



THE KENYA POWER
AND LIGHTING CO. LTD.

CODE OF PRACTICE

for

CONSTRUCTION OF MEDIUM VOLTAGE OVERHEAD LINES
(VOLTAGES UP TO 33KV)

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REVISION RECORD

REVISION	DESCRIPTION OF REVISION	DATE	APPROVAL
0	1 ST ISSUE	JULY 1998	

CONSTRUCTION OF OVERHEAD LINES UP TO 33KV

CONTENTS

1. Foreword
2. Scope
3. Factors of Safety
4. Working Conditions
5. Materials
6. Clearances and Spans
7. Drawings

FOREWORD

- 1.1 This standard has been prepared by the Standards Department of the Technical Audit R&D Division, KPLC and lays down the recommendations for the construction of medium voltage overhead.
- 1.2 This standard supersedes all standards for construction of low voltage lines issued before the revision date.

2. SCOPE

- 2.1 This standard lays down the requirement for the design, erection and installation of overhead medium voltage electric power distribution lines of voltages up to 33kV.
- 2.2 This standard covers the design and erection of
 - (i) Three phase, 3-wire and single phase, 2-wire medium voltage overhead lines erected on wood poles, including constituent component parts.

3. FACTORS OF SAFETY

The minimum factors of safety at assumed maximum simultaneous working loadings shall be as follows:-

3.1 Line conductors, based on ultimate strength

Maximum tension	3.0
Everyday stress	5.0

3.2 Insulators and fittings, based upon electro-mechanical test and minimum failing load insulators and insulator fittings

and insulator fittings	2.5
Dead end clamps and conductor fittings	2.5

3.3 Steel structures, bolts and other steel pole members based on elastic limit of tension members and on crippling loads of compression members

Steel structures	2.5
(including steel cross-arm)	
Bolts, nuts and washers	2.5

3.4 Supports, stays and cross-arms subjected to the longitudinal, transverse and vertical loads resulting in the loading conditions stated above.

Wood supports and cross-arms	3.5
Concrete structures	2.5
Steel supports and cross-arms	2.5
Stay assembly and fittings	2.5

3.5 Foundation - Concrete

2.5

4 WORKING CONDITIONS

The maximum assumed working conditions shall be as follows:-

4.1 Minimum temperature of line	5°C
4.2 Ambient temperature of line conductor	35°C
4.3 Maximum temperature of line conductors	65°C (70°C)
4.4 Wind pressure on the whole projected area of conductors	400 N/m ²
4.5 Wind pressure on the projected area of insulator	400 N/m ²
4.6 Wind pressure on the projected area of support	400 N/m ²

5 MATERIALS

5.1 Line Conductors

Nominal Area of Conductor	mm ²	25	75	150
Conductor		ACSR	ACSR	ACSR
Number and diameter of wires: Aluminium:	No/mm	1 / 2 36	6 / 4. 10	30 / 2.59
Steel		6 / 2. 36	1 / 4. 10	7 / 2.59
Maximum resistance per km at 20°C	ohms	1.093	0.3623	0.1823
Overall diameter	mm	7.08	12.3	18.13
Mass (Weight)	kg/km	106	320	726
Nominal breaking load	Newton's	9600	272000	69200
Maximum full load current	Amps	115	219	329

5.2 Insulators and Fittings

(a) Pin Insulators

Type of insulators		Pin
Material		Porcelain
Minimum failing load	11kV	10kN
	33kV	10kN
Outside diameter	11kV	165 mm max.
	33kV	315 mm max.
Creepage distance	11kV	225mm
	33kV	700mm
Power frequency withstand voltage	11kV Dry	95kV
	Wet	45kV
	33kV Dry	200kV
	Wet	90kV

(b) Disc Insulator

(i) String Insulator Unit

Type of Insulator		Disc
Material		Glass (Porcelain)
Minimum failing load		70kN
Outside diameter		255mm
Distance between centres of units		146mm
Creepage distance		280mm
Power frequency withstand voltage	Dry	-
	Wet	40 kV
Impulse withstand voltage	Dry	95 kV

