Total pole-mounted transformer capacity
Total Transformer Capacity	5.1 MVA	
Estimated Load of Step Voltage Regulator	4.3 MVA	(5.1 MVA x 0.85)
Required Step Voltage Regulator Capacity	5.0 MVA	

(b) Voltage Regulator at Wabigalo

Given the total capacity of the transformers to be connected to the step voltage regulator at Wabigalo as listed below, the capacity of the planned step voltage regulator is set at 3 MVA to approximate the required capacity.

Area	Transformer Capacity	Remarks
Nakasongola Substation	2.0 MVA	2.0 MVA x 2/ 1 for duty, 1 for stand-by
Project Site (Area C)	0.7 MVA	Total pole-mounted transformer capacity
Total Transformer Capacity	2.7 MVA	
Estimated Load of Step Voltage Regulator	2.3 MVA	(2.7 MVA x 0.85)
Required Step Voltage Regulator Capacity	3.0 MVA	

3) Layout Plan

(a) Extension of Njeru Substation

The planned equipment will be installed using available land on the Njeru Substation premises. The 33 kV circuit breaker panel will be installed using the foundations constructed during the previous aid project to line up with the existing 33 kV circuit breaker panel (see Drawing N-2).

(b) Construction of New Kayunga Substation

The new Kayunga Substation will be constructed on the site acquired by the UEB in the suburb of Kayunga. The site will be prepared by the UEB prior to the commencement of the work by the Japanese side for the Project (see Drawing K-2).

(c) Installation of Hoima Booster Station

The new booster station will be constructed using vacant or open space on the Hoima Substation premises (see Drawing H-2).

(d) Installation of Wabigalo Booster Station

The new booster station will be constructed at the branching point (Wabigalo) of the 33 kV transmission line to the project sites (see Drawing W-2).

4) Connection to SCADA System

The following work will be conducted to enable signal exchanges with the SCADA system of the UEB.

(a) Njeru Substation

The new switchgear to be procured and installed under the Project will be connected to the existing SCADA interface panel using the control cable for necessary signal exchanges.

(b) Kayunga Substation

As the Kayunga Substation will be newly constructed, a SCADA interface panel will be installed for signal exchanges required by the SCADA system through the interface panel.

5) Basic Specifications of Substation Construction

The facilities for each substation, etc. are planned based on the details given in the following tables.

- Njeru Substation : Table 2-3-7
- Kayunga Substation : Table 2-3-8
- Hoima Booster Station : Table 2-3-9
- Wabigalo Booster Station : Table 2-3-10

Table 2-3-7 Details of Njeru Substation Extension Work

Item	Quantity	Specifications
(1) Construction of site facilities		
1) Foundations to support surge arresters	one set	The existing foundations constructed under a previous Japanese aid project will be used for the 33 kV circuit breaker panel
(2) Procurement and installation of 33 kV switchgear panel	1	
1) Type		Outdoor, enclosed, air-insulation type feeder panel (single face)
2) Number of faces		
(3) Procurement and installation of surge arresters	3	
1) Rated voltage		30 kV (r.m.s.): minimum
2) Rated discharge current		10 kA
3) Accessories		Mounting metalware; frame
(4) Procurement and installation of distribution equipment, etc.		
1) Low voltage cable	one set	600 V XLPE insulation, PVC sheath, copper conductor cable
2) Control cable	one set	As above
3) Miscellaneous materials for distribution work	one set	
(5) Procurement of connection materials for 33 kV transmission line		Installation work to be conducted by the UEB
1) 33 kV cable	50 m	33 kV XLPE insulation, PVC sheath, copper conductor cable (CVT: 185 mm^2)
2) Terminal materials for 33 kV cable	one set	Terminal board, support and conduit, etc.
3) Connection materials between surge arrester and aerial cable (conductor and clamp, etc.)	one set	To be supplied as materials for 33 kV transmission line

Table 2-3-8 Details of New Kayunga Substation Construction Work

Item	Quantity	Specifications
(1) Construction of site facilities		
1) Equipment foundations	one set	
2) Grounding network	one set	Bare copper cable
3) De-oiling tank	one set	
(2) Procurement and installation of main transformer	1	
1) Type		Outdoor, oil self-cooling, on load top changer
2) Rated voltage		33 kV/11 kV
Rated capacity		2.5 MVA
Taps		17 taps (+6 taps x 1.25%, -10 taps x 1.25%)
Connection (vector symbol)		Y, yn0, D11
Temperature rise		
- Winding temperature		65°C
- Oil temperature		60°C
Impedance voltage		6.7% ± 10%
(3) Procurement and installation of 33 kV switchgear panels	one set	
1) Type		Outdoor, enclosed, air insulation type
2) Number of panels		- Feeder panels (4 units) - Main transformer feeder panel (one unit) - Station auxiliary equipment panel (one unit)
(4) Procurement and installation of 11 kV switchgear panel	one set	
1) Type		Outdoor, enclosed, air insulation type
2) Number of panels		- Feeder panels (4 units) - Main transformer feeder panel (one unit) - Station transformer feeder panel (one unit) - DC equipment panel (one unit) - SCADA interface panel (one unit)
(5) Procurement and installation of surge arresters	3	
1) Rated voltage		30 kV (r.m.s.): minimum
2) Rated discharge current		10 kA
3) Accessories		Mounting metalware; frame
(6) Procurement and installation of distribution equipment, etc.		
1) 33 kV cable for main transformer primary	one set	33 kV XLPE insulation, PVC sheath, copper conductor cable
2) Terminal materials for 33 kV cable	one set	
3) 11 kV cable for main transformer secondary	one set	11 kV XLPE insulation, PVC sheath, copper conductor cable
4) Terminal materials for 11 kV cable	one set	
5) Low voltage cable	one set	600 V XLPE insulation, PVC sheath, copper conductor cable
6) Control cable	one set	600 V XLPE insulation, PVC sheath, copper conductor cable
7) Miscellaneous materials for distribution work	one set	
(7) Procurement of connection materials for 33 kV transmission line		(To be installed by the UEB)
1) 33 kV cable	200 m	33 kV XLPE insulation, PVC sheath, copper conductor cable (CVT: 185 mm^2)
2) Terminal materials for 33 kV cable	4 sets	Terminal boards and conduits, etc.
3) Connection materials between surge arresters and aerial cable (conductor and clamp, etc.	one set	To be supplied as materials for 33 kV transmission line)

Table 2-3-9 Details of New Booster Station in Hoima Substation

Item	Quantity	Specifications
(1) Construction of site facilities		
1) Equipment foundations	one set	
2) Grounding network	one set	Bare copper cables
3) De-oiling tank	one set	
(2) Procurement and installation of voltage regulators	1	
1) Type		Outdoor, oil self-cooling
2) Rated voltage		33 kV
Rated capacity		5 MVA
Taps		17 taps (+2 taps x 1.5%, -14 taps x 1.5%)
Adjustment range		+3.0% - -21.0%
Connection		Y connection, auto-transformer
Temperature rise		
- Winding temperature		65°C
- Oil temperature		60°C
(3) 33 kV switchgear panels	one set	
1) Type		Outdoor, enclosed, air insulation type
2) Number of panels		- Incoming panel (one unit) - Instrumentation panel (one unit) - Station auxiliary equipment panel (one unit) - Feeder panel (one unit)
(4) Procurement and installation of surge arresters	9	
1) Rated voltage		30 kV (r.m.s.): minimum
2) Rated discharge current		10 kA
3) Accessories		Mounting metalware; frame
(5) Procurement and installation of distribution equipment, etc.		
1) 33 kV cable for transformer primary and secondary	one set	33 kV XLPE insulation, PVC sheath, copper conductor cable
2) Low voltage cable	one set	600 V XLPE insulation, PVC sheath, copper conductor cable
3) Control cable	one set	600 V XLPE insulation, PVC sheath, copper conductor cable
4) Miscellaneous materials for distribution work	one set	
(6) Procurement of connection materials between surge arresters and aerial cable (conductor and clamp, etc.)		(To be installed by the UEB)
1) 33 kV cable	150 m	33 kV XLPE insulation, PVC sheath, copper conductor cable (CVT: 185 mm^2)
2) Terminal materials for 33 kV cable	3 sets	Terminal boards and conduits, etc.
3) Connection materials between surge arresters and aerial cable (conductor and clamp, etc.)	one set	To be supplied as materials for 33 kV transmission line

Table 2-3-10 Details of New Wabigalo Booster Station

Item	Quantity	Specifications
(1) Construction of site facilities		
1) Equipment foundations	one set	
2) Grounding network	one set	Bare copper cables
3) De-oiling tank	one set	
(2) Procurement and installation of voltage regulators	1	
1) Type		Outdoor, oil self-cooling
2) Rated voltage		33 kV
Rated capacity		3 MVA
Taps		17 taps (+4 taps x 1.25%, -12 taps x 1.25%)
Adjustment range		+5.0% - -15.0%
Connection		Y connection, auto-transformer
Temperature rise		
- Winding temperature		65°C
- Oil temperature		60°C
(3) 33 kV switchgear panels	one set	
1) Type		Outdoor, enclosed, air insulation type
2) Number of panels		- Incoming panel (one unit) - Instrumentation panel (one unit) - Station auxiliary equipment panel (one unit) - Feeder panel (one unit)
(4) Procurement and installation of surge arresters	6	
1) Rated voltage		30 kV (r.m.s.): minimum
2) Rated discharge current		10 kA
3) Accessories		Mounting metalware; frame
(5) Procurement and installation of distribution equipment, etc.		
1) 33 kV cable for transformer primary and secondary	one set	33 kV XLPE insulation, PVC sheath, copper conductor cable
2) Low voltage cable	one set	600 V XLPE insulation, PVC sheath, copper conductor cable
3) Control cable	one set	600 V XLPE insulation, PVC sheath, copper conductor cable
4) Miscellaneous materials for distribution work	one set	
(6) Procurement of connection materials between surge arresters and aerial cable (conductor and clamp, etc.)		(To be installed by the UEB)
1) 33 kV cable	150 m	33 kV XLPE insulation, PVC sheath, copper conductor cable (CVT: 185 mm^2)
2) Terminal materials for 33 kV cable	3 sets	Terminal boards and conduits, etc.
3) Connection materials between surge arresters and aerial cable (conductor and clamp, etc.)	one set	To be supplied as materials for 33 kV transmission line

(6) Basic Design Drawings

The basic design drawings for the Project are listed below.

Drg.No	Title
1) 33 kV Transmission Line	
G-1	Transmission and Distribution Network in Uganda
T-1	Pole Type A
T-2	Pole Type UEB-1
T-3	Pole Type UEB-2
T-4	Pole Type UEB-3
T-5	Pole Type UEB-5
T-6	Pole Type UEB-6
T-7	Pole Type E
T-8	Pole Type G
T-9	Pole Type F
T-10	Pole Type H
2) Njeru Substation	
N-1	Single-Line Diagram (Njeru Substation)
N-2	Equipment Layout (Njeru Substation)
3) Kayunga Substation	
K-1	Single-Line Diagram (Kayunga Substation)
K-2	Equipment Layout (Kayunga Substation)
4) Hoima Booster Station	
H-1	Single-Line Diagram (Hoima Substation)
H-2	Equipment Layout (Hoima Substation)
5) Wabigalo Booster Station	
W-1	Single-Line Diagram (Wabigalo Booster Station)
W-2	Equipment Layout (Wabigalo Booster Station)

LEGEND

SCOPE OF PROJECT

(PP1995-6) PREVIOUS PROJECT YEAR

P/S or S/S

Transformer Auto Trans.

Circuit Breaker

132kV Transmission Line

33kV Transmission/Distribution Line

11kV Distribution Line

132/33kV Planed route

HOIMA S/S
5MVA
Masindi S/S
Kinyala S/S
Apac S/S
C Area (HOIMA)
Hoima - Munteme(33kV, 33km)
Kakumira S/S
WABIGALO CONNECTING POINT
Busunju S/S
B Area (NAKASONGOLA)
Migera - Wabigalo(33kV, 31km)
3MVA
Gulu S/S
Lira S/S
Lira-Spinning S/S
Soroti S/S
Mbale S/S
Kumi S/S
Serere S/S
Kalaki S/S
Opuyo S/S
132kV
Tororo S/S
132kV to Kenya
Mubende S/S
Nakasongola S/S
Mityana S/S
2.5MVA
5MVA
Bombo S/S
Fort Portal S/S
Nkonge S/S
Kampala North S/S
Owen Falls P/S
Kibumba S/S
Iganga S/S
Nkenda S/S
Kabulasoke SS
(PP1995-6)
Ntinda S/S
Masaka West S/S
Kawanda S/S
(PP1995-6)
Kireka S/S
Kasese S/S
Kawala S/S
(PP1995-6)
Nyanza Textiles S/S
Magamaga S/S
Kamuli S/S
A2 Area (KAMULI)
Jinja-Budondo-Mbulamuti
(33kV, 44km)
BUWENGE CONNECTING POINT
Kakira S/S
Kiriri S/S
open
Lugogo S/S
(PP1993-4)
Queensway S/S
Portbell S/S
Mulco Textiles S/S
Rukungiri P/S
Mbarara S/S
Masaka Center S/S
132kV to Tanzania
Mutundwe S/S
Kisugu S/S
(PP1995-6)
New Kayunga S/S
Njeru - Kayunga
- Bale
(33kV, 92km)
A1 Area (MUKONO)
Njeru S/S
(PP1995-6)
Maziba George P/S
Kampala South S/S
(PP1995-6)
Gaba S/S
33kV EXPANSOIN SWGR
Jinja Industrial S/S
Kajjansi S/S
Kisubi S/S
(PP1995-6)
Enteebe S/S

DWG NO. : G-1

TRANSMISSION AND DISTRIBUTION NETWORK IN UGANDA

LEGEND

SCOPE OF PROJECT

(PP1995-6) PREVIOUS PROJECT YEAR

P/S or S/S

Transformer, Auto Trans., Circuit Breaker, 132kV Transmission Line, 33kV Transmission/Distribution Line, 11kV Distribution Line, 132/33kV Planed route

HOIMA S/S, 5MVA, Masindi S/S, Kinyala S/S, Apac S/S

C Area (HOIMA)

Hoima - Muntemo(33kV, 33km)

WABIGALO CONNECTING POINT

B Area (NAKASONGOLA)

Migera - Wabigalo(33kV, 31km)

3MVA

Nakasongola S/S

Gulu S/S

Lira S/S

Lira-Spinning S/S

Soroti S/S

Mbale S/S

Serere S/S

Kumi S/S

Kalaki S/S

Opuyo S/S

Tororo S/S

132kV to Kenya

Kibumba S/S

Iganga S/S

Magamaga S/S

Kakira S/S

Busunju S/S

Mityana S/S

Bombo S/S

2.5MVA

5MVA

Kampala North S/S

Kawanda S/S (PP1995-6)

Kawala S/S (PP1995-6)

(PP1993-4) Queensway S/S

Lugogo S/S

Kisugu S/S (PP1995-6)

Kampala South S/S (PP1995-6)

Kajjansi S/S

Kisubi S/S (PP1995-6)

Entebbe S/S

Gabu S/S

Portbell S/S

Kireka S/S

(PP1995-6) Ntinda S/S

Oren Falls P/S

Nyanza Textiles S/S

Mulco Textiles S/S

Kamuli S/S

A2 Area (KAMULI)

Jinja-Budondo-Mbulamuti (33kV, 44km)

BUWENGE CONNECTING POINT

New Kayunga S/S

Njeru - Kayunga - Bale (33kV, 92km)

A1 Area (MUKONO)

Njeru S/S (PP1995-6)

