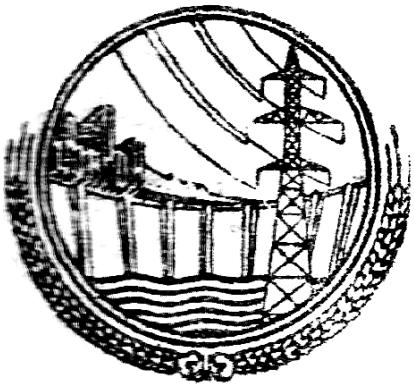
Water and Power Development Authority

Power Distribution System

Pocket Book

For

Construction Drawings



Distribution Design Cell

General Manager Distribution's Office

Power Wing Wapda

POWER DISTRIBUTION CONSTRUCTION DRAWINGS

1. Of late necessity was being felt to provide a pocket size booklet to field Engineers and Line Superintendents, which should contain a Collection of Construction Drawings along with the technical data, which is required to be frequently consulted. For this purpose, construction drawings have been extracted from S.D.Is and Technical Instructions issued by Design Department (POWER) and reduced to pocket size.

2. After reduction in size, most of the dimensions indicated on drawings have remained legible. However, there are a few drawings which require the use of magnifying glass to read them. Wherever more details concerning design or construction methods are required, the relevant SDI/TI(C) should be consulted, As this booklet is not meant to be their substitute.

3. In order to exercise quality control over new works, it is desired that the standardisation drawings should be strictly followed without allowing any deviation. The tabulated information should be used freely and frequently to achieve the following objectives in particular:-

    i. Selection of proper conductor and cable sizes and limiting lengths of feeders and cables on the basis of capacity in KVA Kilometers/KVA meters and percentage voltage drops(and not merely on the current carrying capacity).

    ii. Proper span lengths, clearances, sag at different ambient temperatures, earths and foundations.

    iii. Enforcing standard conductor jointing techniques.

SD/-

(CH:MASUD-UR-RAHMAN)

GENERALMANAGER(DISTRIBUTION)POWER

WAPDA,WAPDA HOUSE LAHORE.

CONTENTS

POWER DISTRIBUTION CONSTRUCTION DRAWINGS

AND

RELATED TECHNICAL DATA

EDITED BY

-Sd-

(Ch KHALID SAIFULLAH)

DIRECTOR DISTRIBUTION DESIGN

OFFICE OF THE GENERAL MANAGER

(DISTRIBUTION) POWER WAPDA

NOTE

Efforts have been made to make the book self-explanatory. However, if any essential details/clarification are sought, the field officers may directly refer to the undersigned.

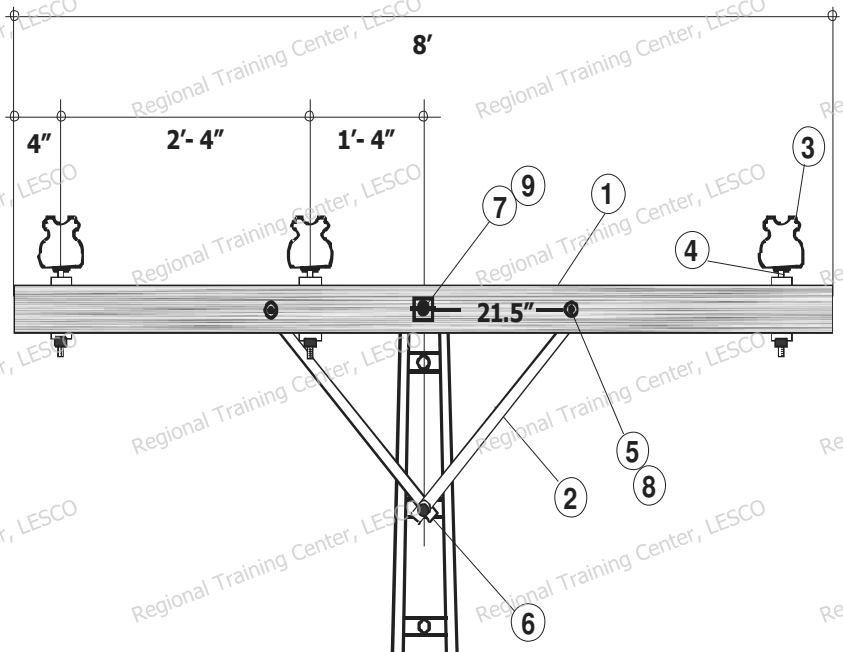
For reading maps, the magnifying glass standardized vide PD-98 may be used.

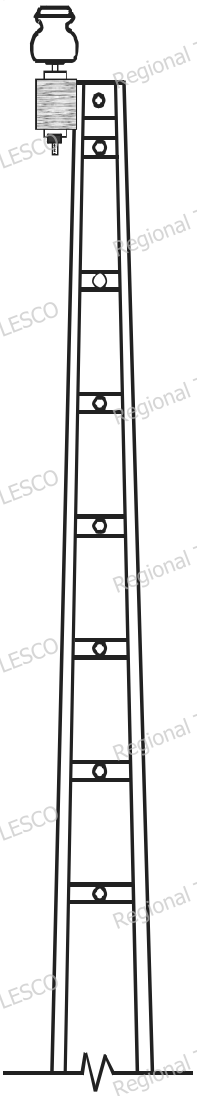
Any suggestions to improve the contents of the book will be welcome.

Sd/-
Ch. Khalid Saifullah,
Director Dist. Design
150, WAPDA HOUSE,
LAHORE.

Sd/-
Raja Saeed Akhtar
Chief Engineer Design Dist.
605-Wapda House,
LAHORE.

WEST PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY	NO. ES/DD-1L





APPLICATION TABLE

CONDUCTOR	LINE ANGLES
GOPHER	0^{o} To 11^{o}
RABBIT	0^{o} To 8^{o}
DOG	0^{o} To 3^{o}

NOTE:-
USE AT TANGENT POSITIONS AND SMALL ANGLES. SPAN 440 TO 500 FT.

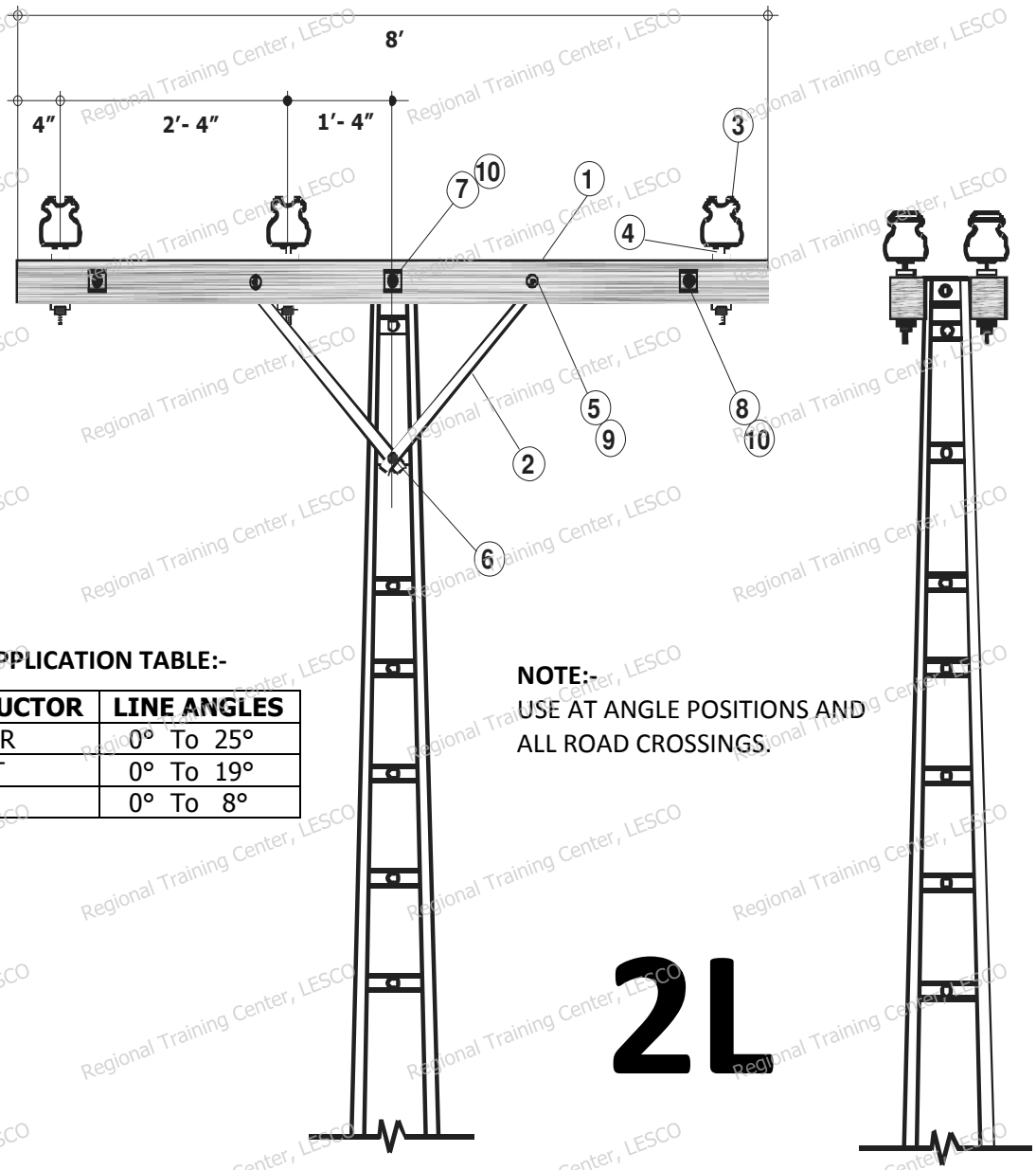
1L

ITEM	DESCRIPTION	QTY	DWG.NO.	STOCK NO.
1	Wood Cross Arm 4″x5″x8′-0″	1	EW/DF-251	T-1173
2	Cross Arm Brace 1 ¼″x 1/4″x28″	2	EW/DF-254	T-1362
3	11 KV Pin Type Insulator	3	EW/DF-252	T-3211
4	Insulator Pin.	3	EW/DF-256	T-3217
5	M.S. Bolt 3/8″x6″	2	EW/DF-272	S-1265
6	M.S. Bolt 5/8″x2″	1	EW/DF-260	S-1297
7	M.S. Bolt 5/8″x14″	1	EW/DF-260	S-1303
8	Round Washer 1″ Dia. 7/16″ Hole	2	EW/DF-268	S-1791
9	Square Washer 2¼″ x 2¼″,11/16″ Hole	1	EW/DF-269	S-1792

11 KV SINGLE CROSSARM ASSEMBLY 1-L

DWN		ASSTT:DIR.		REV.
CKD	L.E.W T.MCC.	DIR.		REV.

WEST PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY	NO. ES/DD-2L



APPLICATION TABLE:-

CONDUCTOR	LINE ANGLES
GOPHER	0° To 25°
RABBIT	0° To 19°
DOG	0° To 8°

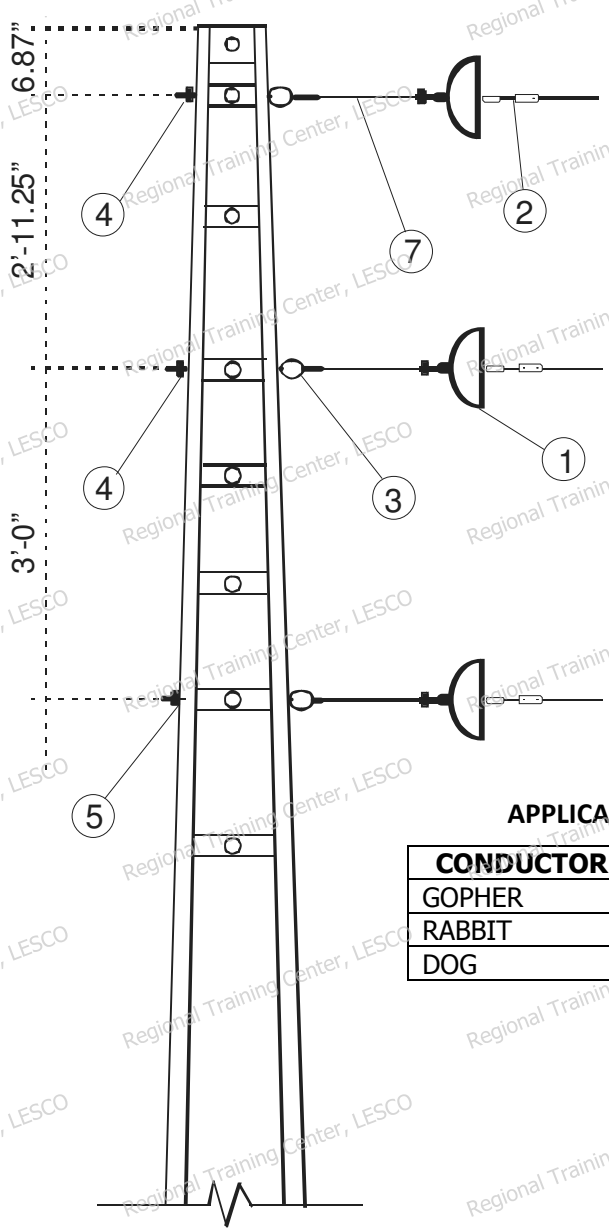
NOTE:-
USE AT ANGLE POSITIONS AND ALL ROAD CROSSINGS.

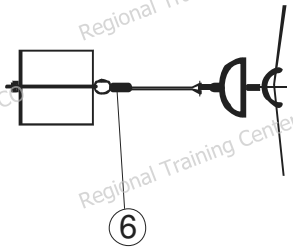
2L

ITEM	DISCRIPTION		QTY	DWG.NO	STOCK NO.
1	Wood Cross Arm	4″x5″x8′-0″	2	EW/DF-251	T-1173
2	Cross Arm Brace	1¼″x ¼″x28″	4	EW/DF-254	T-1352
3	11 KV Pin Type Insulator		6	EW/DF-252	T-3211
4	Insulator Pin		6	EW/DF-256	T-3217
5	M.S. Bolt	3/8″x6″	4	EW/DF-272	S-1265
6	M.S. Bolt	5/8″x2″	2	EW/DF-260	S-1297
7	M.S. Bolt	5/8″x18″	1	EW/DF-280	S-1265
8	Double Arming Bolt	5/8″x20″	2	EW/DF-270	S-1083
9	Round Washer 1″ Dia. 7/16″ Hole		4	EW/DF-268	S-1791
10	Square Washer 2 ¼″ x2 ¼″, 11/16″ Hole		10	EW/DF-269	S-1792

11 K.V DOUBLE CROSSARM ASSEMBLY 2-L FOR LATTICE STEEL POLE

DWN	ASSTT. DIR.		REV.
CKD L.E.W T.MCC.	DIR.		REV.





NOTE:-
USE THIS ASSEMBLY AT MEDIUM ANGLE LOCATIONS FOR 11 K.V LINE WITHOUT L.T. WITH DOG ACSR CONDUCTOR, ESPECIALLY WHERE CLEARANCE ON THE GUY SIDE IS REQUIRED. USE ONE GUY.

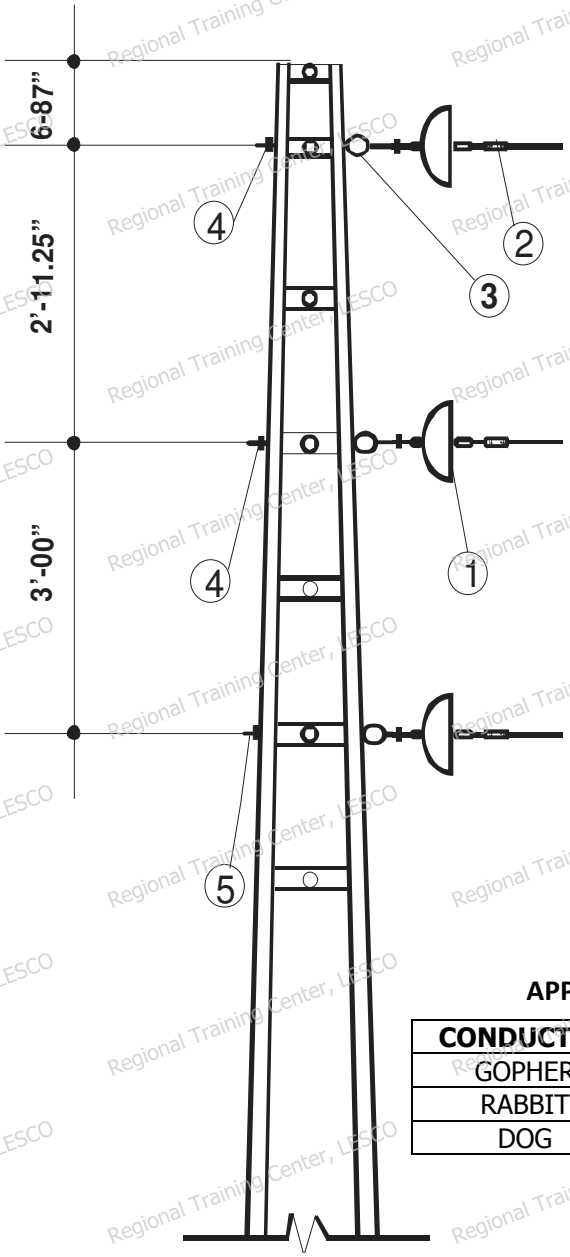
APPLICATION TABLE:-

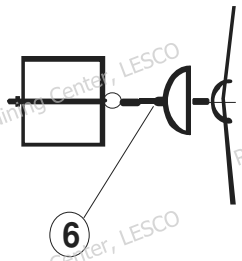
CONDUCTOR	LINE ANGLES
GOPHER	Use Assembly 4-L
RABBIT	Use Assembly 4-L
DOG	6° to 12°

3L

ITEM	DISCRIPTION	QTY	DWG.NO	STOCK NO.
1	11 K.V Disc Insulator 10” Dia Clevis Type	3	EW/DF-257	T-3004
2	Suspension (Angle) Clamp	3	EW/DF-253	T-5096
3	Eye Nut 5/8”	3	GW/DF-36	S-1366
4	Double Arming Bolt 5/8” x 12”	2	EW/DF-270	S-1080
5	Double Arming Bolt 5/8” x 14”	1	EW/DF-270	S-1081
6	Anchor Shackle	3	EW/DF-266	T-3167
7	Extension Link 14”	3	EW/DF-267	T-3166

PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY			ENGINEERING DEPARTMENT
11 K.V VERTICAL ANGLE ASSEMBLY 3-L (WITH EXTENSION LINK) FOR LATTICE STEEL POLE			
DWN		SCALE:	DATE:5.11.66
TCD	ASSTT. DIR.	DWG NO. ES/DD-3 L	
CKD LEW T.M.C.C.	APPRVD.		





NOTE:- USE THIS ASSEMBLY AT HEAVY ANGLE FOR 11 K.V LINE WITH ALL STANDARD ACSR CONDUCTORS. USE ONE GUY FOR GOPHER AND GUY RABBIT CONDUCTOR. FOR DOG CONDUCTOR USE ONE GUY FOR LINE ANGLE UP TO 40 DEGREES AND TWO GUYS FOR GREATER ANGLES.

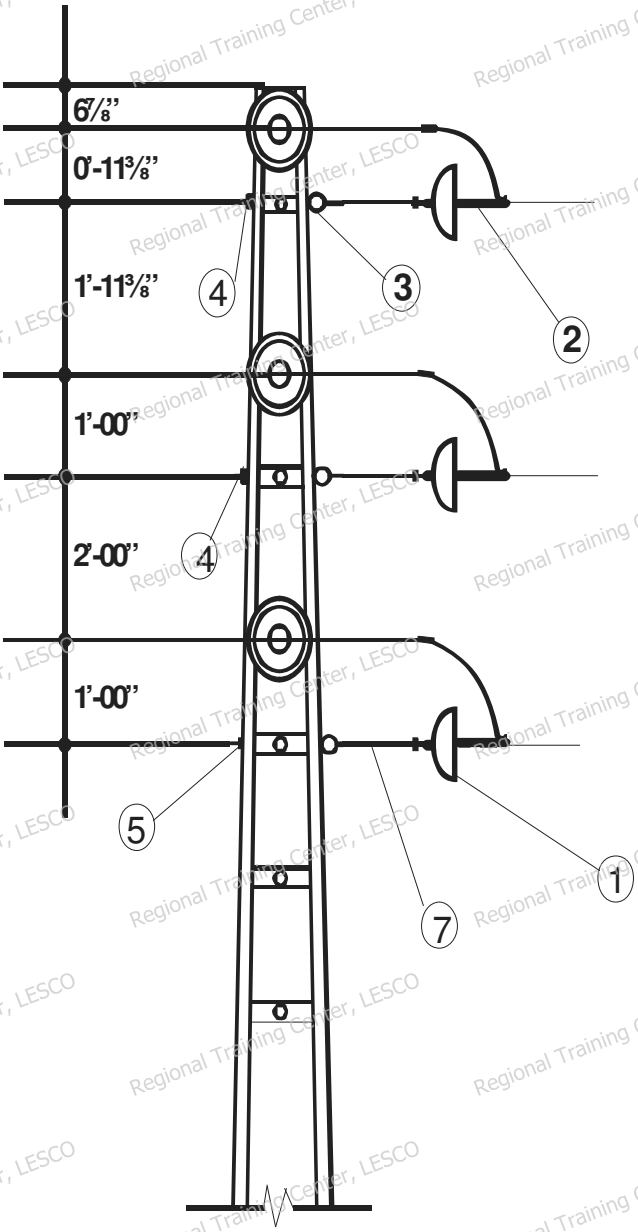
APPLICATION TABLE:-

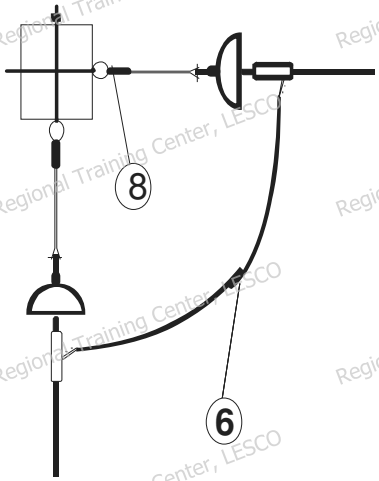
CONDUCTOR	LINE ANGLES
GOPHER	20° TO 60°
RABBIT	15° TO 60°
DOG	12° TO 60°

4L

ITEM	DISCRIPTION	QTY	DWG.NO.	STOCK NO.
1	11 KV Disc Insulator 10"Dia Clevis type.	3	EW/DF-257	T-3004
2	Suspension (Angle)Clamp.	3	EW/DF-253	T-5096
3	Eye-Nut 5/8"	3	GW/DF-36	S-1366
4	Double Arming Bolt.5/8" x 12"	2	EW/DF-270	S-1080
5	Double Arming Bolt.5/8" x 14".	1	EW/DF-270	S-1081
6	Anchor Shackle.	3	EW/DF-266	T-3167

PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY			ENGINEERING DEPARTMENT
11 K.V VERTICAL ANGLE ASSEMBLY 4-L (WITHOUT EXTENSION LINK) FOR LATTICE STEEL POLE			
DWN		SCALE:	DATE:1.11.66
TCD	ASSTT. DIR.	DWG NO. ES/DD-4 L	
CKD L.E.W T.M.C.C	APPRVD.		



