

SPECIFICATION NO. 3.32

SPECIFICATION OF WOODEN POLES FOR 33KV, 11KV AND 415 VOLTS OVERHEAD LINES (Revised in April, 2002)

1. Standard Specification:

The poles shall be designed, fabricated and tested to conform and comply with the latest editions of the following British Standard (B.S) or appropriate IEC or any other equivalent international standard, which shall be subject to the approval of FEWA.

- a) Wood pole : B.S. 1990 - 1984
- b) Coal tar creosating : B.S 144 & B.S 913

One copy each of the specifications to which the materials are manufactured and tested are to be forwarded with the offer.

2. Site Conditions:

The poles shall be suitable for continuous use at outdoor without deterioration in the hot, humid and salty climate prevailing in the area. The maximum values of humidity and temperature experienced in this country are 100% and 50 deg. C. respectively.

3. Scope and nature of work:

The specification provides for the design, manufacture, test at manufacturer's works in presence of FEWA representatives, suitable packing, transporting, offloading at site of works or FEWA stores in satisfactory conditions and proper stacking as directed by FEWA.

4. Wood pole species and quality:

Poles shall be of the best grade of red wood or scots pine (*Pinus sylvestris*) or Larch as per British Standard 1990.

Wood poles shall be sound, straight free from warp, short crook, large checks, ring shakes, honeycombing, decay, large or dead knots, sweep, spirl or twist grain, bark, fungi, splits, insects damage, plugged holes, cross breaks except within the limit permitted by B.S. 1990.

5. Fabrication of Wood Pole:

The necessary drilling, slotting, scarfing and boring as required by latest international standards to enable poles to be assembled and the pole top steel work to be fitted should be completed before the preservation process is carried out. A template should be used for making holes and placed with its centre line parallel with the effective centre line of the pole. This ensures that the cross arm fits centrally on the pole and normal to it.

Poles should be fabricated so that any bends in the pole are in the plane of the line direction so that they do not affect the straightness of the line. Pole tops shall be evenly quartered, the height of the apex shall be 50 mm.

6. Gauge Mark on wood pole:

A gauge mark to be made on every pole at exactly 3000 mm from the butt end and at this point the length, and diameter (or classification i.e. stout or medium), the species (i.e. Red Wood or Scots pine, Larch), the year of manufacture, supplier's and creosoter's names are to be indicated. It is also important for this information to be stamped on the butts of poles to enable stacked poles in stores to be identified. Gauge mark shall be as per B.S. 1990.

7. Seasoning:

The poles shall be well seasoned before impregnation so that no individual pole shall have a moisture content above 35% in any group for which the average moisture content is 28% or less.

8. Creosoting:

When fully seasoned and fabricated poles shall be creosoted in accordance with B.S 913 with coal tar creosote complying with the requirements of B.S 144. The average net retention of creosote shall not be less than 115Kg/m³.

To eliminate any risk of internal decay and the possibility of premature failure, it is essential that the sap wood of every pole is completely penetrated with creosote.

9. Holes on wood pole for 11KV:

Two holes of 25mm dia. each should be made at a distance of 100mm from top and 550mm from top of the pole. Additional two holes of 25mm dia. each should be made at a distance of 1050mm from the butt and 300mm from the butt of the pole on every pole to fix kicking blocks. These two holes for kicking block shall be right angle to each other. The wooden pole shall be as per drawing No. FEWA/E/GEN/211/2002.

10. Wood pole dimensions for 11KV:

Poles shall have the following particulars:-

Type	:	Stout as per B.S 1990
Length	:	10.5 metre
Top diameter (maximum)	:	250 mm
Top diameter (minimum)	:	190 mm
Minimum diameter at 1500 mm from butt end	:	290 mm
Ultimate extreme fibre stress	:	53.8 N/mm ² (Red wood & Scots pine)
	:	65.5 N/mm ² (Larch)
Modulus of Elasticity	:	10480 N/mm ² (Red wood & Scots pin)
	:	11380 N/mm ² (Larch)

Strength of the Poles when stayed (Strut)

Length	:	10.5 metre
Effective diameter	:	226.7 mm
Crippling load	:	134 KN

Strength of the Pole when unstayed (Cantilevers)

Length	:	10.5 M
Minimum diameter at 1500 mm from butt end	:	290 mm
Depth of planting (assumed)	:	1.5 metre
Ultimate load at 600 mm from pole top	:	15.33 KN (Red wood & Scots pine)
	:	18.67 KN (Larch)
Load per mm of deflection at point of application of load	:	12.5N (Red wood), 13.5N (Larch)

11. Kicking Block for 11kv OHL:

Two nos. of creosoted wooden kicking blocks shall be supplied with every pole along with fixing bolts (20x500mm), nuts, curved and flat washers as per latest international standards. The dimension of wooden kicking block shall be 1300x250x125mm.

12. Holes on wood poles of 415 volts:

4 Nos. of holes of 19mm dia. should be made at an interval of 230mm, the first hole being 100mm from the top of the pole.

One additional hole of 19mm dia. should also be made at a distance of 675mm from the top for fixing spindle for eyebolt for stay at right angle to the above holes. The wooden pole shall be as per drawing No. FEWA/E/GEN/210/2002.

13. Wood pole dimension for 415 volt:

Poles shall have the following particulars:-

Type	:	Medium as per B.S 1990
Length	:	8.5 metre
Top diameter (maximum)	:	180 mm
Top diameter (minimum)	:	150 mm
Minimum diameter at 1500 mm from butt end	:	215 mm
Ultimate extreme fibre stress	:	53.8 N/mm ² (Red wood & Scots pine)
	:	65.5 N/mm ² (Larch)
Modulus of Elasticity	:	10480 N/mm ² (Red wood & Scots pine)
	:	11380 N/mm ² (Larch)

Strength of the Poles when stayed (Strut):

Length	:	8.5 metre
Effective diameter	:	174.5 mm
Crippling load	:	77.8 KN

Strength of the Poles when unstayed (Cantilever):

Length	:	8.5 metre
Minimum diameter at 1500 mm from butt end	:	215 mm
Depth of planting (assumed)	:	1.5 metre
Ultimate load at 600 mm from pole top	:	8.20 KN (Red wood & Scots pine)
	:	9.99 KN (Larch)
Load per mm of deflection at point of application of load	:	9.9 N (Larch), 9.1 N (Red wood).

14. Wood Pole Dimension for 33KV OHL:

a) Intermediate poles for umbrella cross arm shall have the following particulars:

Type	:	Stout as per B.S. 1990
Length	:	10.5 Metre
Top diameter (maximum)	:	250 mm
Top diameter (minimum)	:	190 mm
Minimum diameter at 1500 mm from butt end	:	290 mm
Ultimate extreme fibre stress	:	53.8 N/mm ² (Red wood & Scots pine)
	:	65.5 N/mm ² (Larch)
Modules of Elasticity	:	10480 N/mm ² (Red wood & Scots pine)
	:	11380 N/mm ² (Larch)

Strength of the pole when stayed (Strut):

Length	:	10.5 metre
Effective diameter	:	226.7 mm
Crippling load	:	134 KN.

Strength of the Poles when unstayed (Cantilevers):

Length	:	10.5 M
Minimum diameter at 1500 mm from butt end	:	290 mm
Depth of Planting (assumed)	:	1.5 M
Ultimate load at 600mm from Pole top	:	15.33 KN (Red wood & Scots pine)
	:	18.67 KN (Larch)
Load per mm.of deflection at point of application of load	:	12.5 N (Red wood)
	:	13.5 N (Larch)

b) Section/Angle/Terminal poles shall have the following particulars:

Type	:	Stout as per BS. 1990
Length	:	13.0 M
Top diameter (maximum)	:	255 mm.
Top diameter (minimum)	:	195 mm.
Minimum diameter at 1500 mm from butt end	:	320 mm.

Strength of the Pole when stayed (Strut):

Length	:	13.0 M
Effective	:	238.9 mm.
Crippling load	:	106.7 KN.

Strength of the Poles when unstayed (Cantilevers):

Length	:	13.0 M
Minimum diameter at 1500 mm from butt end	:	320 mm.
Depth of planting(assumed)	:	1.8 M
Ultimate load at 600 mm from Pole top	:	15.73 KN (Red wood)
	:	19.16 KN (Larch)
Load per mm. of deflection at point of application of load	:	8.3 N (Red wood)
	:	9.0 N (Larch)

15. Holes on Wood Pole for 33KV:

Holes on intermediate, section, angle and terminal poles for fixing umbrella, phase, earth cross arms and stays shall be as per the following drawings:

- a) FEWA/E/GEN/212/2002
- b) FEWA/E/GEN/213/2002
- c) FEWA/E/GEN/214/2002
- d) FEWA/E/GEN/215/2002

Additional two holes of 25mm. dia. each should be made at distances of 1050 mm. and 300 mm. from the butt end of the pole on every pole to fix kicking blocks. These two holes for kicking block shall be right angle to each other.