33kV EXPANSOIN SWGR

Jinja Industrial S/S

Kakumira S/S

Mubende S/S

Fort Portal S/S

Nkonge S/S

Nkenda S/S

Kabulasoke SS

Masaka West S/S

Kiriri S/S

open

Masaka Center S/S

132kV to Tanzania

Kasese S/S

Rukungiri P/S

Mbarara S/S

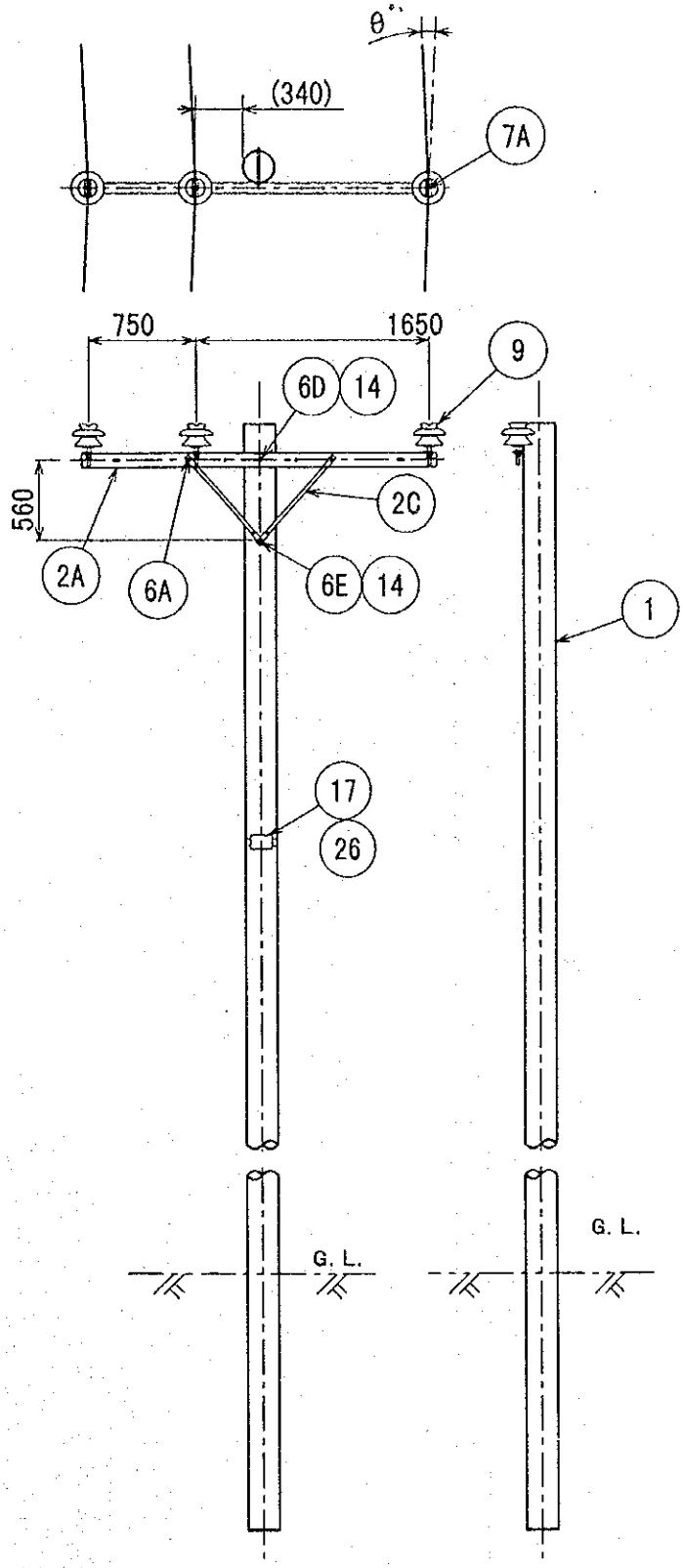
Maziba George P/S

Mutundwe S/S

132kV

DWG NO. : G-1

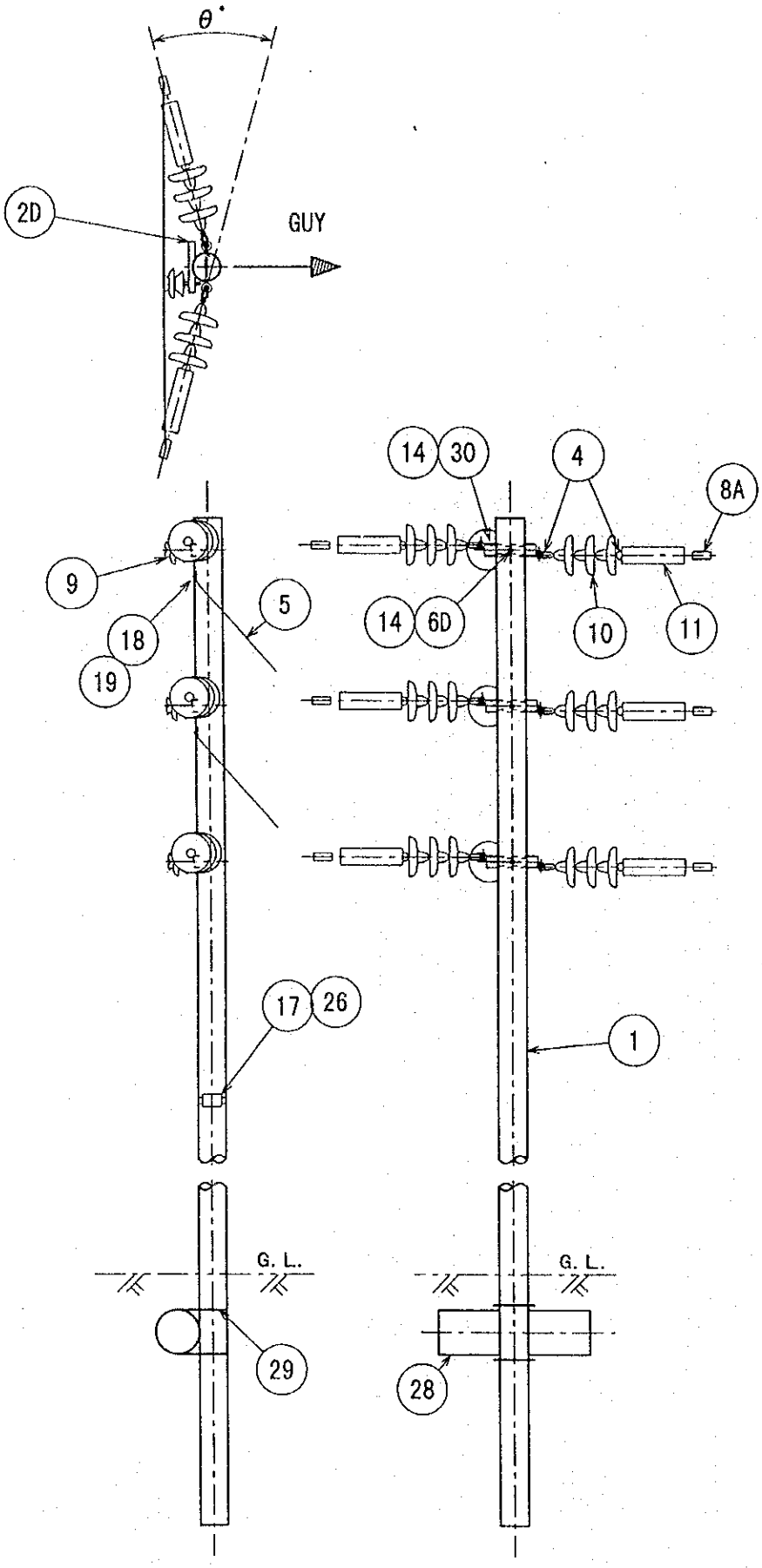
TRANSMISSION AND DISTRIBUTION NETWORK IN UGANDA



STRAIGHT LINE POLE $0 \leqq \theta \leqq 5$

PART. NO.	DESCRIPTION	Q'TY
1	WOODEN POLE	1
2A	CROSSARM L100X75X7X2500	1
2C	CROSSARM BRACE	2
6A	BOLT&NUT M16X50(CROSSARM/BRACE)	2
6D	BOLT&NUT M16X350(CROSSARM/POLE)	1
6E	BOLT&NUT M16X400(POLE/BRACE)	1
7A	PREFORMED TOP TIE	3
9	33KV PIN POST INSULATOR	3
14	SQUARE WASHER	2
17	NUMBER PLATE	1
26	STAINLESS BAND L=1200mm	1

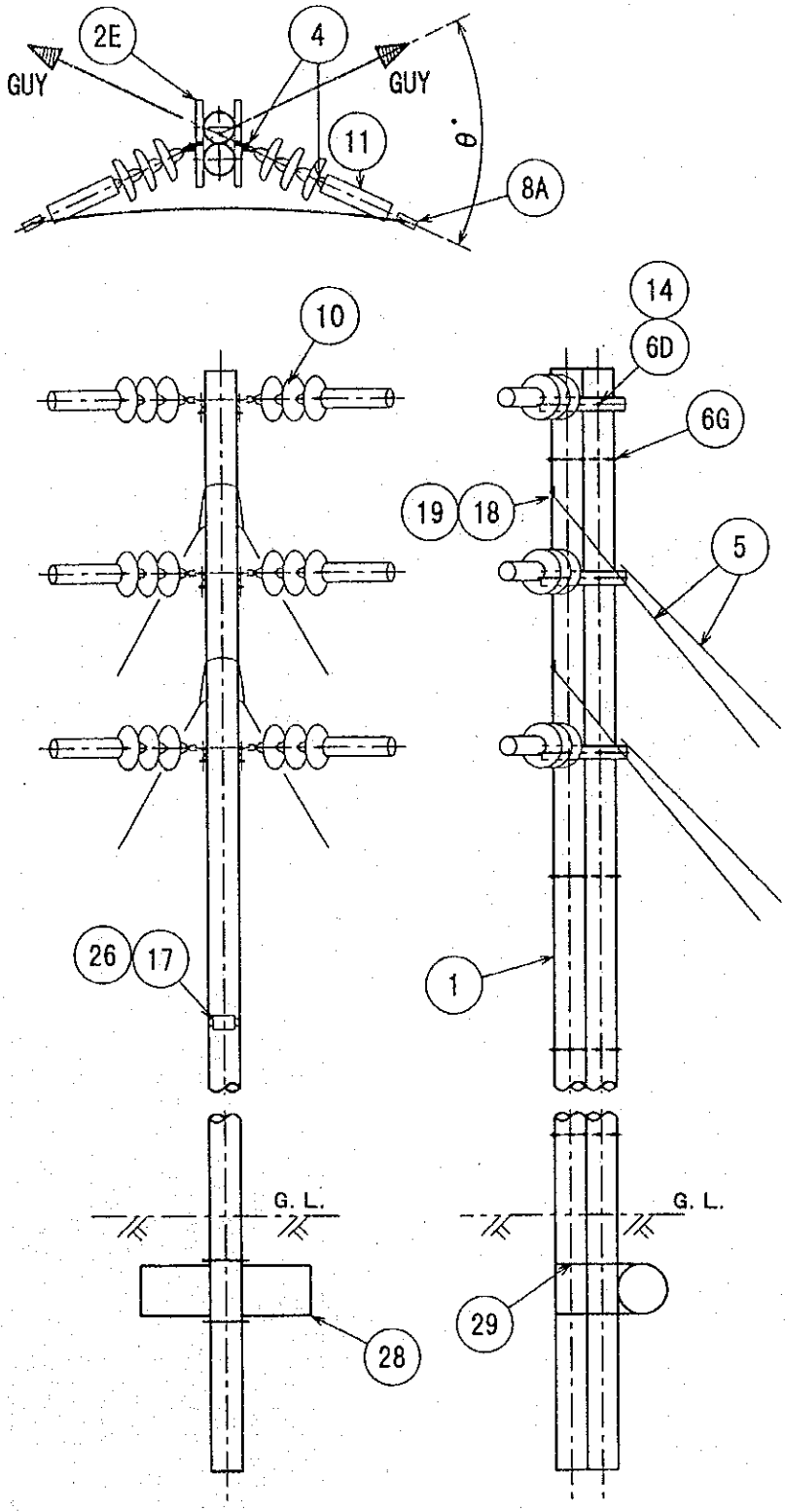
DWG NO.T-1: Pole Type A Intermediate Pole



LIGHT ANGLE LINE POLE 5≦θ≦30

PART. NO.	DESCRIPTION	Q'TY
1	WOODEN POLE	1
2D	CROSSARM C100×50×5×600	3
4	ANCHOR SHACKLE	6
4	BALL CLEVIS	6
4	SOCKET EYE	6
5	STRAIN PLATE	2
5	DEAD END GRIP FOR POLE	2
5	DEAD END GRIP FOR THIMBLE	2
5	DEAD END GRIP FOR INSULATOR	4
5	STAY WIRE 45sq.㎜(20m)	2
5	STAY INSULATOR 33kV	2
5	STAY ROD	2
5	STAY PLATE/STAY ANCHOR	2
5	TURNBACKLE	2
6D	BOLT&NUT M16X350(CROSSARM/POLE)	3
7A	PREFORMED TOP TIE	3
8A	COMPRESSION CONECTOR(A1/A1)	6
9	33kV PIN POST INSULATOR	3
10	DISC INSULATOR	18
11	DEAD END CLAMP	6
14	SQUARE WASHER	9
17	NUMBER PLATE	1
18	NAIL	18
19	STEPLE	8
26	STAINLESS BAND L=1200㎜	1
28	KICKING BLOCK	1
29	IRON WIRE	1
30	EYE BOLT(M20X350)	6

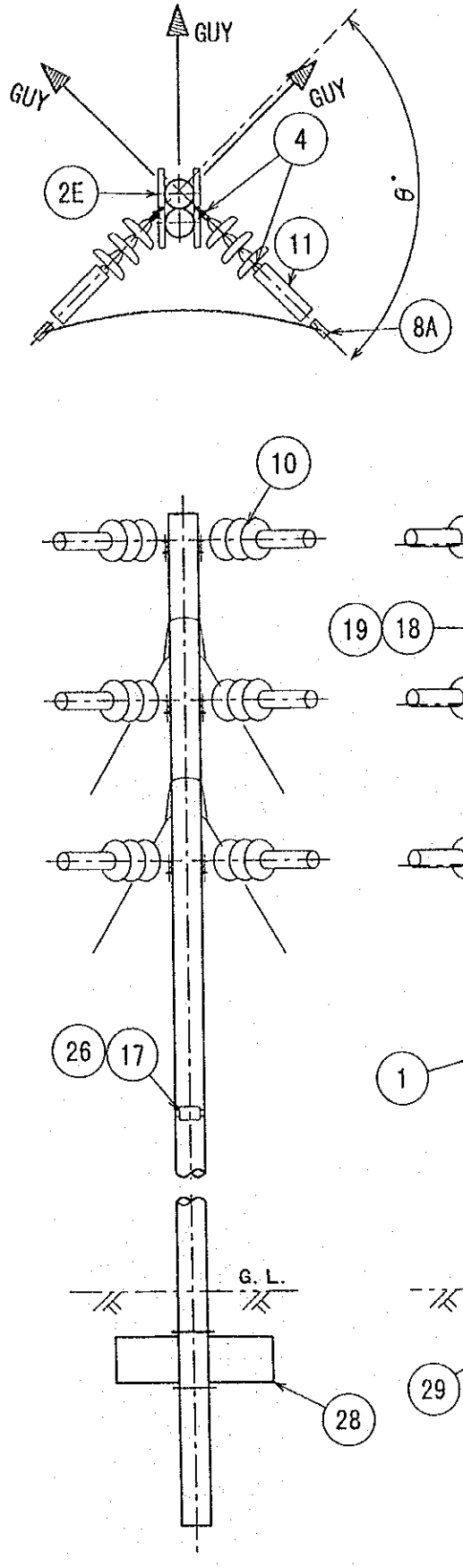
DWG NO.T-2: Pole Type UEB-1 Light Angle Pole



MEDIUM ANGLE LINE POLE 30≦ θ ≦50

PART. NO	DESCRIPTION	Q'TY
1	WOODEN POLE	2
2E	CROSSARM L100×75×7×600	6
4	ANCHOR SHACKLE	6
4	BALL CLEVIS	6
4	SOCKET EYE	6
5	STRAIN PLATE	4
5	DEAD END GRIP FOR POLE	4
5	DEAD END GRIP FOR THIMBLE	4
5	DEAD END GRIP FOR INSULATOR	8
5	STAY WIRE 45sq.㎜(20m)	4
5	STAY INSULATOR 33kV	4
5	STAY ROD	4
5	STAY PLATE/STAY ANCHOR	4
5	TURNBACKLE	4
6D	BOLT&NUT M16X350(CROSSARM/POLE)	6
6G	BOLT&NUT M20X800 WITH SQUARE WASHER	4
8A	COMPRESSION CONECTOR(A1/A1)	6
10	DISC INSULATOR	18
11	DEAD END CLAMP	6
14	SQUARE WASHER	12
17	NUMBER PLATE	1
18	NAIL	36
19	STEPLE	16
26	STAINLESS BAND L=1200㎜	1
28	KICKING BLOCK	1
29	IRON WIRE	1

DWG NO.T-3: Pole Type UEB-2 Heavy Angle Pole(30-50)

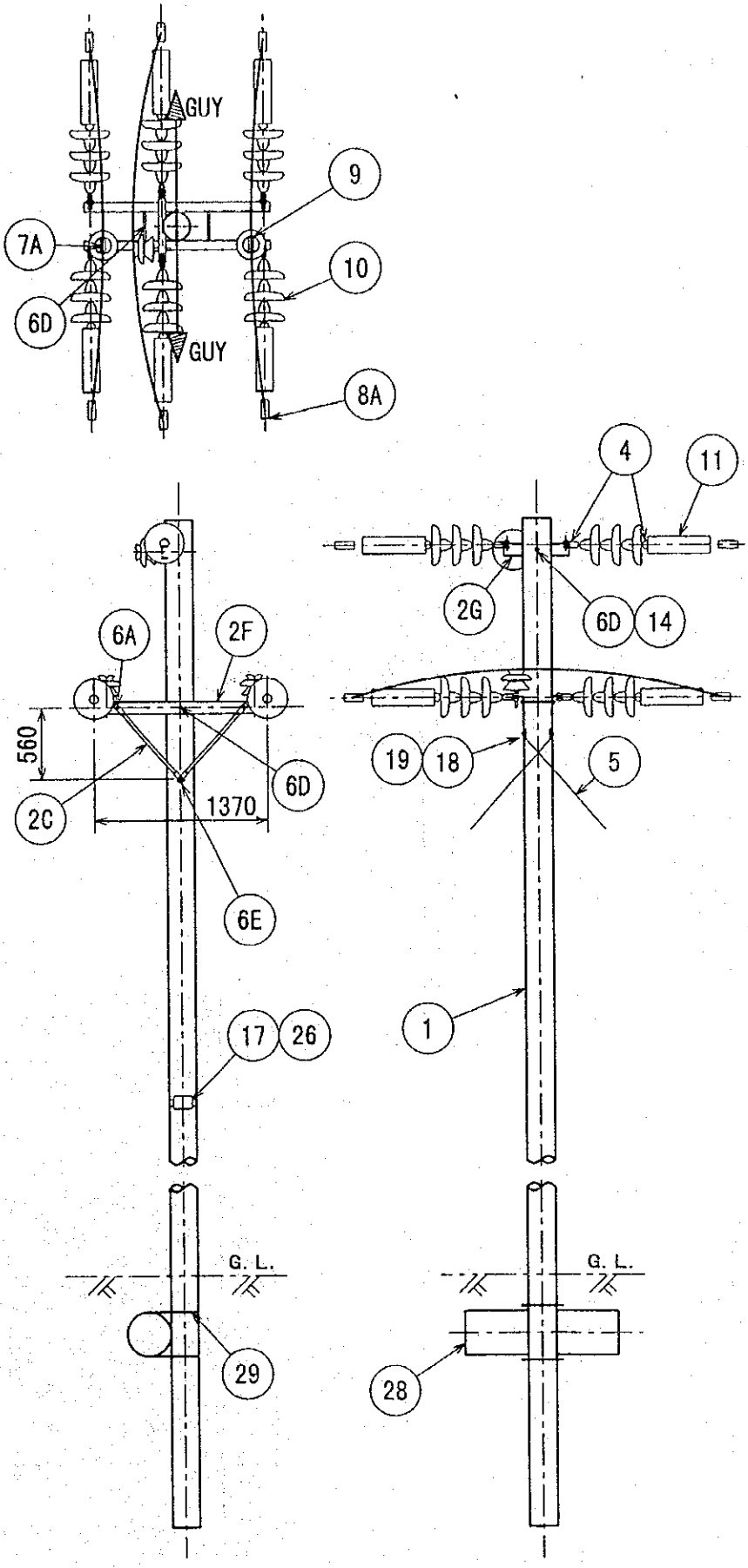


HEAVY ANGLE LINE POLE 50≦θ≦90

PART. NO	DESCRIPTION	Q'TY
1	WOODEN POLE	2
2E	CROSSARM L100×75×7×600	6
4	ANCHOR SHACKLE	6
4	BALL CLEVIS	6
4	SOCKET EYE	6
5	STRAIN PLATE	5
5	DEAD END GRIP FOR POLE	5
5	DEAD END GRIP FOR THIMBLE	5
5	DEAD END GRIP FOR INSULATOR	10
5	STAY WIRE 45sq. mm(20m)	5
5	STAY INSULATOR 33kV	5
5	STAY ROD	5
5	STAY PLATE/STAY ANCHOR	5
5	TURNBACKLE	5
6D	BOLT&NUT M16X350(CROSSARM/POLE)	6
6G	BOLT&NUT M20X800 WITH SQUARE WASHER	4
8A	COMPRESSION CONECTOR(A1/A1)	6
10	DISC INSULATOR	18
11	DEAD END CLAMP	6
14	SQUARE WASHER	12
17	NUMBER PLATE	1
18	NAIL	45
19	STEPLE	20
26	STAINLESS BAND L=1200mm	1
28	KICKING BLOCK	1
29	IRON WIRE	1