(ii) Insulator Sets-Complete

Number of strings per phase		1
Minimum failing load of fitting		70kN
Minimum failing load of complete set		70kN
Number of units in each string (minimum)	11kV	1
	33kV	3
Impulse withstand voltage (1.2/50us)	11kV	95 kV
	33kV	200 kV
Power frequency (1 minute) withstand voltage	11kV	40 kV
	33kV	90 kV

5.3 Supports

5.3.1 Poles

- (a) The safe working maximum fibre stress (ultimate bending strength or modulus of rupture) for the wood poles of eucalyptus saligna species being used shall be taken as 520 kg/cm².
- (b) The standard sizes of the different categories of poles for use shall be as follows:-

	Length (m)	Minimum ground line diameter (mm)	Minimum top diameter (mm)	Planting depth (m)
Light	8.5	180	140	1.5
	10.0	180	140	1.8
	11.0	190	140	1.8
	12.0	200	140	1.8
Medium	8.5	200	150	1.5
	10.0	220	150	1.8
	11.0	230	160	1.8
	12.0	240	160	1.8
	14.0	270	160	2.0
Stout	10.0	285	200	1.5
	11.0	295	220	1.8
	12.0	305	220	1.8
	14.0	335	230	2.0
	15.0	360	230	2.0
	17.0	375	230	2.0

5.3.2 Cross-Arms

The standard sizes of the different wood cross-arms and their application shall be as follows:-

Cross-Arms Dimension				Line Voltage	Conductor Size	Application
Length		Cross Section				
Imperial	Metric	Imperial	Metric			
(Inch.)	(m)	(Inch.)	(mm)			
425	1.7	5x4	130x100	11kV	75sq.mm	Intermediate pole
425	1.7	5x5	130x130	11kV	150sq.mm	Intermediate pole
675	2.7	5x4	130x100	11kV	75sq.mm	Intermediate (long span) or horizontal section pole
675	2.7	5x5	130x130	33kV	150sq.mm	Intermediate pole
275	1.1	5x5	130x100	33kV	75sq.m	Aerial earth wire construction
275	1.1		130x130	33kV	150sq.m	Aerial earth wire construction

6. CLEARANCES AND SPANS

6.1 Medium overhead lines minimum clearances at operating temperatures.

Lines not exceeding 11kV across or along road	5.8m (19ft)
Lines not exceeding 11kV over private land	5.2m (17ft)
Lines not exceeding 66kV over private land	6.2m (20ft)

6.2 Additional Clearances

11kV line conductor to any part of the building	2.7m (8ft. 8 inch)
33kV line conductor to any part of the building	2.9m (9ft. 5 inch)

6.3 Distances between conductors of different voltages in substation

Rigid jumper connections phase to phase:	11kV - 25cm (10 inch) 33kV - 46cm (18 inch)
Rigid jumper connections phase to earth:	11kV - 25cm (10 inch) 33kV - 36cm (14 inch)

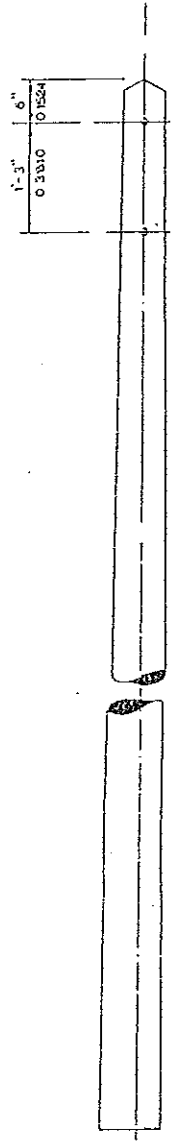
6.4 Special Clearances

(a) Railway crossing clearances

- (i) All types of line including guard nets 8.1m (30 ft).
- (ii) The minimum clearance of any pole or structure from the centre of a tract shall be the height of the pole above ground plus 2.1m (7 ft).
- (iii) Where the tract is in a cutting, no such pole shall be closer to the edge of the cutting than a distance equal to the height of the pole.