16. Dimension of kicking block for 33KV OHL:

Two Nos. of creosoted wooden kicking blocks shall be supplied with every pole along with fixing bolts (20x530 mm). nuts, curved and flat washers, etc. The dimension of kicking block shall be 1300x250x125 mm.

17. Packing:

Each item is to be packed properly and protected for shipment and transported from the place of manufacture to FEWA stores or at site of work.

Each crate of package is to contain a packing list in a waterproof envelope. All cases, packages etc. are to be clearly marked on the outside to indicate total weight, identification mark of shipping documents, name of item, quantities, Authority's tender No. etc.

18. Testing at Manufacturer's Works:

The poles shall be subjected to all type, special and routine tests in accordance with relevant B.S.S. and IEC recommendation. Certified copies of type and special test certificates shall be supplied along with the offer. Routine tests shall be carried out in presence of FEWA representatives at the manufacturer's works. The supplier shall make provision in his offer to bear all costs that are incurred in carrying out these tests to the satisfaction of FEWA. However, costs towards travel, accommodation etc. of FEWA representatives shall not be included in the quoted price.

SCHEDULE 'A'**SUB-MANUFACTURERS**

The Tenderer shall state below the names of the sub-manufacturers to the main manufacturer and details of the equipment proposed to be manufactured or supplied by them:

Name & Address of the Sub-Manufacturer	Description of Equipment

Signature : _____

Designation : _____

Name of Tenderer ; _____

Date : _____

SCHEDULE 'B'**PLACE OF MANUFACTURE, TESTING AND INSPECTION**

The Tenderer to complete the following schedule for all materials he proposes to supply

Item No.	Description	Manufacturer	Place of manufacture	Place of testing and inspection

Signature : _____

Designation : _____

Name of Tenderer : _____

Date : _____

SCHEDULE 'C'**DEVIATION FROM TENDER SPECIFICATION**

Normally, the tenderer shall quote for all the items and quantities in the price schedule based on tender specification requirements. The basis of the offer submitted by the tenderer to arrive at the quoted price should include compliance with specification requirements as well as deviations, if any. Such deviations, from the specification shall be brought out and tabulated in the table given below. The extra cost, if any, required by the tenderer to fully comply with the specification (assume deviation is not accepted by FEWA) shall be indicated against each deviations. If extra cost is not indicated in the table given below, against the deviation, it shall be deemed that the tenderer has no extra cost to fully comply with the specification requirement.

SI No.	BOQ Item No.	Description as per BOQ	Qty.	Deviation from Specification	Extra cost for fully complying with specification

NB : Deviations other than those listed above will not be accepted under any circumstances.

Signature :

Designation :

Name of Tenderer :

Date :

SCHEDULE 'D'**TECHNICAL PARTICULARS & GUARANTEES FOR WOOD POLE**

Tenderer is to give the following technical particulars of wooden pole :

Sl. No.	Description	Particulars		
		33KV	11KV	415V
1.	Manufacturer's name and address			
2.	Type of pole (light, medium, stout)			
3.	Length of pole in metres			
4.	Minimum diameter at 1500 mm from butt end in mm			
5.	Diameter at top: Minimum in mm Maximum in mm			
6.	For unstayed poles a) Assumed depth of planting in metre b) Ultimate load at 600 mm from top of pole in KN c) Load per mm of deflection at point of application of load in N			
7.	For stayed poles a) Effective diameter in mm b) Crippling load in KN			
8.	Ultimate extreme fibre stress in N/sq.mm			
9.	Modules of elasticity in N/sq.mm			
10.	Cresoter's name and mark			
11.	Species of wood (Red wood, Scots pine or Larch)			
12.	Kicking blocks: a) Dimensions in mm b) Quantity per pole c) Size of bolts, nuts and washers d) Quantity of bolts, nuts & washers per pole			
13.	Applicable standards			

Signature : _____

Designation : _____

Name of Tenderer : _____

Date : _____

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SCHEDULE 'E'

DETAILS OF PAST EXPERIENCE OF MANUFACTURER

WOODEN POLES

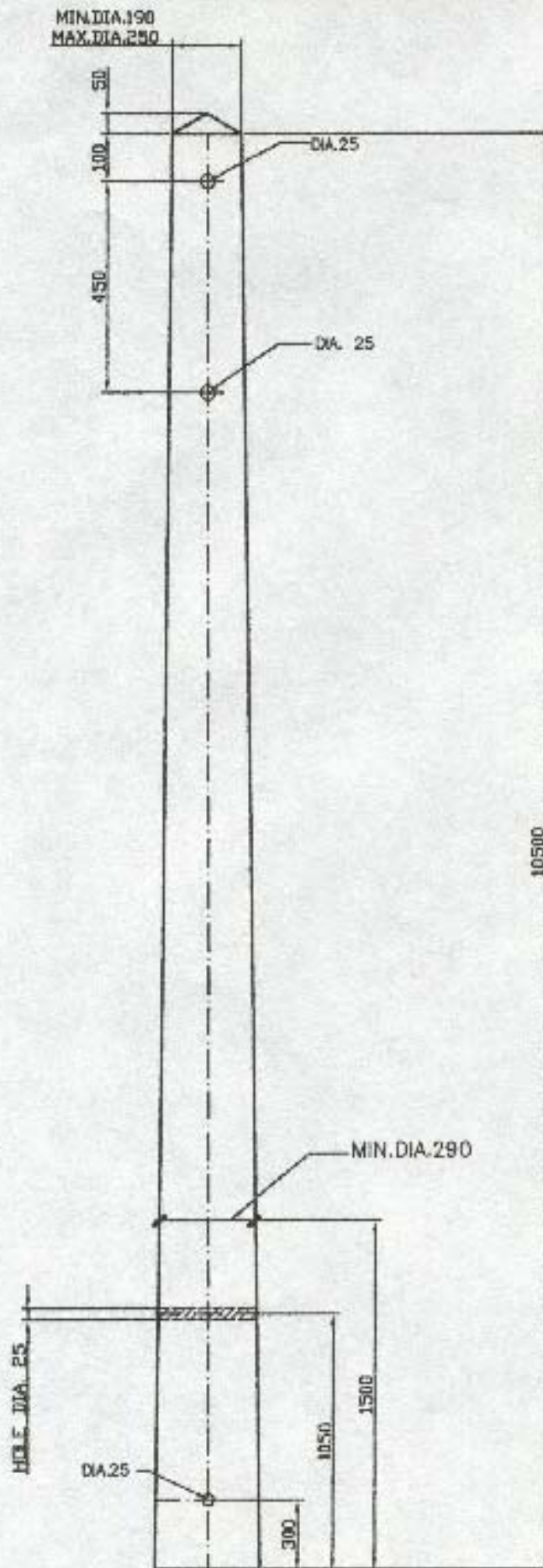
Name and address	Species, Type and size of poles	Qty.	Year of supply	Remarks

Signature : _____

Designation : _____

Name of Tenderer : _____

Date : _____



NOTES:-
ALL DIMENSIONS ARE IN MM

REV.	DATE	BY	CHKD.	APPD.	REVISION
 United Arab Emirates Federal Electricity & Water Authority P.O. BOX 1672 DUBAI U.A.E					
Directorate Of Planning Federal Electricity & Water Authority					
PROJECT					
DRG. TITLE 10.5 METERS STOUT POLE FOR 11 KV OHL					
DRG. No.			TENDER NO.	REV.	SCALE:
FEWA/GEN/211/2002			-----	0	NTS
DESIGNED	CADD	CHECKED	APPROVED	DATE	

SPECIFICATION NO. 3.33
(Revised in March, 2010)

SPECIFICATION FOR (A) 11,000 VOLTS TENSION DISC INSULATORS AND FITTINGS, (B) 11,000 VOLTS PIN INSULATORS AND FITTINGS AND (C) 415 VOLTS SHACKLE INSULATORS AND FITTINGS

1. Standard Specification:

The insulators and fittings shall be manufactured and tested to conform and comply with the latest editions of B.S. 137, IEC 305 or any other equivalent international standard. Steel used for fittings shall be as per B.S. 3288. One copy each of the specifications, to which the insulator and fittings are manufactured and tested are to be forwarded with the offer.

2. Site Conditions:

The insulator and fittings shall be suitable for continuous operation without deterioration in hot, humid and salty climate prevailing in the area. The maximum values of humidity and temperature experienced in this country are 100% and 50 deg.C. respectively.

3. Scope and Nature of Work:

The specification provides for the design, manufacture, test at manufacturer's works in presence of FEWA representatives, suitable packing, transporting, offloading at site of works or FEWA stores in satisfactory conditions and proper stacking as directed by FEWA.