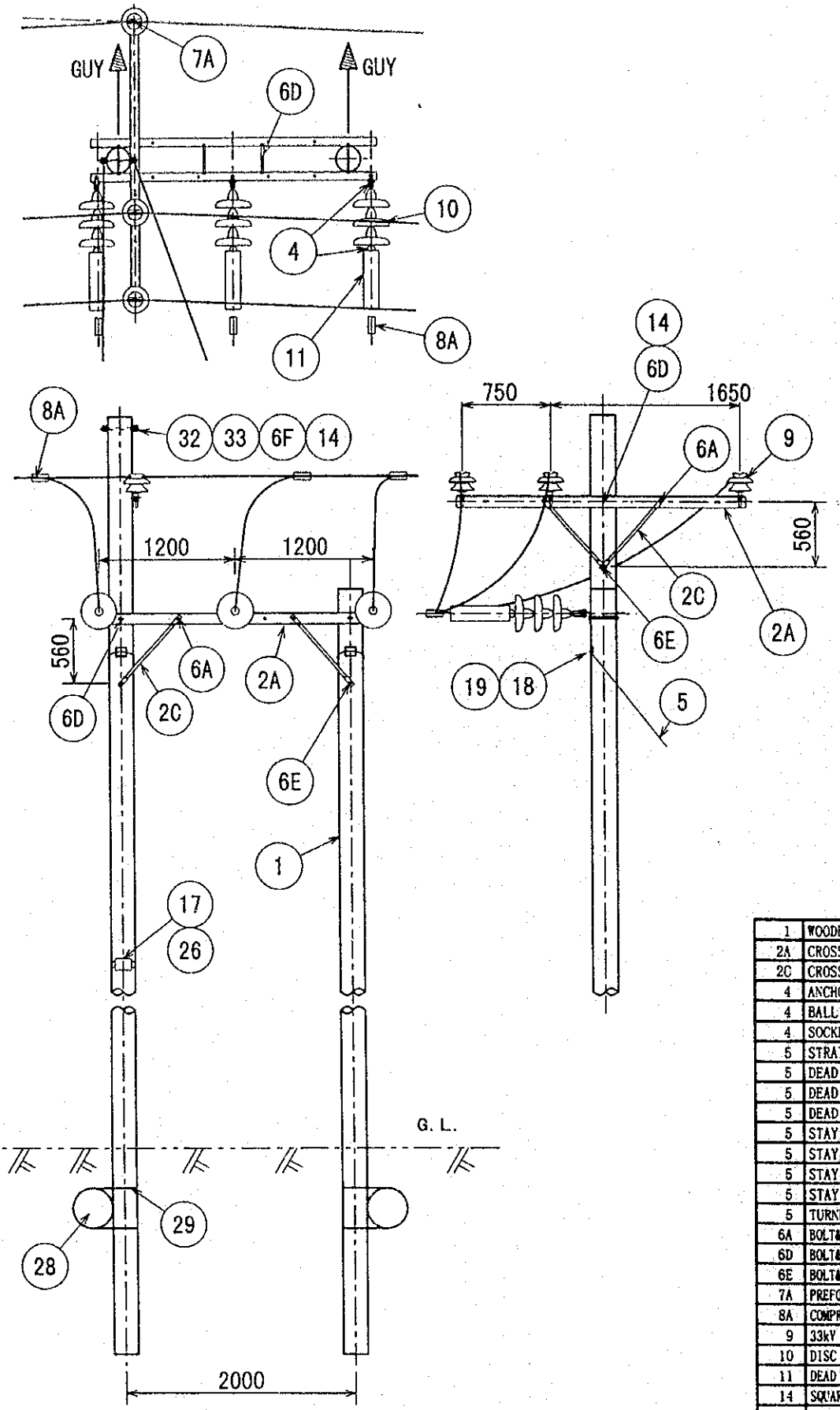
DWG NO.T-4: Pole Type UEB-3

Heavy Angle Pole(50-90)



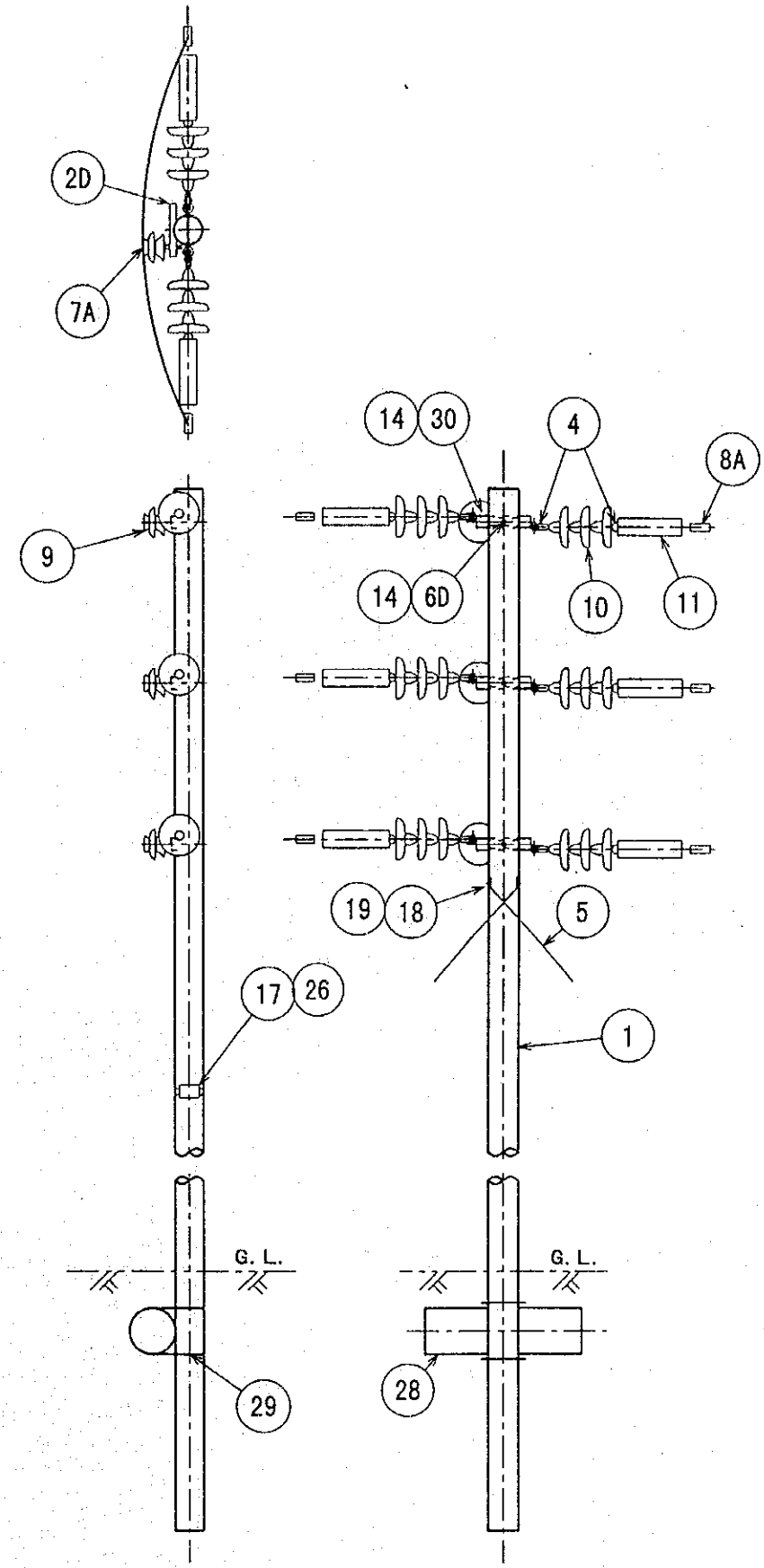
PART. NO	DESCRIPTION	Q'TY
1	WOODEN POLE	1
2C	CROSSARM BRACE	4
2F	CROSSARM L100×75×7×1500	2
2G	TENSION ARM C100×50×5×600	1
4	ANCHOR SHACKLE	6
4	BALL CLEVIS	6
4	SOCKET EYE	6
5	STRAIN PLATE	2
5	DEAD END GRIP FOR POLE	2
5	DEAD END GRIP FOR THIMBLE	2
5	DEAD END GRIP FOR INSULATOR	4
5	STAY WIRE 45sq.㎜(20m)	2
5	STAY INSULATOR 33kV	2
5	STAY ROD	2
5	STAY PLATE/STAY ANCHOR	2
5	TURNBACKLE	2
6A	BOLT&NUT M16X50(CROSSARM/BRACE)	4
6D	BOLT&NUT M16X350(CROSSARM/POLE)	4
6E	BOLT&NUT M16X400(POLE/BRACE)	1
7A	PREFORMED TOP TIE	3
8A	COMPRESSION CONECTOR(A1/A1)	6
9	33kV PIN POST INSULATOR	3
10	DISC INSULATOR	18
11	DEAD END CLAMP	6
14	SQUARE WASHER	1
17	NUMBER PLATE	1
18	NAIL	18
19	STEPLE	8
26	STAINLESS BAND L=1200㎜	1
28	KICKING BLOCK	1
29	IRON WIRE	1

DWG NO.T-5: Pole Type UEB-5 Section Pole (Triangle)



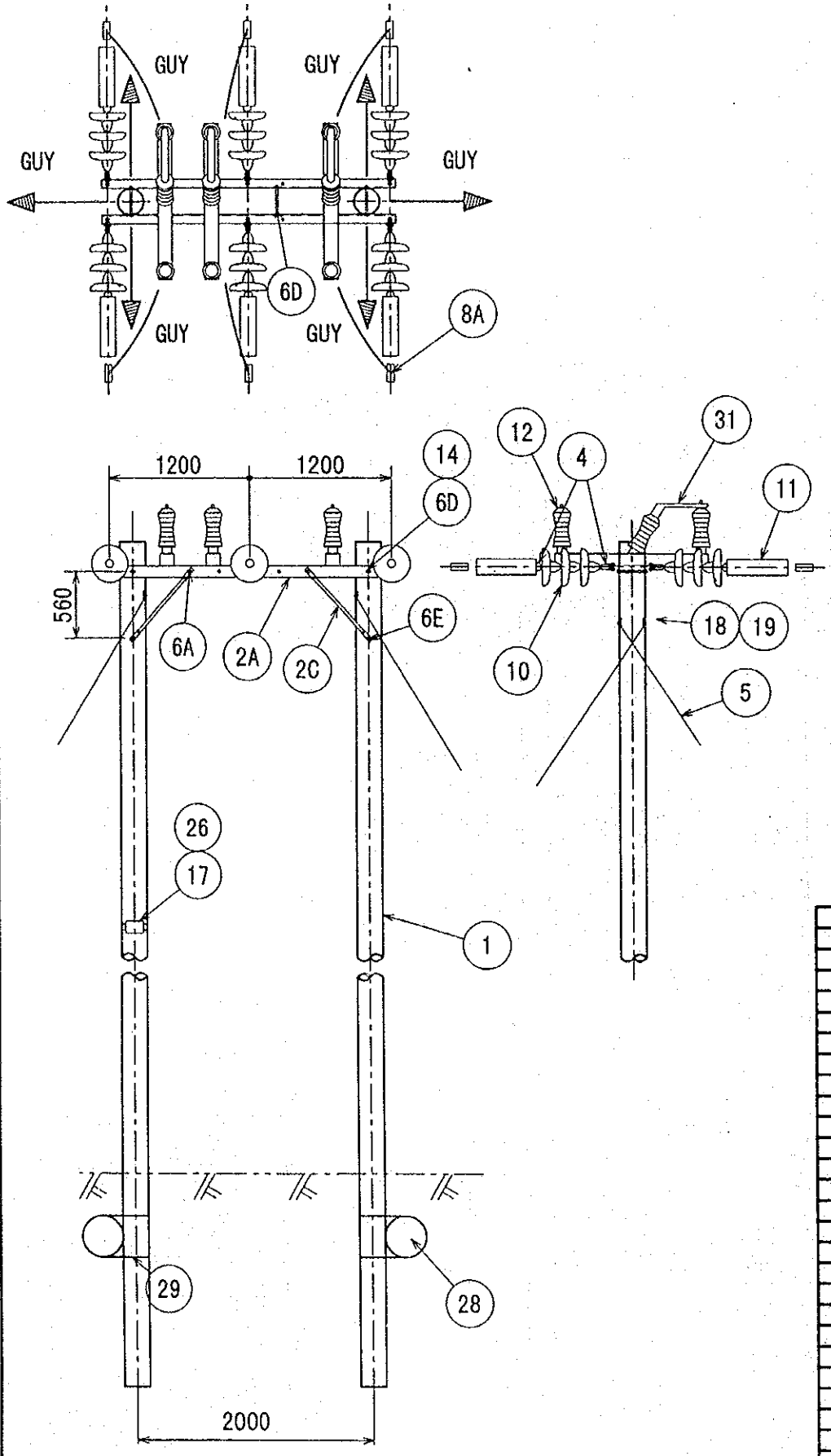
PART. NO.	DESCRIPTION	Q'TY
1	WOODEN POLE	2
2A	CROSSARM L100×75×7×2500	3
2C	CROSSARM BRACE	6
4	ANCHOR SHACKLE	3
4	BALL CLEVIS	3
4	SOCKET EYE	3
5	STRAIN PLATE	2
5	DEAD END GRIP FOR POLE	2
5	DEAD END GRIP FOR THIMBLE	2
5	DEAD END GRIP FOR INSULATOR	4
5	STAY WIRE 45sq.mm(20m)	2
5	STAY INSULATOR 33kV	2
5	STAY ROD	2
5	STAY PLATE/STAY ANCHOR	2
5	TURNBACKLE	2
6A	BOLT&NUT M16X50(CROSSARM/BRACE)	6
6D	BOLT&NUT M16X350(CROSSARM/POLE)	5
6E	BOLT&NUT M16X400(POLE/BRACE)	4
7A	PREFORMED TOP TIE	3
8A	COMPRESSION CONECTOR(A1/A1)	6
9	33kV PIN POST INSULATOR	3
10	DISC INSULATOR	9
11	DEAD END CLAMP	3
14	SQUARE WASHER	7
17	NUMBER PLATE	1
18	NAIL	18
19	STEPLE	8
26	STAINLESS BAND L=1200mm	1
28	KICKING BLOCK	2
29	IRON WIRE	2
32	REEL INSULATOR	2
33	DEAD END GRIP FOR THIMBLE(22sq.mm)	2