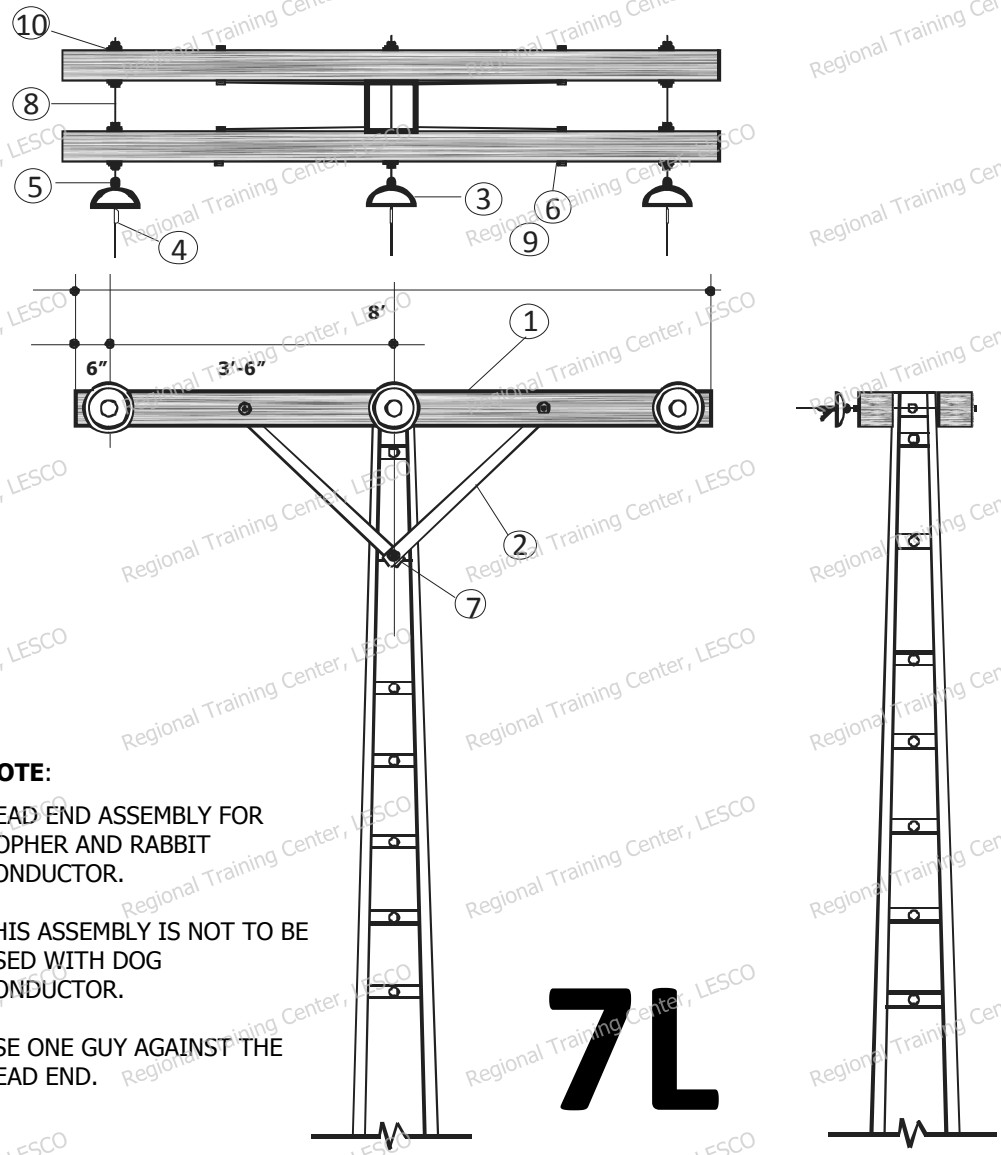


NOTE:- USE ON LINE ANGLES 60° TO 90° USE ONE GUY FOR GOPHER AND RABBIT AGAINST EACH END. FOR DOG USE TWO GUYS AGAINST EACH DEAD END.

5L

ITEM	DISCRIPTION	QTY	DWG NO.	STOCK NO.
1	11 KV Disc Insulator 10"Dia Clevis eye type	6	EW/DF-257	T-3004
2	Dead End Clamp Two Bolt Type	6	EW/DF-259	T-5044
3	Eye-Nut 5/8"	6	GW/DF-36	S-1366
4	Double Arming Bolt.5/8" x 12"	4	EW/DF-270	S-1080
5	Double Arming Bolt.5/8" x 14"	2	EW/DF-270	S-1081
6	P.G Clamp two Bolt type	3	EW/DF-271	T-5017
7	Extension Link 14 "	6	EW/DF-267	T-3166
8	Anker Shackle	6	EW/DF-266	T-3117

PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY			ENGINEERING DEPARTMENT
11 K.V VERTICAL DEAD END ASSEMBLY 5-L (WITH EXTENSION LINK) FOR LATTICE STEEL POLE			
DWN		SCALE:	DATE:1.11.66
TCD	ASSTT. DIR.	DWG NO. ES/DD-5L	
CKD L.E.W T.M.C.C	APPRVD.		



NOTE:

DEAD END ASSEMBLY FOR GOPHER AND RABBIT CONDUCTOR.

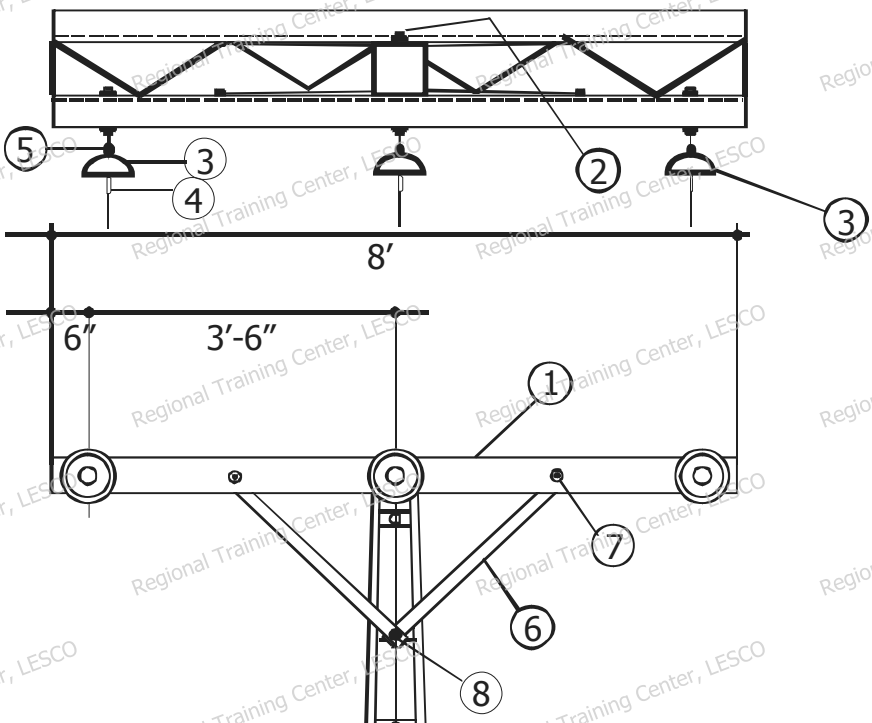
THIS ASSEMBLY IS NOT TO BE USED WITH DOG CONDUCTOR.

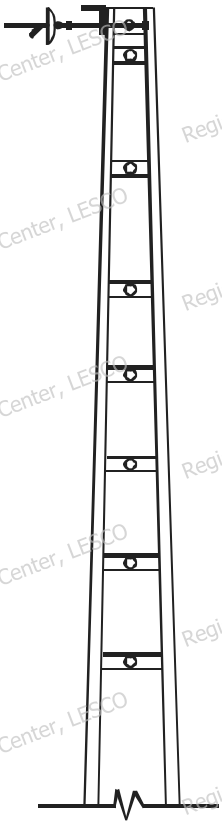
USE ONE GUY AGAINST THE DEAD END.

7L

ITEM	QTY	DISCRIPTION	DWG NO.	STOCK NO.
1	2	Wood Cross Arm 4"x5"x8'-0"	EW/DF-251	T-1173
2	4	Cross Arm Brace 1¼"x 1/4"x28"	EW/DF-254	T-1352
3	3	11 KV Disc Insulator 10" Dia Clevis Eye Type	EW/DF-257	T-3004
4	3	Dead End Clamp	EW/DF-259	T-5044
5	3	Eye Nut 5/8"	GW/DF-36	S-1366
6	4	M.S. Bolt 3/8"x6"	EW/DF-272	S-1265
7	2	M.S. Bolt 5/8"x2"	EW/DF-260	S-1297
8	3	Double Arming Bolt 5/8" x 20"	EW/DF-270	S-1083
9	4	Round Washer 1" Dia. 7/16" Hole	EW/DF-268	S-1791
10	10	Square Washer 2 ¼" x2 ¼", 11/16" Hole	EW/DF-269	S-1792

PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY			ENGINEERING DEPARTMENT
11 K.V HORIZONTAL SINGLE DEAD END ASSEMBLY 7-L (WOOD CROSS ARM) FOR LATTICE STEEL POLE			
DWN		SCALE:	DATE:28.10.66
TCD	ASSTT. DIR.	DWG NO. ES/DD-7L	
CKD L.E.W T.M.C.C	APPRVD.		



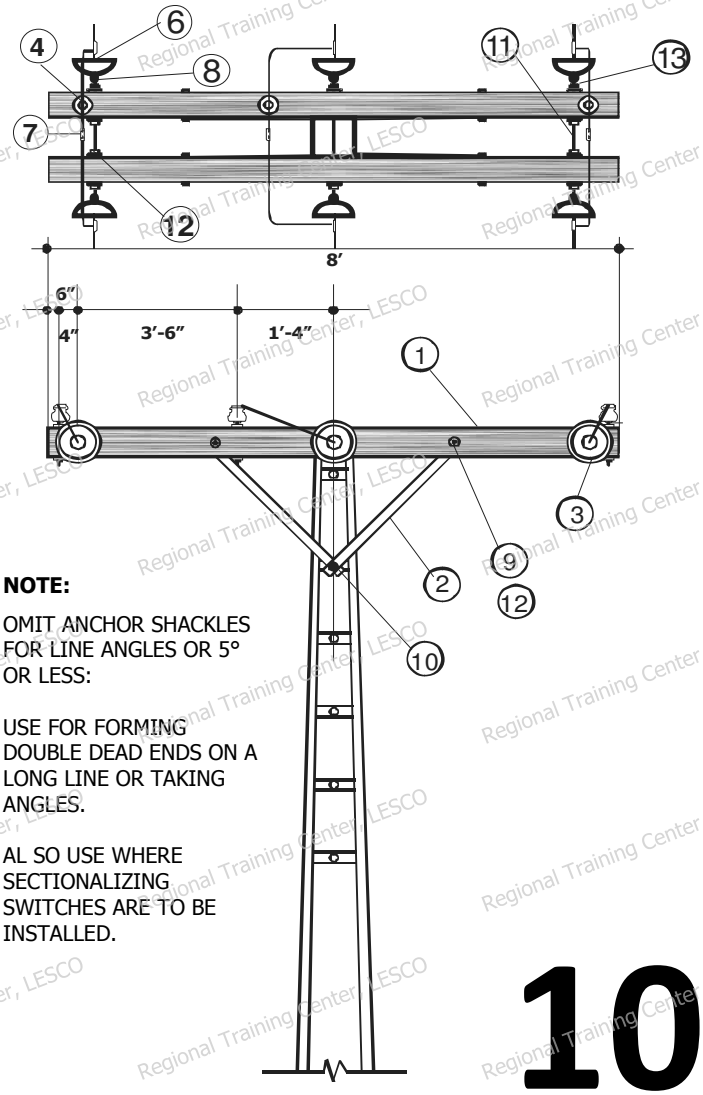


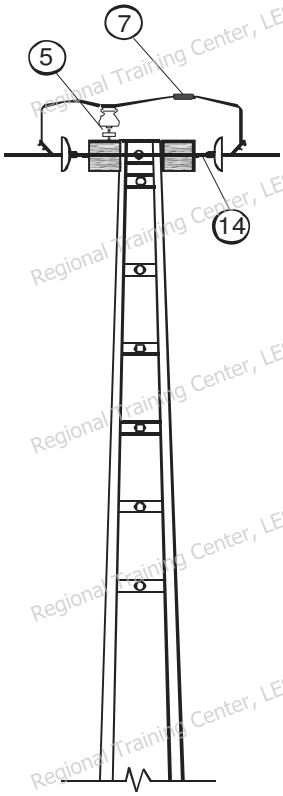
NOTE: THIS ASSEMBLY TO BE USED FOR DEAD ENDING DOG CONDUCTOR USE TWO STAYS AGAINST DEAD END.

8L

ITEM	DISCRIPTION	QTY	DWG NO.	STOCK NO.
1	Lattice Steel Cross arm	1	EW/DF-289	-
2	M.S. Bolt 5/8″ x 2″	2	EW/DF-260	S-1297
3	11 KV Disc Insulator 10″ Dia Clevis Eye Type	3	EW/DF-257	T-3004
4	Dead End Clamp	3	EW/DF-259	T-5044
5	Anchor Shackle	3	EW/DF-266	T-3167
6	Cross Arm Brace 1 ¼″x1/4″x28″	4	EW/DF-254	T-1352
7	M.S. Bolt 3/8″ x 2″	4	EW/DF-272	S-1265
8	M.S. Bolt 5/8″ x 2″	2	EW/DF-260	S-1297

PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY			ENGINEERING DEPARTMENT
11 K.V HORIZONTAL SINGLE DEAD END ASSEMBLY 8-L (STEEL CROSS ARM) FOR LATTICE STEEL POLE			
DWN		SCALE:	DATE: 28.10.66
TCD	A.D	DWG NO. ES/DDS-8 L	
CKD L.E.W. T.M.C.C	APPRVD.		





NOTE:

OMIT ANCHOR SHACKLES FOR LINE ANGLES OR 5° OR LESS:

USE FOR FORMING DOUBLE DEAD ENDS ON A LONG LINE OR TAKING ANGLES.

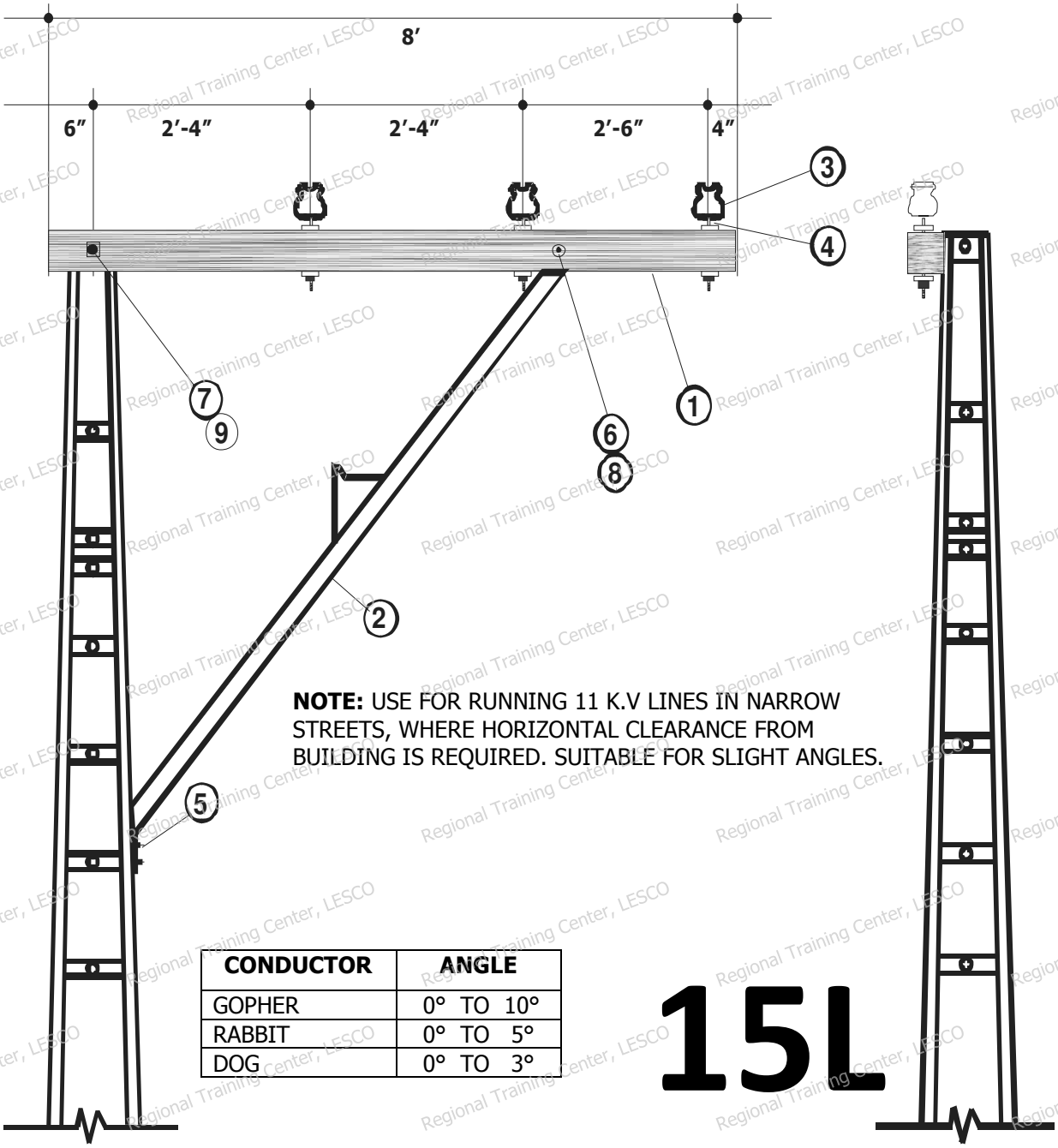
AL SO USE WHERE SECTIONALIZING SWITCHES ARE TO BE INSTALLED.

10L

ITEM	DISCRIPTION	QTY	DWG NO.	STOCK NO.
1	Wood Cross Arm, 4"x5"x8'-0"	2	EW/DF-251	T-1173
2	Cross Arm Brace, 1¼"x 1/4"x28"	4	EW/DF-254	T-1352
3	11 KV Disc Insulator 10" Dia Clevis Eye Type	6	EW/DF-257	T-3004
4	11 KV Pin Type Insulator.	3	EW/DF-252	T-3211
5	Insulator Pin.	3	EW/DF-256	T-3217
6	Dead End Clamp.	6	EW/DF-259	T-5044
7	P. G. Clamp two bolt type.	3	EW/DF-271	T-5017
8	Eye Nut 5/8"	6	GW/DF-36	T-1366
9	M.S. Bolt 3/8"x6"	4	EW/DF-272	S-1265
10	M.S. Bolt 5/8"x2"	2	EW/DF-260	T-1297
11	Double Arming Bolt 5/8" x 20".	3	EW/DF-270	T-1083
12	Round Washer 1" Dia. 7/16" Hole.	4	EW/DF-268	S-1791
13	Square Washer 2 ¼" x2 ¼", 11/16" Hole.	10	EW/DF-269	S-1792
14	Anchor Shackle.	6	EW/DF-266	T-3167

PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY		ENGINEERING DEPARTMENT	
11 K.V HORIZONTAL DOUBLE DEAD END ASSEMBLY 10-L (WOOD CROSS ARM) FOR LATTICE STEEL POLE			
DWN		SCALE:	DATE:2.10.66
TCD	ASSTT. DIR.	DWG NO. ES/DD-10 L	
CKD L.E.W T.M.C.C	APPRVD.		

PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY	NO.ES/DD-15 L



NOTE: USE FOR RUNNING 11 K.V LINES IN NARROW STREETS, WHERE HORIZONTAL CLEARANCE FROM BUILDING IS REQUIRED. SUITABLE FOR SLIGHT ANGLES.

CONDUCTOR	ANGLE
GOPHER	0° TO 10°
RABBIT	0° TO 5°
DOG	0° TO 3°

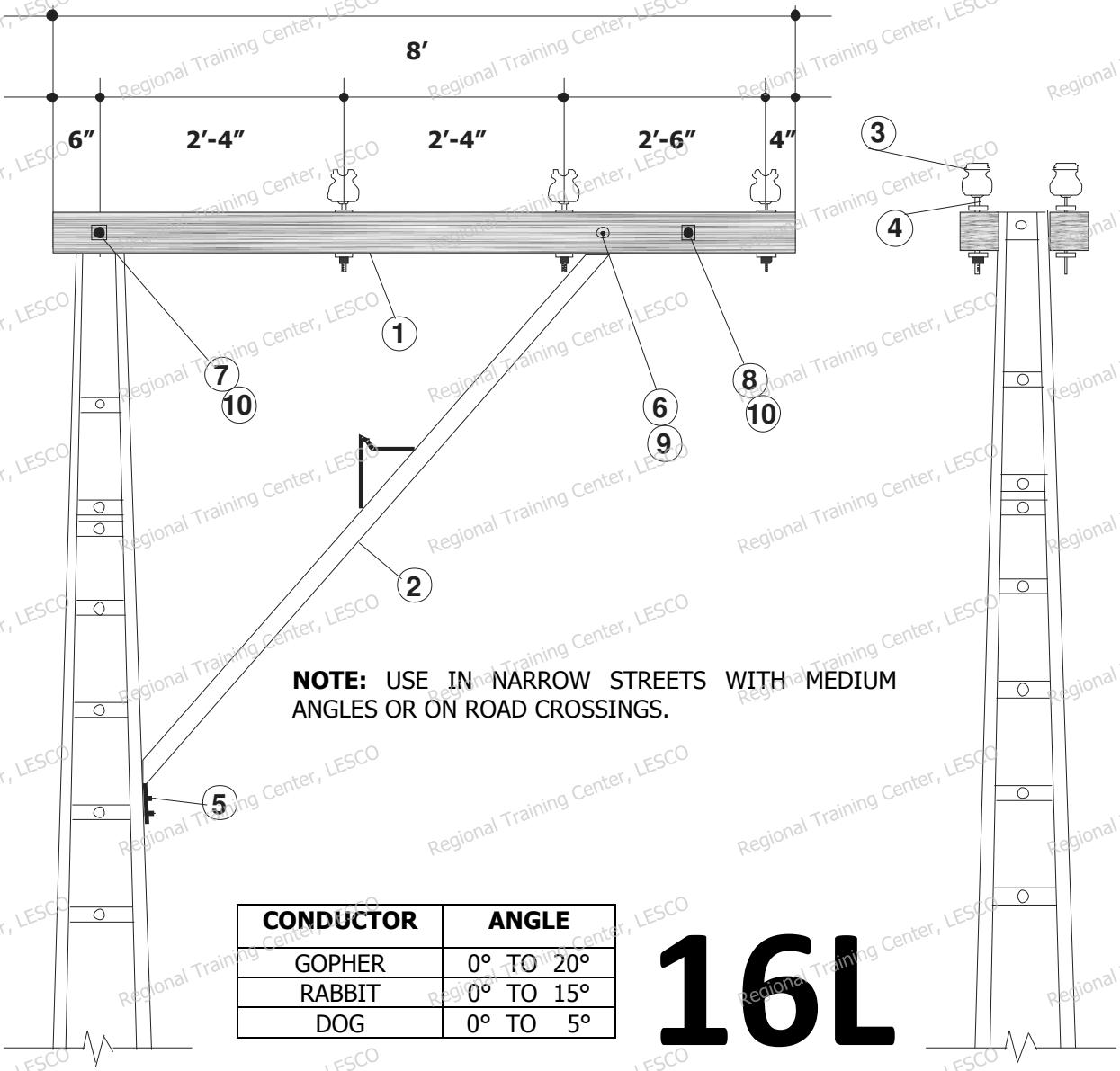
15L

ITEM	DESCRIPTION	QTY	DWG.NO.	STOCK NO.
1	Wood Cross Arm 4″x5″x8′-0″	1	EW/DF-251	T-1173
2	Cross Arm Step Brace 1¼″x 3/16″x7′-0″	1	EW/DF-287	T-1358
3	11 KV Pin Type Insulator	3	EW/DF-252	T-3211
4	Insulator Pin.	3	EW/DF-256	T-3217
5	M.S. Bolt 1/2″ x 2″	2	EW/DF-286	S-1057
6	M.S. Bolt 1/2″x6″	1	EW/DF-286	S-1059
7	M.S. Bolt 5/8″x14″	1	EW/DF-260	S-1285
8	Round Washer 1¼″ Dia. 9/16″ Hole	1	EW/DF-268	S-1791
9	Square Washer 2 ¼″ x2 ¼″, 11/16″ Hole	1	EW/DF-269	S-1792

II K.V OFFSET SINGLE CROSSARM ASSEMBLY 15-L FOR LATTICE STEEL POLE

DWN	ASSTT:DIR.	REV.
CKD L.E.W T.M.C.C	DIR.	REV.

PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY	NO.ES/DD-16 L



NOTE: USE IN NARROW STREETS WITH MEDIUM ANGLES OR ON ROAD CROSSINGS.

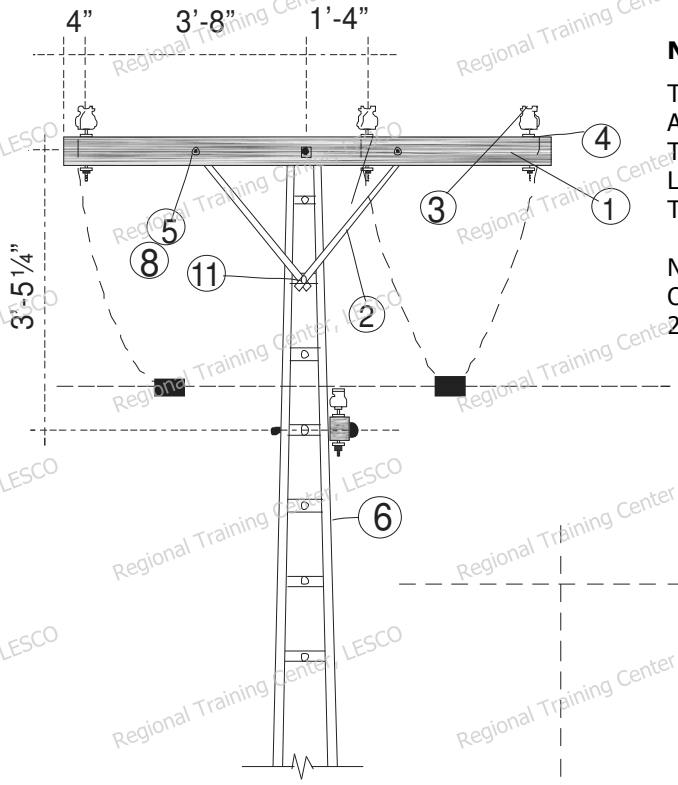
CONDUCTOR	ANGLE
GOPHER	0° TO 20°
RABBIT	0° TO 15°
DOG	0° TO 5°

16L

ITEM	DESCRIPTION		QTY	DWG.NO.	STOCK NO.
1	Wood Cross Arm	4″x5″x8′-0″	2	EW/DF-251	T-1173
2	Cross Arm Step Brace	1¾″x 3/16″x7′-0″	2	EW/DF-287	T-1358
3	11 KV Pin Type Insulator		6	EW/DF-252	T-3211
4	Insulator Pin		6	EW/DF-256	T-3217
5	M.S. Bolt	1/2″ x 2″	4	EW/DF-286	S-1057
6	M.S. Bolt	1/2″x6″	2	EW/DF-286	S-1059
7	M.S. Bolt	5/8″x18″	1	EW/DF-260	S-1285
8	Double Arming Bolt	5/8″x20″	1	EW/DF-270	S-1083
9	Round Washer 1¼″ Dia. 9/16″ Hole		2	EW/DF-268	S-1791
10	Square Washer 2¼″ x2¼″, 11/16″ Hole		6	EW/DF-269	S-1792

11 K.V OFFSET DOUBLE CROSSARM ASSEMBLY 16-L FOR LATTICE STEEL POLE.

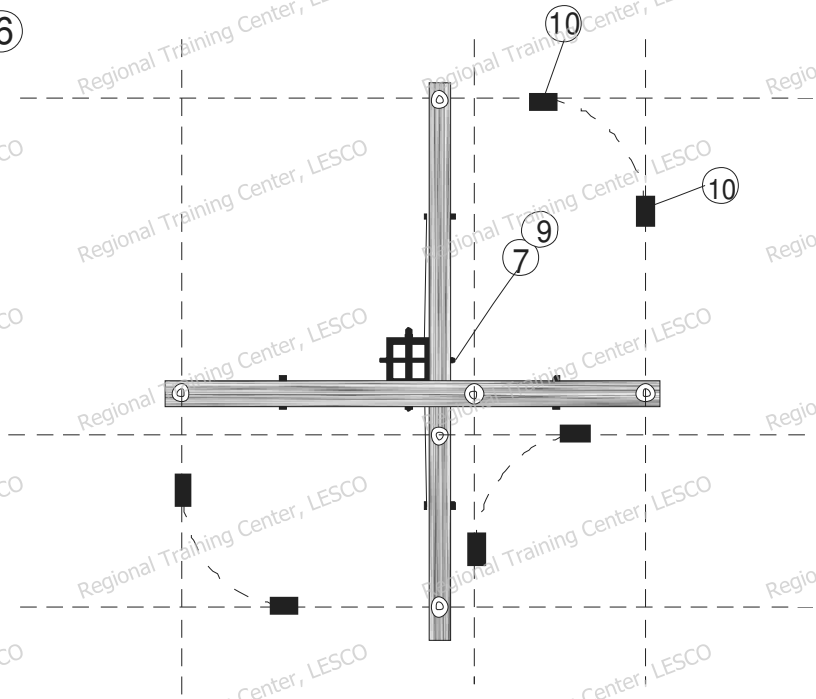
DWN	ASSTT:DIR.	REV.
CKD L.E.W T.M.C.C	DIR.	REV.



NOTE:

THIS ASSEMBLY IS COMBINATION OF 1L AND 21L. USE FOR CROSSING OVER AND TAPPING 11 KV LINES (NOT DEAD ENDING). LINE COMING FROM SOURCE AT TOP AND TAP AT LOWER POSITION.

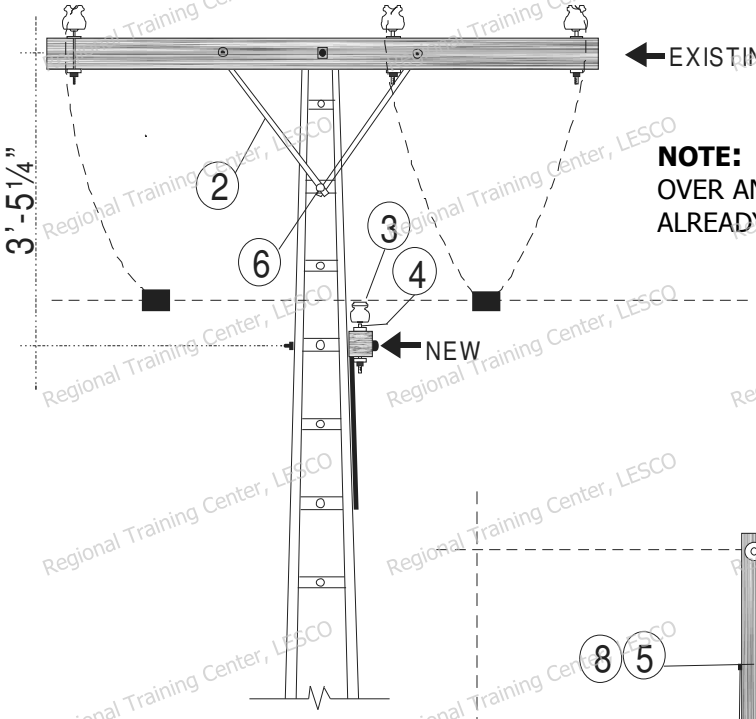
NORMAL SPAN FOR TAP LINE, BUT IN CASE OF TAP, ADJACENT SHOULD NOT EXCEED 250 FT. JUMPERING TO BE DONE AS SHOWS.



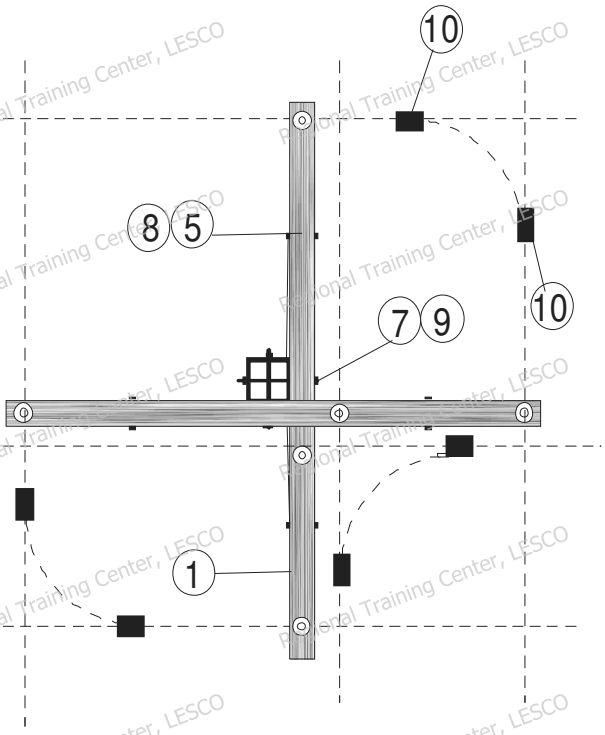
20L

ITEM	DESCRIPTION	QTY	DWG.NO.	STOCK NO.
1	Wood Cross Arm 4"x5"x8'-0"	2	EW/DF-251	T-1173
2	Cross Arm Brace 1¼"x¼"x28"	4	EW/DF-254	T-1352
3	11 KV Pin Type Insulator	6	EW/DF-252	T-3211
4	Insulator Pin.	6	EW/DF-256	T-3217
5	M.S. Bolt 3/8" x 6"	4	EW/DF-272	S-1268
6	M.S. Bolt 5/8"x2"	2	EW/DF-260	S-1297
7	M.S. Bolt 5/8"x14"	2	EW/DF-260	S-1303
8	Round Washer 1" Dia. 7/16" Hole.	4	EW/DF-268	S-1791
9	Square Washer 2¼" x2 ¼"x11/16" Hole.	2	EW/DF-269	S-1792
10	P.G Clamp Two Bolt Type	6	EW/DF-271	T-5017
11	M.S. Bolt 5/8" x 2".	1	EW/DF-260	S-1297

PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY			ENGINEERING DEPARTMENT
11 K.V CROSSOVER AND TAP ASSEMBLY 20-L FOR LATTICE STEEL POLE			
DWN		SCALE:	DATE:20.10.66
TCD	ASSTT. DIR.	DWG NO. ES/DD-20 L	
CKD L.E.W T.M.C.C	APPRVD.		



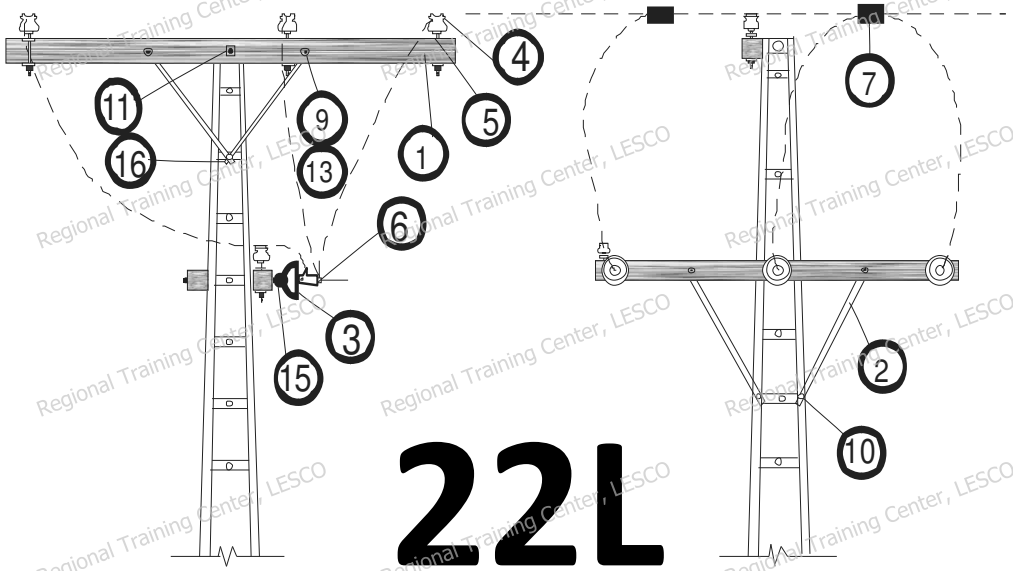
NOTE: USE FOR CROSSING OVER AND TAPPING. TOP LINE ALREADY EXISTS.



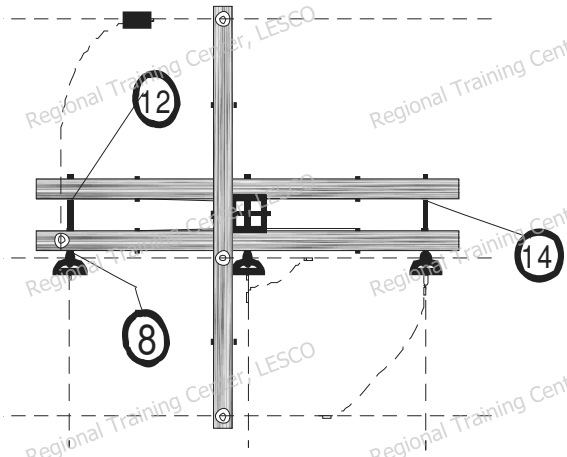
21L

ITEM	DESCRIPTION	QTY	DWG.NO.	STOCK NO.
1	Wood Cross Arm 4″x5″x8′-0″	1	EW/DF-251	T-1173
2	Cross Arm Brace 1¼″x¼″x28″	2	EW/DF-254	T-1352
3	11 KV Pin Type Insulator	3	EW/DF-252	T-3211
4	Insulator Pin	3	EW/DF-256	T-3217
5	M.S. Bolt 3/8″ x 6″	2	EW/DF-272	S-1265
6	M.S. Bolt 5/8″x2″	2	EW/DF-260	S-1297
7	M.S. Bolt 5/8″x14″	1	EW/DF-260	S-1303
8	Round Washer 1″ Dia. 7/16″ Hole	2	EW/DF-268	S-1791
9	Square Washer 2¼″x2¼″, 11/16″ Hole	1	EW/DF-269	S-1792
10	P.G Clamp Two Bolt Type	6	EW/DF-271	T-5017

PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY			ENGINEERING DEPARTMENT
11 K.V CROSSOVER AND TAP ASSEMBLY 21-L (FOR EXISTING LINE) FOR LATTICE STEEL POLE			
DWN		SCALE: DWG. NO.ES/DO-4L	DATE: 24-10-66
TCD	ASSTT. DIR,.	DWG NO. ES/DD-21 L	
CKD L.E.W T.M.C.C	APPRVD.		



22L



NOTE:-

OMIT ANCHOR SHACKLE FOR TEE TYPE OFF ANGLES OF 5° OR LESS.

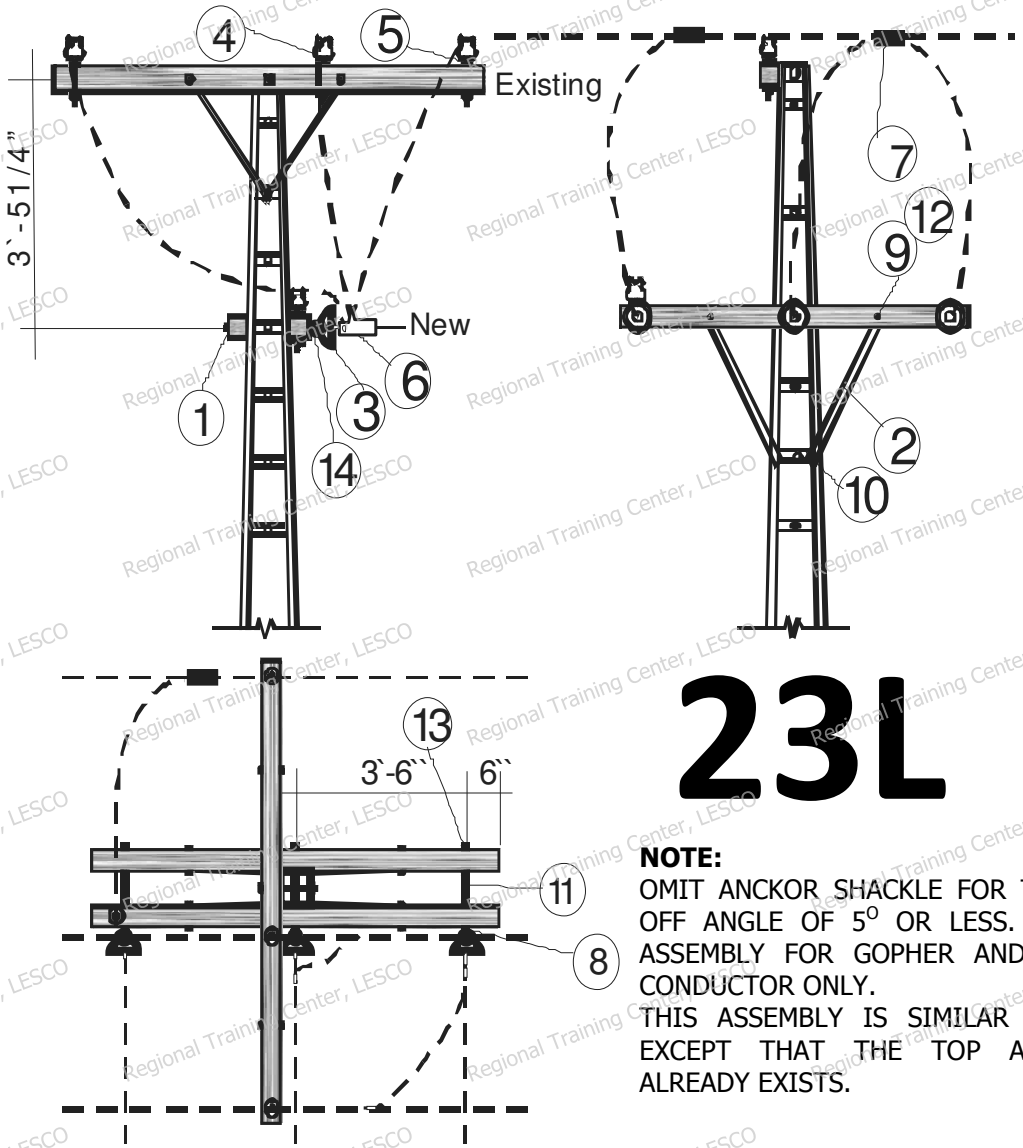
TEE OFF ASSEMBLY FOR GOPHER AND RABBIT CONDUCTORS ONLY.

USE THIS ASSEMBLY WHEN APART FROM A STRAIGHT RUN, A TEE-OFF OF THE 11 KV IS DESIRED.

CENTRAL PIN INSULATOR SHOULD BE ON THE SAME SIDE OF THE CROSS ARM AS THE TEE-OFF. INSTALL DEAD END CLAMPS IN SUCH A MANNER THAT THE CONDUCTOR TALLS COME OUT IN AN UPWARD DIRECTION.USE THESE TAILS FOR JUMPERING AS INDICATED IN THE DRAWING.

ITEM	DISCRIPTION	QTY	DWG NO.	STOCK NO.
1	Wood Cross Arm 4"x5"x8'-0"	3	EW/DF-251	T-1173
2	Cross Arm Brace 1¼"x 1/4"x28"	6	EW/DF-254	T-1352
3	11 KV Disc Insulator 10" Dia Clevis Eye Type	3	EW/DF-257	T-3004
4	11 KV Pin Type Insulator	4	EW/DF-252	T-3211
5	Insulator Pin	4	EW/DF-256	T-3217
6	Dead End Clamp	3	EW/DF-259	T-5044
7	P. G. Clamp two bolt type	3	EW/DF-271	T-5019
8	Eye Nut 5/8"	3	GW/DF-36	S-1366
9	M.S. Bolt 3/8"x6"	6	EW/DF-272	S-1265
10	M.S. Bolt 1/2"x2"	4	EW/DF-286	S-1057
11	M.S. Bolt 5/8"x14"	1	EW/DF-260	S-1303
12	Double Arming Bolt 5/8" x 20"	3	EW/DF-270	S-1083
13	Round Washer 1" Dia. 7/16" Hole	6	EW/DF-268	S-1791
14	Square Washer 2 ¼" x2 ¼"x11/16" Hole	11	EW/DF-269	S-1792
15	Anchor Shackle	3	EW/DF-266	S-3167
16	M.S. Bolt 5/8"x2"	1	EW/DF-260	S-1297

PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY		ENGINEERING DEPARTMENT	
11 K.V TEE-OFF ASSEMBLY 22-L FOR LATTICE STEEL POLE			
DWN		SCALE	DATE 28-10-66
TCD	A.D	DWG NO. ES/DD-22-L	
CKD	DIR.		



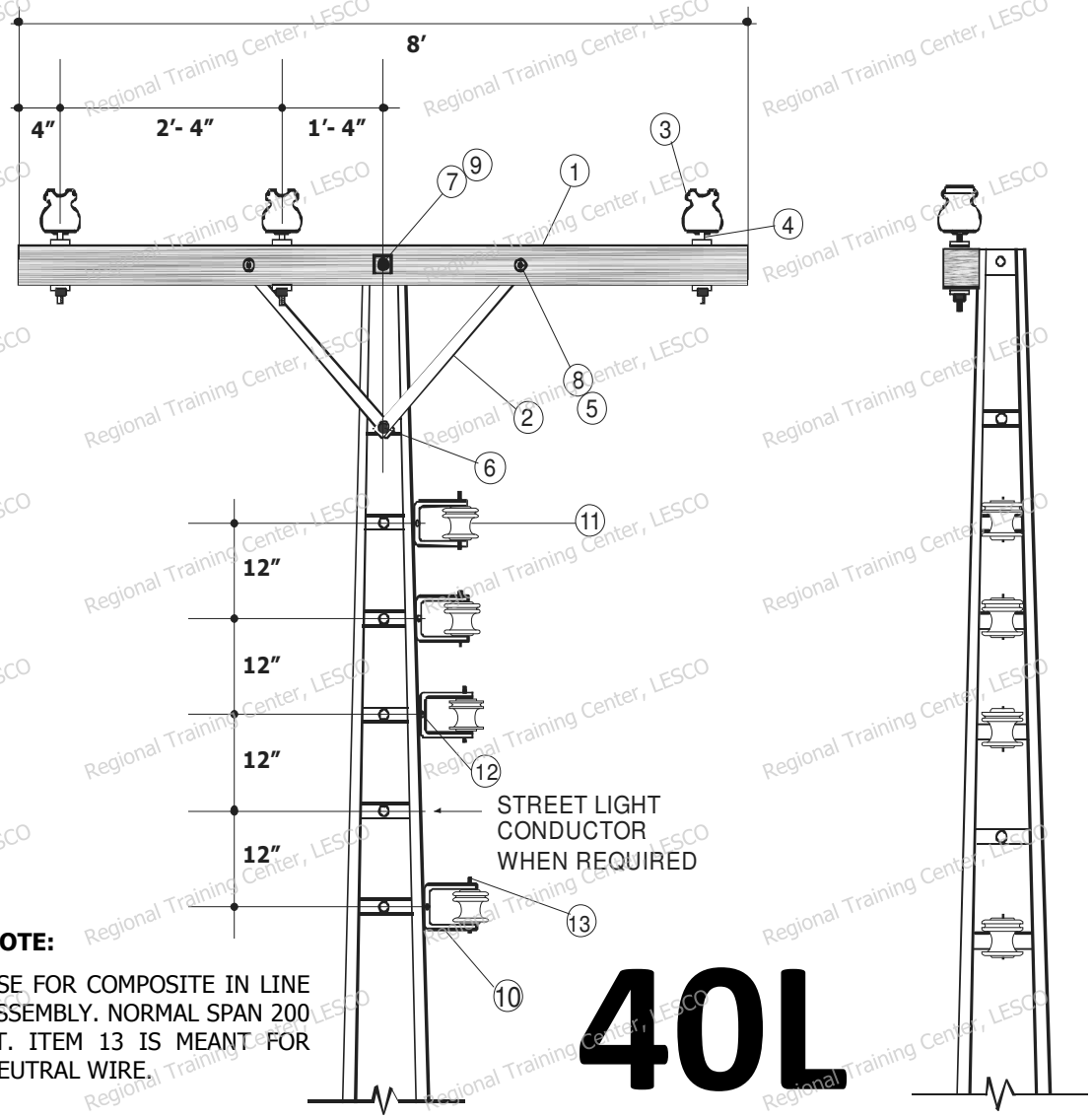
23L

NOTE:
OMIT ANCKOR SHACKLE FOR TEE TAIL OFF ANGLE OF 5^{O} OR LESS. TEE-OFF ASSEMBLY FOR GOPHER AND RABBIT CONDUCTOR ONLY.
THIS ASSEMBLY IS SIMILAR TO 22-L EXCEPT THAT THE TOP ASSEMBLY ALREADY EXISTS.