(A): 11KV TENSION DISC INSULATORS & FITTINGS:

4. Construction and Material:

The insulator shall be made of brown glazed porcelain or toughened glass and shall be sound, thoroughly vitrified and free from defects and blemishes which might adversely affect the life of the insulator. The exposed parts of the porcelain shall be smoothly glazed and shall be brown in colour.

Materials to be used for the manufacture of various components of tension insulator set are given below:

a) Anchor Shackle ('U' bolt) with pin and locking arrangement:

Anchor shackle and pin shall be made of high tensile steel (forged steel). Locking shall be made of stainless steel. Anchor shackle and pin shall be hot dip galvanized.

b) Eye Bolt (Ball Eye):

Ball eye shall be made of high tensile steel (forged steel) and shall be hot dip galvanized.

c) Cap and Pin Porcelain Insulator Disc:

Cap shall be made of malleable cast iron and shall be hot dip galvanized. Pin shall be made of high tensile steel (Forged steel) and shall be hot dip galvanized. Locking shall be made of stainless steel. Insulators shall be made of either porcelain or toughened glass.

d) Eye Socket:

Eye socket shall be made of malleable iron (ductile iron) and shall be hot dip galvanized. Locking shall be made of stainless steel.

e) Tension Clamp:

Tension clamp shall be made of aluminium alloy. Bolts and nuts shall be made of mild steel and shall be hot dip galvanized. It shall be gun type with 3 Nos. of 'U' bolts and washers and shall be suitable to use with 100 sq.mm. aluminium alloy conductor.

For all the components detailed above, the galvanization layer shall be not less than 185 micron. The galvanization shall conform to BS.729 or equivalent standard. Ball and socket coupling of the insulator shall comply with B.S.3288 part 2 or IEC 120 and 471. Tenderers are required to attach drawings for insulators and fittings with the offer.

5. Components of each Tension Insulator set:

- a) One No. of 'U' bolt with pin & locking arrangement. (Anchor shackle).
- b) One No. Eye bolt (ball eye)
- c) Two Nos. Cap and pin insulator discs.
- d) One No. Eye socket.
- e) One No. Tension clamp.

6. Type & Creepage of Disc Insulators:

The disc insulator shall be of open profile aerodynamic type to permit a large degree of self cleaning by wind, rain, etc. Because of heavy pollution experienced in this country, the total creepage distance of the insulator set (minimum two disc insulators) shall not be less than 561mm (i.e. 51mm/kv). The insulators shall be used for 11kv, 50 Hz. system with system highest voltage of 12KV.

7. Mechanical and Electrical Characteristics of Single Disc Insulator:

The minimum failing load of the individual disc insulator and fittings shall be not less than 80 KN and 66.7 KN respectively. The electrical characteristic of individual disc insulator shall be as follows:

1.	P.F. dry withstand voltage	:	70 kv.
2.	P.F. wet withstand voltage	:	45 kv.
3.	P.F. dry flashover voltage	:	75 kv
4.	P.F. wet flashover voltage	:	50 kv
5.	Lightning impulse withstand voltage	:	110kv (Peak)
6.	Impulse flashover voltage positive	:	115kv (Peak)
	negative	:	115kv (Peak)
7.	Power frequency puncture voltage	:	125kv

B): 11KV PIN INSULATORS & FITTINGS:8. Pin Insulator & Fittings:

Pin insulator shall be brown glazed porcelain complying with BS.137 or IEC or any other relevant international standards. Each pin insulator shall comprise of:

- i) One brown glazed porcelain line insulator rated for heavily polluted area and for system highest voltage of 12kv (11kv service voltage). The insulator shall be open profile type. Because of heavy pollution experienced in this country the total creepage distance of the pin insulator shall not be less than 561 mm. (51 mm/kv).
- ii) One spindle made of heavily galvanized steel to fit the above insulator as per B.S. 137 complete with two washers, one full nut and one half lock nut. The pin shall be hot dip galvanized as BS 729 and under collar portion screwed not less than 45 mm.

9. Mechanical and Electrical Characteristic of Pin Insulator:

The minimum failing load of the insulator and pin shall be not less than 10KN as specified in BS. 137.

Dry P.F. withstand	:	70 KV
" " flashovers	:	75 KV
Wet P.F. flashovers	:	50 KV
Wet " withstand	:	45 KV
Impulse flashovers	:	+ 115 KV (peak)
	:	- 115 KV (peak)
P.F. puncture voltage	:	130 KV

Drawings of insulators and pins shall be attached with the offer.

C): 415 VOLTS SHACKLE INSULATORS & FITTINGS:

10. Shackle Insulator and Fittings:

- i) The insulator shall be of the bobbin type and shall be made of brown glazed porcelain complying with B.S. 137 and B.S. 3288. The total creepage distance shall be not less than 67 mm.
- ii) 'D' iron and bolts shall be made of mild steel and shall be galvanized. 'D' iron and bolts for fixing 'D' iron with pole and for fixing shackle insulator with 'D' iron along with nuts and washers shall be supplied.

11. Mechanical & Electrical Characteristics of Shackle Insulators:

The minimum failing load of the shackle insulator shall be not less than 15KN. Wet one minute power frequency withstand voltage for shackle insulator shall be not less than 3KV (r.m.s.).

Tenderers are required to attach drawing of 'D' iron, shackle insulator, bolts, nuts, washers, etc. specifying all the dimensions along with the offer.

12. Identification of Insulator:

Insulator unit shall be marked with the name of trade mark of manufacturer and the year and month of manufacture and also should be marked with electro- mechanical or mechanical failing load or mechanical routine test load. The markings shall be legible and indelible.

13. Packing:

The material is to be packed properly and protected for shipment and transported from the place of manufacture to FEWA stores or at site of works.

Each crate of package is to contain a packing list in a waterproof envelope. All cases, packages, etc. are to be clearly marked on the outside to indicate total weight, identification mark of shipping documents, name of item, quantities and FEWA's Tender No. etc.

14. Testing at Manufacturer's Works:

The insulators and fittings shall be subjected to all type, special and routine tests in accordance with BS or IEC recommendations. Certified copies of type and special test reports not older than seven years shall be supplied along with the offer. FEWA reserves the right to ask for conducting any or all type and special tests in presence of FEWA representatives, if acceptable type and special test reports are not submitted with the offer, without any extra cost to the Authority.

Routine tests shall be carried out in presence of FEWA representatives manufacturer's works. The supplier shall make provision in his offer to bear all costs that are incurred in carrying out these tests to the satisfaction of FEWA. However, costs towards travel, accommodation, etc. of FEWA representatives shall not be included in the quoted price.

SCHEDULE 'A'**SUB-MANUFACTURERS**

The Tenderer shall state below the names of the sub-manufacturers to the main manufacturer and details of the equipment proposed to be manufactured or supplied by them:

Name & Address of the Sub-Manufacturer	Description of Equipment

Signature : _____

Designation : _____

Name of Tenderer : _____

Date : _____

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SCHEDULE 'B'

PLACE OF MANUFACTURE, TESTING AND INSPECTION

The Tenderer to complete the following schedule for all materials he proposes to supply

Item No.	Description	Manufacturer	Place of manufacture	Place of testing and inspection

Signature : _____

Designation : _____

Name of Tenderer ; _____

Date : _____

SCHEDULE 'C'**DEVIATION FROM TENDER SPECIFICATION**

The Tenderer to state in the following schedule the deviations from the tender specifications proposed in his offer. Deviations other than those specifically listed below will not be taken note of:

Item No.	Description	Precise Details of the Deviations

Signature : _____

Designation : _____

Name of Tenderer ; _____

Date : _____

SCHEDULE 'D-1'**TECHNICAL PARTICULARS & GUARANTEES FOR
11KV TENSION INSULATORS AND FITTINGS**

Sl. No.	Description	Unit	Particulars
1	Name & address of manufacturer		
2	Type and reference No.		
3	Material of insulator		
4	Rated voltage for single disc	KV	
5	<u>Power frequency dry for single disc:</u>		
	a) Withstand voltage (one minute)	KV	
	b) Flashover voltage	KV	
6	<u>Power frequency wet for single disc:</u>		
	a) Withstand voltage (one minute)	KV	
	b) Flashover voltage	KV	
7	Lightning impulse withstand voltage (1.2/50) for single disc	KV	
8	Impulse flashover voltage positive for single disc.	KV	
9	Impulse flashover voltage negative for single disc.	KV	
10	Power frequency puncture voltage for single disc.	KV	
11	Total creepage distance	mm	
12	Protected creepage distance	mm	
13	Overall diameter	mm	
14	Overall length	mm	
15	Net weight of insulator without fittings	KG	
16	Minimum failing load	KN	
17	<u>Ball and socket couplings :</u>		
	a) Designation		
	b) Standard applicable		
	c) Material of cap and pin		