DWG NO.T-6: Pole Type UEB-6 T-off Pole



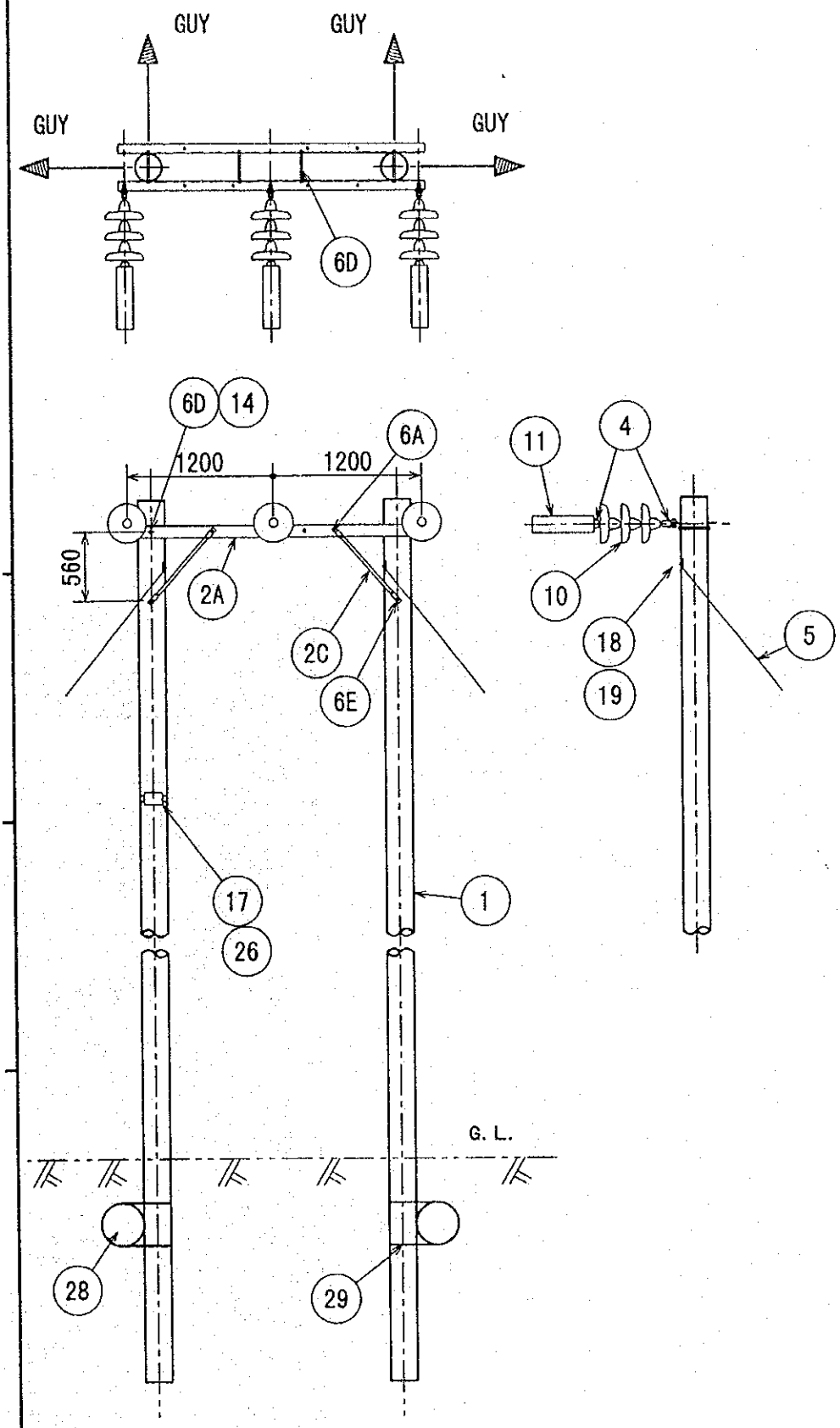
PART. NO	DESCRIPTION	Q'TY
1	WOODEN POLE	1
2D	CROSSARM C100×50×5×600	3
4	ANCHOR SHACKLE	6
4	BALL CLEVIS	6
4	SOCKET EYE	6
5	STRAIN PLATE	2
5	DEAD END GRIP FOR POLE	2
5	DEAD END GRIP FOR THIMBLE	2
5	DEAD END GRIP FOR INSULATOR	4
5	STAY WIRE 45sq. mm(20m)	2
5	STAY INSULATOR 33kV	2
5	STAY ROD	2
5	STAY PLATE/STAY ANCHOR	2
5	TURNBACKLE	2
6D	BOLT&NUT M16X350(CROSSARM/POLE)	3
7A	PREFORMED TOP TIE	3
8A	COMPRESSION CONECTOR(A1/A1)	6
9	33kV PIN POST INSULATOR	3
10	DISC INSULATOR	18
11	DEAD END CLAMP	6
14	SQUARE WASHER	9
17	NUMBER PLATE	1
18	NAIL	18
19	STEPLE	8
26	STAINLESS BAND L=1200mm	1
28	KICKING BLOCK	1
29	IRON WIRE	1
30	EYE BOLT(M20X350)	6

DWG NO.T-7: Pole Type E Section Pole (Vertical)



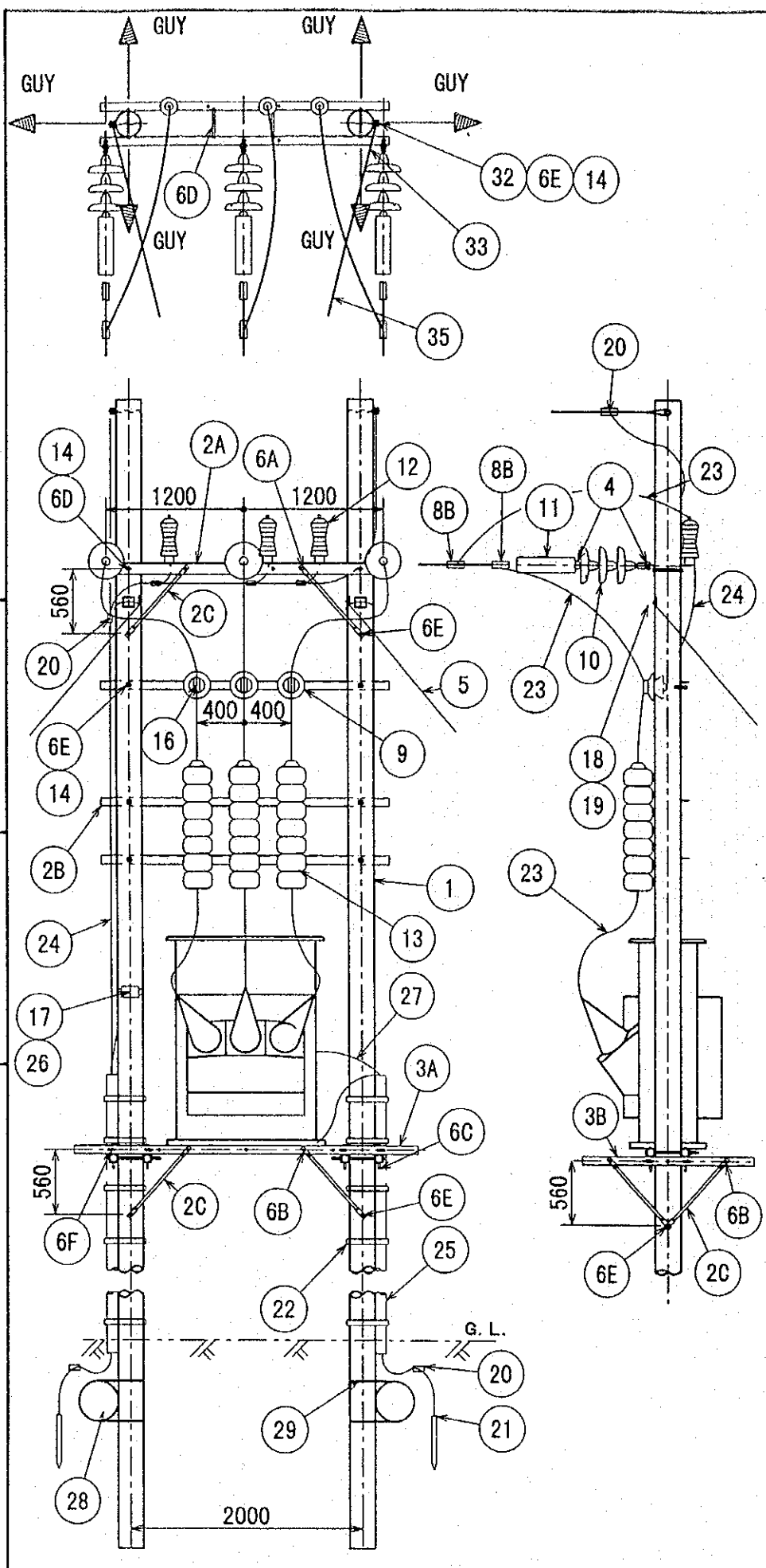
PART. NO	DESCRIPTION	Q'TY
1	WOODEN POLE	2
2A	CROSSARM L100×75×7×2500	2
2C	CROSSARM BRACE	4
4	ANCHOR SHACKLE	6
4	BALL CLEVIS	6
4	SOCKET EYE	6
5	STRAIN PLATE	6
5	DEAD END GRIP FOR POLE	6
5	DEAD END GRIP FOR THIMBLE	6
5	DEAD END GRIP FOR INSULATOR	12
5	STAY WIRE 45sq. mm (20m)	6
5	STAY INSULATOR 33kV	6
5	STAY ROD	6
5	STAY PLATE/STAY ANCHOR	6
5	TURNBACKLE	6
6A	BOLT&NUT M16X50 (CROSSARM/BRACE)	4
6D	BOLT&NUT M16X350 (CROSSARM/POLE)	4
6E	BOLT&NUT M16X400 (POLE/BRACE)	2
8A	COMPRESSION CONECTOR (A1/A1)	
8B	COMPRESSION CONECTOR (A1/Cu)	
10	DISC INSULATOR	18
11	DEAD END CLAMP	6
12	33kV LIGHTNING ARRESTER	
14	SQUARE WASHER	4
17	NUMBER PLATE	1
18	NAIL	24
19	STEPLE	24
20	P.G. CLAMP	
26	STAINLESS BAND L=1200mm	1
28	KICKING BLOCK	2
29	IRON WIRE	2
31	LOAD BRAEK SWITH	

DWG NO.T-8: Pole Type G Load Break Switch Pole



1	WOODEN POLE	2
2A	CROSSARM L100×75×7×2500	2
2C	CROSSARM BRACE	4
4	ANCHOR SHACKLE	3
4	BALL CLEVIS	3
4	SOCKET EYE	3
5	STRAIN PLATE	4
5	DEAD END GRIP FOR POLE	4
5	DEAD END GRIP FOR THIMBLE	4
5	DEAD END GRIP FOR INSULATOR	8
5	STAY WIRE 45sq. mm (20m)	4
5	STAY INSULATOR 33kV	4
5	STAY ROD	4
5	STAY PLATE/STAY ANCHOR	4
5	TURNBACKLE	4
6A	BOLT&NUT M16X50 (CROSSARM/BRACE)	4
6D	BOLT&NUT M16X350 (CROSSARM/POLE)	4
6E	BOLT&NUT M16X400 (POLE/BRACE)	2
10	DISC INSULATOR	9
11	DEAD END CLAMP	3
14	SQUARE WASHER	4
17	NUMBER PLATE	1
18	NAIL	18
19	STEPLE	16
26	STAINLESS BAND L=1200mm	1
28	KICKING BLOCK	2
29	IRON WIRE	2
PART. NO.	DESCRIPTION	Q'TY

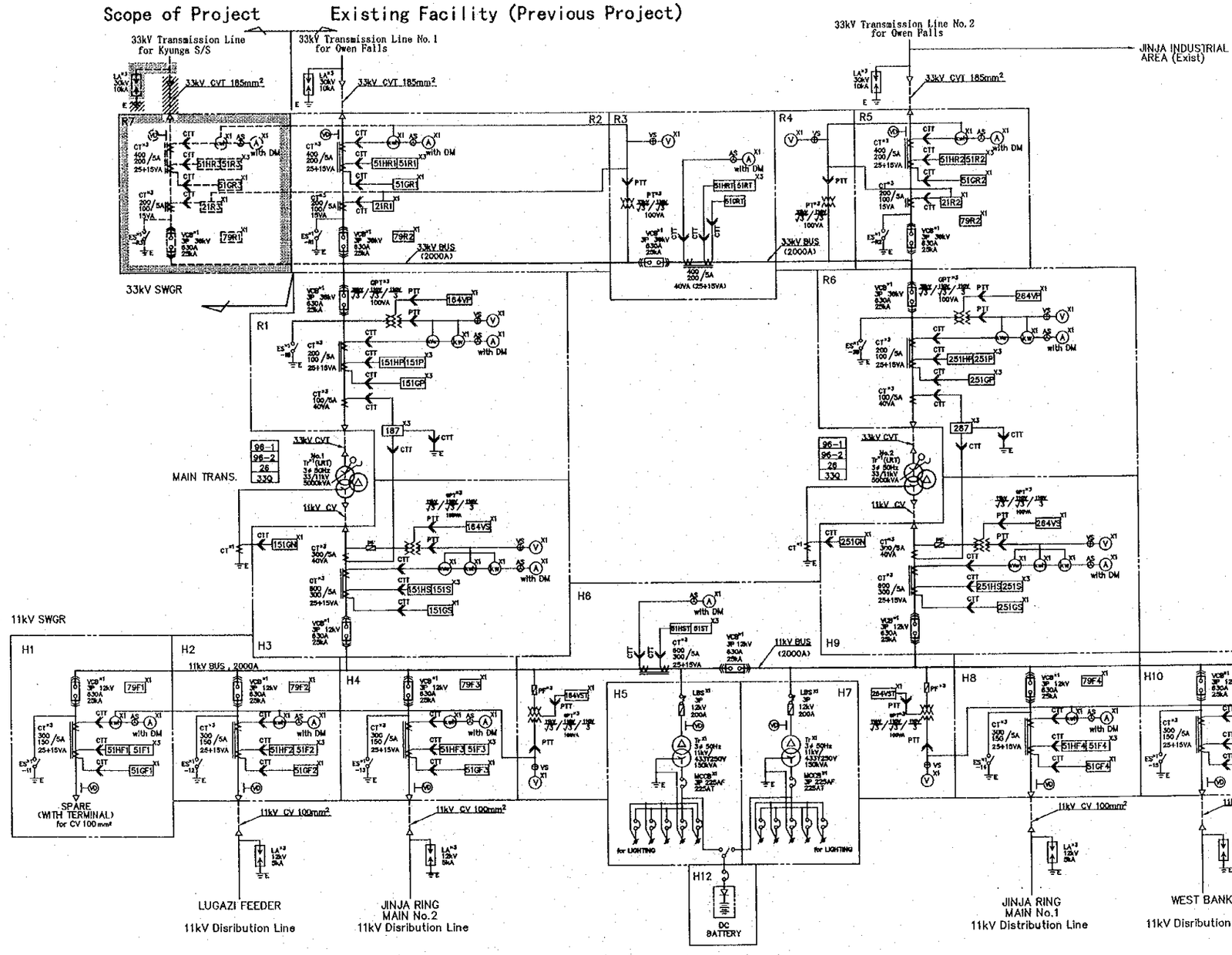
DWG NO.T-9: Pole Type F Terminal Pole



1	WOODEN POLE	2
2A	CROSSARM L100×75×7×2500	2
2B	CROSSARM FOR PIN SUPPORT	3
2C	CROSSARM BRACE	16
3A	TR. SUPPORT (A) 75X75X3. 2X3000	2
3B	TR. SUPPORT (B) 75X75X3. 2X1500	4
4	ANCHOR SHACKLE	3
4	BALL CLEVIS	3
4	SOCKET EYE	3
5	STRAIN PLATE	6
5	DEAD END GRIP FOR POLE	6
5	DEAD END GRIP FOR THIMBLE	6
5	DEAD END GRIP FOR INSULATOR	12
5	STAY WIRE 45sq. mm (20m)	6
5	STAY INSULATOR 33kV	6
5	STAY ROD	6
5	STAY PLATE/WOOD LOG	6
5	TURNBACKLE	6
6A	BOLT&NUT M16X50 (CROSSARM/BRACE)	4
6B	BOLT&NUT M16X150 (TR. SUPPORT/BRACE)	12
6C	BOLT&NUT M16X200 (TR. SUPPORT A/B)	8
6D	BOLT&NUT M16X350 (CROSSARM/POLE)	6
6E	BOLT&NUT M16X400 (POLE/BRACE)	12
6F	BOLT&NUT M16X500 (TR. SUPPORT/POLE)	3
8B	COMPRESSION CONECTER (Al/Cu)	6
9	33kV PIN POST INSULATOR	6
10	DISC INSULATOR	9
11	DEAD END CLAMP	3
12	33kV LIGHTNING ARRESTER	3
13	33kV FUSE CUTOUT	3
14	SQUARE WASHER	16
15	ALUMINUM BINDING WIRE	
16	COPPER BINDING WIRE	
17	NUMBER PLATE	1
18	NAIL	24
19	STEPLE	24
20	P.G. CLAMP	12
21	GROUND ROD	2
22	IBT BAND	24
23	DROP WIRE (PDC22sq. mm)	
24	GROUNDING WIRE (IV14sq. mm)	
25	PVC PROTECTION PIPE L=4m	2
26	STAINLESS BAND L=1200mm	7
27	IV 38 sq. mm	
28	KICKING BLOCK	2
29	IRON WIRE	2
32	REEL INSULATOR	2
33	DEAD END GRIP FOR THIMBLE (22sq. mm)	2
35	OVER HEAD GROUNDING WIRE (22sq. mm)	120
PART. NO.	DESCRIPTION	Q'TY

DWG NO.T-10: Pole Type H Transformer Pole

Scope of Project　　Existing Facility (Previous Project)



LEGEND	
51H	Over current relay
51G	Over current ground relay
64V	Over voltage ground relay
87	Differential relay
79	Reclosing relay
VD	Voltage detector
GPT	Grounding potential transformer
96−1	Buchholz relay (alarm)
96−2	Buchholz relay (trip)
26	Thermal relay
33Q	Oil level gauge
21	Distance relay