ITEM	DISCRIPTION	QTY	DWG NO.	STOCK NO.
1	Wood Cross Arm 4"x5"x8'-0"	2	EW/DF-251	T-1173
2	Cross Arm Brace 1¼"x¼"x28"	4	EW/DF-254	T-1352
3	11 KV Disc Insulator 10" Dia Clevis Eye Type	3	EW/DF-257	T-3004
4	11 KV Pin Type Insulator	1	EW/DF-252	T-3211
5	Insulator Pin	1	EW/DF-256	T-3217
6	Dead End Clamp	3	EW/DF-259	T-5044
7	P. G. Clamp two bolt type	3	EW/DF-271	T-5019
8	Eye Nut 5/8"	3	GW/DF-36	T-1366
9	M.S. Bolt 3/8"x6"	4	EW/DF-272	S-1265
10	M.S. Bolt 1/2"x2"	4	EW/DF-286	S-1057
11	Double Arming Bolt 5/8" x 20"	3	EW/DF-270	S-1083
12	Round Washer 1" Dia. 7/16" Hole	4	EW/DF-268	S-1791
13	Square Washer 2 ¼" x2 ¼"x11/16" Hole	10	EW/DF-269	S-1792
14	Anchor Shackle	3	EW/DF-286	T-3167

PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY			ENGINEERING DEPARTMENT
11 K.V TEE-OFF ASSEMBLY 23-L (FOR EXISTING LINE)FOR LATTICE STEEL POLE			
DWN		SCALE	DATE 31-10-66
TCD	ASSTT.DIR.	DWG NO. ES/DD-23-L	
CKD	DIRECTOR		

PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY	NO.ES/DD-40 L



NOTE:

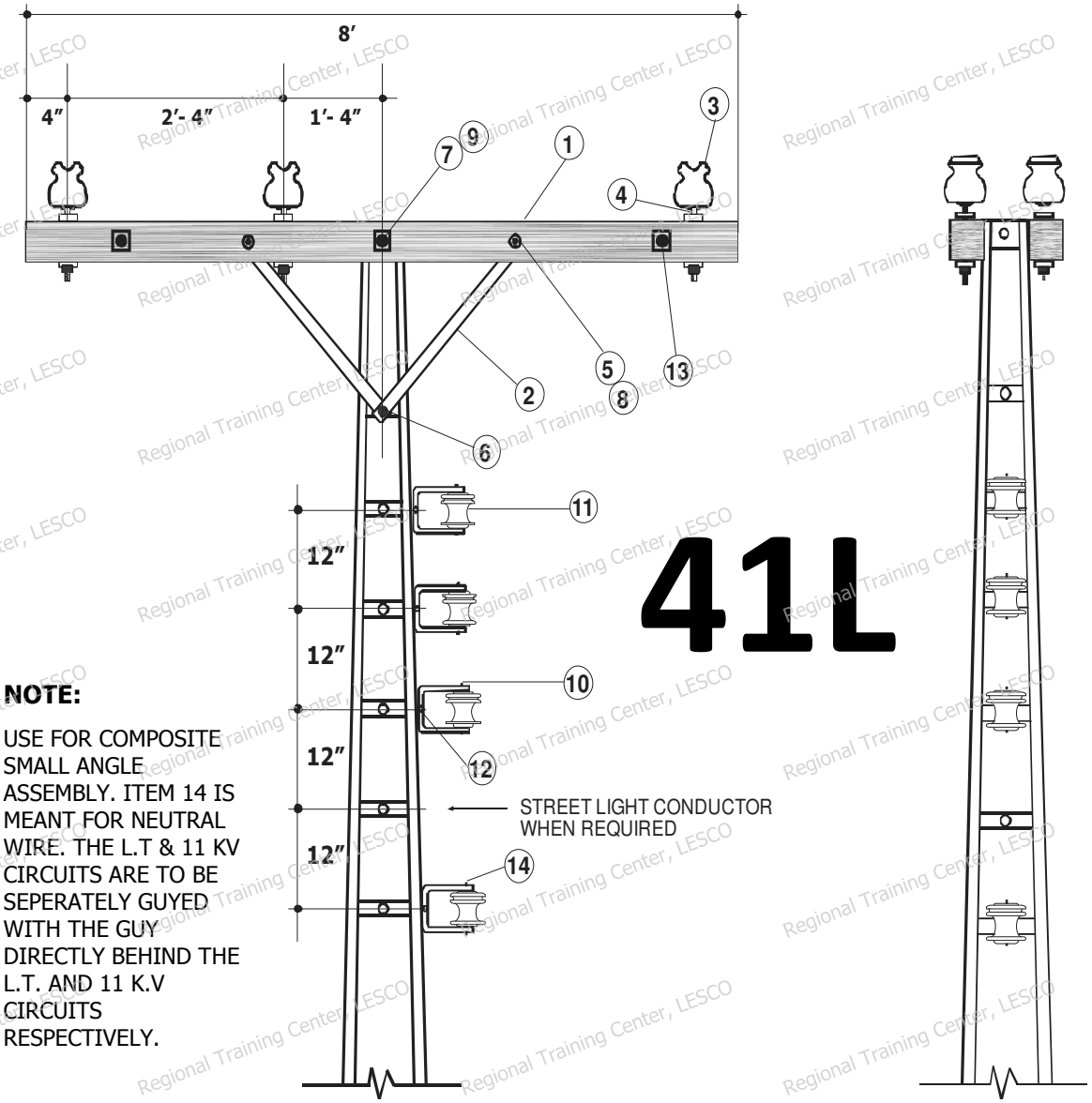
USE FOR COMPOSITE IN LINE ASSEMBLY. NORMAL SPAN 200 FT. ITEM 13 IS MEANT FOR NEUTRAL WIRE.

ITEM	DISCRIPTION	QTY	DWG NO.	STOCK NO.
1	Wood Cross Arm 4"x5"x8'-0"	1	EW/DF-251	T-1173
2	Cross Arm Brace 1¼"x 1/4"x28"	2	EW/DF-254	T-1352
3	11 KV Pin Type Insulator	3	EW/DF-252	T-3211
4	Insulator Pin	3	EW/DF-256	T-3217
5	M.S. Bolt 3/8"x6"	2	EW/DF-272	S-1265
6	M.S. Bolt 5/8"x2"	1	EW/DF-260	S-1297
7	M.S. Bolt 5/8"x14"	1	EW/DF-260	S-1303
8	Round Washer 1" Dia. 7/16" Hole	2	EW/DF-268	S-1791
9	Square Washer 2 ¼" x2 ¼"x11/16" Hole	1	EW/DF-269	S-1792
10	D-Shackle	4	GW/DF-13	T-3265
11	Spool Insulator	4	GW/DF-30	T-3267
12	M.S. Bolt 5/8"x1-1/2"	4	EW/DF-260	T-1296
13	Mild Steel Pin, Cotter Pin	4	SW/DF-34,35	T-3266

11 K.V AND 400 VOLT COMPOSITE IN LINE ASSEMBLY 40 L FOR LATTICE STEEL POLES

DWN.	ASSTT.DIR.	SCALE
CKD	DIRECTOR.	DATE.18-4-87

PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY	NO.ES/DD-41 L



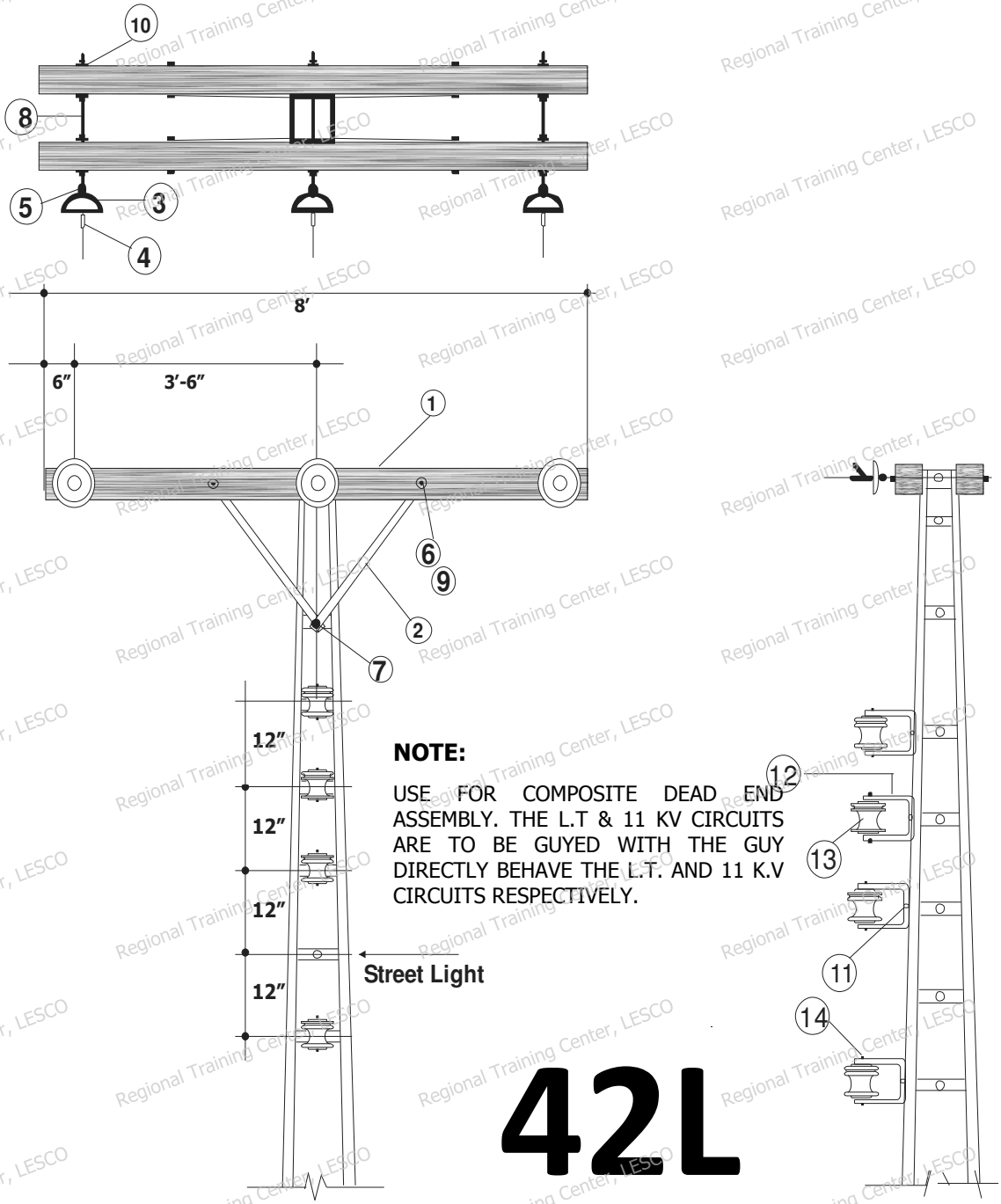
NOTE:

USE FOR COMPOSITE SMALL ANGLE ASSEMBLY. ITEM 14 IS MEANT FOR NEUTRAL WIRE. THE L.T & 11 KV CIRCUITS ARE TO BE SEPERATELY GUYED WITH THE GUY DIRECTLY BEHIND THE L.T. AND 11 K.V CIRCUITS RESPECTIVELY.

ITEM	DISCRIPTION	QTY	DWG NO.	STOCK NO.
1	Wood Cross Arm 4″x5″x8′-0″	2	EW/DF-251	T-1173
2	Cross Arm Brace 1¼″x ¼″x28″	4	EW/DF-254	T-1352
3	11 KV Pin Type Insulator	6	EW/DF-252	T-3211
4	Insulator Pin	6	EW/DF-256	T-3217
5	M.S. Bolt 3/8″x6″	4	EW/DF-272	S-1265
6	M.S. Bolt 5/8″x2″	2	EW/DF-260	S-1297
7	M.S. Bolt 5/8″x18″	1	EW/DF-260	S-1305
8	Round Washer 1″ Dia. 7/16″ Hole	4	EW/DF-268	S-1791
9	Square Washer 2 ¼″ x2 ¼″x11/16″ Hole	10	EW/DF-269	S-1792
10	D- Shackle	4	GW/DF-13	T-3265
11	Spool Insulator	4	GW/DF-30	T-3267
12	M.S. Bolt 5/8″x1½″	4	EW/DF-260	T-1296
13	Double Arming Bolt 5/8″ x 20″	2	EW/DF-270	S-1083
14	Mild Steel Pin, Cotter Pin	4	SW/DF-34,35	T-3266

11 K.V AND 400 VOLT COMPOSITE SMALL ANGLE ASSEMBLY 41 L FOR LATTICE STEEL POLES

DWN.	ASSTT.DIR.	SCALE
CKD	DIRECTOR.	DATE.



NOTE:

USE FOR COMPOSITE DEAD END ASSEMBLY. THE L.T & 11 KV CIRCUITS ARE TO BE GUYED WITH THE GUY DIRECTLY BEHAVE THE L.T. AND 11 K.V CIRCUITS RESPECTIVELY.

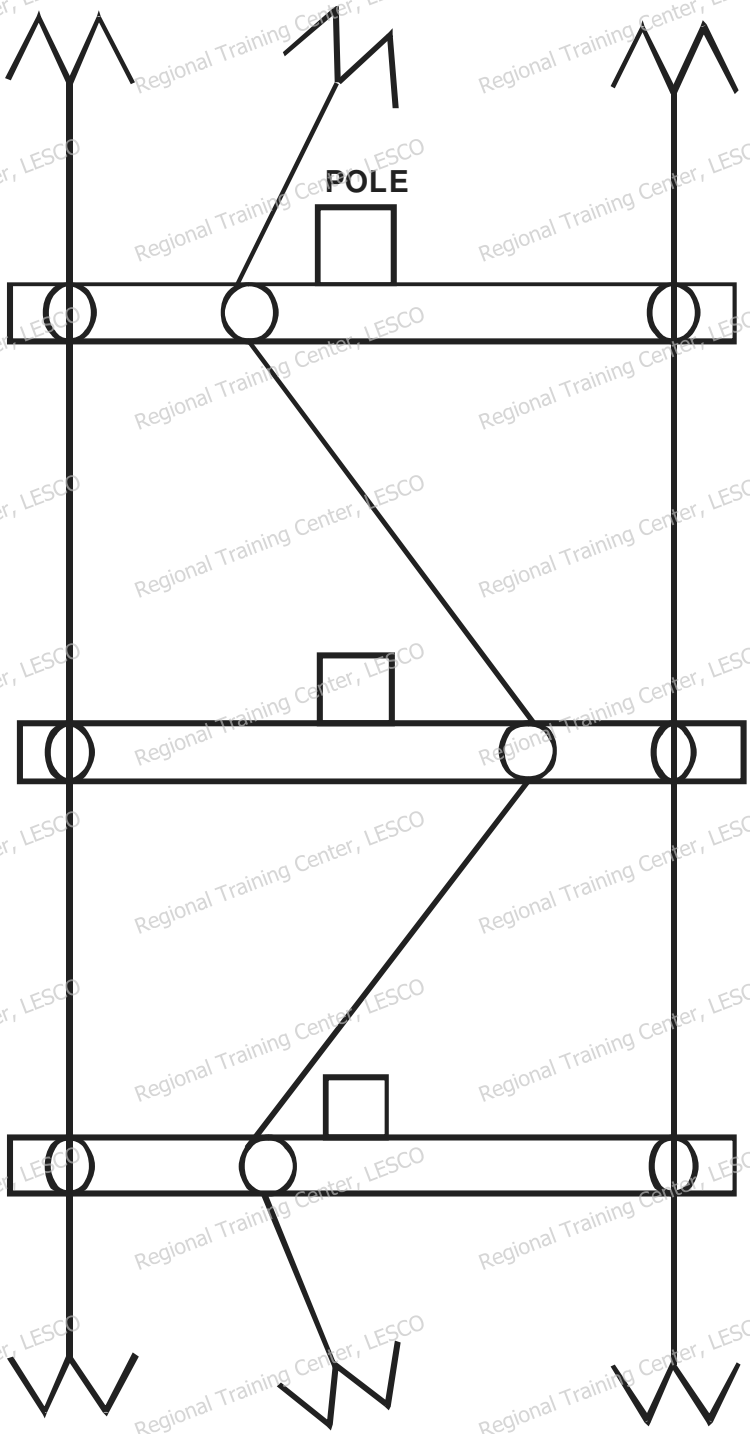
42L

ITEM	DISCRIPTION	QTY	DWG NO.	STOCK NO.
1	Wood Cross Arm 4″x5″x8′-0″	2	EW/DF-251	T-1173
2	Cross Arm Brace 1 ¼″x 1/4″x28″	4	EW/DF-254	T-1352
3	11 KV Disc Insulator 10″ Dia clevis eye type	3	EW/DF-257	T-3004
4	Dead End clamp	3	EW/DF-259	T-5044
5	Eye Nut 5/8″	3	GW/DF-36	T-1266
6	M.S. Bolt 3/8″x6″	4	EW/DF-272	S-1265
7	M.S. Bolt 5/8″x2″	2	EW/DF-260	S-1297

ITEM	DISCRIPTION	QTY	DWG NO.	STOCK NO.
8	Double Arming Bolt 5/8″x20″	3	EW/DF-270	S-1083
9	Round Washer 1″ Dia. 7/16″ Hole.	4	EW/DF-268	S-1791
10	Square Washer 2¼″ x2¼″x11/16″ Hole	10	EW/DF-269	S-1792
11	M.S. Bolt 5/8″x1½″	4	EW/DF-260	S-1296
12	D- Shackle.	4	GW/DF-13	T-3265
13	Spool Insulator	4	GW/DF-30	T-3267
14	Mild Steel Pin, Cotter Pin	4	SW/DF-34,35	T-3266

PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY		ENGINEERING DEPARTMENT	
11 K.V AND 400 VOLT COMPOSITE DEAD END ASSEMBLY 42-L			
DWN		SCALE	DATE 18-4-67
TCD	ASSTT.DIR.	DWG NO.	

SKETCH SHOWING TRANSPOSITION OF CENTRALPHASE OF 11 KV LINE FOR OBTAINING MECHANICAL BALANCE



CROSSARM 8'.0"x5"x4"

NOTE:

USE SIDE GROOVES OF PIN INSULATORS FOR THE MIDDLE INSULATORS AND TOP GROOVE FOR TWO OUTER CONDUCTORS.

THE TRANSPOSITION OF CENTRAL PHASE PROVIDES THE ADDITION OF MECHANICAL

BALANCE AS WELL AS INCREASE OF CLEARANCE BETWEEN CONDUCTORS AT THE MID SPAN.

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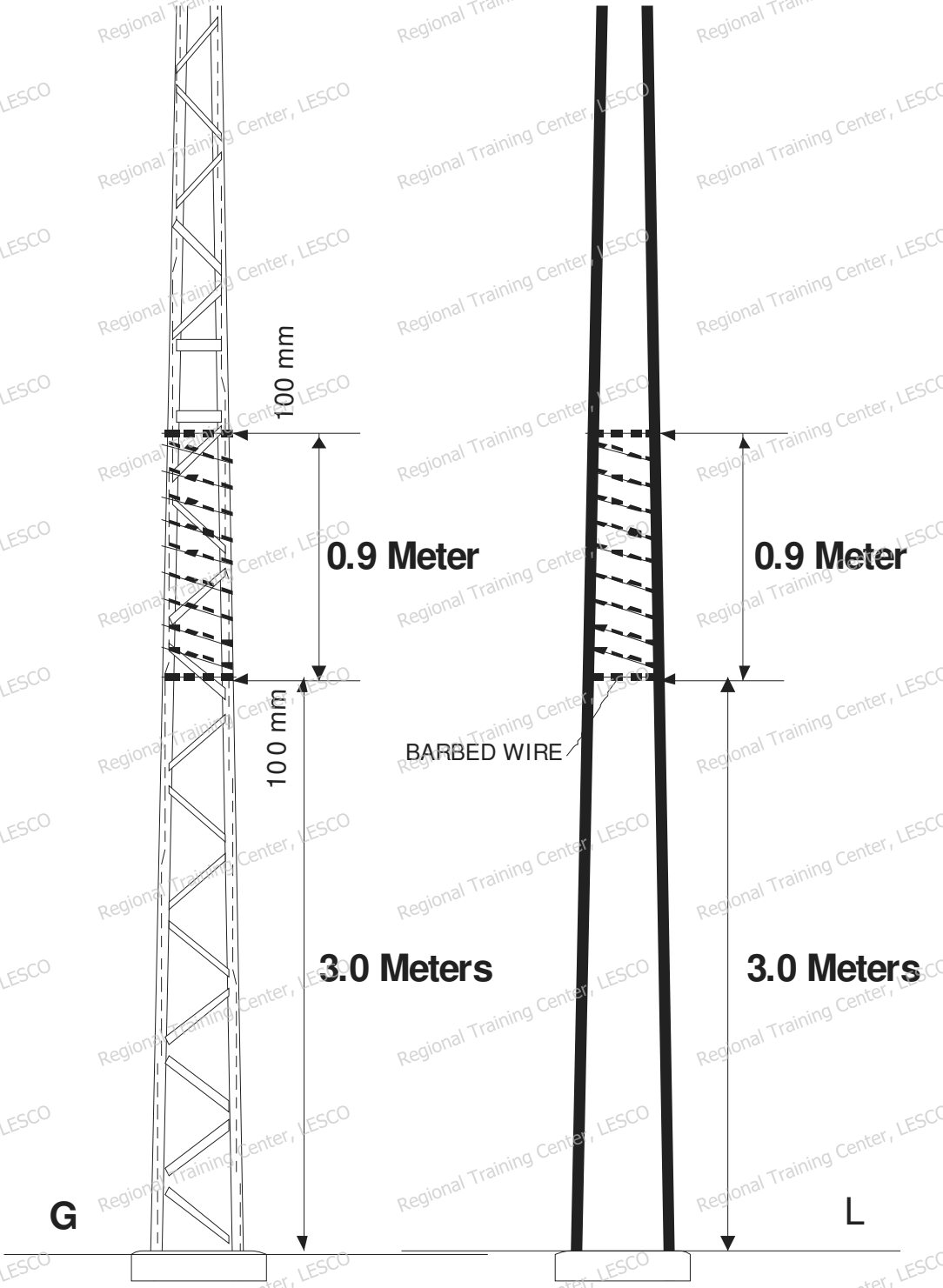
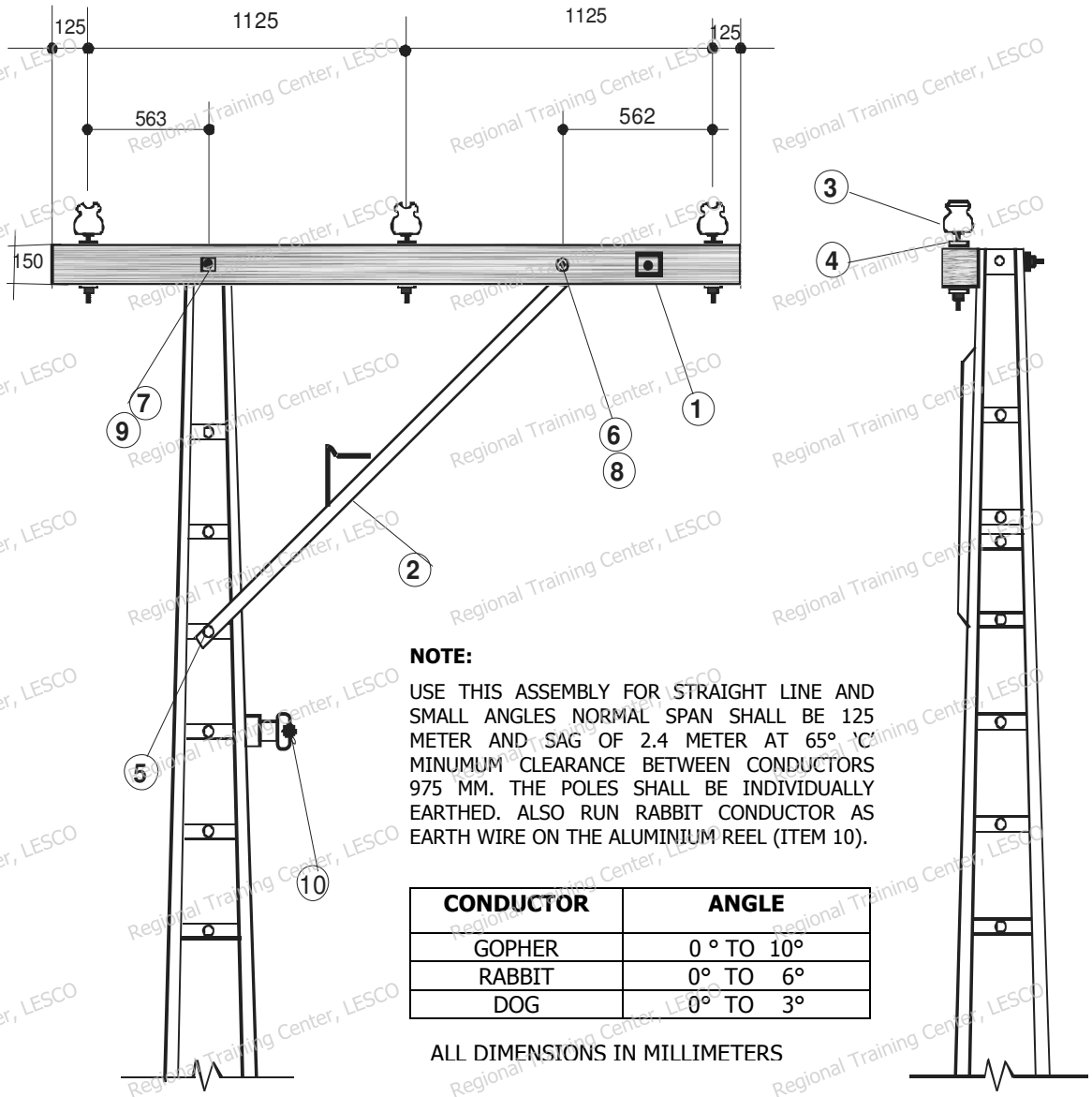


PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY			STANDARDS AND DESIGN
ANTI CLIMBING DEVICE FOR 11 K.V POLES & STRUCTURES.			
DWN	A.E	SCALE	DATE 15.3.65
TCD	ASSTT.DIR.	DWG NO.GW/DF-48	
CKD	DIRIRECTOR		



NOTE:

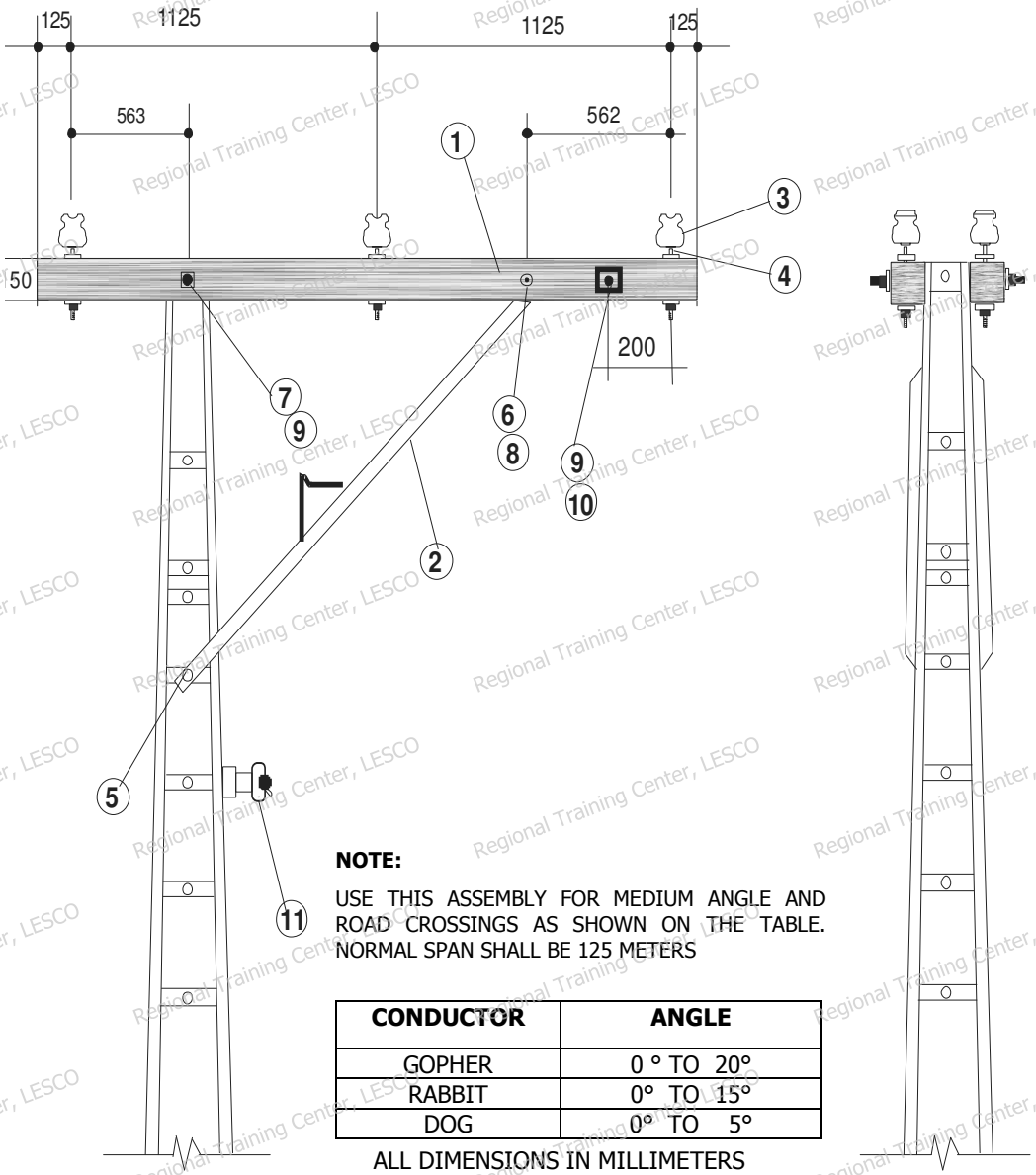
USE THIS ASSEMBLY FOR STRAIGHT LINE AND SMALL ANGLES NORMAL SPAN SHALL BE 125 METER AND SAG OF 2.4 METER AT 65° 'C' MINUMUM CLEARANCE BETWEEN CONDUCTORS 975 MM. THE POLES SHALL BE INDIVIDUALLY EARTHED. ALSO RUN RABBIT CONDUCTOR AS EARTH WIRE ON THE ALUMINIUM REEL (ITEM 10).

CONDUCTOR	ANGLE
GOPHER	0 ° TO 10°
RABBIT	0° TO 6°
DOG	0° TO 3°

ALL DIMENSIONS IN MILLIMETERS

ITEM	DESCRIPTION	QTY	Wapda Spec: No.	DWG.NO.
1	Wood Cross Arm (X-33)	1	P - 1	PDW/DF-181
2	Cross Arm Step Brace (SB-33)	1	P - 101	PDW/DF-178
3	33 KV Pin Type Insulator	3	P - 17	EW/DF-280
4	Insulator Pin	3	P - 18	PDW/DF-183
5	M.S. Bolt 5/8" x 38 mm	1	P - 19	EW/DF-260
6	M.S. Bolt ½" x 150 mm	1	P - 19	EW/DF-286
7	M.S. Bolt 5/8" x 356 mm	1	P - 19	EW/DF-260
8	Round Washer 32 Dia. 14 Hole	1	P - 20	EW/DF-268
9	Square Washer 57 x 57,18" Hole	1	P - 20	EW/DF-269
10	Aluminum Reel with Bolt	1	-	PDW/DF-173

WEST PAKISTAN WATER AND POWER DEVELOPMENT AYTHORITY			DESIGN DEPARTMENT
33 K.V SINGLE CROSSARM ASSEMBLY FOR LATTICE STEEL POLE			
DWN		SCALE:	DATE.19.01.1976
TCD	A.D	DWG.NO.PDW/DF-171	
CKD	DIR.		



NOTE:

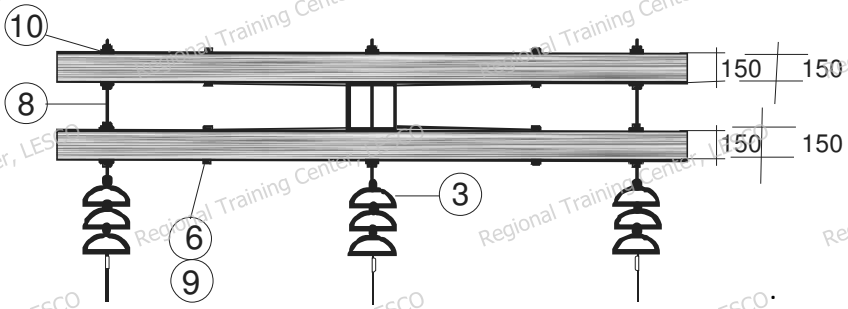
USE THIS ASSEMBLY FOR MEDIUM ANGLE AND ROAD CROSSINGS AS SHOWN ON THE TABLE. NORMAL SPAN SHALL BE 125 METERS

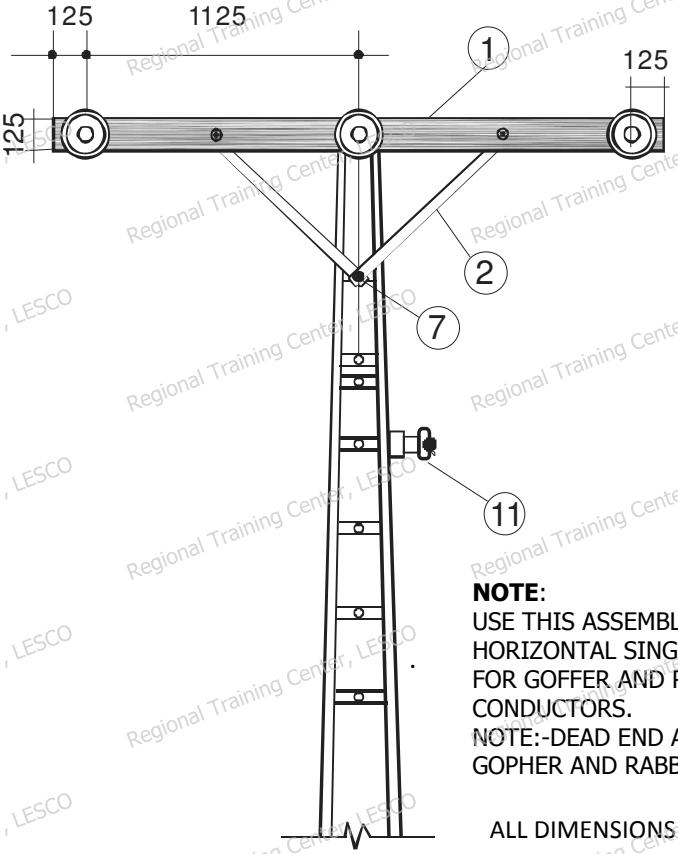
CONDUCTOR	ANGLE
GOPHER	0 ° TO 20°
RABBIT	0° TO 15°
DOG	0° TO 5°

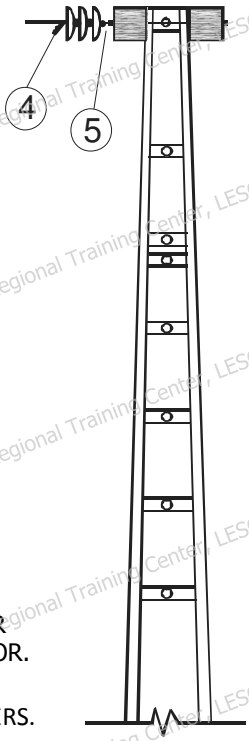
ALL DIMENSIONS IN MILLIMETERS

ITEM	DESCRIPTION	QTY	Wapda Spec: No.	DWG.NO.
1	Wood Cross Arm (X-33)	2	P - 1	PDW/DF-181
2	Cross Arm Step Brace (SB-33)	2	P - 101	PDW/DF-178
3	33 KV Pin Type Insulator	6	P - 17	EW/DF-280
4	Insulator Pin	6	P - 18	PDW/DF-183
5	M.S. Bolt 5/8" x 38 mm	2	P - 19	EW/DF-260
6	M.S. Bolt ½" x 150 mm	2	P - 19	EW/DF-286
7	M.S. Bolt 5/8" x 508 mm	1	P - 19	EW/DF-260
8	Round Washer 32" Ø ,14 Hole	2	P - 20	EW/DF-268
9	Square Washer 57 x 57, 18 Hole	6	P - 20	EW/DF-269
10	Double Arming Bolt 5/8" x 508 mm	1	PD - 56	EW/DF-270
11	Aluminum Reel with Bolt	1	-	PDW/DF-173

PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY			DESIGN DEPARTMENT
33 K.V DOUBLE CROSSARM ASSEMBLY FOR LATTICE STEEL POLE			
DWN	A.D	SCALE	DATE:22.1.76
TCK	DIR.	DWG NO.PDW/DF-172	





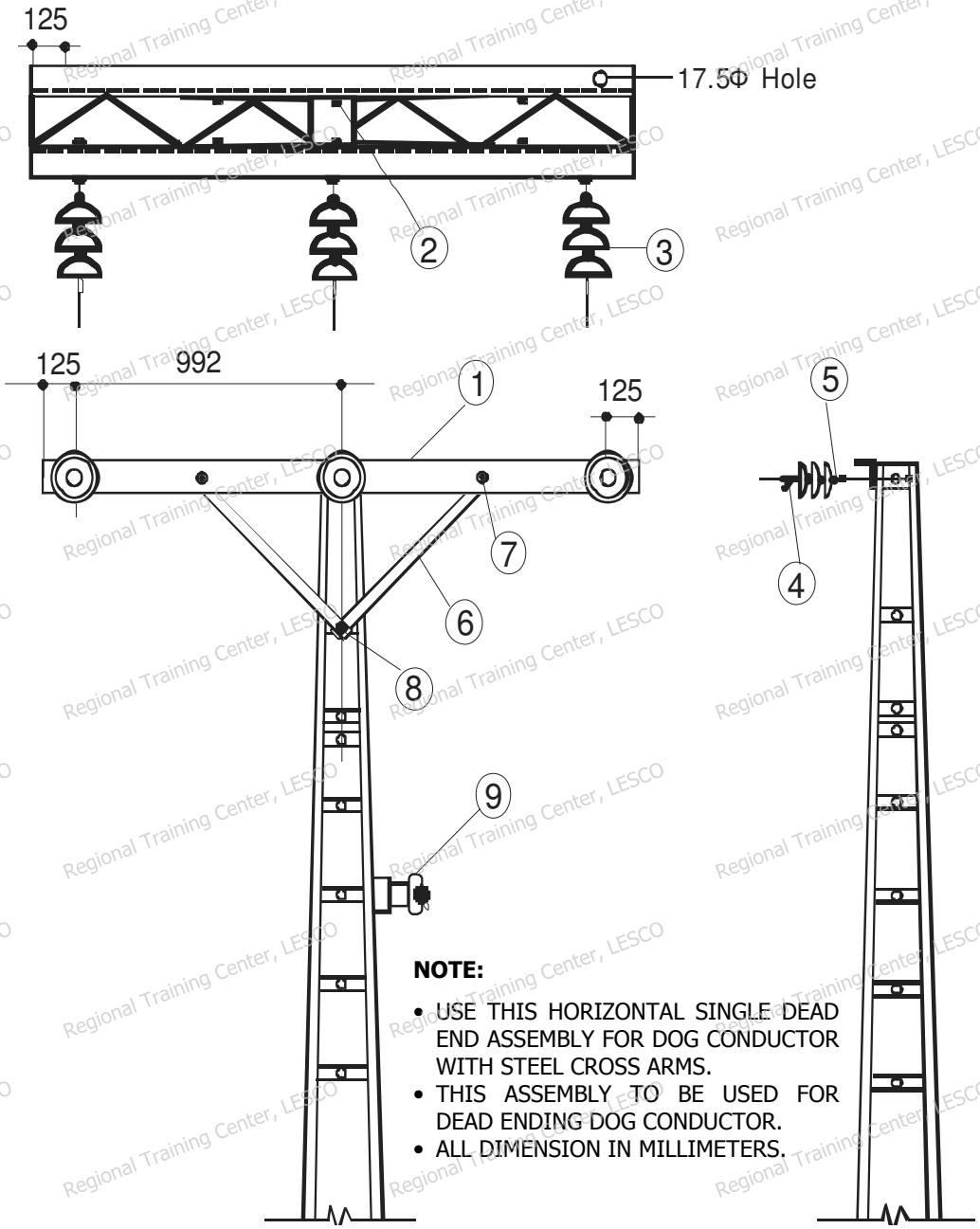


NOTE:
USE THIS ASSEMBLY FOR HORIZONTAL SINGLE DEAD END FOR GOFFER AND RABBIT CONDUCTORS.
NOTE:-DEAD END ASSEMBLY FOR GOPHER AND RABBIT CONDUCTOR.

ALL DIMENSIONS IN MILLIMETERS.

ITEM	DISCRIPTION	QTY	Wapda Sepc: No.	DWG NO.
1	33 K.V Wood Cross Arm X-33	2	P-1	PDW/DF-181
2	11 K.V Cross Arm Brace (B-11)	4	P-101	PDW/DF-178
3	11 KV Disc Insulator Clevis Eye Type	9	P-8	EW/DF-257
4	Dead End clamp	3	PD-73	EW/DF-259
5	Eye Nut 5/8"	3	-	GW/DF-36
6	M.S. Bolt 3/8" x 175 mm	4	P-19	EW/DF-272
7	M.S. Bolt 5/8 x 50 mm	2	P-19	EW/DF-260
8	Double Arming Bolt 5/8" x 558 mm	3	PD-56	EW/DF-270
9	Round Washer 25 Ø, 11 Hole	4	P-20	EW/DF-268
10	Square Washer 57 x 57, 18 Hole	10	P-20	EW/DF-269
11	Aluminum Reel with Bolt	1	-	PDW/DF-173

PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY			DESIGN DEPARTMENT
33 K.V HORIZONTAL SINGLE DEAD END ASSEMBLY (WOOD CROSSARM)FOR LATTICE STEEL POLE			
DWN	A.E	SCALE	DATE.29.1.76
TCD	A.D	DWG.NO. PDW/DF-175	
CKD	DIR.		

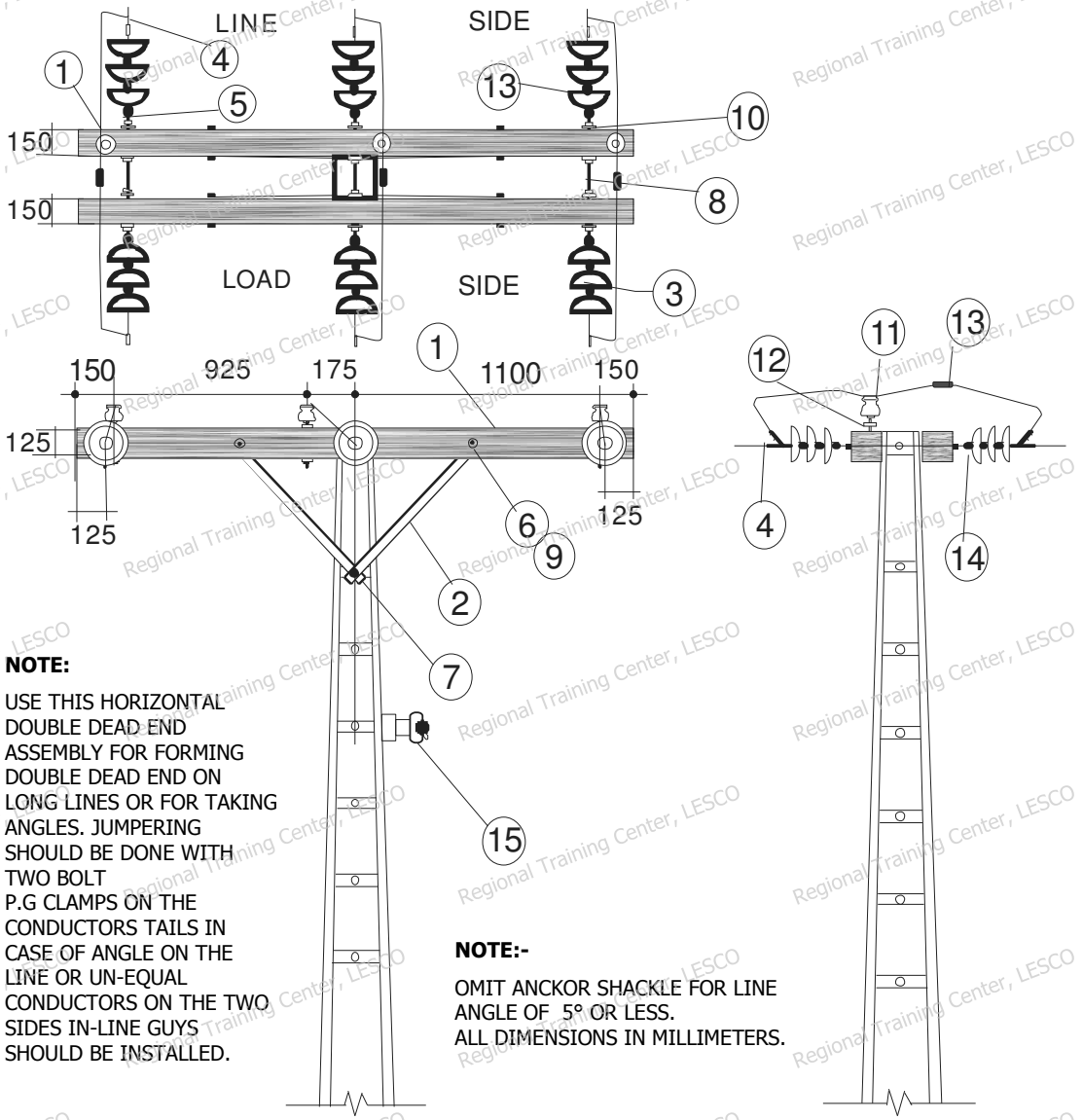


NOTE:

- USE THIS HORIZONTAL SINGLE DEAD END ASSEMBLY FOR DOG CONDUCTOR WITH STEEL CROSS ARMS.
- THIS ASSEMBLY TO BE USED FOR DEAD ENDING DOG CONDUCTOR.
- ALL DIMENSION IN MILLIMETERS.