Signature of Tenderer : _____

SCHEDULE 'D-1'**TECHNICAL PARTICULARS & GUARANTEES FOR
11KV TENSION INSULATORS AND FITTINGS**

Sl. No.	Description	Unit	Particulars
A)	<u>Eye bolt & U bolt & Eye socket :</u>		
1	Type of metal used		
2	Thickness of galvanizing	Micron	
3	Mechanical withstand load	KN	
4	Minimum failing load	KN	
B)	<u>Tension clamp :</u>		
1	Type of metal used		
2	Thickness of galvanizing	Micron	
3	Mechanical withstand load	KN	
4	Minimum failing load	KN	
5	No. of U bolts		
6	No. of washers per bolt		

Signature of Tenderer : _____

SCHEDULE 'D-2'**TECHNICAL PARTICULARS & GUARANTEES FOR
11KV PIN INSULATORS AND FITTINGS**

Sl. No.	Description	Unit	Particulars
1	Name & address of manufacturer		
2	Type and reference No.		
3	Material of insulator		
4	Rated voltage	KV	
5	<u>Power frequency dry :</u>		
	a) Withstand voltage (one minute)	KV	
	b) Flashover voltage	KV	
6	<u>Power frequency wet :</u>		
	a) Withstand voltage (one minute)	KV	
	b) Flashover voltage	KV	
7	Lightning impulse withstand voltage (1.2/50)	KV	
8	Impulse flashover voltage positive	KV	
9	Impulse flashover voltage negative	KV	
10	Power frequency puncture voltage	KV	
11	Total creepage distance	mm	
12	Protected creepage distance	mm	
13	Overall diameter of insulator	mm	
14	Overall length of insulator	mm	
15	Net weight of insulator without fittings	KG	
16	Minimum failing load of insulator	KN	
17	<u>Dimension of pin:</u>		
	a) Diameter	mm	
	b) Length	mm	
	c) Length of thread under collar	mm	
18	Material of pin	mm	
19	Thickness of galvanizing	Micron	
20	Minimum failing load pin	KN	

Signature of Tenderer : _____

SCHEDULE 'D-3'**TECHNICAL PARTICULARS & GUARANTEES FOR
415 VOLT SHACKLE INSULATORS AND FITTINGS**

Sl. No.	Description	Unit	Particulars
1	Name & address of manufacturer		
2	Type and reference No.		
3	Material of insulator		
4	Rated voltage	KV	
5	<u>Power frequency dry :</u>		
	a) Withstand voltage (one minute)	KV	
	b) Flashover voltage	KV	
6	<u>Power frequency wet :</u>		
	a) Withstand voltage (one minute)	KV	
	b) Flashover voltage	KV	
7	Lightning impulse withstand voltage (1.2/50)	KV	
8	Impulse flashover voltage positive	KV	
9	Impulse flashover voltage negative	KV	
10	Power frequency puncture voltage	KV	
11	Total creepage distance	mm	
12	Protected creepage distance	mm	
13	Overall diameter of shackle	mm	
14	Overall length of shackle	mm	
15	Net weight of shackle without fittings	KG	
16	Minimum failing load	KN	
17	Dimension of 'D' iron (LxDxW)	mmxmmxmm	
18	Thickness of galvanizing	Micron	
19	Minimum failing load of 'D' iron	KN	
20	<u>Size of bolts for :</u>		
	a) Fixing 'D' iron with pole		
	b) Fixing shackle with 'D' iron		

Signature of Tenderer : _____

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SCHEDULE 'E'

DETAILS OF PAST EXPERIENCE OF MANUFACTURER

Name and address	Quantity Supplied	Year of supply	Remarks

Signature : _____

Designation : _____

Name of Tenderer : _____

Date : _____

SPECIFICATION NO. 3.35

LINE SUPPORT ASSEMBLY

(STAY ROD, STAY BLOCK, STAY INSULATOR & STAY WIRES)

(Prepare in July, 1987)

1. Standard Specification:

Stay rod, stay block, stay insulator and stay wires shall be designed, manufactured and tested to confirm and comply with B.S. 1320 or equivalent international standard and shall be subject to the approval of FEWA. One copy each of the specification to which the materials are manufactured and tested are to be forwarded with the offer.

2. Site Condition:

The materials shall be suitable for continuous use at outdoor without deterioration in the hot, humid and salty climate prevailing in U.A.E. The maximum values of humidity and temperature experienced in this country are 100% and 50 deg. C. respectively.

3. Scope and nature of work:

The specification provides for the design, manufacture, test at manufacturer's works, suitable packing, transporting, off-loading at site of works or FEWA stores in satisfactory conditions and proper stacking as directed by FEWA.

4. Line Support Assembly:

Each line support assembly shall consist of the following materials.

- | | | |
|--|---|------------|
| 1. Stay rod | : | 1 No. |
| 2. Stay block | : | 1 No. |
| 3. Stay Insulator | : | 1 No. |
| 4. Stay Wires | : | 16 Metres. |
| 5. Necessary fittings for stay rod, block and wires. | | |

5. Stay Rods:

Stay rods shall be fabricated from steel of 28-33 ton quality, complying with BS 15. Stay rod shall be 2.44 metre long and 17.5 mm in diameter. The stay rod shall be adjustable type. It shall be complete with thimble and turn buckle of 470 mm long. The thimble shall be suitable for 7/4 mm stranded galvanized steel stay wire. Stay rod, thimble, turn buckle eye etc. shall be hot dip galvanized. The minimum failing load of stay rod shall be 65 KN. Stay rod, turn buckle and thimble shall be manufactured as per drawing No. FEWA/E/GEN/133/87.

6. Stay Blocks or Baulks:

Stay blocks or baulks shall be made of concrete or creosated wood as per the drawing No. FEWA/E/GEN/134/87, sheet 1 & 2. The design of the concrete block and wood stay block shall be such that they will have a minimum failing load (MFL) and resistance to uplift of 65 KN for use with stay rods. Type test certificate for ultimate failing load of concrete or wood stay blocks shall be attached by the supplier along with the offer.

7. Stay Insulator:

Stay Insulator shall be made of porcelain complying with B.S. 137 and shall be suitable for use with 7/4 mm stranded galvanized steel stay wire. The wet power frequency flash over voltage for stay insulator shall be not less than 16 kv and impulse withstand voltage shall be not less than 95 kv. The minimum failing load (MFL) of insulator shall be not less than 65 KN.

8. Stay Wires:

Stay wires shall be 7/4 mm (7/8 s.w.g) galvanized steel of grade 700 quality complying with B.S. 183. The minimum failing load shall be not less than 61.6 KN. The modulus of elasticity shall be 210000 N/sq.mm. The mass per km shall be 690 kg. The overall diameter is 12 mm.

9. Necessary Fittings:

Necessary fittings like staying rod bottom plate, pole top preformed wire with a collar and thimble for pole top termination etc shall also be supplied.

10. Drawing:

Tenderer shall have to submit the drawings of all the materials of line support assembly for approval of the Authority.

11. Test Certificates:

All the items of line support assembly shall be subjected to all type, special and routine tests in accordance with international standards. Certified copies of type test reports shall be supplied along with the offer. The routine test reports shall be submitted before despatch of consignment.

SCHEDULE 'A'**SUB-MANUFACTURERS**

The Tenderer shall state below the names of the sub-manufacturers to the main manufacturer and details of the equipment proposed to be manufactured or supplied by them:

Name & Address of the Sub-Manufacturer	Description of Equipment

Signature : _____

Designation : _____

Name of Tenderer ; _____

Date : _____

3.35/4

SCHEDULE 'B'

PLACE OF MANUFACTURE, TESTING AND INSPECTION

The Tenderer to complete the following schedule for all materials he proposes to supply

Item No.	Description	Manufacturer	Place of manufacture	Place of testing and inspection

Signature : _____

Designation : _____

Name of Tenderer ; _____

Date : _____

SCHEDULE 'C'**DEVIATION FROM TENDER SPECIFICATION**

The Tenderer to state in the following schedule the deviations from the tender specifications proposed in his offer. Deviations other than those specifically listed below will not be taken note of:

Item No.	Description	Precise Details of the Deviations

Signature : _____

Designation : _____

Name of Tenderer : _____

Date : _____

SCHEDULE ' D '
GUARANTEED PARTICULARS

Tender is to give the following particulars of line support assembly.