---------- : Facilties needs in the Project

: To be supplied and installed by JAPAN

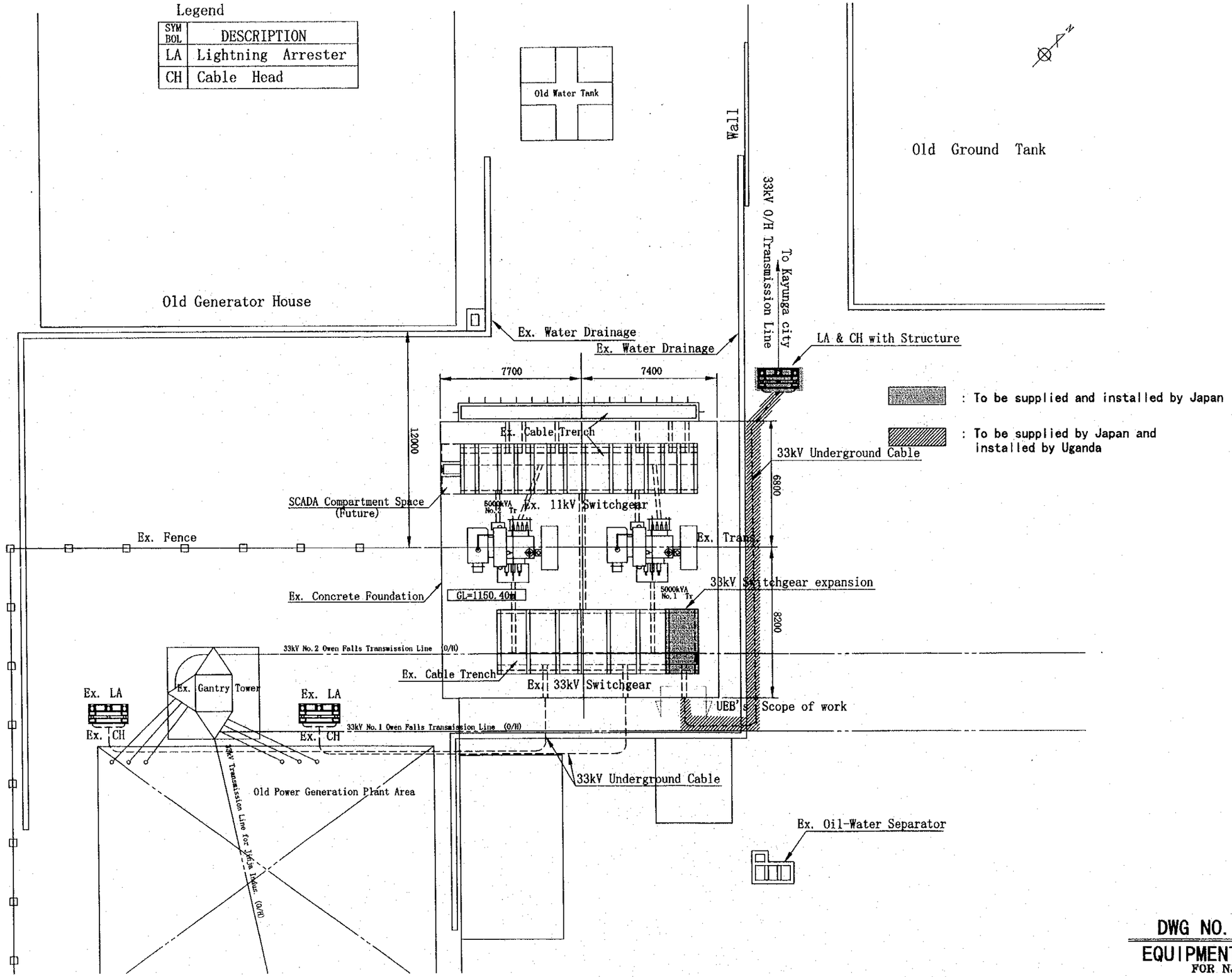
: To be Supplied by JAPAN and Installed by UGANDA

DWG NO. : N-1

SINGLE LINE DIAGRAM
FOR NJERU S/S

Legend

SYMBOL	DESCRIPTION
LA	Lightning Arrester
CH	Cable Head

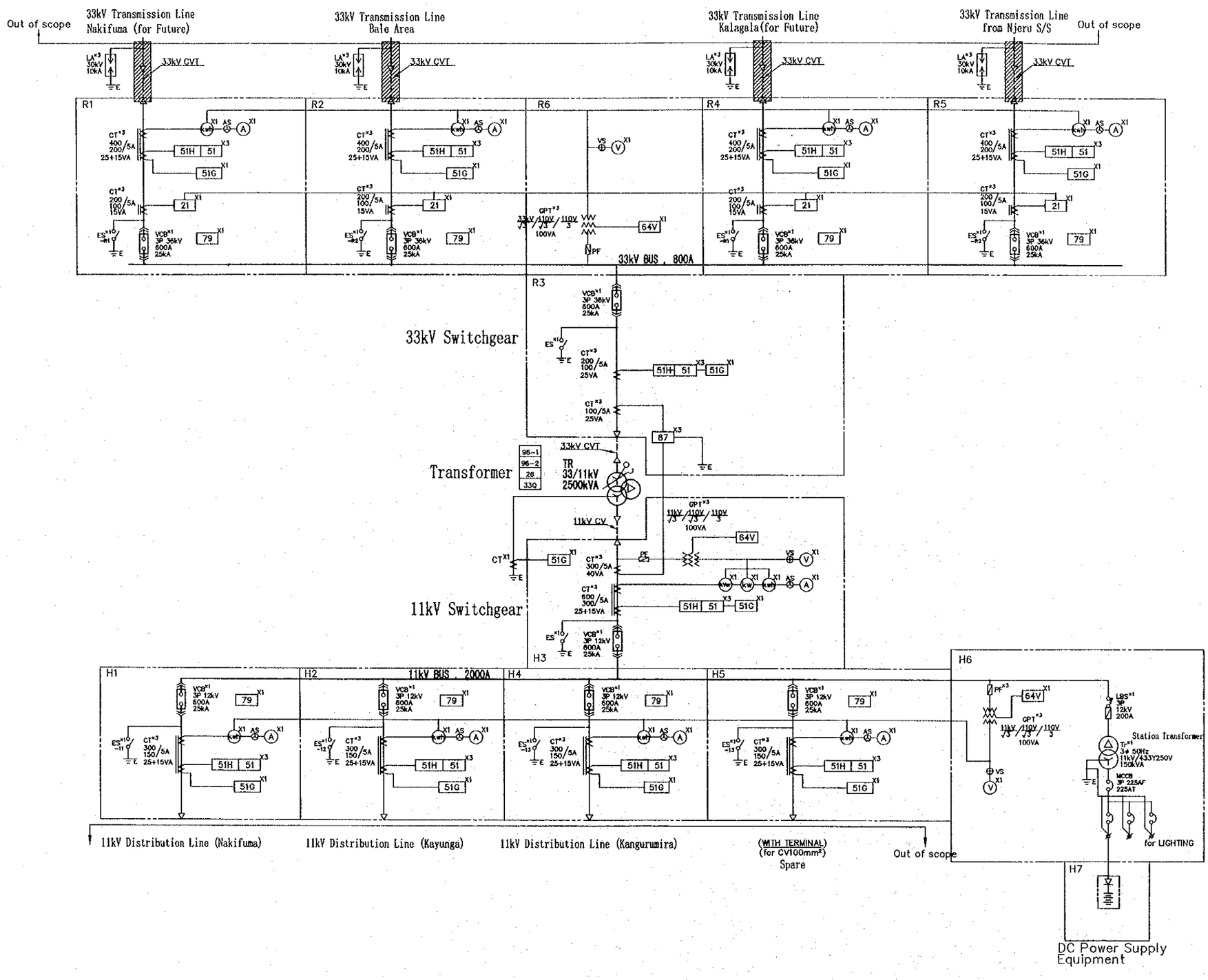


: To be supplied and installed by Japan

: To be supplied by Japan and installed by Uganda

DWG NO. : N-2

EQUIPMENT LAYOUT
FOR NJERU S/S



Legend	
51H	Over current relay
51G	Over current ground relay
64V	Over voltage ground relay
87	Differential relay
79	Reclosing relay
GPT	Grounding potential transformer
96-1	Buchholz relay (alarm)
96-2	Buchholz relay (trip)
26	Thermal relay
33Q	Oil level gauge
21	Distance relay
VCB	Vacuum Circuit Breaker
CT	Current Transformer
LBS	Load Break Switch
ES	Earthing Switch
AS/VS	Amp/Volt Selector Switch

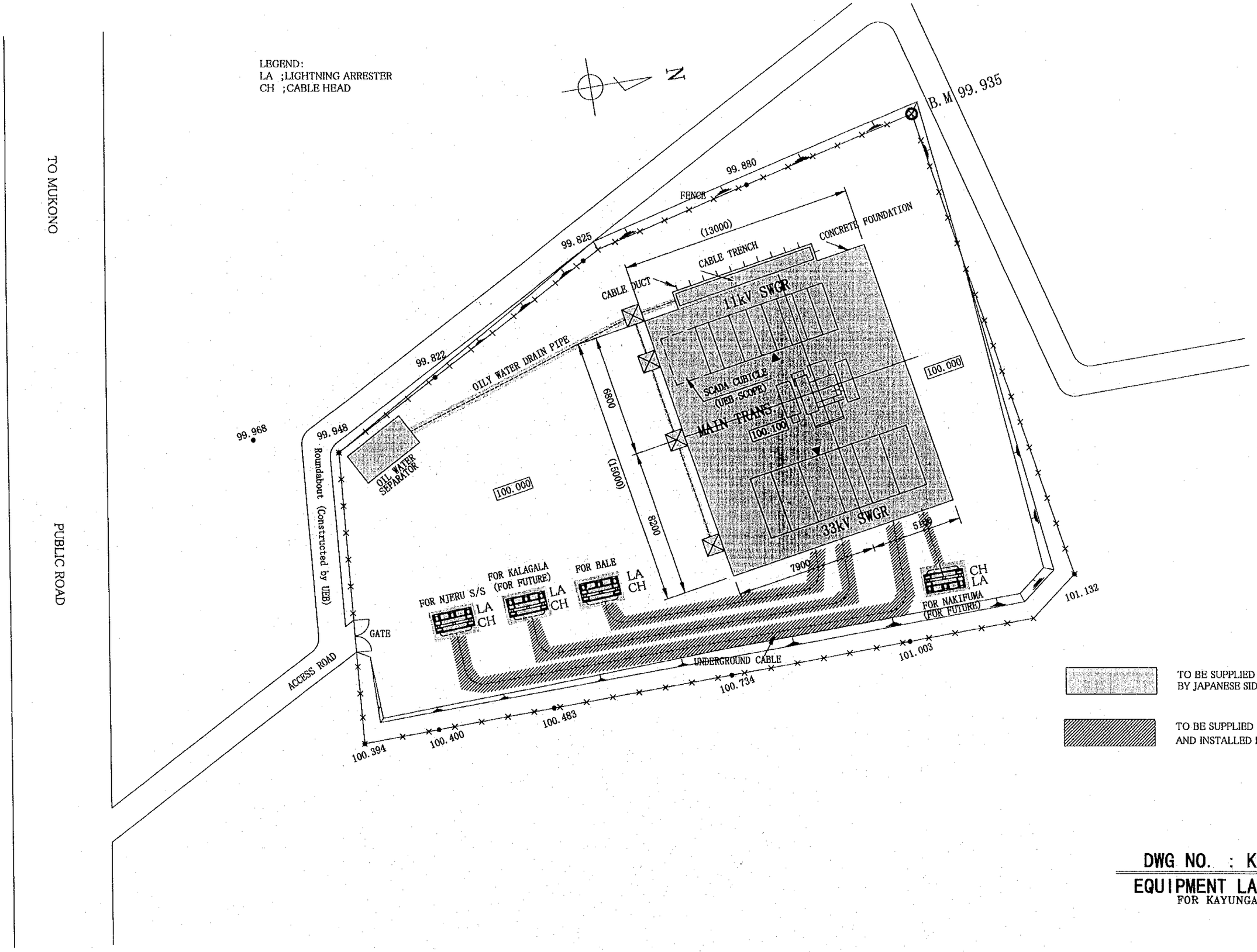
: To be supplied by Japan and installed by Uganda

Note : 11kV Switchgear cubicle will be consist of 8 cubicles. In addition to H1 to H7 cubicles as shown on this drawing, a SCADA interface cubicle (H8) will be provided.