(b) Kenya Posts & Telecommunications Installation Clearances

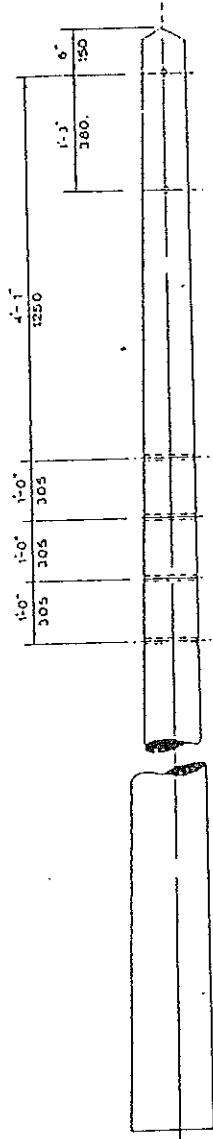
- (i) Guard net 1.3m (4 ft).
- Up to 66kV conductors using cradle guard 1.8m (6 ft).
- (ii) Angles of crossing
Medium voltage, not less than 60°



NOTE:-

1. HOLES TO BE DRILLED $15/16$ " (24mm.)
2. ALL HOLES SHOULD BE DRILLED AT 90° TO THE DIAMETER.

STANDARD 11KV POLE DRILLING		MV/11/ 01	

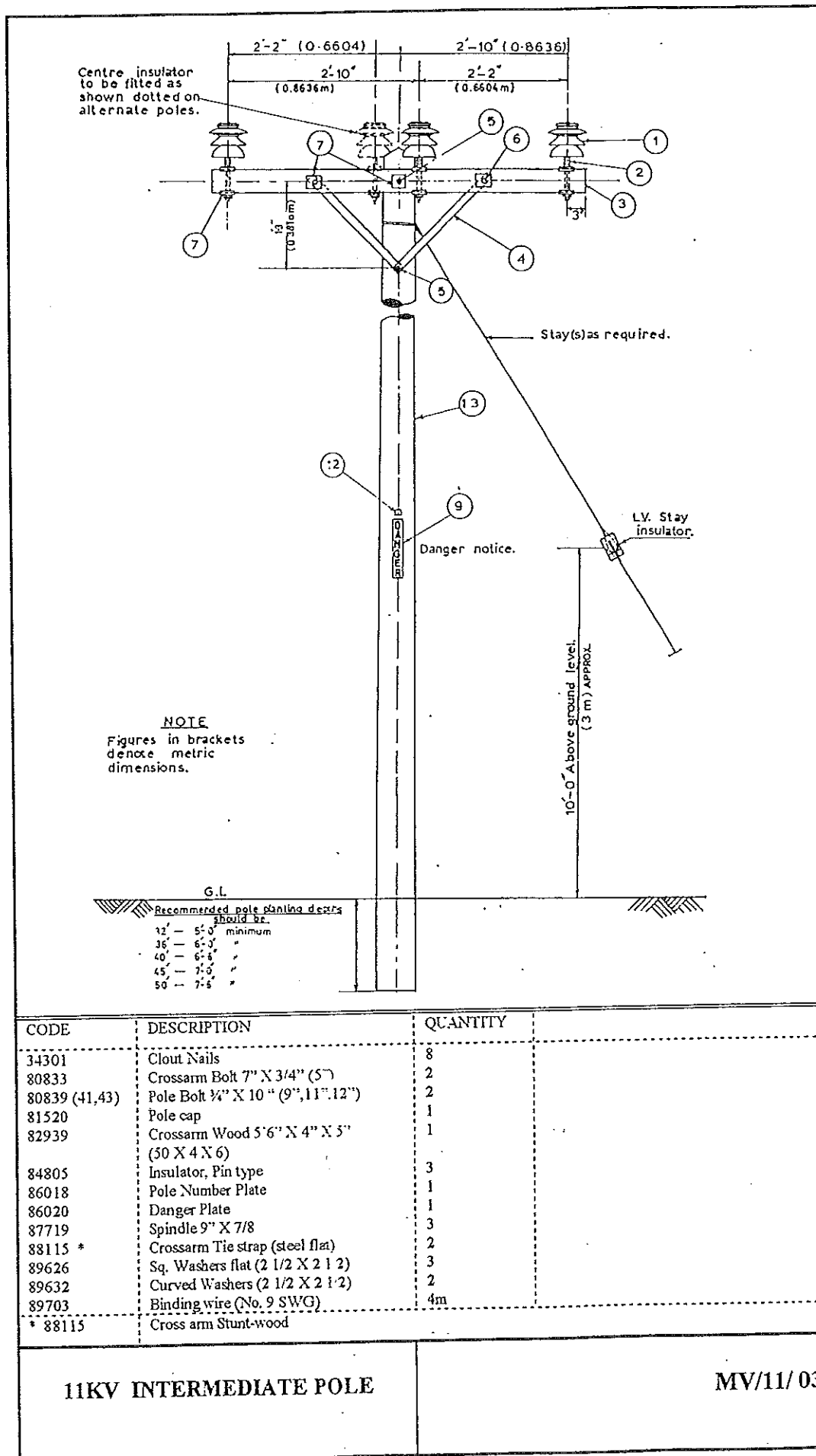