Sl. No.	Description	Unit	Particulars
1	Name of manufacturer		
2	Country of origin		
3	Standards applicable		
4	<u>Stay Rod :</u>		
	a) Quality of steel		
	b) Length of stay rod	mm	
	c) Dia. of stay rod	mm	
	d) Length of turn buckle	mm	
	e) Thickness of galvanization	Micron	
	f) MFL of stay rod	KN	
5	<u>Stay Block :</u>		
	a) Concrete or wood		
	b) Dimension of stay block		
	c) MFL of stay block		
6	<u>Stay Insulator :</u>		
	a) Material of stay insulator		
	b) Impulse withstand voltage		
	c) Wet flash over voltage		
	d) MFL of stay insulator		
7	<u>Stay Wire :</u>		
	a) Quality of steel		
	b) Dia. of each strand		
	c) No. of strand		
	d) dia. of stay wire		
	e) Modulus of elasticity		
	f) Mass of stay wire per km		
	g) Minimum failing load		

Signature of Tenderer ; _____

3.35/7

SCHEDULE 'E'

DETAILS OF PAST EXPERIENCE OF MANUFACTURER

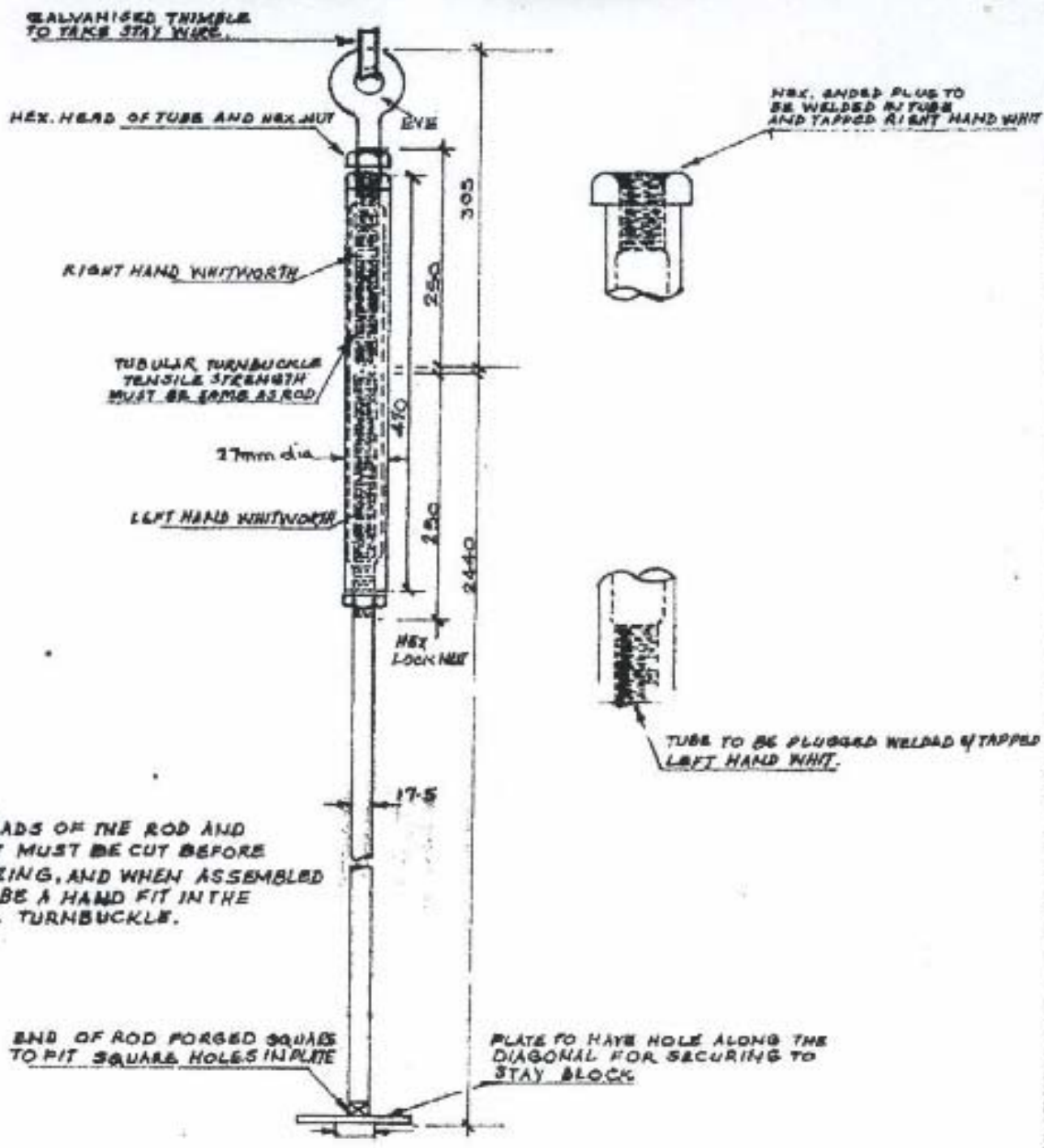
Name and address	Quantity Supplied	Year of supply	Remarks

Signature : _____

Designation : _____

Name of Tenderer : _____

Date : _____

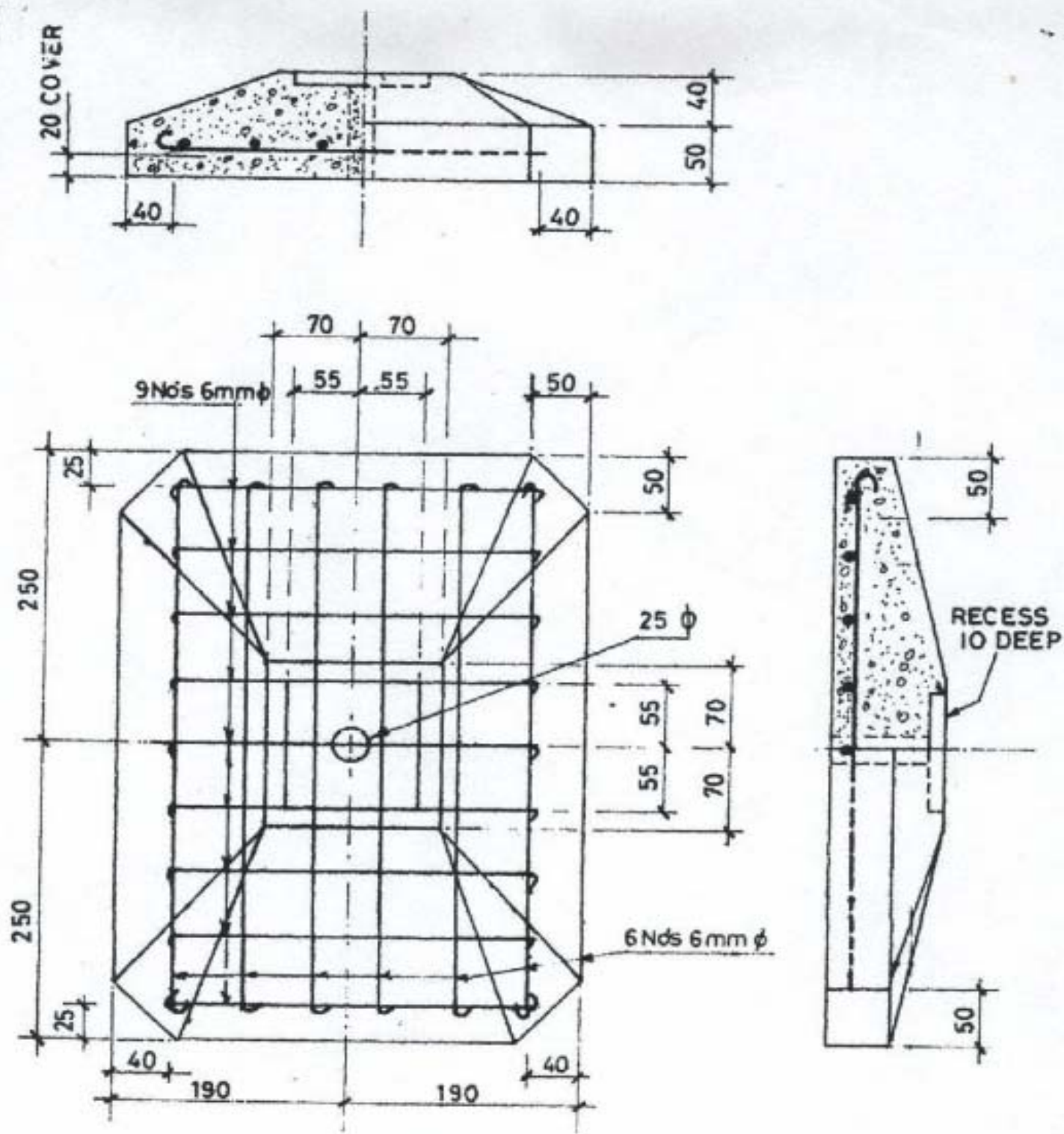


NOTE:
 THE THREADS OF THE ROD AND EYE BOLT MUST BE CUT BEFORE GALVANIZING, AND WHEN ASSEMBLED SHOULD BE A HAND FIT IN THE TUBULAR TURNBUCKLE.