DWG NO. : K-1

SINGLE LINE DIAGRAM
FOR KAYUNGA S/S

LEGEND:
LA ;LIGHTNING ARRESTER
CH ;CABLE HEAD

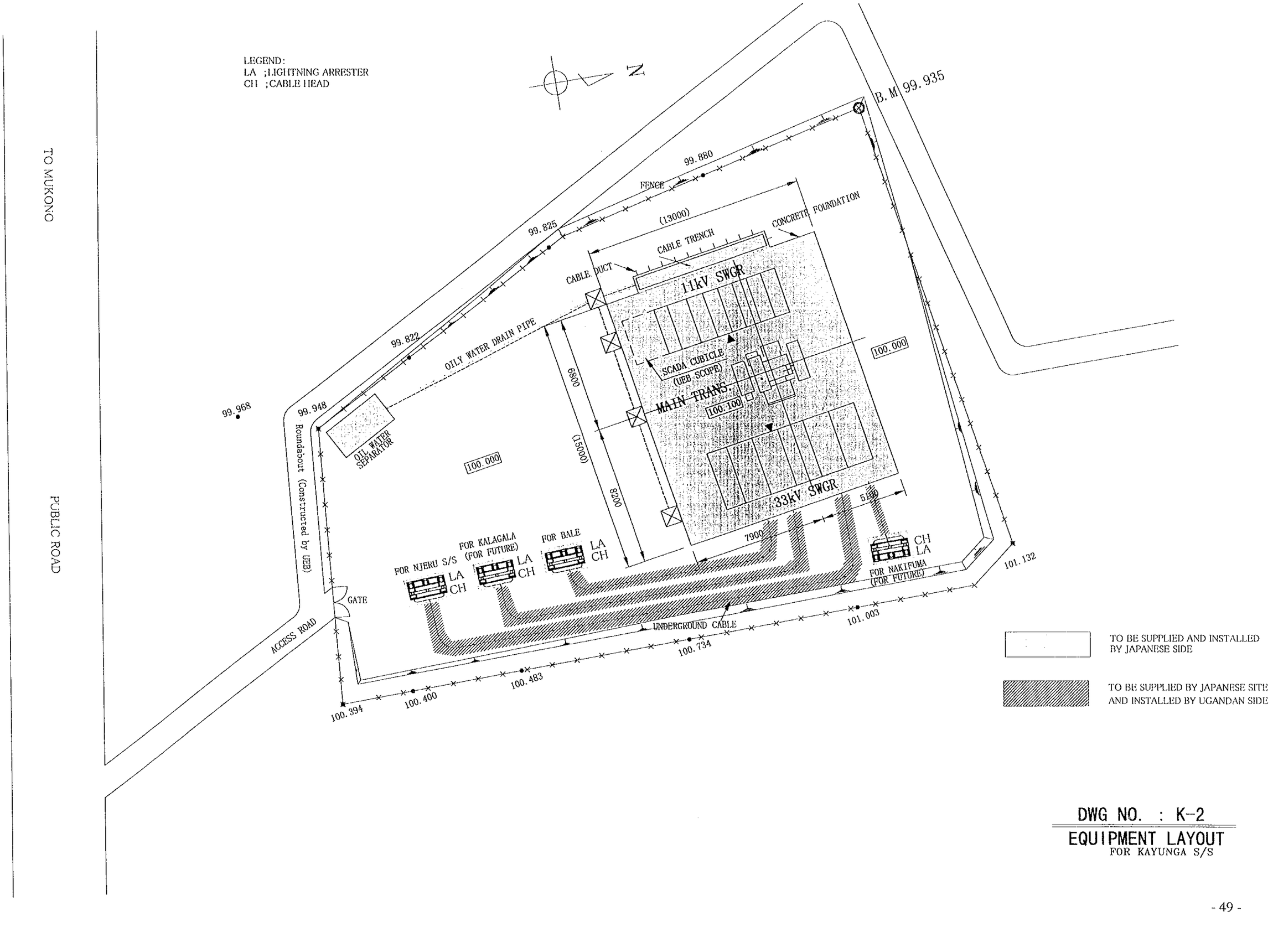


TO BE SUPPLIED AND INSTALLED BY JAPANESE SIDE

TO BE SUPPLIED BY JAPANESE SITE AND INSTALLED BY UGANDAN SIDE

DWG NO. : K-2

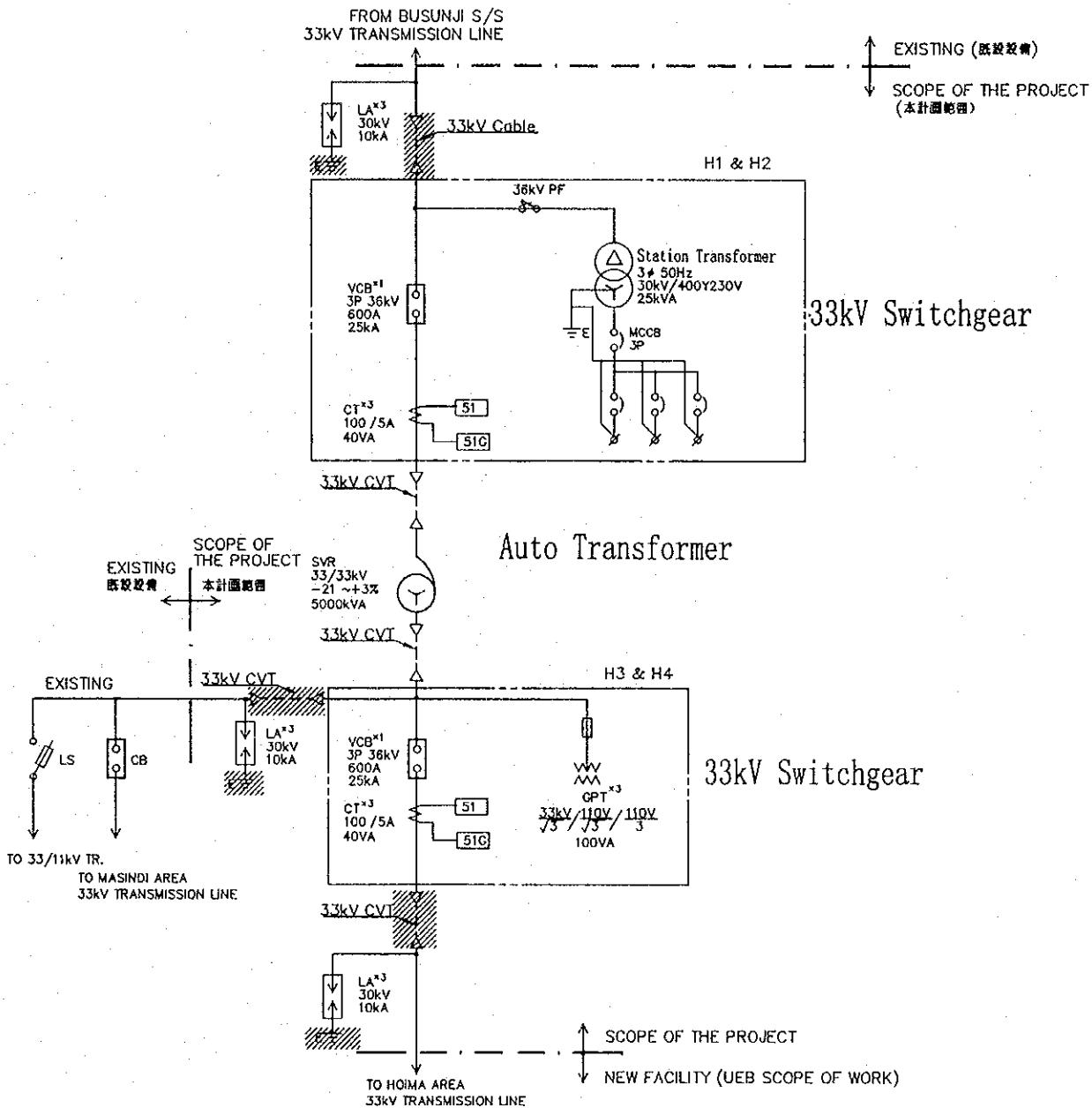
EQUIPMENT LAYOUT
FOR KAYUNGA S/S



DWG NO. : K--2

EQUIPMENT LAYOUT

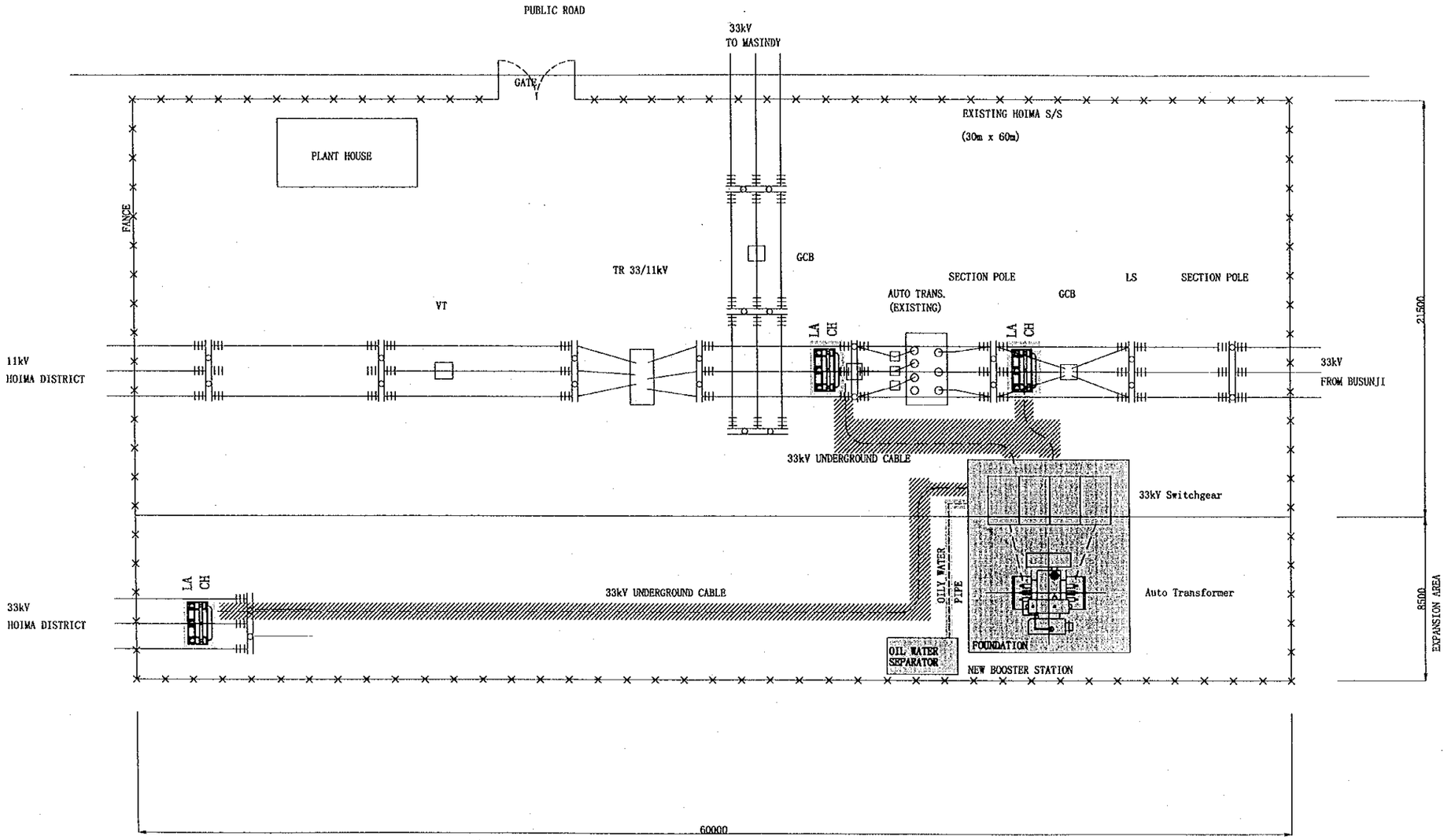
FOR KAYUNGA S/S



TO BE SUPPLIED BY JAPANESE SIDE
AND INSTALLED BY UGANDAN SIDE

DWG No. : H-1

SINGLE LINE DIAGRAM
for HOIMA S/S



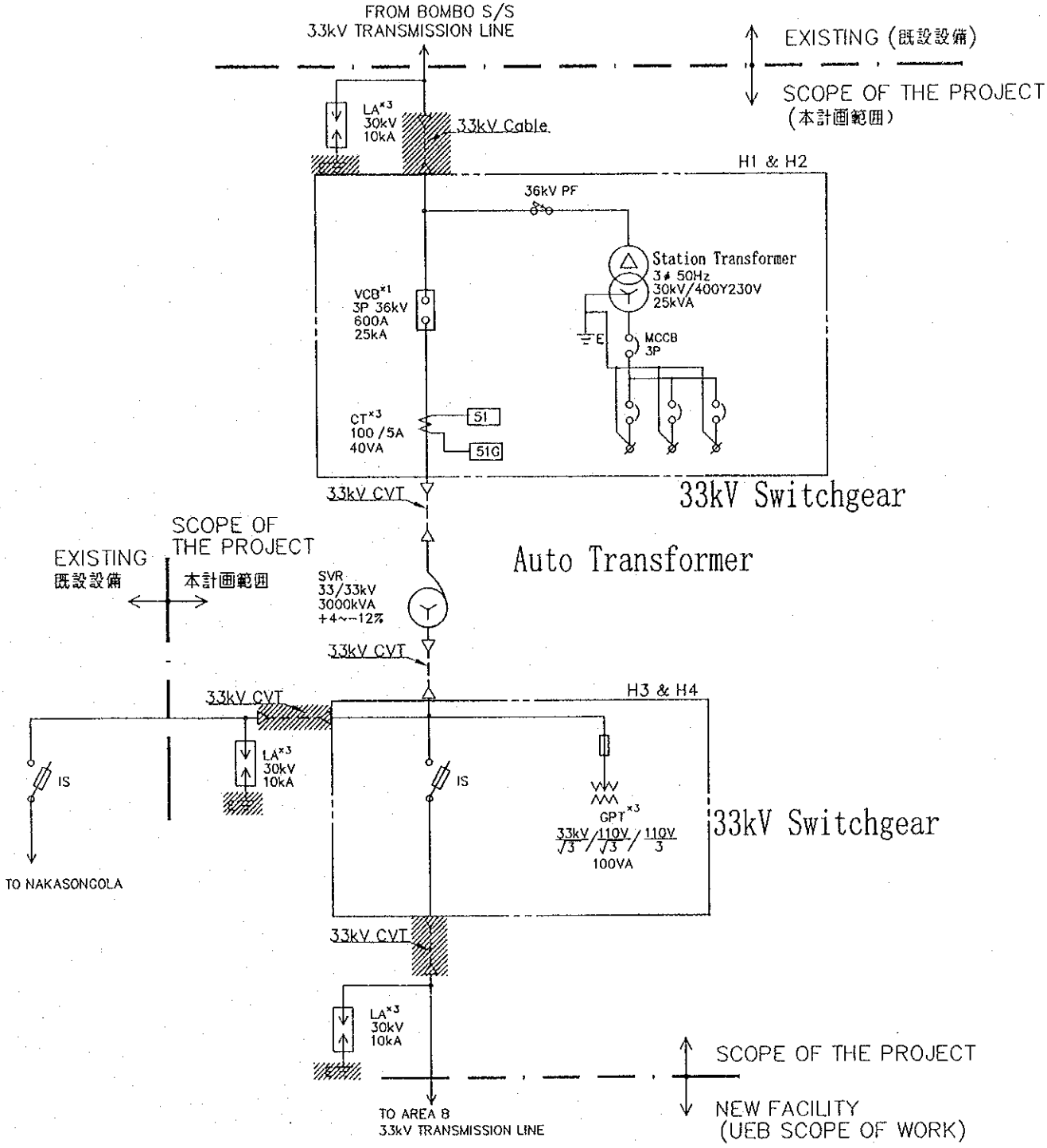
TO BE SUPPLIED AND INSTALLED BY JAPANESE SIDE

TO BE SUPPLIED BY JAPANESE SIDE AND INSTALLED BY UGANDAN SIDE

DWG NO. : H-2

EQUIPMENT LAYOUT

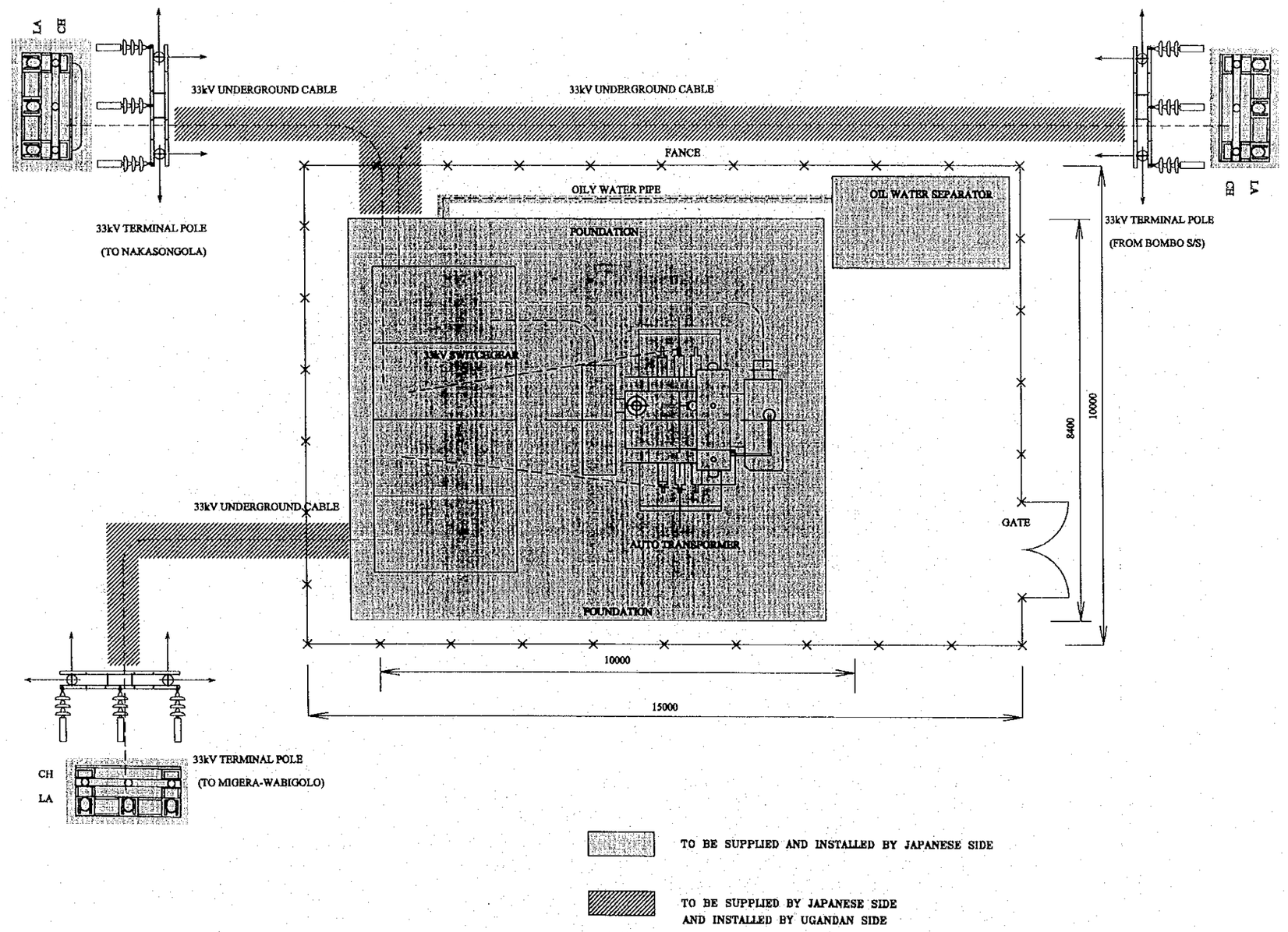
for HOIMA S/S



TO BE SUPPLIED BY JAPANESE SIDE
AND INSTALLED BY UGANDAN SIDE

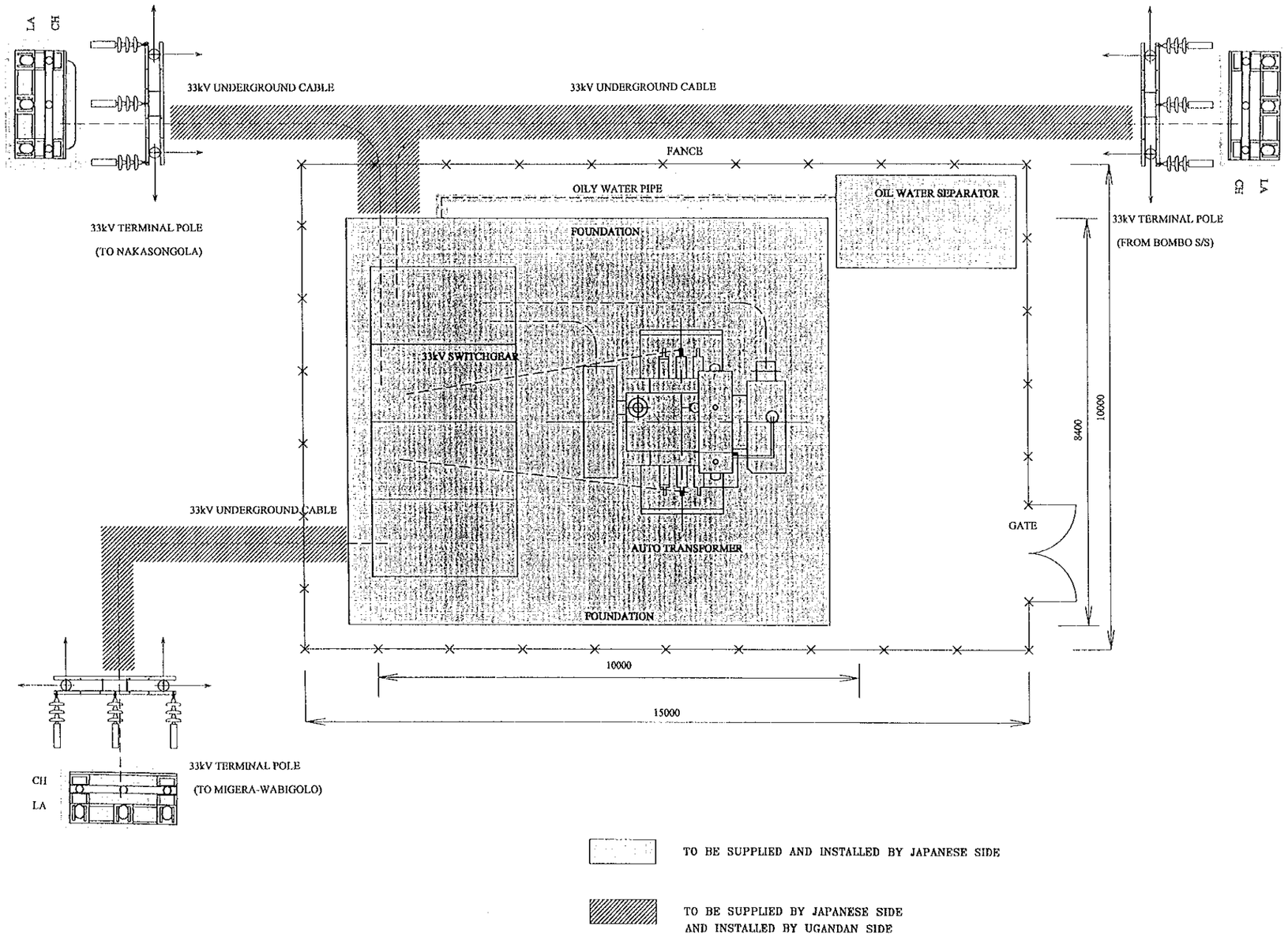
DWG No. : W-1

SINGLE LINE DIAGRAM
for WABIGALO



DWG NO. : W-2

EQUIPMENT LAYOUT
for WABIGALO



DWG NO. : W-2

EQUIPMENT LAYOUT
for WABIGALO

CHAPTER 3

IMPLEMENTATION PLAN

CHAPTER 3 IMPLEMENTATION PLAN

3.1 Implementation Plan

3.1.1 Implementation Concept

The Project will be implemented within the framework of Japan's grant aid cooperation scheme and, therefore, its implementation will only take place after approval of the Project by the Government of Japan and the exchange of notes between the Government of Japan and the Government of Uganda. The basic issues and points to note in the process of implementing the Project are described below.