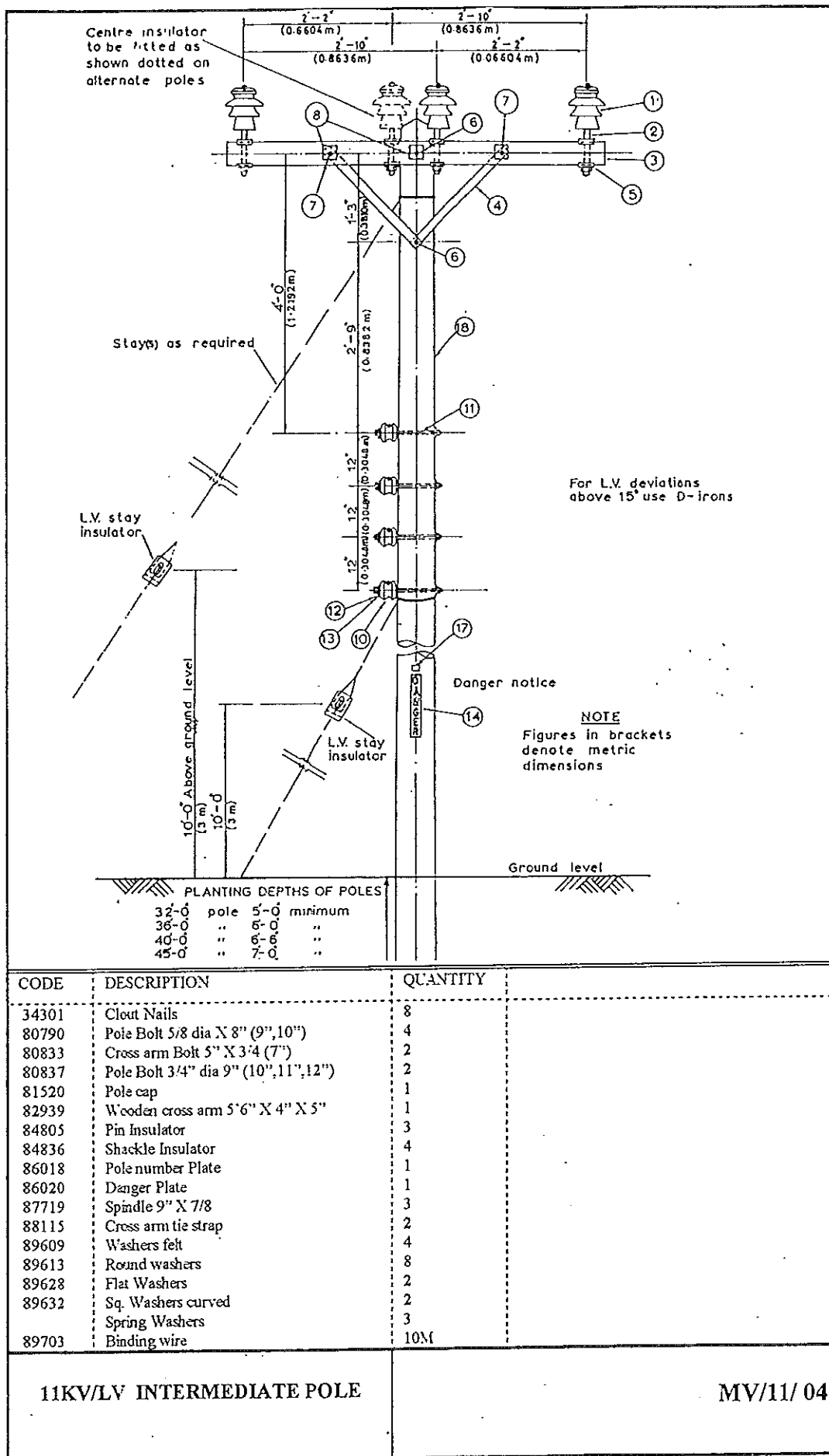
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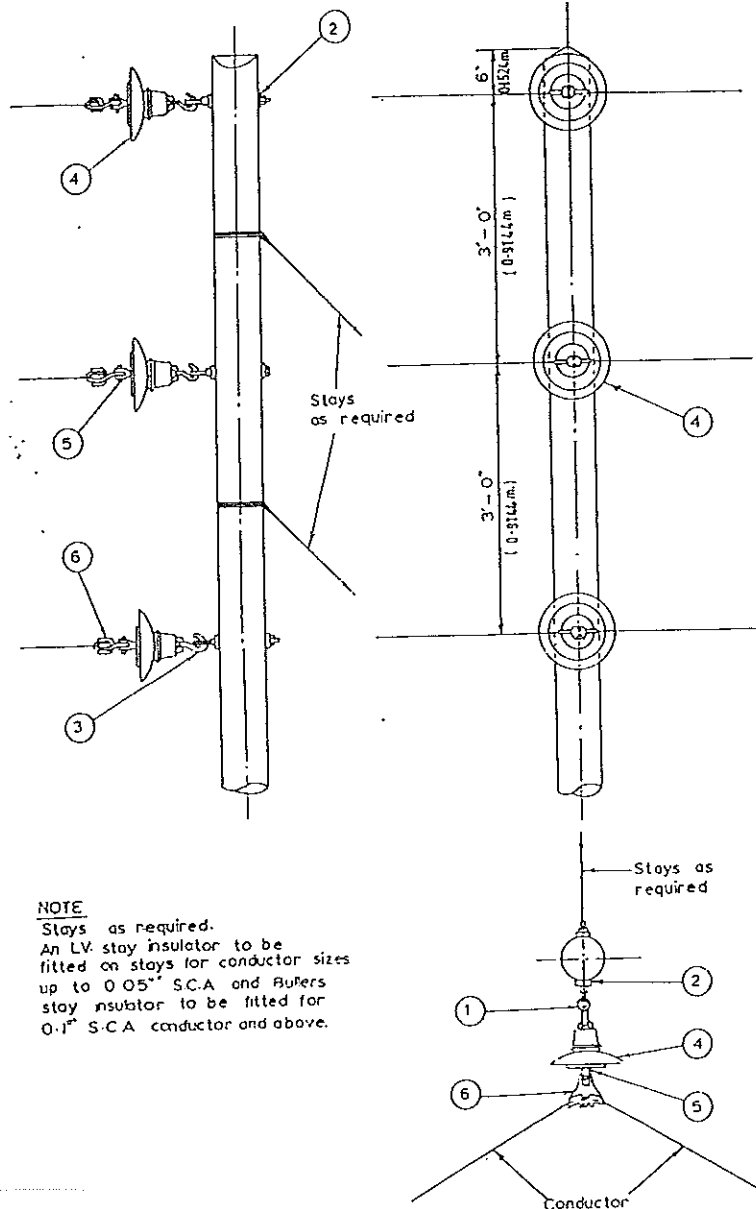
1. HOLES TO BE DRILLED $1\frac{5}{16}$ (24mm) ODS
2. ALL HOLES SHOULD BE DRILLED AT 90° TO THE DIA.