ITEM	DISCRIPTION	QTY	Wapda Sepc: No.	DWG NO.
1	Lattice Steel cross arm	1	PD-91	EW/DF-289
2	M.S. Bolt 5/8" x 50 mm	2	P-19	EW/DF-260
3	11 KV Disc Insulator Cleave Eye Type	9	P-8	EW/DF-257
4	Dead End clamp	3	PD-73	EW/DF-259
5	Anker Shackle	3	PD-74	EW/DF-246
6	11 K.V Cross arm Brace	4	P-101	GW/DF-178
7	M.S. Bolt 3/8" x 50 mm	4	P-19	EW/DF-272
8	M.S. Bolt 5/8" x 50 mm	2	P-19	EW/DF-260
9	Aluminum Reel with Bolt	1	-	PDW/DF-173

PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY			DESIGN DEPARTMENT
33 K.V HORIZONTAL SINGLE DEAD END ASSEMBLY (STEEL CROSSARM)FOR LATTICE STEEL POLE.			
DWN.	A.E	SCALE	DATE.31.1.76
TCD.	A.D	DWG.NO. PDW/DF-176	
CKD.	DIR.		



NOTE:

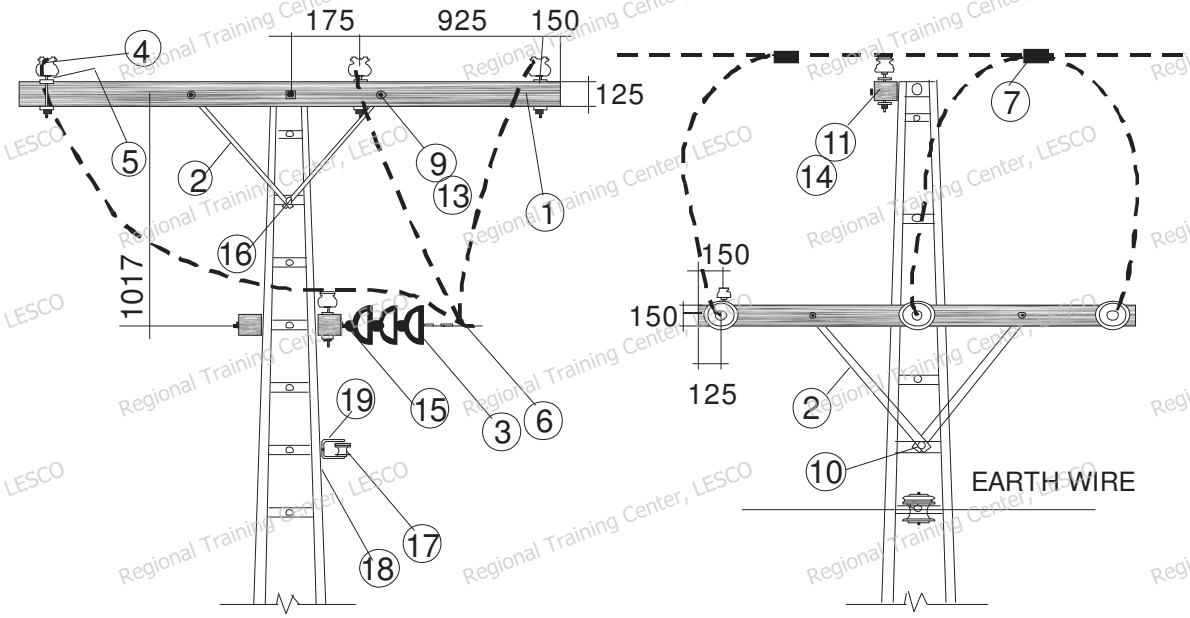
USE THIS HORIZONTAL DOUBLE DEAD END ASSEMBLY FOR FORMING DOUBLE DEAD END ON LONG LINES OR FOR TAKING ANGLES. JUMPERING SHOULD BE DONE WITH TWO BOLT P.G CLAMPS ON THE CONDUCTORS TAILS IN CASE OF ANGLE ON THE LINE OR UN-EQUAL CONDUCTORS ON THE TWO SIDES IN-LINE GUYS SHOULD BE INSTALLED.

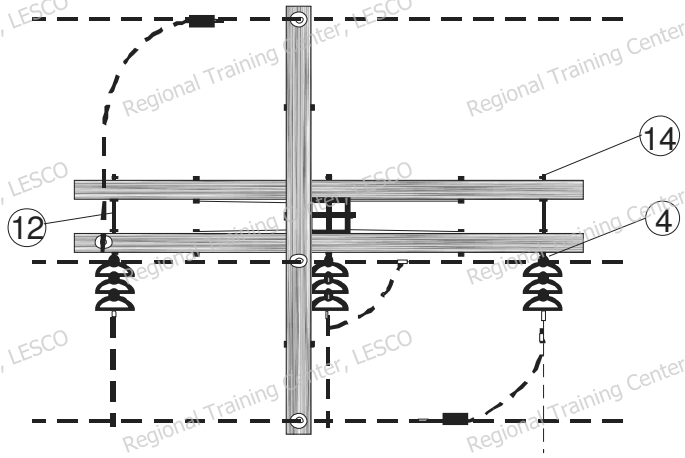
NOTE:-

OMIT ANCKOR SHACKLE FOR LINE ANGLE OF 5° OR LESS.
ALL DIMENSIONS IN MILLIMETERS.

ITEM	DISCRIPTION	QTY	WAPDA SPEC:	DWG NO.
1	33 KV Wood Cross Arm X-33	2	P-1	PDW/DF-181
2	Cross Arm Brace B-11	4	P-101	PDW/DF-178
3	11 KV Disc Insulator 10" Dia cleave eye type.	18	P-8	EW/DF-257
4	Dead End clamp.	6	PD-73	EW/DF-259
5	Eye Nut (5/8")	6	PD-75	GW/DF-36
6	M.S. Bolt 5/8" X 175 mm	4	P-19	EW/DF-286
7	M.S. Bolt 1/6"X50 mm	2	P-19	EW/DF-286
8	Double Arming Bolt 5/8" X 558mm	3	PD-56	EW/DF-270
9	Round Washer 25 Dia. 14 Hole.	4	P-20	EW/DF-268
10	Square Washer 57 x 57 , 18 Hole.	10	P-20	EW/DF-269
11	33 K.V Pin Type Insulator	3	P-17	EW/DF-280
12	Insulator Pin	3	P-18	PDW/DF-123
13	P.G Clamp 2 Bolt Type	3	P-25	EW/DF-271
14	Anchor Shackle	6	PD-74	EW/DF-266
15	Aluminum Reel with Bolt	1	-	PDW/DF-173

PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY			DESIGN DEPARTMENT
33 K.V HORIZONTAL DOUBLE DEAD END ASSEMBLY (WOOD CROSSARM)FOR LATTICE STEEL POLE			
DWN	A.E	SCALE	DATE2.2.76
TCD	A.D	DWG.NO. PDW/DF.177	
CKD	DIR		



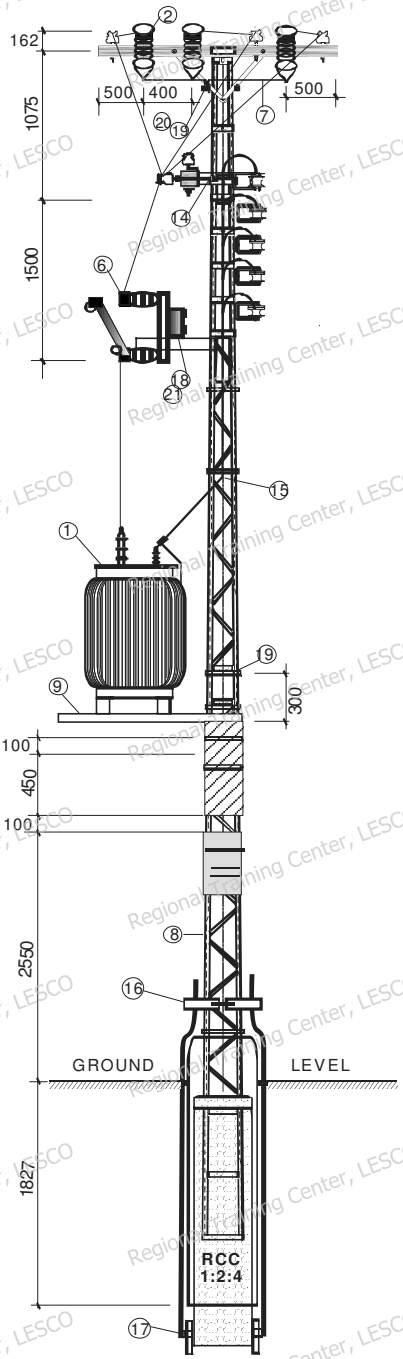


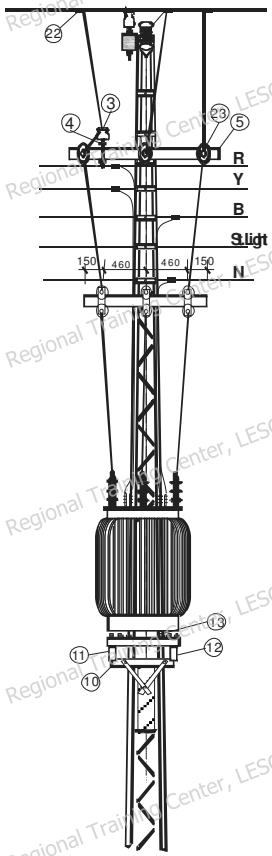
NOTE:

- USE THIS ASSEMBLY WHEN APART FROM A STRAIGHT RUN A TEE-OFF OF THE 33 K.V AS DESIRED. THE CENTRAL PIN INSULATOR SHOULD BE ON THE SAME SIDE OF THE CROSSARM AS THE TEE-OFF.
- OMIT ANCKOR SHACKLE FOR THE TAKE OFF ANGLE OF 5 OR LESS.
- ALL DIMENSIONS IN MILLIMETERS

ITEM	DISCRIPTION	QTY	WAPDA SPEC:	DWG NO.
1	Wood Cross Arm (x 33)	3	P-1	PDW/DF-181
2	11 K.V Cross Arm Brace. B-11	6	P-101	PDW/DF-178
3	11 KV Disc Insulator cleave eye type	9	P-8	EW/DF-257
4	33 K.V Pin Type Insulator	4	P-17	EW/DF-280
5	Insulator Pin	4	P-18	PDW/DF-183
6	Dead End clamp.	3	PD-73	EW/DF-259
7	P.G. Clamp Two Bolt.	3	P-25	EW/DF-271
8	Eye Nut 5/8"	3	PD-75	GW/DF-36
9	M.S. Bolt 3/8" x 175 mm	6	P-19	EW/DF-272
10	M.S. Bolt 1/2" x 50 mm	4	P-19	EW/DF-286
11	M.S. Bolt 5/8" x 358 mm	1	P-19	EW/DF-260
12	Double Arming Bolt 5/8" x 508 mm	3	PD-56	EW/DF-270
13	Round Washer Bolt 25 , 14 Hole	6	P-20	EW/DF-268
14	Square Washer 57 x 57, 18 Hole.	11	P-20	EW/DF-269
15	Anker Shackle	3	PD-74	EW/DF-266
16	M.S. Bolt 5/8 x 50 mm	1	P-19	EW/DF-260
17	Aluminum Reel with Bolt.	1	-	PDW/DF-173
18	M.S. Bolt 3/8 x 38 mm	1	P-19	EW/DF-260
19	D-Shackle Strap.	1	PD-68	GW/DF-13

PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY			DESIGN DEPARTMENT
33 K.V TEE-OFF ASSEMBLY FOR LATTICE STEEL POLE			
DWN.	A.E	SCALE	DATE.5.2.76
TCD.	A.D	DWG .NO. PDW/DF-182	
CKD.	DIR.		





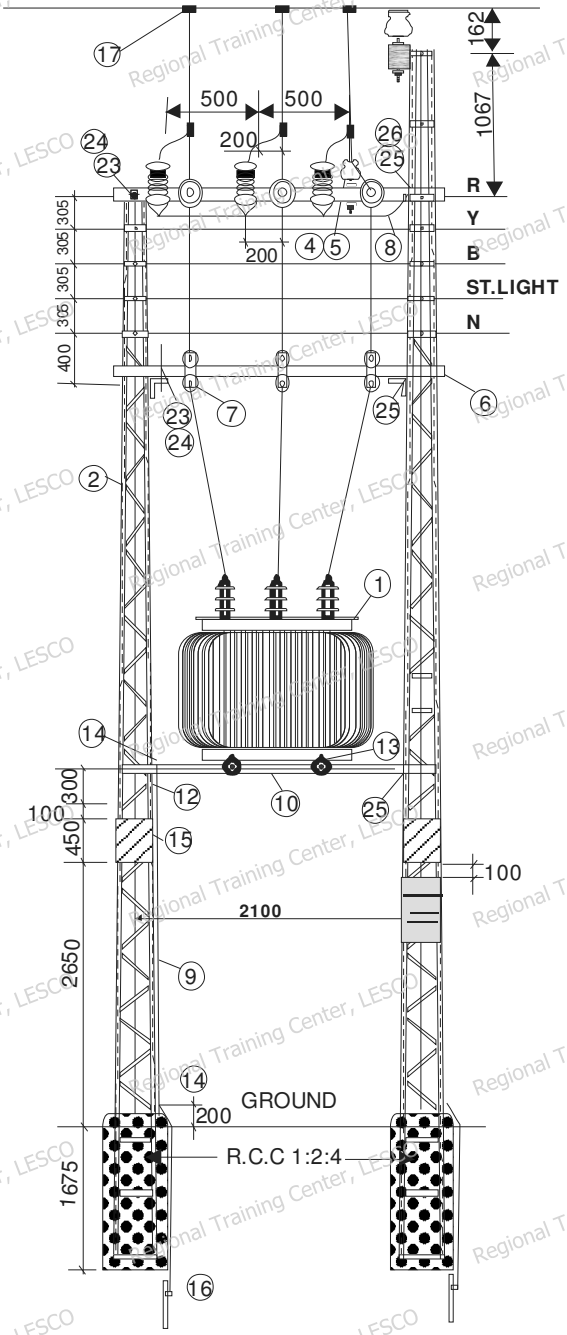
NOTE:

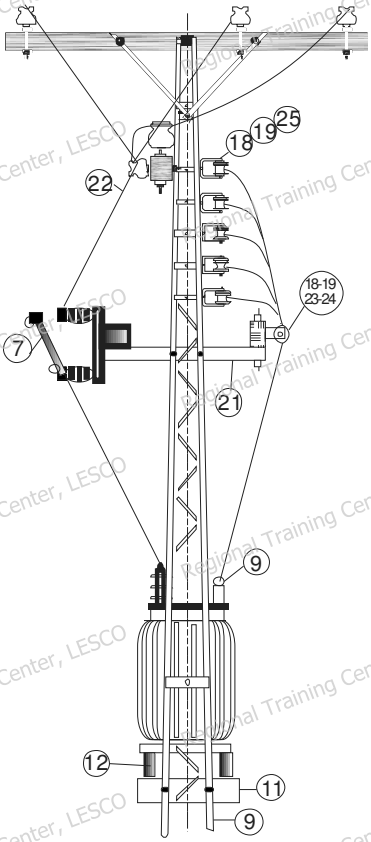
1. FOR 11 K.V LINE MATERIAL SDI NO 40 SHALL BE FOLLOWED.
2. 'H' TYPE STRUCTURE SHALL ALSO BE EARTHED IN ACCORDANCE WITH SDI NO.59.
3. FOR THE INSTALLATION OF LIGHTNING ARRESTERS CLAUSE NO. 4.5 OF THIS SDI SHALL BE FOLLOWED.

NO.	DESCRIPTION	QTY	DWG.NO.	WAPA SPECFY NO.
1	Transformer	1	-	P-13
2	Lightning Arrester	3	DSW/DF-9	P-11
3	Pin Insulator	4	-	P-6
4	Insulator Pin	4	-	P-24
5	1225 LG. W-X-Arm	2	-	P-1
6	Drop Out Cut Out (Assembly)	3	PDW/DF-170	P-68
7	GNAT Conductor	2M	-	P-63
8	G.S Standard wire 10Φ	8M	-	P-12
9	Channel,100x50x1200mm (C-1200)	2	PDW/DF-238	P-112
10	Channel,100x50x600 mm (C-600)	2	PDW/DF-238	P-112
11	Channel,100x50x800 mm (C-800)	2	PDW/DF-238	P-112
12	U-Bolt (U B)	4	PDW/DF-240	P-112

NO.	DESCRIPTION	QTY	DWG.NO.	WAPA SPECFY NO.
13	J-Bolt (JB)	4	PDW/DF-218	P-112
14	Angle Iron Bracket(BSP)	4	PDW/DF-244	P-112
15	Cable Clamp (CCS)	4	PDW/DF-241	P-112
16	Ground Conductor Clamp (S)	2	PDW/DF-236	P-111
17	Earthing Rod with Clamp	1	PDW/DF-237	P-111
18	12 Φ 150 LG.M.S Bolt	4	EW/DF-286	P-19
19	12 Φ 37 LG.M.S Bolt	17	EW/DF-286	P-19
20	Round washer Hole 14 Φ	2	EW/DF-268	P-20
21	Square washer 50x50x3	4	EW/DF269	P-20
22	P.G. Clamp	12	-	P-25
23	Tie wire 4 Φ	7M	-	P-22

PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY			DESIGN DEPARTMENT
25 OR 50 KVA DISTRIBUTION TRANSFORMER STATION ON SINGLE STRUCTURE POLE (DTS-1S)			
DWN.	A.E	SCALE	DATE.
TCD.	A.D.	DWG.NO. PDW/DF-253	
CKD.	DIR.		





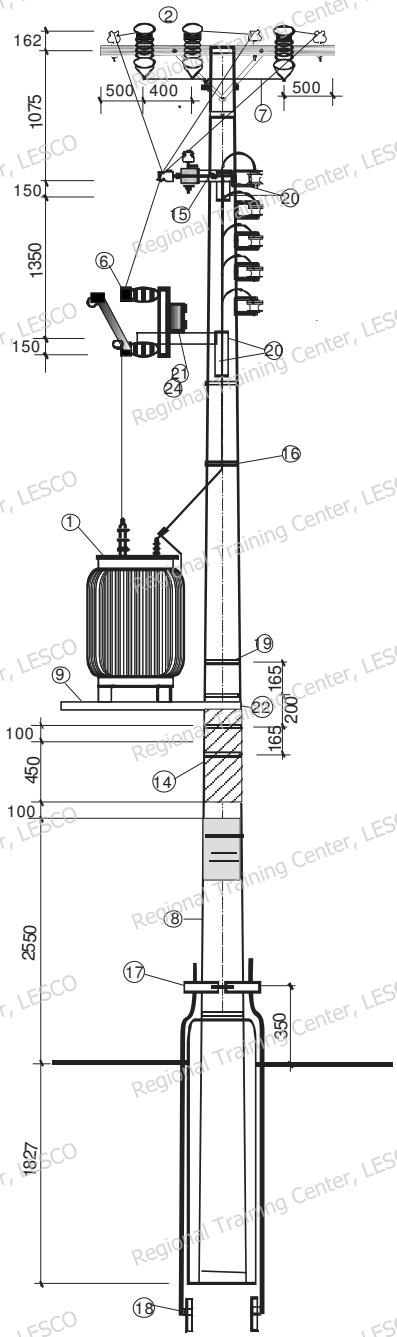
NOTES:

1. FOR 11 K.V LINE MATERIAL SDI NO.40 SHALL BE FOLLOWED.
2. 2.'H' TYPE STRUCTURE SHALL BE EARTHED IN ACCORDANCE WITH SDI NO.59
3. FOR THE INSTALLATION OF LIGHTNING ARRESTERS CLAUSE NO.4.5 OF THIS SDI SHALL BE FOLLOWED.

NO.	DISCRIPTION	QTY	DWG.NO.	WAPDA SPECFY NO.
1	Transformer	1	-	P-13
2	Lattice Steel Structure	1	PDW/DF-10	P-34
3	Lightning Arrester	3	DSW/DF-9	P-11
4	Pin Insulator	4	-	P-6
5	Insulator Pin	4	-	P-24
6	Wood-X-Arm (xii)	3	PDW/DF-185	P-1
7	Drop Out Cut Out (Assembly)	3	PDW/DF-170	P-68
8	GNAT Conductor	2M	-	P-63
9	G.S Standard wire 10 Ø	8M	-	P-12
10	Channel.1000x50x2000mm(C-2000)	2	PDW/DF-238	P-112
11	Channel.100x50x600 mm (C-600)	2	PDW/DF-238	P-112
12	U-Bolt (U B)	4	PDW/DF-240	P-112
13	J-Bolt (J B)	4	PDW/DF-218	P-112

NO.	DISCRIPTION	QTY	DWG.NO.	WAPDA SPECFY NO.
14	Ground Conductor Clamp (S)	2	PDW/DF-236	P-111
15	Anti-Climbing Device	13M	-	PD-76
16	Ear thing Rod with Clamp	1	PDW/DF-234.237	P-111
17	P.G. Clamp	12	-	P-25
18	D-Shackle	9	-	PD-68
19	Spool Insulator	8	-	P-4
20	Aluminum Reel	1	PDW/DF-173	
21	Angle Iron 50x50x6x200 mm(AS)		PDW/DF-239	P-112
22	Tie wire 4 Ø	27M	-	P-22
23	12 Ø 150 LG.M.S Bolt	10	EW/DF-286	P-19
24	Square washer 50x50x3	10	EW/DF269	P-20
25	12 Ø 37 LG.M.S Bolt	9	EW/DF-286	P-19
26	Round washer Hole 14 Ø	2	EW/DF-268	P-20

PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY		DESIGN DEPARTMENT	
100 AND 200 KVA DISTRIBUTION TRANSFORMER STATION ON DOUBLE STRUCTURE (DTS-2S)			
DWN.	A.E	SCALE	DATE.
TCD.	A.D.	DWG.NO. PDW/DF-254	
CKD.	DIR.		



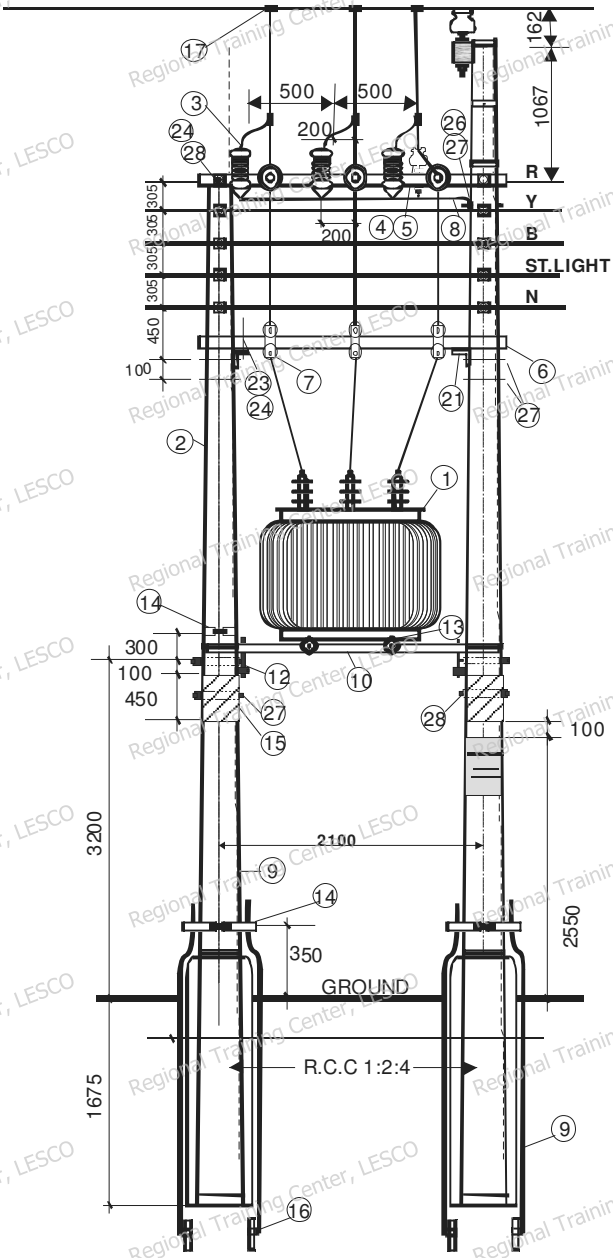
NOTE:

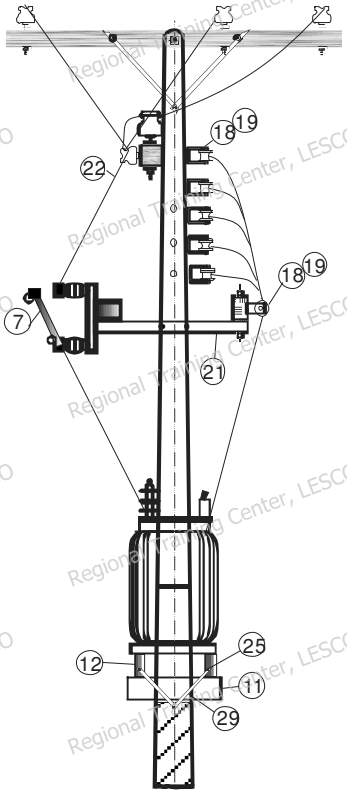
1. FOR 11 K.V LINE MATERIAL SDI NO 40 SHALL BE FOLLOWED.
2. 'H' TYPE STRUCTURE SHALL ALSO BE EARTHED IN ACCORDANCE WITH SDI NO.59.
3. FOR THE INSTALLATION OF LIGHTNING ARRESTERS CLAUSE NO.4.5 OF THIS SDI SHALL BE FOLLOWED.