MATERIAL. GALVANISED MILD STEEL, 28/35 TON QUALITY.

All dimension in mm

PLANNING DEPARTMENT	
MINISTRY OF ELECTRICITY AND WATER	
P. O. BOX. 1672. DUBAI U.A.E	
STAY ROD	
SCALE N.T.S	
Drawn by Barkat Ali	DRG. NO. MEW/E/GEN/133/87 Date 11 - 7 - 87
Checked by Eskander Ali Khan	
Approved by <i>[Signature]</i>	



All dimension in mm.

NOTES.

- 1- SULPHATE RESISTING CEMENT COMPLYING B.S. 4037 USED. MINIMUM CONTENT SHALL BE 350 kg/m³ OF CONCRETE.
- 2- THE CUBE CRUSHING STRENGTH SHALL BE 300 kg/cm²
- 3- MILD STEEL REINFORCEMENT OF 6mm ϕ WELDED MESH SHALL BE USED. NO. OF RODS SHALL BE AS PER DETAIL.
- 4- CONCRETE COVERS TO REINFORCEMENT SHALL BE AS PER DRAWING. BUT IT SHALL NOT BE IN ANYCASE LESS THAN 25MM.
- 5- THE BLOCKS SHALL BE FAIR FACED.

PLANNING DEPARTMENT MINISTRY OF ELECTRICITY AND WATER P.O. BOX, 1672 DUBAI U.A.E	
CONCRETE STAY BLOCK	
SCALE N.T.S	
Drawn by Barkat Ali Checked by Eskander Ali Khan Approved by <i>MC</i>	DRG. NO. MEW/E/GEN/134/87 Date 11th July 1987

SPECIFICATION NO. 3.40
(Revised in March 2010)

SPECIFICATION FOR 11KV DROP-OUT FUSE

1. Standard Specification:

The D.O. Fuse shall conform to the latest edition of B.S. 2692 and IEC 282. The support insulators shall conform to the latest edition of the relevant B.S. or IEC or any other International Standard, which shall be subject to the approval of the Authority. One copy each of the Standard Specifications to which the components of the D.O. fuse conform shall be submitted with the offer.

2. Site Condition:

The D.O. fuse shall be suitable for continuous service under specified system conditions in the hot, humid, dusty and salty climate prevailing in the area. The maximum values of humidity and temperature experienced in this country are 100% and 50 deg. C. respectively.

3. Scope and Nature of Work:

This specification provides for the design, manufacture, test at manufacturer's works in the presence of FEWA inspectors, suitable packing, transportation and off loading at site of works or FEWA stores in satisfactory condition and proper stacking as directed by the FEWA.

4. Specification of Drop Out Fuse:

The Drop out fuse for 11KV lines and substation consist of the following components:

- a) Distribution fuse cut out.
- b) Expulsion fuse link.
- c) Operating rods. - Optional items as per the requirement of BOQ.
- d) Fixing bracket assembly.

a) Distribution Fuse Cut out:

This can be categorized into the following types based on its compact lightweight construction. The creepage distance to earth will not be less than 560 mm.

- i) A single insulator style is secured by a single bolt fixing at a centre mounting point for extra heavy-duty performance.
- ii) A double insulator style either vertically mounted on a channel or angular mounted secured by a single bolt fixing at centre mounting points. These will be suitable for use where adverse environmental conditions necessitate for higher level of insulation. The main components of all the three types of cutouts are common in design and have following features. FEWA have option to select any of the above three types for use in the system.

The fuse carrier will drop down when the fuse element melts providing positive fault isolation and a clear indication that the cutout has operated.

The operating ring should accommodate most standard operating rod heads, allowing the cutouts to be integrated into the system without the need of additional line operating equipment.

Fixing and removal of the fuse carrier is to be done by positive engagement of the operating rod head onto a pickup tongue positioned at the hinge end of the expulsion tube.

A spring loaded flipper and locking mechanism at the lower end of the fuse carrier will ensure consistent tension on the fuse link and will prevent element damage during switching on operation. The flipper will also assist rapid withdrawal of the fuse link from the tube under fault condition.

Current transfer must be via high pressure silver electroplated contacts and will be completely independent of the lower support hinge. The lower contact arrangement will ensure positive seating at the hinge point and will limit degree of misalignment during movement of the fuse carrier when operating.

The galvanized steel hood must be provided to protect the upper contact assembly to ensure protection against the influence of dust and other contaminants and this will also guide the fuse carrier into its correct latching position during switching on.

The cutouts will be supplied complete with connector terminals suitable for conductor size of 100 sq.mm up to 200 sq.mm.

The catalogues and detailed dimensional drawing of the D.O. fuse offered and mounting arrangement shall be submitted with the offer.

b) Expulsion Fuse-link:

The fuse carrier link will be designed according to above-mentioned international standards/DIN standard and the dimension should be such that it can be interchangeable with any of the popular makes of the equipment.

It will be a type employing a fibre glass type barrel of button head pattern and will be suitable for fast operating time current characteristics.

The expandable cap design should be provided with venting facilities during high fault current interruptions.

The maximum continuous current rating at rated voltage shall be 100 Amps. The requirement of fuse ratings to be supplied will be in accordance with the BOQ.

The non-corrosive element material and the extra heavy tin plated flexible wire used on all lower ratings will have design features which will safeguard against mechanical damage and extend normal service life even under the most severe atmospheric conditions.

c) Operating Rods:

The fixing and removal of the fuse carrier will be made from ground level by means of an operating rod. The quantity of operating rod to be supplied will be in accordance with BOQ. The operating rod will be manufactured from the highest quality Reinforced Fibre Glass Tubing. It will consist of five sections each of 1.22 metres long, which comprises of:

- i) Top section with operating head
- ii) Intermediate sections.
- iii) Bottom section with hand grip.
- iv) Rubber rain shield, earthing chain, spike and canvas carrying bag.

This item is an optional item; the quantity to be supplied is as per BOQ.

d) Fixing Bracket Assembly:

The adjustable support bracket, complete with bolts, nuts and washers will be supplied along with the D.O fuse. The D.O. fuse will also be supplied with suitable horizontal channel for mounting the above three nos. of single pole units on the wooden pole complete with bolts, nuts and washers, etc. The approximate dimension between poles will be 1800 mm and the exact requirement shall be to the approval of Authority.

5. Technical Specifications:

i)	Maximum Design Voltage (KV)	:	12 KV
ii)	Nominal system voltage (KV)	:	11 KV
iii)	Frequency (Hz)	:	50 C/s
iv)	Continuous current rating (A)	:	100 A
v)	Interrupting capacity in kA	:	
	Symmetrical	:	8 KA
	Asymmetrical	:	12.8 KA
vi)	Creepage distance to earth in mm	:	560 mm.

6. Testing at Manufacturer's Works:

The components of the Drop out fuse isolator, viz. links, insulators, etc. shall be subjected to all types of routine tests in accordance with IEC-282-2 and BS:2692-2. Certified copies of the type test certificates not older than seven years shall be supplied with the offer. If type test certificates are not enclosed with the offer, FEWA reserves its right to ask for carrying out of the same in presence of FEWA inspectors without any extra cost. Routine tests will also be carried out in the presence of FEWA inspectors at the manufacturer's works. The supplier shall make provision in his offer to bear all costs that are incurred in carrying out the tests to the satisfaction of FEWA. However, costs towards travel, accommodation, etc. of FEWA representatives shall not be included in the quoted price.

The following type tests are to be conducted as per IEC 282-2 and BS-2692-2:

- i) Lighting impulse voltage test.
- ii) Power frequency HV dry test.
- iii) Power frequency HV wet test.
- iv) Time-current characteristics tests on fuses.
- v) Breaking capacity test.

The following routine tests are to be conducted on all samples as per IEC-282-2.

- i) Temperature rise test.
- ii) Contact resistance test.
- iii) Tension test.
- iv) Voltage drop across fuse link.
- v) Dimensional checks in line with drawings.
- vi) Mechanical operation check.
- vii) Mechanical Assembly checks of Multisection operating rods.
- viii) Inspection of porcelain and quality of plated/galvanized components.

All the above test procedure along with drawings and copies of IEC/BS to be submitted well in advance to FEWA prior to inspection tests begins for the approval.