STANDARD 11KV/LV POLE DRILLING		MV/11/ 02	

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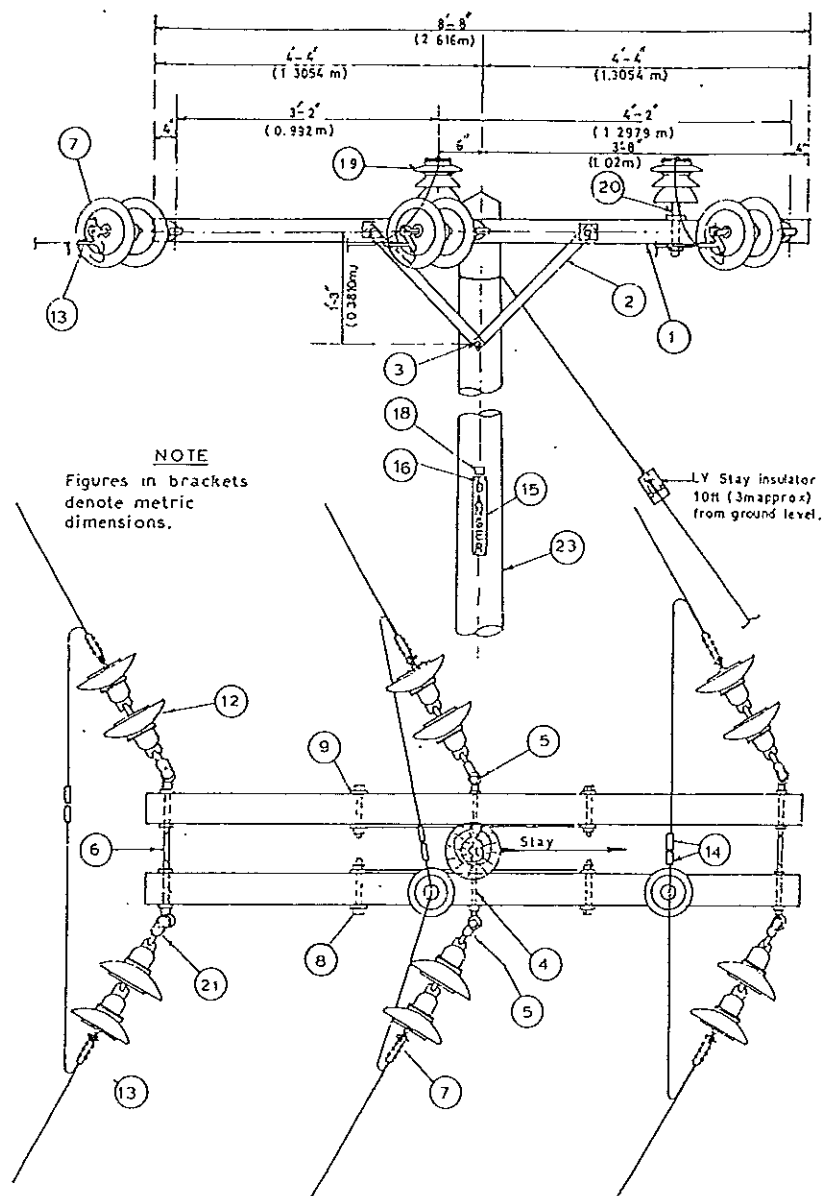