NO.	DESCRIPTION	QTY	DWG.NO.	WAPDA SPECFY NO.
1	Transformer	1	-	P-13
2	Lightning Arrester	3	DSW/DF-9	P-11
3	Pin Insulator	4		P-6
4	Insulator Pin	4	-	P-24
5	Wood-X-Arm (1225 LG)	2	PDW/DF-185	P-1
6	Drop Out Cut Out (Assembly)	3	PDW/DF-170	P-68
7	Gnat Conductor	2M	-	P-63
8	G.S Standard wire 10Φ	8M	-	P-12
9	Channel,100x50x1200mm(C-1200)	2	PDW/DF-238	P-112
10	Channel,100x50x600mm (C-600)	2	PDW/DF-238	P-112
11	Channel,100x50x800mm (C-800)	2	PDW/DF-238	P-112
12	U-Bolt (U B)	4	PDW/DF-240	P-112
13	J-Bolt (J B)	4	PDW/DF-218	P-112

NO.	DESCRIPTION	QTY	DWG.NO.	WAPDA SPECFY NO.
14	Brace 50x400x3 mm (BP)	4	PDW/DF-242	P-112
15	Standard Angle Iron Bracket	4	PDW/DF-244	P-112
16	Cable Clamp (CCP)	2	PDW/DF-245	P-112
17	Ground Conductor Clamp (PL)	2	PDW/DF-231	P-111
18	Ear thing Rod with Clamp	1	PDW/DF-237	P-111
19	16 Φ 300 LG.M.S Bolt	4	-	P-19
20	16 Φ 225 LG.M.S Bolt	5	-	P-19
21	12 Φ 150 LG.M.S Bolt	4	EW/DF-286	P-19
22	12 Φ 37 LG.M.S Bolt	8	EW/DF-286	P-19
23	Round washer Hole 14 Φ	2	EW/DF-268	P-20
24	Square washer 50x50x3	4	EW/DF269	P-20
25	P.G. Clamp	12	-	P-25
26	Tie wire 4 Φ	7M	-	P-22

PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY			DESIGN DEPARTMENT
25 AND 50 KVA DISTRIBUTION TRANSFORMER SUB STATION ON SINGLE POLE (DTS-1P)			
DWN.	A.E	SCALE	DATE.
TCD.	A.D.	DWG.NO. PDW/DF-255	
CKD.	DIR.		





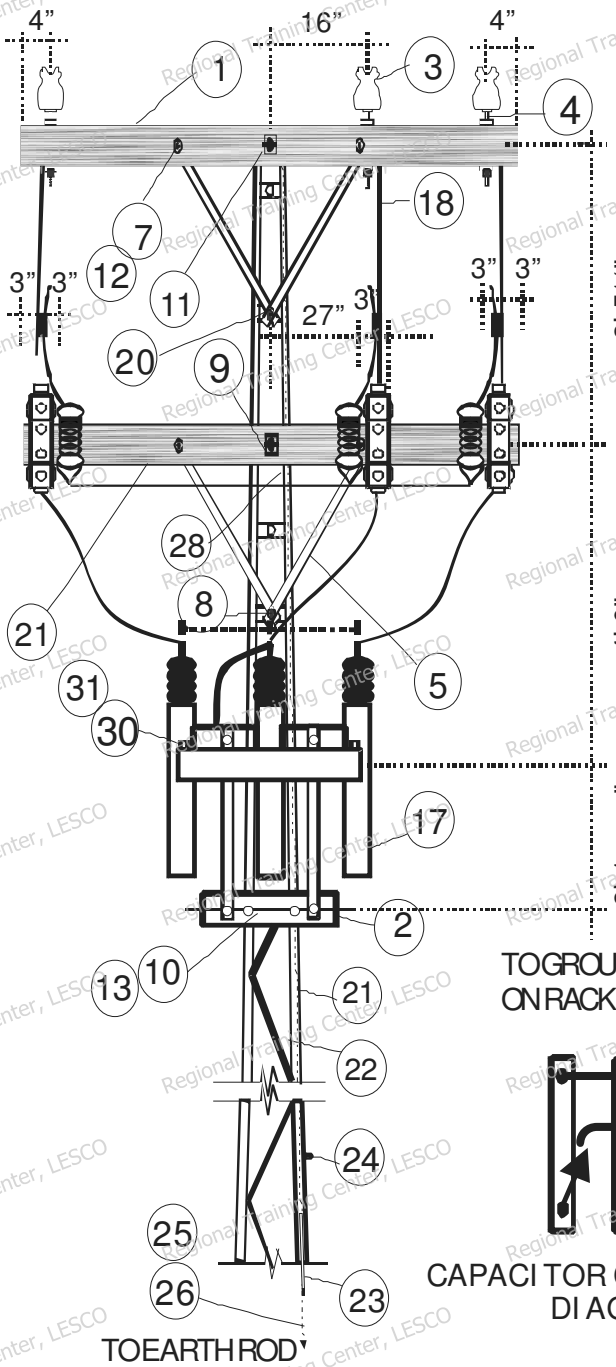
NOTE:-

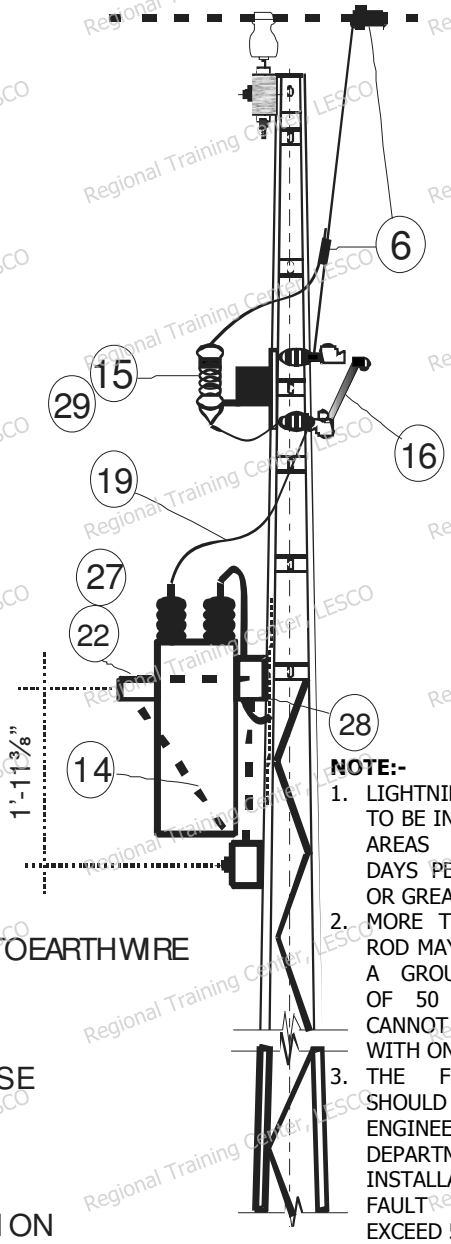
1. FOR 11 K.V LINE MATERIAL SDI NO.58 SHALL BE FOLLOWED.
2. 'H' TYPE TUBULAR POLE SHALL ALSO BE EARTHED IN ACCORDANCE WITH SDI NO.59
3. FOR THE INSTALLATION OF LIGHTNING ARRESTERS CLAUSE NO.4.5 OF THIS SDI SHALL BE FOLLOWED.

NO	DISCRIPTION	QTY	DWG.NO.	WAPA SPECFY NO.
1	Transformer	1	-	P-13
2	L-Type Tubular pole	1	PDW/DF-153	P-94
3	Lightning Arrester	3	DSW/DF-9	P-11
4	Pin Insulator	4	-	P-6
5	Insulator Pin	4	-	P-24
6	Wood-X-Arm (1225 LG)	3	PDW/DF-185	P-1
7	Drop Out Cut Out (Assembly)	3	PDW/DF-170	P-68
8	Gnat Conductor	2M	-	P-63
9	G.S Standard wire 10	8M	-	P-12
10	Channel,100x50x2000mm (C-2000)	2	PDW/DF-238	P-112
11	Channel,100x50x600mm (C-600)	2	PDW/DF-238	P-112
12	U-Bolt (U B)	4	PDW/DF-240	P-112
13	J-Bolt (U B)	4	PDW/DF-218	P-112
14	Ground Conductor Clamp (PL)	2	PDW/DF-231	P-111
15	Anti Climbing Device	13M	-	PD-76

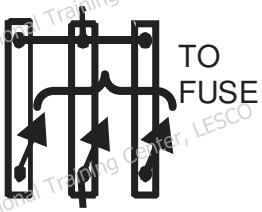
NO	DISCRIPTION	QTY	DWG.NO.	WAPA SPECFY NO.
16	Ear thing Rod with Clamp	1	PDW/DF-237	P-111
17	P.G. Clamp	12	-	P-25
18	D-Shackle	9	-	PD-68
19	Spool Insulator	8	-	P-4
20	Aluminum Reel	1	PDW/DF-173	-
21	Standard L-Iron (AP)	2	PDW/DF-243	P-112
22	Tie wire 4 dia	27M	-	P-22
23	12 dia 150 mm Lonmg.M.S Bolt	14	EW/DF-286	P-19
24	Square washer 18 dia Hole	14	EW/DF269	P-20
25	12 dia 37 mm Long.M.S Bolt	4	EW/DF-286	P-19
26	Round washer Hole 16 dia	2	EW/DF-268	P-20
27	16 dia 300 LG.M.S Bolt	5	-	P-19
28	16 dia 225 LG.M.S Bolt	4	-	P-19
29	Brace 50x400x3 mm (BP)	4	PDW/DF-242	P-112

PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY		DESIGN DEPARTMENT	
100 & 200 KVA DISTRIBUTION TRANSFORMER STATION ON DOUBLE POLES(DTS-2P)			
DWN.	A.E	SCALE	DATE.
TCD.	A.D	DWG.NO. PDW/DF-256	
CKD	DIR		





TO GROUND CLAMP ON RACK AND THEN TO EARTH WIRE



CAPACITOR CONNECTION DIAGRAM

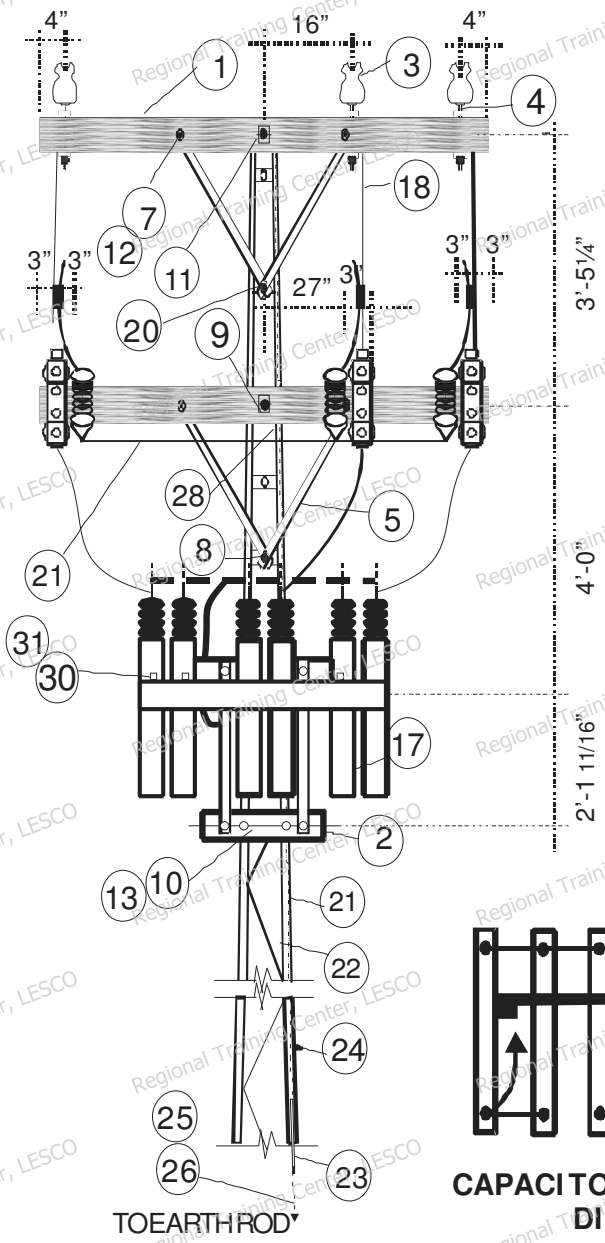
NOTE:-

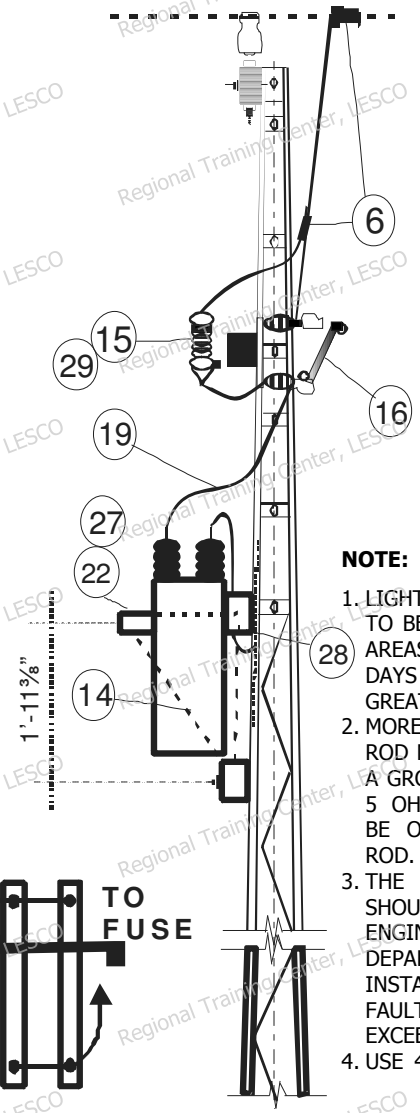
1. LIGHTNING ARRESTER ARE TO BE INSTALLED ONLY IN AREAS WITH THUNDER DAYS PER ANNUM OF 50 OR GREATER.
2. MORE THAN ONE EARTH ROD MAY BE REQUIRED IF A GROUND RESISTANCE OF 50 OHM OR LESS CANNOT BE OBTAINED WITH ONE ROD.
3. THE FIELD ENGINEER SHOULD CONSULT THE ENGINEERING DEPARTMENT FOR INSTALLATIONS WHERE FAULT CURRENTS MAY EXCEED 5000 AMPS.
4. USE 20 K TYPE FUSE LINK ONLY IN CUTOUT AS SPECIFIED.

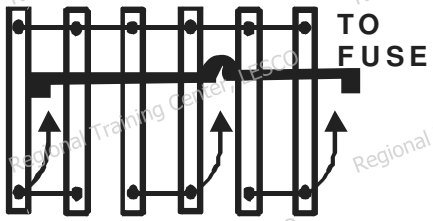
ITEM	DESCRIPTION	QTY	DWG NO.	STOCK No
1	Wood Cross Arm 4" x 5" x 8'-0"	2	EW/DF-251	T-1173
2	Wood Cross Arm 4"x 5" x 4'-0"	2	EW/DF-251	T-1173
3	11 K.V Pin Type Insulator	3	EW/DF-252	T-3211
4	Insulator Pin	3	EW/DF-256	T-3217
5	Cross Arm Brace 1¼" x ¼" x 28"	4	EW/DF-254	T-1352
6	P.G Clamp Two Bolt Type.	6	EW/DF-271	T-5017
7	M.S. Bolt 3/8" x 6"	4	EW/DF-272	S-1265
8	M.S. Bolt 1/2" x 2"	2	EW/DF-286	S-1057
9	M.S. Bolt 5/8" x 14"	2	EW/DF-260	S-1303
10	M.S. Bolt 1/2" x 6"	8	EW/DF-286	S-1059
11	Square Washer 2¼" X 2¼", 11/16" Hole	2	EW/DF-269	S-1792
12	Round Washer 1" Dia, 7/16" Hole	4	EW/DF-268	S-1791
13	Round Washer 1¼"Dia,9/16" Hole	8	EW/DF-268	S-1791
14	Capacitor Rack (See Detail Dwg.)	1	EW/DF-1	T-1365
15	12 K.V Lightning Arrester	3	EW/DF-333	E-3666

ITEM	DESCRIPTION	QTY	DWG NO.	STOCK No
16	11 K.V Load Break cut out with 20 K Fuse Link	3	EW/DF-215	E-3557
17	100 KVAR Capacitor	3		E-3551
18	Jumper Wire (As Required)	-		
19	Insulated Jumper, 5 KV (NON-SHIELDED)	15'		
20	M.S. Bolt 5/8" x 2"	1	EW/DF-260	S-1297
21	Earth Wire No.5 SWG Copper Solid	48'		
22	J-Bolt Clamp for earth wire on 4' center	3	EW/DF-298	S-1445
23	¾" Conduit	10'		T-7137
24	J-Bolt Clamp for Conduit ¾"	3	EW/DF-297	S-1444
25	Copper Clad Earth Rod 3/5"x8'.0"	1	EW/DF-323	T-1586
26	Earth Rod Clamp for 5/8" Rod	1	EW/DF-323	T-1587
27	Single Coil Rectangular Spring Steel Washer 3/8"	3	EW/DF-331	S-1797
28	Connector P.G CU NO.5 SWG	3	EW/DF-329	T-5001
29	Mounting Bracket for 12 K.V Lightning Arrester	3	EW/DF-332	E-3674

PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY		DESIGN DEPARTMENT	
300 KVAR CAPACITOR BANK ASSEMBLY 55-L FOR LATTICE STEEL POLE			
DWN.	A.E	SCALE	DATE. 11-3-67
TCD.	A.D	DWG.NO. ES/DD-55 L	
CKD.	DIR.		







CAPACITOR CONNECTION DIAGRAM

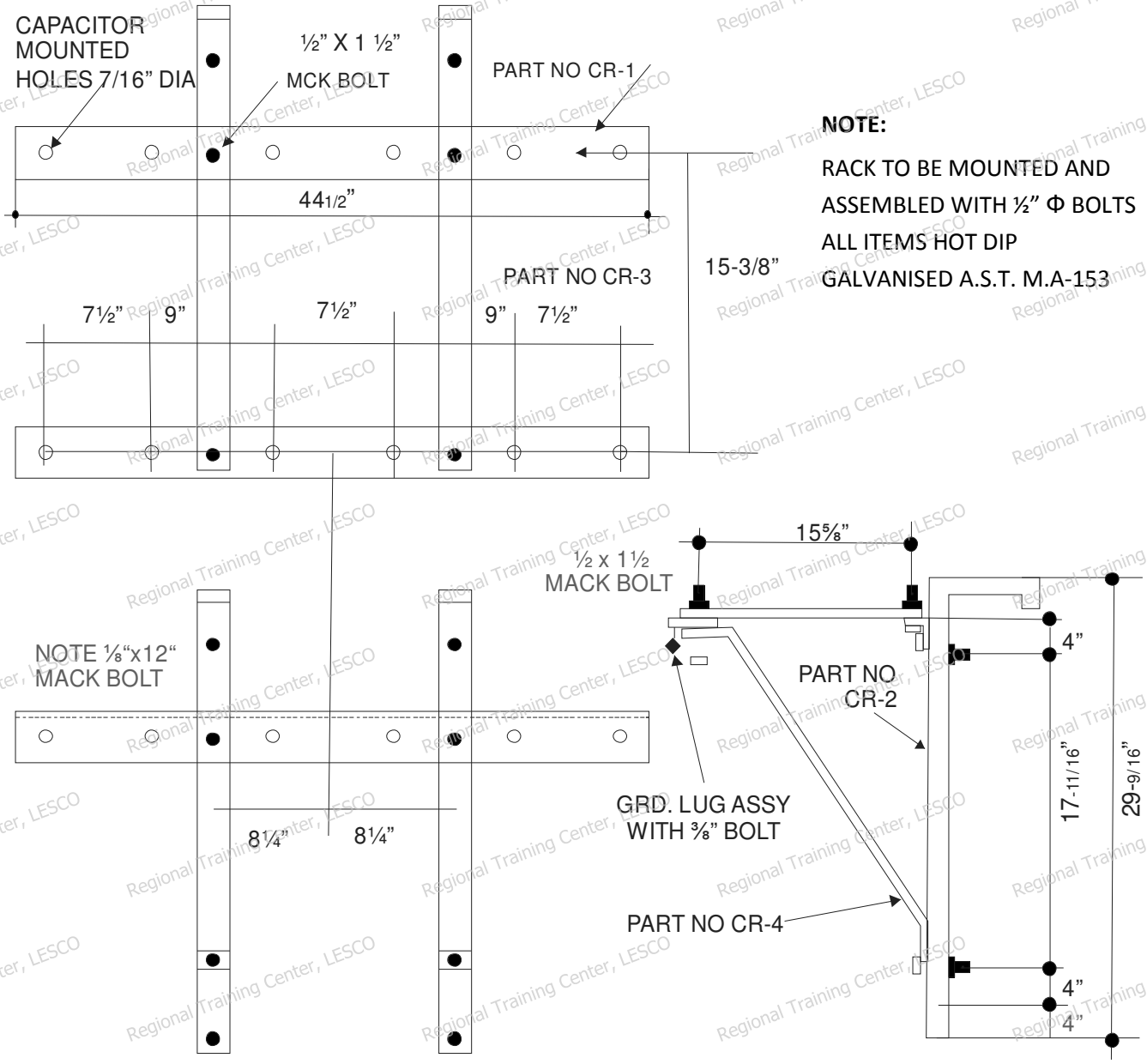
NOTE:

1. LIGHTNING ARRESTER ARE TO BE INSTALLED ONLY IN AREAS WITH THUNDER DAYS PER ANNUM OF 50 OR GREATER.
2. MORE THAN ONE EARTH ROD MAY BE REQUIRED IF A GROUND RESISTANCE OF 5 OHM OR LESS CANNOT BE OBTAINED WITH ONE ROD.
3. THE FIELD ENGINEER SHOULD CONSULT THE ENGINEERING DEPARTMENT FOR INSTALLATIONS WHERE FAULT CURRENTS MAY EXCEED 5000 AMPS.
4. USE 40 K TYPE FUSE LINK

ITEM	DESCRIPTION	QTY	DWG NO.	STOCK No.
1	Wood Cross Arm 4" x 5" x 8'-0"	2	EW/DF-251	T-1173
2	Wood Cross Arm 4"x 5" x 4'-0"	2	EW/DF-251	T-1173
3	11 K.V Pin Type Insulator	3	EW/DF-252	T-3211
4	Insulator Pin	3	EW/DF-256	T-3217
5	Cross Arm Brace 1 ¼" x ¼" x 28"	4	EW/DF-254	T-1352
6	P.G Clamp Two Bolt Type.	6	EW/DF-271	T-5017
7	M.S. Bolt 3/8" x 6"	4	EW/DF-272	S-1265
8	M.S. Bolt 1/2" x 2"	2	EW/DF-286	S-1059
9	M.S. Bolt 5/8" x 14"	2	EW/DF-260	S-1303
10	M.S. Bolt 1/2" x 6"	8	EW/DF-286	S-1059
11	Square Washer 2¼" X2¼" X11/16"Hole	2	EW/DF-269	S-1792
12	Round Washer 1" Dia. 7/16" Hole.	4	EW/DF-268	S-1791
13	Round Washer ¼" Dia. 9/16" Hole.	8	EW/DF-268	S-1791
14	Capacitor Rack (See Detail Dwg.)	1	EW/DE-1	T-1365
15	11 K.V Lightning Arrester	3	EW/DF-333	E-3666

ITEM	DESCRIPTION	QTY	DWG NO.	STOCK No.
16	11 K.V Load Break cut out with 40 K Fuse Link	3	EW/DF-215	E-3557
17	100 KVAR Capacitor	6		E-3551
18	Jumper Wire (As Required)	-		
19	Insulated Jumpers, 5 KV Non Shielded	15'		
20	M.S. Bolt 5/8" x 2"	1	EW/DF-260	S-1297
21	Earth Wire No.5 SWG Copper Solid	48'		
22	J-Bolt Clamp for earth wire on 4' centers	2	EW/DF-297	S-1445
23	¾" Conduit	10'		T-7137
24	J-Bolt Clamp for 3/4" conduit	3	EW/DF-298	S-1444
25	Copper Clad Earth Rod 5/8"x8'-0"	1	EW/DF-323	T-1586
26	Earth Rod Clamp for 5/8" Rod	1	EW/DF-323	T-1587
27	Single Coil Rectangular Spring Steel Washer 3/8	3	EW/DF-331	T-1797
28	Connector P.G CU NO.5 SWG	3	EW/DF-329	T-5001
29	Mounting Bracket for 12 K.V Lightning Arrester	3	EW/DF-332	E-3674

PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY		ENGINEERING DEPARTMENT	
600 KVAR CAPACITOR BANK ASSEMBLY 56-L FOR LATTICE STEEL POLE			
DWN.	A.E	SCALE	DATE.4.3.67
TCD.	A.D	DWG.NO. ES/DD-56 L	
CKD.	DIR.		