(1) Project Implementation Body

The organization responsible for the implementation of the Project on the Ugandan side is the UEB and the Transmission Department of the UEB will be directly responsible for the Project as described earlier in 2.4.1. It will, therefore, be necessary for the Director of the UEB's Transmission Department to maintain close contact and to consult with the Japanese consultant and contractor and to select a person to be responsible for the Project to ensure the smooth progress of the Project.

The person selected to be responsible for the Project will be required to full explain the contents of the Project to the staff members of those substations which are subject to expansion/new construction under the Project as well as to local people living at the project sites in order to facilitate their understanding of the Project and to encourage their cooperation for the implementation of the Project.

(2) Consultant

A Japanese consultant will conclude a design and supervision agreement with the UEB and will conduct the detailed design and work supervision for the Project to materialize the planned procurement and installation of equipment and the construction of various facilities under the Project. The consultant will also prepare the tender documents and will conduct the tender on behalf of the UEB, the project implementation body.

(3) Contractor

In accordance with the mechanism of Japan's grant aid cooperation scheme, a Japanese contractor selected by the Ugandan side through open tender will conduct the procurement and installation of equipment and the construction of facilities. As it is

deemed necessary for the contractor to provide after-services, including the supply of spare parts and an appropriate response to breakdowns, the contractor must pay proper attention to the establishment of an adequate communication channel with the Ugandan side after the handing over of the equipment and facilities to the UEB.

(4) Necessity for Dispatch of Japanese Engineers

In order to complete the planned substation construction as well as expansion work and the installation work of the booster stations in a short period of time, the careful coordination of all types of work will be essential given their complexity, ranging from earth work and foundation work to the installation of such substation equipment as transformers and distribution panels. As most of the different work will be simultaneously conducted, it is essential that a site manager who is capable of controlling and guiding all the work in an integral manner be dispatched from Japan to ensure work progress, quality and safety.

As most transmission and distribution work in Uganda has long been conducted only by the UEB as described later in 3.1.2-(1), private construction companies in Uganda have few skilled workers who are also conversant with the installation, testing and adjustment of transforming equipment. Even in the case of staff of the UEB, it may be possible that they do not fully understand the latest technologies while having mastered more conventional technologies. It will, therefore, be necessary for the manufacturers of the substation equipment to dispatch experts to Uganda to supervise the installation, testing and adjustment of the said equipment.

(5) Consultant Supervision of Work Conducted by Ugandan Side

The installation of the 33 kV transmission equipment to be provided under the Project will fall within the scope of work to be conducted by the Ugandan side. The 33 kV transmission line between Njeru and Kayunga in Area A-1 and some parts of the 33 kV transmission lines in Areas B and C in particular must be completed by the time of the completion of the substation construction and booster station installation work by the Japanese side so that the delivery testing of these facilities/equipment can be completed within the planned project period.

To ensure prompt completion, the engineers dispatched by the consultant to supervise the work by the Japanese side will also provide guidance on process control, quality control, schedule control and safety control in regard to the work by the Ugandan side with a view to the transfer of technologies/techniques regarding accident prevention, planning

and work management, all of which appear to be particularly required by the Ugandan side at present.

3.1.2 Implementation Conditions

(1) State of Construction Industry in Uganda and Technology Transfer

Even though the construction of factories and large buildings is in progress in Uganda, major work is contracted to the local subsidiaries of foreign construction company with local companies working as subcontractors.

In the electricity sector, such large-scale projects as the construction of hydropower projects have also been commissioned to foreign construction companies while such relatively small-scale work as the construction of substations and distribution lines is often directly conducted by the UEB. This suggests that the employment of workers, construction machinery, etc. of local companies is possible and that it will be difficult to employ engineers capable of installing the substation and transmission equipment under the Project.

Accordingly, as far as the substation construction work under the Project is concerned, local construction companies will mainly be used to provide machinery and workers and engineers will be dispatched from Japan to supervise the quality control, process control, schedule control, safety control and testing/adjustment. Using the presence of Japanese engineers on site during the construction period, technology transfer to Ugandan engineers will be attempted by means of OJT.

(2) Use of Local Equipment and Materials

In planning the construction work plan, emphasis will be placed on the maximum use of locally available equipment and materials. As it is possible to procure aggregate, cement, reinforcing bars, etc., for civil engineering work in Uganda, these will be procured for the equipment foundation construction work under the Project. In comparison, in regard to substation equipment, not only such main equipment as distribution panels and transformers but also such auxiliary equipment as structural steel, cables and insulators are not manufactured domestically, making their import from Japan and/or a third country necessary.

3.1.3 Scope of Work

There is a division of work to be conducted by the Japanese side and the Ugandan side under the Project. The Japanese side will be responsible for (i) procurement, installation, testing, adjustment and the necessary civil engineering work for the New Kayunga Substation and (ii) the booster stations at the Hoima Substation and Wabigalo.

The Ugandan side will be responsible for (i) cabling after the 11 kV distribution panels and extension of the 33 kV overhead line at the Kayunga Substation and (ii) the 33 kV cable connection work at the Hoima Substation and Wabigalo. In the case of the installation of an additional distribution panel at the Njeru Substation, the Japanese side will procure and install the distribution panel and will dispatch an expert to supervise the installation work, testing and adjustment.

In regard to the 33 kV transmission line construction work, the Ugandan side will conduct the installation of the equipment and materials procured by the Japanese side, and will procure and erect wooden electric poles. The scope of work for the Ugandan side will also include the procurement and installation of all equipment and materials, including cables, cable accessories, surge arresters, electric poles, insulators, etc., for the low voltage distribution lines.

Tale 3-1-1 shows the detailed division of work between the Japanese and Ugandan sides.

Table 3-1-1 Division of Work Between Japanese and Ugandan Sides

Work Item	Work Division		Remarks
	Japan	Uganda	
1. Construction of New Kayunga Substation			
(1) Procurement and installation of 33/11 kV transformer	○		
(2) Procurement and installation of distribution panel for transformer	○		
(3) Procurement and installation of 33kV distribution panel	○		
(4) Procurement and installation of 11 kV distribution panel	○		
(5) Procurement and installation of SCADA		○	
(6) Civil engineering work, foundation work and bus-bar (including poles and insulators, etc.) installation for (1) through (5) above	○		
(7) Relocation of existing poles		○	
(8) Procurement of 33 kV underground distribution cable	○		Upto connection point with overhead distribution line
(9) Laying of 33 kV underground distribution cable		○	As above
(10) Procurement and laying of 11kV underground distribution cable		○	
(11) Procurement of spare parts, testing equipment and installation/maintenance manuals	○		Two years supply of spare parts
(12) Site testing before handing over to Ugandan side	○		
(13) Construction of rainwater drainage system, perimeter fencing, gate and roundabout		○	
2. Additional Distribution Panel (Njeru Substation)			
(1) Procurement and installation of 33 kV distribution panel	○		
(2) Procurement of 33kV underground distribution cable	○		
(3) Laying of 33kV underground distribution cable		○	
(4) Connection to existing facilities		○	Including grounding work
(5) Procurement of spare parts, testing equipment and installation/maintenance manuals	○		Two years supply of spare parts
(6) Site testing before handing over to Ugandan side	○		
3. Renewal of Step Voltage Regulator (Hoima Substation)			
(1) Procurement and installation of voltage regulator and 33 kV distribution panel	○		
(2) Procurement of 33kV underground distribution cable	○		
(3) Laying of 33kV underground distribution cable		○	
(4) Removal of existing equipment		○	
(5) Equipment foundation, de-oiler and cable trenching work	○		
(6) Connection to existing cables and equipment		○	
(7) Procurement of spare parts, testing equipment and installation/maintenance manuals	○		Two years supply of spare parts
(8) Site testing before handing over to Ugandan side	○		
4. Installation of New Step Voltage Regulator (Wabigalo)			
(1) Procurement and installation of voltage regulator and 33 kV distribution panel	○		
(2) Procurement of 33kV underground distribution cable	○		
(3) Laying of 33kV underground distribution cable		○	
(4) Equipment foundation, de-oiler and cable trenching work	○		
(5) Connection to existing cables		○	
(6) Procurement of spare parts, testing equipment and installation/maintenance manuals	○		Two years supply of spare parts
(7) Site testing before handing over to Ugandan side	○		
5. 33 kV Transmission Line Work			
(1) Procurement of bare wires, pole-mounted transformers, air-break switches, surge arresters, insulators and metalware, etc.	○		
(2) Procurement and erection of wooden poles		○	
(3) Installation of materials and equipment, and wiring work		○	
(4) Procurement of spare parts	○		Two years supply
(5) Procurement of maintenance vehicles	○		Two trucks with a crane
6. Low Voltage Distribution Line Work			
(1) Procurement of cables, distribution panel, cable accessories, insulators and metalware, etc.		○	
(2) Procurement and erection of wooden poles		○	
(3) Installation of materials and equipment, and cabling work		○	
(4) Procurement of spare parts		○	

Note: ○ indicates the responsible side for the work/procurement concerned.

3.1.4 Consultant Supervision

The consultant will organize a consistent project team to conduct the detailed design and work supervision to ensure the smooth implementation of the Project, taking the objectives of the basic design into consideration, based on Japan's grant aid scheme. Given the dispersion of the project sites over a wide area and the plan by the Ugandan side to conduct the transmission line construction work with two teams in parallel with the work by the Japanese site, the consultant will appoint at least two full-time on-site supervisors during the work supervision stage to conduct schedule control, quality control and safety control. In addition, the consultant will dispatch engineers in line with the progress of the equipment installation, test operation, adjustment and commissioning test to supervise the relevant work conducted by the contractor.

Furthermore, the consultant will assign Japanese experts to witness the factory testing and pre-shipment testing of equipment to be manufactured in Japan so that any equipment problems after the arrival of the equipment in Uganda can be prevented in advance.

(1) Basic Principles for Work Supervision

The basic principles for the consultant to execute its assigned work are supervision of the work progress to ensure completion within the set schedule, to ensure the quality specified in the agreement and to supervise the contractor so that the site work is safely conducted. Important points to note for the work supervision are described below.

1) Schedule Control

The implementation schedule planned at the time of concluding the construction agreement and the actual state of progress will be compared every month or every week to ensure that the contractor complies with the date of handing over specified in the agreement. If any delay of the work is anticipated, the consultant will issue a warning to the contractor and will request that the contractor implement measures to improve the situation so that the work is completed within the contracted period. The above comparison will mainly be conducted for the following items.

① Quantity of work completed (quantity of equipment manufacture completed at the factory and quantity of completed civil engineering work on site)

② Quantity of equipment and materials delivered (substation and transmission equipment)

③ State of temporary work and preparation of construction machinery

④ Actual number of engineers, skilled workers and labourers and their ratios compared to the original plan

2) Quality and Specification Control

The consultant will supervise the items listed below to ensure that the equipment and materials manufactured, delivered and installed and that the facilities constructed meet the quality and specifications demanded by the agreement. If there is any doubt in regard to their satisfactory quality or specifications, the consultant will immediately request the contractor to rectify, alter or improve the situation.

① Checking of shop drawings and specifications of equipment and materials

② Witnessing of factory inspection of equipment and materials, or checking of factory inspection results

③ Checking of equipment installation drawings and instructions

④ Checking of instructions on test operation, adjustment, testing and inspection of equipment

⑤ Supervision of equipment installation work and witnessing of test operation, adjustment, testing and inspection

⑥ Checking of construction progress based on design, drawings

3) Safety Control

The consultant will conduct work supervision to prevent site accidents involving site workers and/or third persons during the construction period in consultation and cooperation with the site representative(s) of the contractor. The following points should be carefully noted regarding safety control on site.

① Enforcement of safety control rules and appointment of a safety control manager

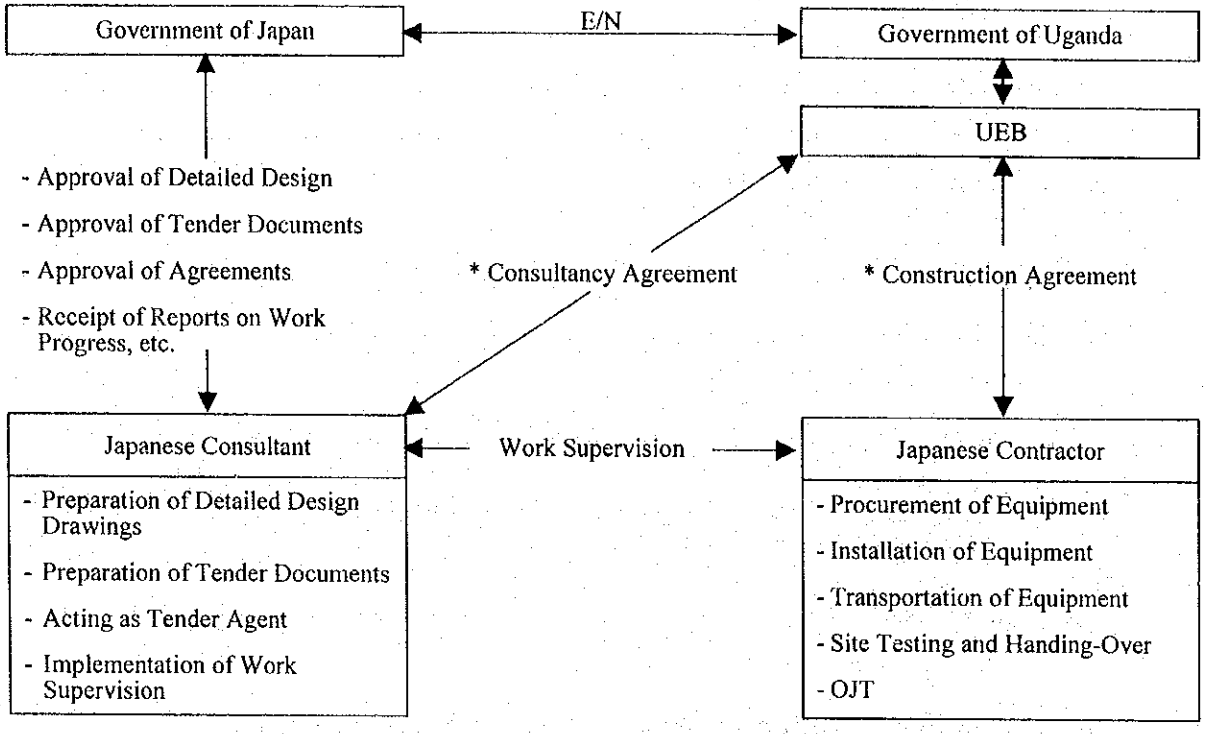
② Prevention of accidents by means of regular inspection of construction machinery

③ Clear instruction of travelling routes for work-related vehicles and construction machinery and strict enforcement of slow driving on site

④ Enforcement of welfare measures and days-off for workers

(2) Project Implementation System

The relationship between those involved in the implementation of the Project, including the work supervision stage, is shown in Fig. 3-1-1.



Note: The consultancy agreement and construction agreement must be verified by the Government of Japan.

Fig. 3-1-1 Project Implementation System

(3) Supervisory Engineers

In conducting the equipment and materials installation work as well as the necessary civil engineering work at the Kayunga Substation and the booster stations at the Hoima Substation and Wabigalo, the contractor will procure and deliver the transmission equipment and materials, and will use a local construction company as a subcontractor. As it will be necessary for the subcontractor to fully understand the contents of the subcontracting agreement regarding the work schedule, work quality and compliance with the specifications and safety measures, the contractor will dispatch Japanese engineers with experience of overseas work similar to that under the Project to guide/educate the subcontractor.

Given the scale and contents of the planned substation construction work under the Project, it is desirable that the contractor dispatch at least those engineers listed in Table 3-1-2 for full-time assignment on site.

Table 3-1-2 Desirable Dispatch of Engineers by Contractor

Type of Engineer	No.	Assigned Work	Assignment Period
Site Manager	1	Overall work management; consultation and coordination with related organizations and obtaining of necessary permits, etc.; OJT supervision; equipment procurement and control; customs clearance; personnel control; accounting	Entire construction period
Electrical Engineer (A)	1	Installation supervision of transformers	Relevant equipment installation period
Electrical Engineer (B)	1	Installation supervision of distribution panels, cabling, etc.	Relevant equipment installation period
Civil Engineer	1	Supervision of civil engineering work, including foundation work for substation equipment	Relevant civil engineering work period
Testing and Adjustment Engineers	2	Testing and adjustment	Relevant work period

3.1.5 Equipment and Materials Procurement Plan

The transforming and distribution equipment to be procured and installed under the Project is not manufactured in Uganda and transformers, distribution panels, conductors, insulators, etc. are all imported from such European countries as the UK and Sweden as well as from other countries, including Japan. This variety of import sources is a reflection of the wide base of overseas aid of Uganda. Few manufacturers, however, have agents in Uganda to provide after-services in connection with breakdown repair and spare parts supply. According to the opinion of the Ugandan side, reliable after-services are provided by manufacturers in Japan.

As far as the materials for civil engineering and building work are concerned, locally produced aggregate, cement and timber and imported reinforcing bars and paint are readily available in the domestic market and can, therefore, be procured in Uganda. In contrast, it will be necessary to newly import structural steel and finishing materials, etc., as in the case of the substation and transmission equipment.

As 50 ton class cranes and trailers can be leased locally, no problems are anticipated in regard to equipment installation and transportation.

Given the above situation, the required equipment and materials for the Project will be procured in the following manner.

(1) Equipment and Materials for Local Procurement

Wooden poles, cement, sand, concrete aggregate, concrete blocks, bricks, reinforcing bars, paint, timber, petrol, diesel oil, small vehicles, crane; trailer, and other equipment and materials for temporary work

(2) Equipment and Materials to be Procured from Japan

1) Substation Equipment and Materials

Transformers, 33 kV and 11 kV distribution panels, and step voltage regulators

2) Distribution Equipment, etc.