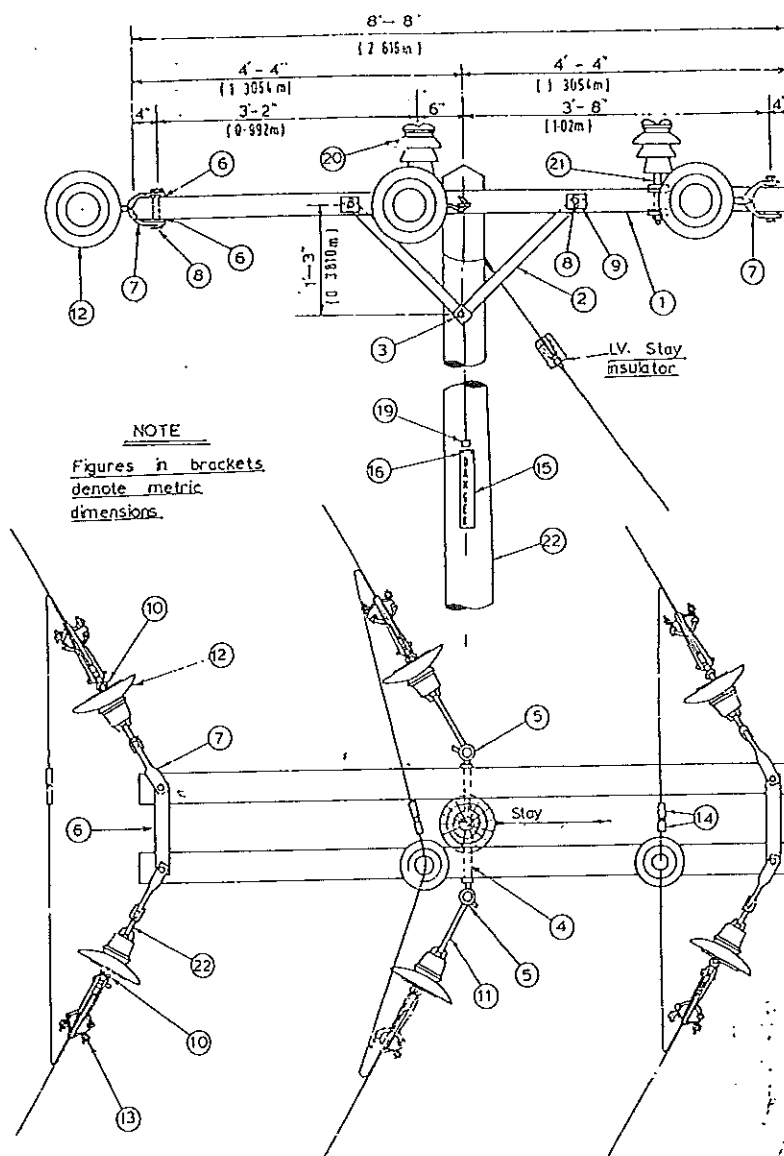


CODE	DESCRIPTION	QUANTITY	
34301	Clout Nails	6	
80111	Socket Clevis Adaptor	3	
80911	Eye Bolt 3/4 X 10"	3	
81520	Pole Cap	1	
81926	Suspension Clamp (alt. 81925)	3	
84501	Hook Ball ended	3	
84860	Glass Disc Insulators (70KN)	3	
86018	Pole Number Plate	1	
86020	Danger Plate	1	
89632	Sq. Washers curved	6	
11KV VERTICAL FLYING ANGLE POLE (Up to 100 sq. mm conductor)			MV/11/ 05