3.40/4
SCHEDULE 'A'

SUB-MANUFACTURERS

The Tenderer shall state below the names of the sub-manufacturers to the main manufacturer and details of the equipment proposed to be manufactured or supplied by them:

Name & Address of the Sub-Manufacturer	Description of Equipment

Signature : _____

Designation : _____

Name of Tenderer ; _____

Date : _____

3.40/5
SCHEDULE 'B'

PLACE OF MANUFACTURE, TESTING AND INSPECTION

The Tenderer to complete the following schedule for all materials he proposes to supply

Item No.	Description	Manufacturer	Place of manufacture	Place of testing and inspection

Signature : _____

Designation : _____

Name of Tenderer : _____

Date : _____

3.40/6
SCHEDULE 'C'

DEVIATION FROM TENDER SPECIFICATION

The Tenderer to state in the following schedule the deviations from the tender specifications proposed in his offer. Deviations other than those specifically listed below will not be taken note of:

Item No.	Description	Precise Details of the Deviations

Signature : _____

Designation : _____

Name of Tenderer ; _____

Date : _____

3.40/7
SCHEDULE 'D'

TECHNICAL PARTICULARS & GUARANTEES FOR 11KV DROP OUT FUSE

Sl. No.	Description	Unit	Particulars
1	Manufacturer's name		
2	Country of origin		
3	<u>Applicable standard for :</u> a) Fuse link b) Fuse carrier c) Insulator		
4	Place of testing		
5	Dropout fuse designation - type/style		
6	Constructional features of insulator style single / double		
7	Type of mounting - Vertical/angular		
8	Type of contact		
9	Mounting channel provided	Yes/No.	
10	Type and size of connectors	mm ²	
11	Type and rating of expulsion fuse link	A	
12	Max. continuous design voltage	kV	
13	Nominal system voltage	kV	
14	Rated frequency	c/s	
15	Continuous current rating (in UAE climatic conditions)	A	
16	<u>Interrupting capacity in kA</u> a) Symmetrical b) Asymmetrical	kA kA	
17	Creepage distance to earth in mm	mm	
18	<u>Operating Rods : (Optional)</u> a) Quantity offered b) No. of sections c) Length of each section		

Signature of Tenderer : _____

3.40/8
SCHEDULE 'E'

DETAILS OF PAST EXPERIENCE OF MANUFACTURER

Name and address	Quantity Supplied	Year of supply	Remarks

Signature : _____

Designation : _____

Name of Tenderer : _____

Date : _____

SPECIFICATION NO. 3.50
(Revised in March 2010)

SPECIFICATION OF 33 & 11KV SURGE DIVERTERS

1. **STANDARD SPECIFICATION:**

This specification covers for both gap and gapless surge diverters. The Surge Diverters shall conform to the latest edition of IEC 99-1 to 4 and B.S. 2914 or any other equivalent international standard, which shall be subject to the approval of Authority. One copy of each specification in English Language to which the surge diverters are manufactured and tested shall be submitted with the offer.

2. **SITE CONDITIONS:**

The surge diverters shall be installed outdoors in U.A.E. in salt laden dusty atmosphere where the maximum humidity of 100% and maximum ambient temperature of 50 deg. C. can be experienced. Rains along with lightning and thunderstorms are also experienced in the winter. Earth resistivity is very high in this country. The surge diverters shall be suitable for operation at the above site conditions.

3. **SCOPE AND NATURE OF WORK:**

This is meant for protecting power system from lightning and switching surges. The specification provides for design, manufacture, test at manufacturer's works in presence of two FEWA inspectors, suitable packing, transportation and off-loading at site of works or FEWA stores in satisfactory condition and proper stacking as directed by FEWA.

4. **TECHNICAL REQUIREMENTS:**

Surge diverters shall be either of the following two types.

- i) Employing multiple spark gaps in series with silicon nonlinear resistor.
- ii) Employing nonlinear metal oxide resistors without spark gaps.

The diverters shall be housed in robust porcelain/polymer containers filled with inert gas and permanently sealed against the entry of dust, sand, salt, moisture and air. The design shall be such that an even distribution of voltage is maintained across the elements of the arrester under all conditions of pollution and weather, which may be encountered in service.

Arrester shall have a creepage distance of 560 mm for 11kv and 1680 mm for 33kv externally over the insulator shed with as much creepage as possible unprotected.

For gapless type the applicable standard is IEC 99. This should draw negligible current at operating voltages and subsequently this should offer least impedance during the flow of surge current.

The nonlinear block resistors will be mounted in the robust ceramic enclosure filled with inert gas and permanently sealed against the entry of dust, sand, salt, moisture and air.

The maximum continuous operating voltage at power frequency can be continuously applied between diverter terminals and this should be prone to severe over voltage swings for long time connected to weak sources. This will have low watt loss at operating voltage and be able to meet with higher temporary power frequency over voltages for shorter times.

The polymer housed diverter will also be accepted which uses the high quality, metal oxide varistor formulation adding the benefits of a silicon alloy rubber housing. The rubber housing eliminates moisture ingress, which is the major cause of diverter failure. In the event of diverter failure the polymer housing does not fragment as a porcelain housing could, resulting in less danger to adjacent personnel and equipment.

The following criteria must be considered while designing the surge diverters.

- a) Stability and aging factors.
- b) Protective levels.
- c) Voltage distribution.
- d) Pollution performance.

Diverter shall have sufficient capacity to discharge system charging current without damage. It should be preferably fitted with pressure relief diaphragms and are diverting ports and relieve the excessive internal pressure in the event of diverter failure to prevent explosive shattering of porcelain causing damage to the adjacent equipment and personnel.

The diverter shall be provided with following features :

- a) Stainless steel end caps.
- b) Terminals suitable for appropriate aluminium alloy conductor line leads and 70 mm² stranded copper earth leads for 11kv and 150 mm² stranded copper earth lead for 33kv.
- c) Permanent nitrile rubber seal.
- d) Service proven ceramically bonded resistor system (gap or gapless).
- e) High grade electrical porcelain or polymer.
- f) Porcelain/polymer shed profile for achieving required creepage distance as mentioned in Page 1.
- g) Suitable for polluted environment without periodically cleaning.
- h) Facility to disconnect the diverter automatically in case of diverter failure should be provided

The requirement of mounting channels is optional and is dependent on actual BOQ as mentioned in tender documents.

For gap type surge diverter the applicable standard is B.S. 2914.

The gap system shall provide high precision integrated mica and ceramic gap spacers separating the electrodes. The electrodes are manufactured of steel to ensure the clearance of power flow current under all system conditions.

The diverters will be suitable for use on resistance earthed systems where under fault conditions voltages as high as phase to earth voltage may appear across the diverter terminals and it should not be damaged by temporary over voltage.

The diverter will be very fast in operation of having clearing capability less than 5 cycles of power frequency flow current, such that the diverter should not be damaged by lightning and prevent shattering of the porcelain housing.

Each arrester shall be identified by a rating nameplate in accordance with the requirement of IEC 99-1. In addition an identification mark shall be permanently inscribed on each unit so that the unit can be replaced in the correct place in the event of them being dismantled.

Mounting Channel

The adjustable support bracket, complete with bolts, nuts and washers will be supplied along with the diverters. The diverters will also be supplied with suitable horizontal channel for mounting the above three nos. of single pole units on the wooden pole complete with bolts, nuts and washers, etc. The approximate dimension between poles will be 1800 mm and the exact requirement shall be to the approval of Authority.

	<u>Technical Specification</u>	<u>11KV</u>	<u>33KV</u>
a)	Diverter designation : Type/style	Gap/Gapless	Gap/Gapless
b)	Max. continuous operating voltage	12 kv	36 kv
c)	Nominal discharge current	5 kA	10 kA
d)	Rated frequency	50 c/s	50 c/s
e)	Rated system voltage	11 kv	33 kv
f)	Nominal discharge time	5 cycles	5 cycles
g)	Diverter earth resistance	10 Ohms	10 Ohms
h)	Total creepage distance of porcelain/polymer housing	560 mm	1680 mm
i)	Diverter position	Pole mounted adjacent to transformer or cable box.	

6. TESTING AT MANUFACTURERS WORKS:

The surge diverters shall be tested for type test and routine test in accordance with IEC 99-4. The copies of the type test certificates not older than seven years shall be supplied along with the offer. If the following test certificates of type test are not attached or if the test certificates are not acceptable, FEWA reserves its right to ask for carrying out the same in presence of FEWA inspectors without any extra cost.

The following type tests shall be carried out :

- a) Insulation withstand test.
 - i) Lightning impulse withstand
 - ii) Power frequency withstand
- b) Residual voltage test.
- c) Long duration current impulse withstand test.
- d) Operating duty cycle test.
- e) Pressure relief test.
- f) Test of diverter disconnecter (if applicable).
- g) Artificial pollution test.
- h) Partial discharge test.
- i) Seal leakage test.
- J) Time/current curve test.

The routine tests and acceptance tests will be carried out on all diverters at manufacturer's works. The supplier shall make provision in his offer to bear all costs that are incurred in carrying out these tests to the satisfaction of FEWA.

The following routine tests shall be carried out on all diverter sections. FEWA representative will witness the tests of some samples selected at random.

- a) Reference voltage test.
- b) Residual voltage test.
- c) Partial discharge test.
- d) Leak test.
- e) Radio interference test.