Conductors, Pole-mounted transformers, insulators, surge arresters, air-break switches, etc.

3) Vehicles

Trucks with crane

For the transportation of the products procured from Japan, an adequate packaging method will be employed to ensure safe transportation during the long maritime voyage, landing at the port, land transportation to the Project sites and storage at the Project sites. Port Mombassa in neighboring Kenya appears to be the most appropriate port of landing. Its major loading/unloading facilities are suitable for the landing of the equipment to be procured under the Project. The road for inland transportation of some 1,100 km in length between Port Mombassa and the Project sites is currently used as a trunk road to Uganda. Even though the paving conditions of some sections are not very satisfactory, large trailers can use this road with cautious driving. It usually takes one month for imported goods to undergo the customs clearance process at Port Mombassa and, therefore, the contractor should prepare the necessary documentation in advance in order to minimize the length of this process to comply with the planned project implementation schedule.

3.1.6 Implementation Schedule

The project implementation schedule shown in Fig. 3-1-2 is suggested based on Japan's grant aid cooperation scheme.

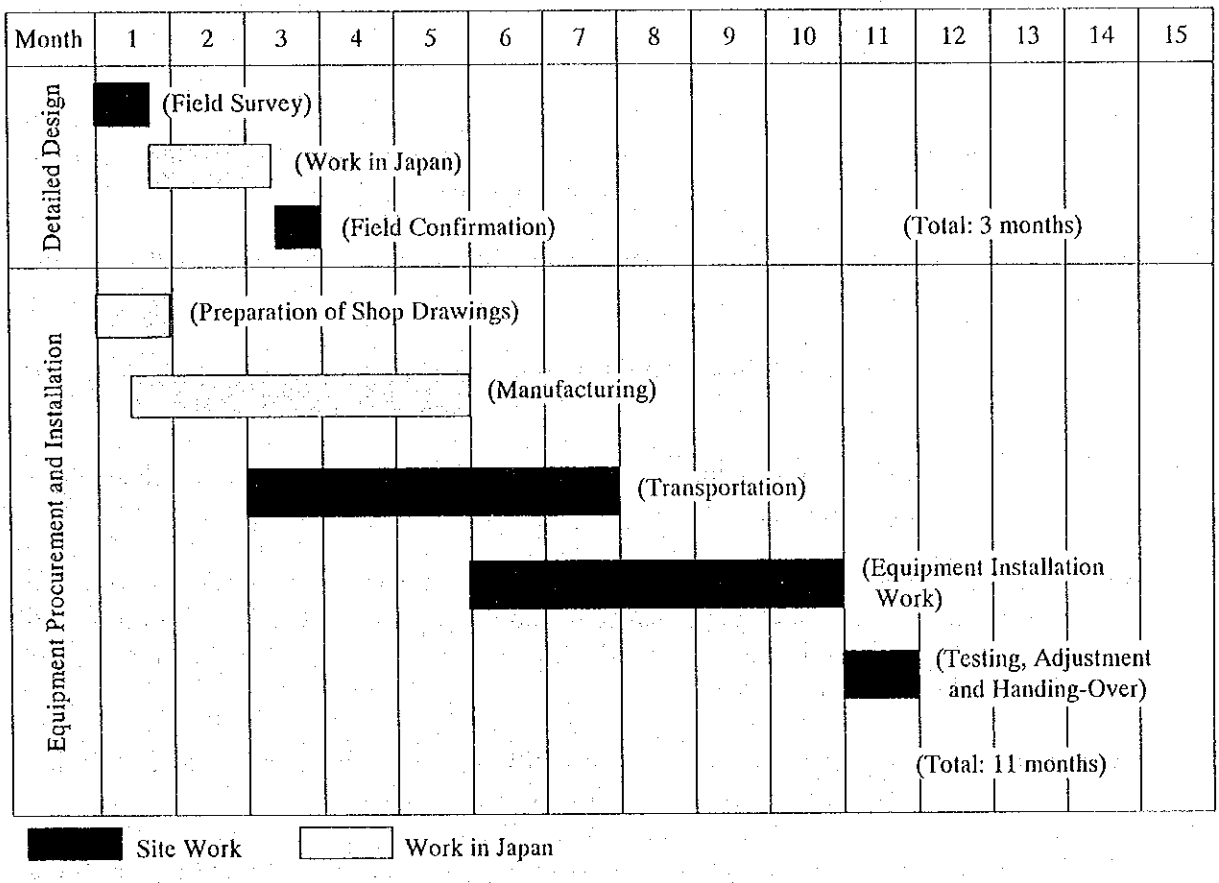


Fig. 3-1-2 Implementation Schedule

3.1.7 Obligations of Recipient Country

In the course of the implementation of the Project, the Government of Uganda will be responsible for conducting the following work or providing the following items in addition to the scope of work for the Ugandan side described in 3.1.3.

(1) To provide necessary data and information for the Project.

(2) To secure and provide cleared, embanked and leveled land as well as access road for the new substation and booster stations, prior to the commencement of the construction for the Project.

(3) To ensure speedy unloading, customs clearance and tax exemption of the goods for the Project at port and /or airport of disembarkation, and internal transportation in the Republic of Uganda.

(4) To accord Japanese nationals whose services may be required in connection with the supply of products and services under the verified contracts such facilities as may be necessary for their entry into the Republic of Uganda and stay therein for the performance of their work.

(5) To exempt Japanese nationals from custom duties, internal taxes and other fiscal levies which may be imposed in the Republic of Uganda with respect to the supply of the products and services under the verified contracts.

(6) To bear commissions to a Japanese bank for the banking services based upon the banking arrangement.

(7) To bear all the expenses other than those to be borne by the Grant Aid necessary for the execution of the Project.

(8) To provide proper arrangements for the construction/installation work, such as water supply, electricity, drainage, etc, if necessary.

(9) To assign exclusive counterpart engineers and technicians to the Project in order to transfer the operation and maintenance technique for the Project and to witness and confirm construction/installation works and qualities of equipment and materials when inspection is carried out.

(10) To take necessary measures and responsibility for the stoppage of electricity during construction / installation period, when it is necessary.

(11) To construct and to connect the cables supplied by the Japan's grant aid for incoming and outgoing feeders for substations and booster stations, which will be constructed under the Project.

(12) To use and maintain properly and effectively all the equipment and materials provided under the Japan's Grant Aid.

(13) To construct incidental outdoor facilities, boundary fence, entrance gate and outdoor lighting at the new substation and booster stations by the completion of the Project

(14) To install equipment and materials for transmission lines supplied under the Project in accordance with the proper implementation schedule to meet the requirements of the Japan's Grant Aid.

(15) To provide proper disposal places of excavated soil, waste water and oil discharged during the implementation period.

(16) To provide temporary yard for the contractor's office, the consultant's office, equipment and materials storage yard, etc., in the new substation and booster stations.

(17) To provide load for test operation of the new substation and booster stations during the implementation period.

3.2 Operation and Maintenance Plan

(1) Basic Concept

The proper operation and maintenance (O & M) of the transmission and substation equipment and the preservation of a proper working environment are essential to achieve the improved reliability of the electricity supply system to provide stable electricity supply services for users at the Project sites. Given the absence of electricity supply at the Project sites as described earlier, appropriate preventive maintenance aimed at reducing the accident rate and improving the reliability, safety and efficiency of the transforming and distribution equipment is highly desirable to ensure a stable electricity supply for users at the Project sites.

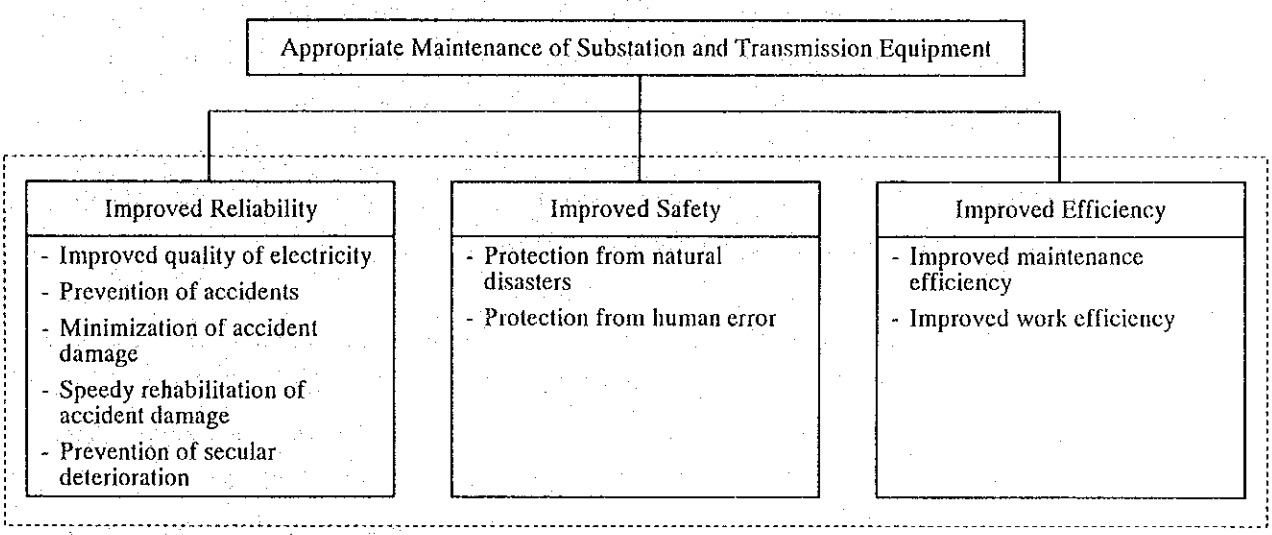


Fig. 3-2-1 Basic Concept of Substation and Transmission Equipment Maintenance

Based on the basic maintenance concept described above, the maintenance emphasis for the procured and installed equipment and constructed buildings under the Project should be placed on preventive maintenance which should then be conducted without fail.

The implementation of OJT on the operation and maintenance of the Substation equipment is planned by engineers to be dispatched by the Japanese contractor during the installation work and testing and adjustment work periods. The UEB is, therefore, expected to conduct maintenance work after the commencement of actual operation using the operation and maintenance skills acquired through OJT, bearing the basic issues described above in mind.

(2) Regular Inspection Items

1) Regular Inspection of Transforming Equipment

The standard regular inspection items for the transforming equipment to be procured and installed under the Project are shown in Table 3-2-1. As the table shows, inspection of the substation equipment is classified as ① "patrolling inspection" which is conducted daily using human senses to check any abnormal heating, sound, etc., of the equipment, ② "standard inspection" to check items beyond the daily patrolling inspection, including the fastening conditions of bolts, etc., of the equipment and the cleanliness of or damage to such loaded sections as the surface of insulated items, etc. and ③ "detailed inspection" to check the proper functioning of the interlocking mechanism between equipment and other mechanisms.

Standard inspections are conducted every one or two years while detailed inspections are conducted approximately every four years.

The regular replacement of certain parts at the time of either standard inspection or detailed inspection based on the characteristics as well as frequency of use of such parts is desirable. These include the fuses, measuring instruments, relays, etc., installed inside the distribution panels and others which are liable to performance deterioration, including the insulation performance, abrasion of the contact points and changes of the characteristics.

Table 3-2-1 Regular Inspection Items for Standard Substation and Transmission Equipment

Subject	Inspection Item (Method)	Patrolling Inspection	Standard Inspection	Detailed Inspection
Equipment Outlook	Switchgear indicator and indication light	○	○	
	Abnormal sound or odor	○	○	
	Thermal discoloration of terminals	○	○	
	Cracks, damage or staining of bushing and insulator	○	○	
	Rust on casings and frames	○	○	
	Abnormal temperature (thermometer)	○	○	
	Fastening of bushing terminals (mechanical check)	○	○	
Operating Apparatus and Control Panel	Pressure gauge indication	○	○	○
	Counter indication		○	○
	Condensation and damage inside console and parts		○	○
	State of oil supply and cleaning		○	○
	Fastening of cable terminals	○	○	○
	State of switchgear indication		○	○
	Air leakage and oil leakage		○	○
	Pressure before and after operation (air pressure, etc.)		○	○
	Working of instruments		○	○
	Rust, deformation and/or damage to springs	○	○	○
	Abnormality of fastening pins		○	○
	Auxiliary switchgear and relays		○	○
Measurement/ Testing	Measurement of insulation resistance		○	○
	Measurement of contact resistance			○
	Breaking of heater cable		○	○
	Testing of relay function		○	○

2) Regular Inspection of Transmission Lines

One of the most important user services is the maintenance of transmission lines by means of detecting breakdowns and damage through regular patrolling and immediate repair. In addition, if short-circuiting or any other accident is envisaged due to the contact of a tree, etc., with a transmission line, it is essential to take preventive measures, including the felling of the tree. The major check items for patrolling inspection are listed below.

① Breakage of conductors
② Damage to insulators
③ Contact between conductors and trees
④ Damage to poles
⑤ Straightness of poles

⑥ Position of pole-mounted transformers
⑦ Abnormal temperature increase of pole-mounted transformers
⑧ Operational status of circuit switches

(3) Maintenance Cost

The existing local offices of the UEB will be mainly responsible for the operation and maintenance of the Kayunga Substation, Njeru Substation, Booster station at Wabigalo, Booster station at the Hoima Substation and the 33 kV transmission lines for which equipment will be either newly installed or renewed under the Project following the commencement of their operation. As these offices at the project sites have their own operation and maintenance staff, it will be unnecessary to recruit new staff following the implementation of the Project.

The substation equipment to be installed is basically maintenance-free and no regular replacement will be required except for some items (for example, silica gel for the transformer, etc.) However, the spare parts shown in Table 3-2-2 will be required in preparation for unexpected breakdowns. Consequently, it will be necessary for the Ugandan side to make the necessary budgetary appropriation for the smooth implementation of the operation and maintenance of the equipment in question.

(4) Spare Parts Procurement Plan

The spare parts for the substation and transmission equipment are classified as standard accessories requiring regular replacement depending on the state of deterioration and renewal parts required for such emergencies as accidents and breakdowns. It will be necessary for the Ugandan side to purchase these spare parts in line with the regular inspection cycle described in (2) above. Two years supply of spare parts and maintenance tools will be procured under the Project as listed in Table 3-2-2. By the end of the second year after the completion of the Project, it will be necessary for the UEB to secure the necessary budget for the purchase of additional spare parts from the third year onwards.

Table 3-2-2 Spare Parts and Maintenance Tools to be Procured Under the Project

Item	Unit	Substation (S/S) or Booster Station (B/S)			
		Njeru S/S	Kayunga S/S	Wabigalo B/S	Hoima B/S
1. Spare parts for substation or Booster Station					
1.1 Spare parts for transformer					
1) 33 kV bushing	piece		1	1	1
2) 11 kV bushing	piece		1		
3) Silica gel for dehumidifier (for transformer)	set		1	1	1
4) Buchholz relay	piece		1	1	1
5) Dial thermometer	piece		1	1	1
6) Dial oil gauge (for main body)	piece		1	1	1
7) Repair packing	set		1	1	1
1.2 Spare parts for distribution panel					
1) Switch coil for 33 kV circuit breaker	piece	1	1	1	1
2) Trip coil for 33 kV circuit breaker	piece	1	1	1	1
3) Switch coil for 11 kV circuit breaker	piece		1		
4) Trip coil for 11 kV circuit breaker	piece		1		
5) Disconnecting switch for 33 kV grounding device (for single phase)	piece	1	1		
6) Disconnecting switch for 11 kV grounding device (for single phase)	piece		1		
7) Ammeter (with demand mechanism) 100 A	piece			1	1
8) Ammeter (with demand mechanism) 400 A –200 A	piece	1	1		
9) Ammeter (with demand mechanism) 200 A –100 A	piece	1	1		
10) Ammeter (with demand mechanism) 600 A –300 A	piece		1		
11) Ammeter (with demand mechanism) 300 A – 150 A	piece		1		
12) Watthour meter (33 kV)	piece	1	1		
13) Watthour meter (11 kV)	piece		1		
14) Effective power meter	piece		1		
15) Reactive power meter	piece		1		
16) Voltmeter 45 kV	piece	1	1	1	1
17) Voltmeter 15 kV	piece		1		
18) Voltmeter 600 V	piece		1	1	1
19) Overcurrent relay (51)	piece	1	1	1	1
20) Distance relay (21)	piece	1	1		
21) Overcurrent relay for grounding (51G)	piece	1	1	1	1
22) Reclosing relay (79)	piece	1	1		
23) Ratio differential relay (87)	piece		1		
24) Voltage relay (64 V)	piece		1		
25) Various auxiliary relays	set	1	1	1	1
26) Various change-over switches	set	1	1	1	1
27) Various control switches	set	1	1	1	1
28) Display lamps	set	1	1	1	1
29) Power and protective fuse links	set	1	1	1	1

Item	Unit	33 kV Transmission Line			
		A-1 Area	A-2 Area	B Area	C Area
2. Spare parts for 33kV Transmission Lines					
1) Pole mounted distribution transformer (25 kVA)	Piece	1 (shared use)			
2) Pole mounted distribution transformer (50 kVA)	Piece	1 (shared use)			
3) Pole mounted distribution transformer (100 kVA)	Piece	1 (shared use)			
4) Pole mounted distribution transformer (200 kVA)	Piece	1 (shared use)			
5) Fused cutout switch (3 nos. for 3 phases)	Set	1 (shared use)			
6) Load break switch	Piece	1 (shared use)			
7) Surge arrester (3 nos. for 3 phases)	Set	1 (shared use)			
3. Maintenance Tools for 33kV Transmission Lines					
1) Crimper	Set	1 (shared use)			
2) Crimping tool (with dies)	Set	1 (shared use)			
3) Cable cutter	Set	1 (shared use)			
4) Operation rod for fused cut-out switch	Set	1	1	1	1
5) Operation rod for load break switch	Set	1	1	1	1