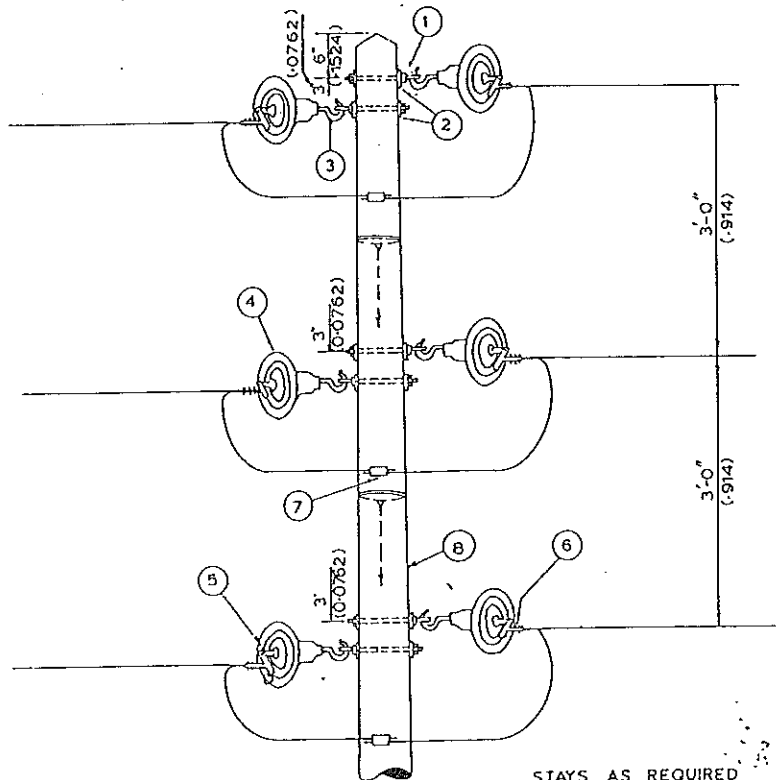
CODE	DESCRIPTION	QUANTITY	CODE	DESCRIPTION	QUANTITY
34301	Clout Nails	8	86020	Danger plate	1
35151	Eye Nut 3/4" dia	2	87719	Spindle	2
80104	Ball ended Clevis adaptor	4	88105	Crossarm shackle strap	4 pairs
80111	Socket - Clevis adaptor	6	88117	Strap (M.S. Flat)	4
80831	Bolt for shackle strap 3/4" dia	4	88916	Terminating thimble	6
80843	Pole bolt 3/4" dia (10", 11", 12")	1	89626	Flat Washer	6
80915	Pole Bolt 3/4" dia 22"	1	89632	Curved Washer	1
81520	Pole cap	1	89703	Aluminium Binding Wire	20M
81813	P.G. Clamp	3			
82948	Wooden crossarm 7'6" x 4" x 5"	2			
84506	Pig tail hook	2			
84805	Pin insulator	2			
84860	Disc Insulator (70KN)	6			
86018	Pole number plate	1			
11KV HORIZONTAL SECTION POLE (Up to 50 sq. mm conductor) 60° MAX. LINE DEVIATION			MV/11/06		



CODE	DESCRIPTION	QUANTITY	CODE	DESCRIPTION	QUANTITY
34301	Clout Nails	8	86018	Pole Number plate	1
35131	Eye Nut 3/4" dia	2	86020	Danger plate	1
80104	Ball - Clevis Adaptor	4	87719	Spindle (Insulator Pin)	2
80121	Socket - tongue Adaptor	6	88105	Cross-arm shackle strap	4
80831	Bolt for shackle strap 3/4" dia	4	88117	Strap (M.S. Flat)	4
80841	Pole bolt 3/4" dia (10", 11", 12")	1	88115	Crossarm tie strap (Flat)	4
80915	22" Pole bolt (22" x 3/4")	1	89626	Flat Washers	6
81520	Pole cap	1	89703	Aluminium binding wire	20M
81816	P.G. Clamp	3			
81920	Tension Clamp	6			
82940	Wooden crossarm 8'8" x 5" x 4"	2			
84506	Pig tail hook	2			
84805	Pin insulator	2			
84860	Disc insulator (70KN)	6			

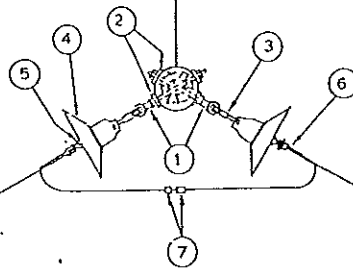
11KV SECTION POLE
(Up to 100 sq. mm conductor)
60° MAX. LINE DEVIATION

MV/11/ 07



NOTE
Figures in brackets
denote metric
dimensions.

Stay(s) as required



CODE	DESCRIPTION	QUANTITY	
34301	Clout Nails	6	
80111	Socket - Clevis Adaptor	6	
80911	Eye bolt 3/4" x 10"	6	
81520	Pole cap	1	
81813	P.G. Clamp	3	
84506	Pig tail hook	6	
84860	Disc Insulator (70KN)	6	
86018	Pole number plate	1	
86020	Danger plate	1	
88916	Terminating thimble	6	
89632	Sq. Washer, curved	6	
89703	Aluminium Binding Wire	15M	
11KV VERTICAL SECTION POLE (Up to 50 sq. mm conductor)		MV/11/ 08	