The following acceptance tests shall also to be carried out in presence of FEWA representative. However, costs towards travel, accommodation etc. of FEWA representatives shall not be included in the quoted price.

- a) Residual voltage test.
- b) Reference voltage test.
- c) Partial discharge test.
- d) Insulation withstand tests.
 - i) Lighting impulse voltage.
 - ii) Power frequency voltage.

On all gapped diverter sections power frequency spark over test must be carried out.

In addition, on all gapless diverter sections, the following tests must also be carried out.

- a) Measurement of grading current when energized at maximum continuous operating voltage.
- b) Measurement of power frequency voltage at a resistive current level to be declared by the manufacturer (1 - 10 mA peak).
- c) Residual voltage at a discharge current level to be agreed with the manufacturer (500 A - 10 KA).

The details of the above test procedures will be available in the relevant IEC as mentioned above. The contractor has to submit details of the routine and acceptance test procedures along with test circuit diagram to FEWA before the witness test is planned to be carried out.

**

SCHEDULE 'A'

SUB-MANUFACTURERS

The Tenderer shall state below the names of the sub-manufacturers to the main manufacturer and details of the equipment proposed to be manufactured or supplied by them:

Name & Address of the Sub-Manufacturer	Description of Equipment

Signature : _____

Designation : _____

Name of Tenderer : _____

Date : _____

SCHEDULE 'B'

PLACE OF MANUFACTURE, TESTING AND INSPECTION

The Tenderer to complete the following schedule for all materials he proposes to supply

Item No.	Description	Manufacturer	Place of manufacture	Place of testing and inspection

Signature : _____

Designation : _____

Name of Tenderer : _____

Date : _____

SCHEDULE 'C'

DEVIATION FROM TENDER SPECIFICATION

The Tenderer to state in the following schedule the deviations from the tender specifications proposed in his offer. Deviations other than those specifically listed below will not be taken note of:

Item No.	Description	Precise Details of the Deviations

Signature : _____

Designation : _____

Name of Tenderer : _____

Date : _____

- 3.50/8 -
SCHEDULE 'D'

**TECHNICAL PARTICULARS & GUARANTEES FOR
33/11KV SURGE DIVERTERS**

SI No.	Description	Unit	Particulars	
			33 KV	11 KV
1	Name of manufacturer			
2	Country of origin			
3	Applicable standard			
4	Diverter designation Type/Style			
5	Constructional features gap/gapless			
6	Type of mounting			
7	Mounting channel provided	Yes/No.		
8	Type & size of connectors - Line/Earth			
9	Max. continuous operating voltage	KV		
10	Nominal discharge current	KA		
11	Rated frequency	C/S\		
12	Rated system voltage	KV		
13	Nominal discharge time	Cycle		
14	Total creepage distance of porcelain housing	mm		

Signature of Tenderer : _____

SCHEDULE 'E'

DETAILS OF PAST EXPERIENCE OF MANUFACTURER

Name and address	Quantity Supplied	Year of supply	Remarks

Signature : _____

Designation : _____

Name of Tenderer : _____

Date : _____

SPECIFICATION NO. EA-8.0
EARTHING ASSEMBLY
(Revised in December 2005)

1 Standard Specification

All the components of earthing assembly, that is earth rod, clamp, driving head shall be designed, manufactured and tested to conform and comply with, IEEE 80, 81 or any other equivalent international standard and shall be subject to the approval of FEWA.

2. Site Conditions

The earthing assembly shall be suitable for continuous use at outdoor without deterioration in the hot, humid and salty climate prevailing in UAE. The maximum values of humidity and temperature experienced in this country are 100% and 50 Deg. C. respectively.

3. Scope and Nature of Work

The specification provides for the design, manufacture, test at manufacturer's works, suitable packing, transporting, off-loading at site of works or FEWA stores in satisfactory conditions and proper stacking as directed by FEWA.

4. Earthing Assembly

Each earthing assembly shall consist of the following components:-

- a) Earth Rod
- b) Earth Clamp
- c) Driving Head
- d) Coupling

Quantity of above components shall be as per Bill of Quantity.

5. Earth Rod

Earth Rod shall be made of low carbon steel with high tensile strength of 600 N/mm² and shall be outwardly clad with copper. Steel rod shall be manufactured from steel conforming to BS 4360, Grade 43A. Minimum thickness of copper cladding shall be 0.35mm. The copper cladding shall be molecularly bonded to steel. The rod shall be capable of being bent through 90 deg. at a maximum radius of 100mm with no copper fracture and with no ill effect on the bond between the steel and the copper cladding. The coupling shall be as per BS 2874. Threads shall be rolled onto the rod, which ensures that a uniform copper covering is maintained even at the root of the threads.

Earth rod shall be extensible type, suitable for connecting upto 100sq.mm copper earth wire. Earth rod shall have tapered bottom for easy driving inside the ground.

The total length of earth rod excluding tapered bottom shall be 1220 mm and minimum shank diameter of 17.2 mm and minimum thread diameter of 19 mm. The length of tapered bottom shall be 50mm.

6. Earthing Clamp

The earthing clamp made of gun metal plates shall be a bull dog clip type in accordance with B.S. 462 part 2 along with copper bolts and nuts and shall be suitable to accept upto 100sq.mm earth wire.

7. Driving Head

The dimension of high tensile steel driving head shall comply with BS 4168 and shall be manufactured from 118 to 142 kgf/mm.sq. tensile steel. It shall be strong enough to accept the heavy blow of a hammer and shall be reusable type.

8. Coupling

Long length copper alloy coupling counter bored to completely enclose threads protecting them from damage and corrosion. Coupling shall be of high strength and also highly corrosion resistant. Loosening shall not occur during driving, however the coupling shall be strong enough to transfer the force while maintaining good electrical contact.

9. Packing

The material is to be packed properly and protected for shipment and transported from the place of manufacture to FEWA stores or at site of works. Each crate or package is to contain a packing list in a weatherproof envelope. All cases, packages etc. are to be clearly marked on the outside to indicate total weight, identification mark of shipping documents, name of item, quantities, FEWA Contract No. etc.

10. Test Certificates

All the items of earthing assembly shall be subjected to all type, special and routine tests in accordance with international standards. Certified copies of type test reports shall be supplied along with the offer. Routine test reports shall be submitted before despatch of consignment.

SCHEDULE 'A'

SUB-MANUFACTURERS

The Tenderer shall state below the names of the sub-manufacturers to the main manufacturer and details of the equipment proposed to be manufactured or supplied by them:

Name & Address of the Sub-Manufacturer	Description of Equipment

Signature : _____

Designation : _____

Name of Tenderer ; _____

Date : _____

SCHEDULE 'B'

PLACE OF MANUFACTURE, TESTING AND INSPECTION

The Tenderer to complete the following schedule for all materials he proposes to supply

Item No.	Description	Manufacturer	Place of manufacture	Place of testing and inspection

Signature : _____

Designation : _____

Name of Tenderer ; _____

Date : _____

SCHEDULE 'C'

DEVIATION FROM TENDER SPECIFICATION

The Tenderer to state in the following schedule the deviations from the tender specifications proposed in his offer. Deviations other than those specifically listed below will not be taken note of:

Item No.	Description	Precise Details of the Deviations

Signature : _____

Designation : _____

Name of Tenderer : _____

Date : _____

SCHEDULE 'D'

TECHNICAL PARTICULARS & GUARANTEES FOR EARTHING ASSEMBLY

Tenderer is to give the following particulars of earthing assembly:

S.NO.	DESCRIPTION	UNIT	PARTICULARS
1.	Name of manufacturer		
2.	Country of origin		
3.	<u>Earth Rod:</u>		
3.1	Applicable standard		
3.2	Grade of steel of earth rod		
3.3	Thickness of copper cladding	mm	
3.4	Minimum diameter over shank		
3.5	Minimum diameter over thread		
3.6	Length of earth rod	mm	
3.7	Resistance of earth rod	Ohm	
4.0	<u>Earth Clamp:</u>		
4.1	Applicable standard		
4.2	Material of earth clamp		
4.3	Diameter of earth clamp	mm	
4.4	Diameter of bolts	mm	
5.0	<u>Driving Head:</u>		
5.1	Applicable standard		
5.2	Dimensions of steel driving head (diameter and length)	mm	
5.3	Tensile strength of driving head	Kgf	
6.0	<u>Coupling:</u>		
6.1	Applicable standard		
6.2	Material		
6.3	Length of coupling	mm	
6.4	Tensile strength	Kgf	

Signature : _____

Designation : _____

Name of Tenderer : _____

Date : _____

SCHEDULE 'E'

DETAILS OF PAST EXPERIENCE OF MANUFACTURER

Name and address	Quantity supplied	Year of supply	Remarks

Signature : _____

Designation : _____

Name of Tenderer ; _____

Date : _____