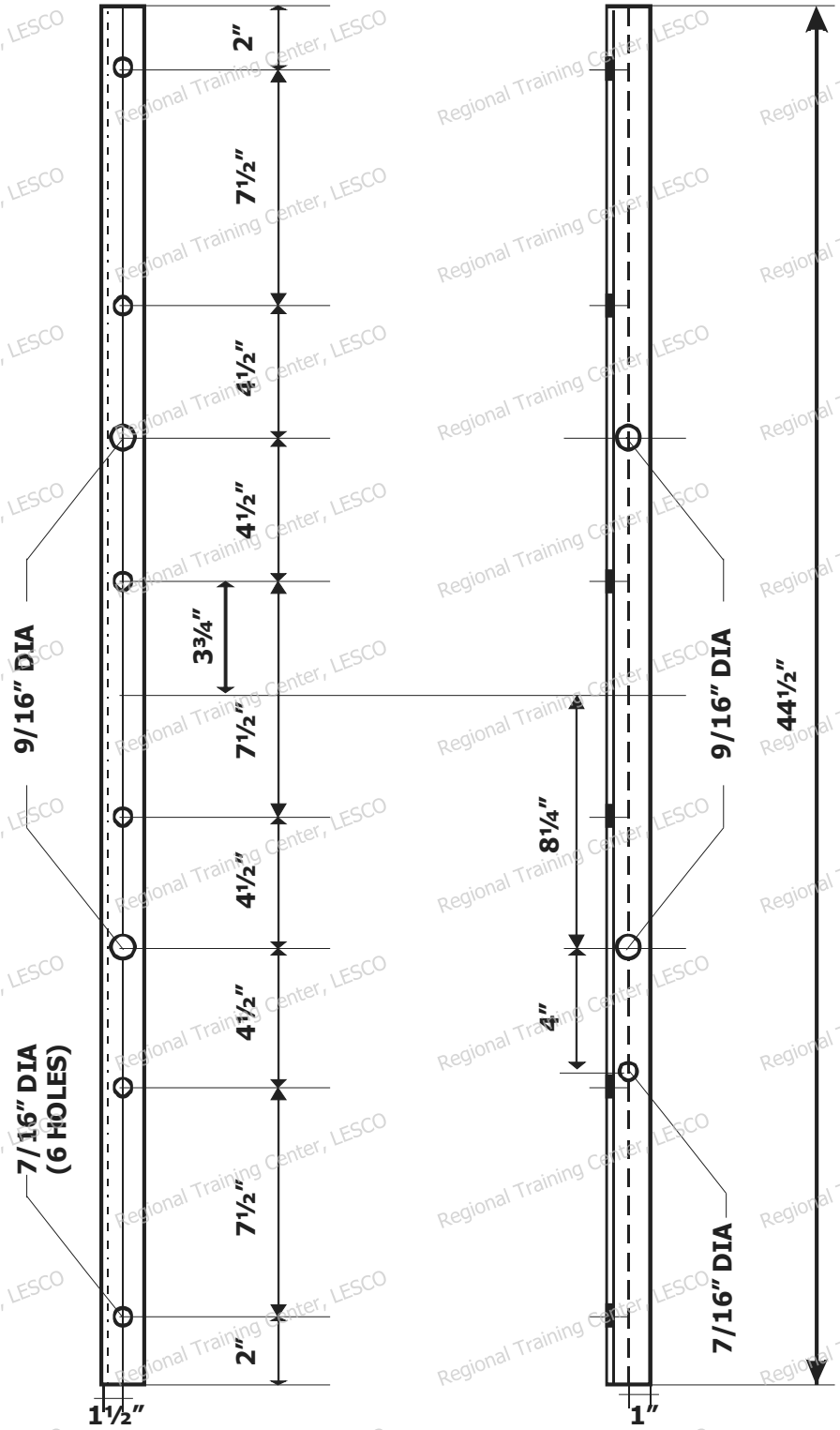
NOTE:

RACK TO BE MOUNTED AND ASSEMBLED WITH ½" Φ BOLTS ALL ITEMS HOT DIP GALVANISED A.S.T. M.A-153

PART NUMBER	DESCRIPTION	QTY	DWG NO.
CR-1	2½" x 2½"x 3/16"Angle Iron 44½" long drilled as per detail.	2	DSW/DF-33
CR-2	¾" x ¾" Flat Bar Blank Length 35-¼" Bent to shape and drilled as per detail	2	DSW/DF-34
CR-4	1 ¼" x ¼"x flat bar blank length 27" bent to shape and drilled as per detail	2	DSW/DF-36
CR-5	1 ¼" x ¼"x flat bar 17" long drilled as per detail	2	DSW/DF-35

PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY			DDESIGN AND STANDARD
CAPACITOR RACK ASSEMBLY FOR CROSSARM MOUNTING			
DWN.	A.E	SCALE	DATE.
TCD.	A.D	DWG.NO. DSW/DF-32	
CKD.	DIR.		

WEST PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY	NO. DSW/DF-33



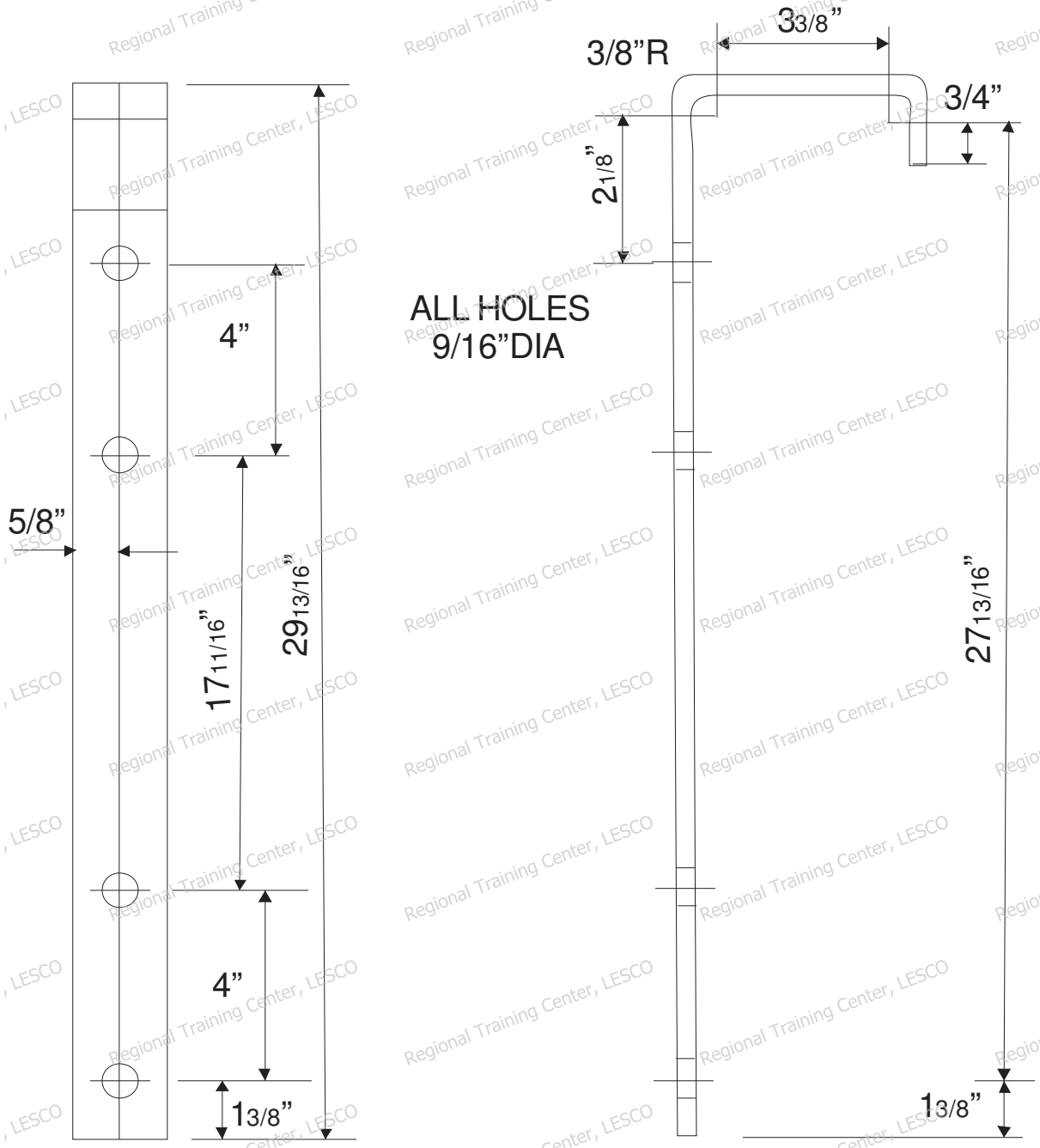
NOTE:

CAPACITORS RACK ASSEMBLY FOR CROSS ARMS MOUNTING SHOWN ON PAGE 32.

MATERIAL: 2-½"x 2-½" X 3/16" STEEL STRUCTURAL ANGLE
FINISH: HOT DIP GALV. A.S.T.M.A – 153

DRILLING DETAIL FOR PART NO.CR-1 CAPACITOR RACK		
DWN.	A.E	DESIGN AND STANDARDS
TCD.	A.D	DATE.21.5.69
CKD.	DIR.	SCALE.

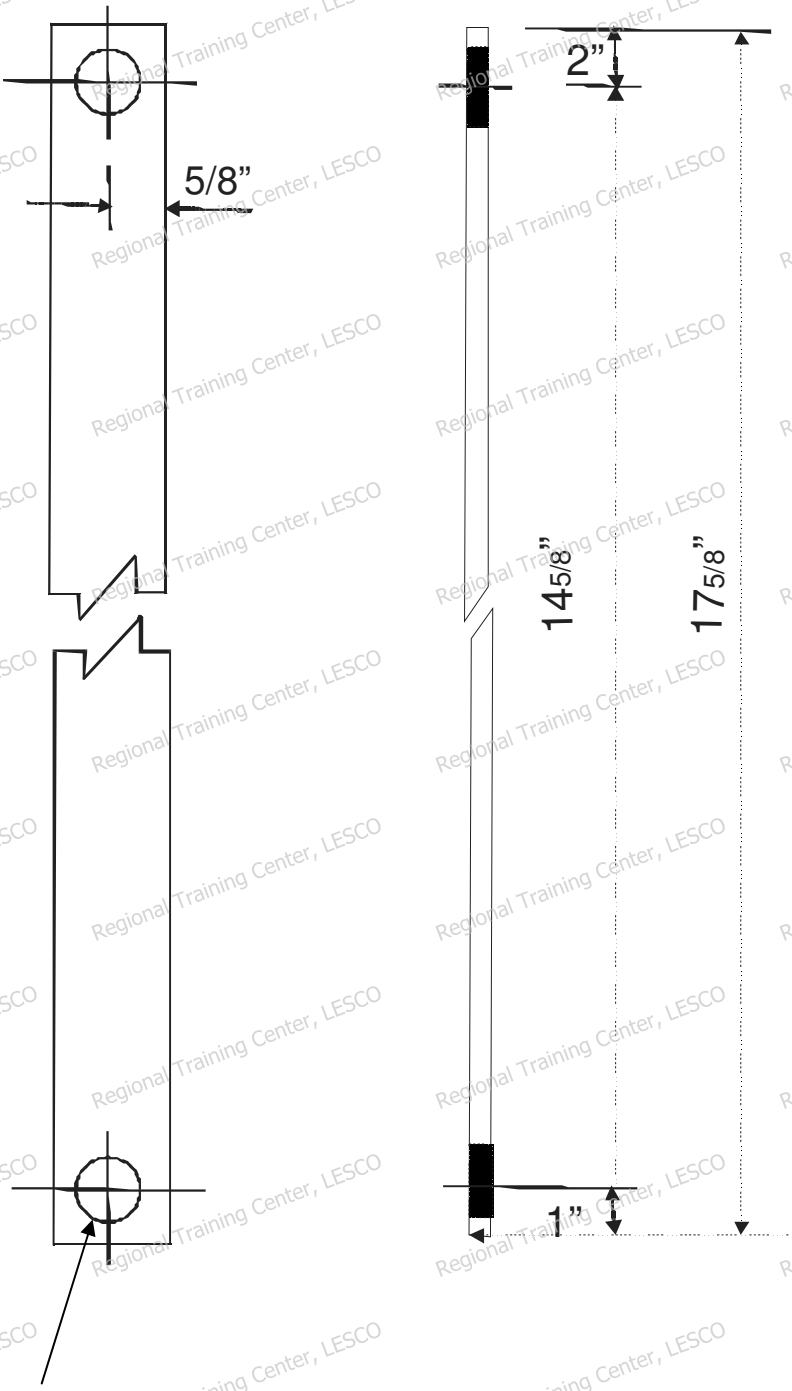
WEST PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY	NO. DSW/DF-34



BLANK LENGTH APPROX 35-1/16”
MATERIAL:..... 1¼” X 3/8” STEEL BAR.
FINISH..... HOT DIP GALV. A.S.T.M.A – 153

CROSSARM BRACE FOR PART NO.CR-2 CAPACITOR RACK		
DWN.	A.E	DESIGNS & STANDARDS
TCD.	A.D	DATE.22.5.69
CKD.	DIR	SCALE

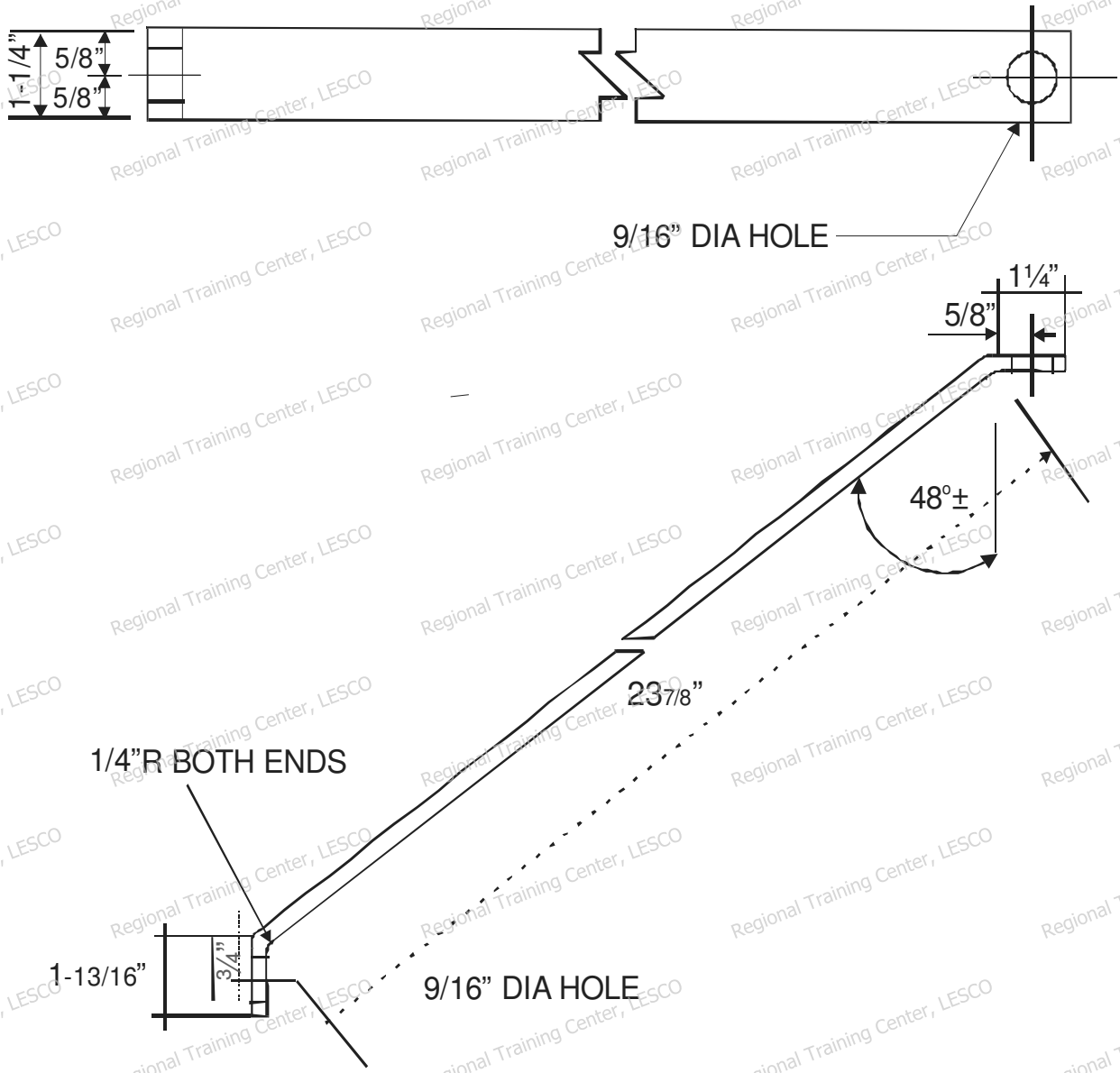
WEST PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY	NO. DSW/DF-35



9/16” DIA (TWO HOLES)
MATERIAL:..... ¼” X 1-¼” STEEL BAR.
FINISH..... HOT DIP GALV. A.S.T.M.A – 189

CROSSARM BRACE FOR PART NO.CR-2 CAPACITOR RACK		
DWN.	A.E	DESIGN & STANDARDS
TCD.	A.D	DATE.20.5.69
CKD.	DIR	SCALE

WEST PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY	NO. DSW/DF-36

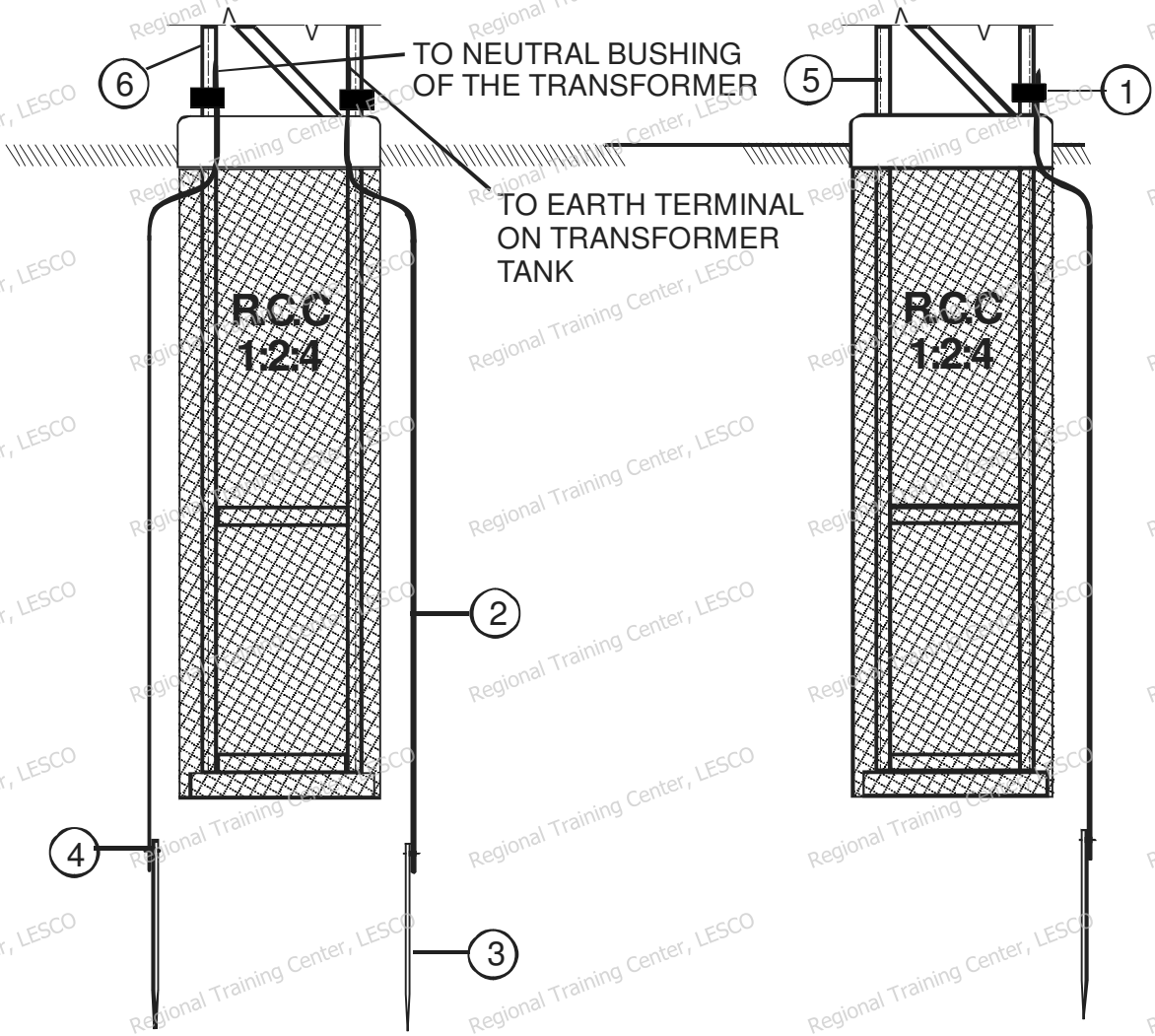


BLANK LENGTH APPROX = 27"

MATERIAL= 1¼" x ¼" STEEL BAR.

FINISH= HOT DIP GALV A.S.T.M.A-153

ANGULAR BRACE FOR PART NO.CR-4 CAPACITOR RACK		
DWN	A.E	DESIGNS & STANDARDS
TCD SCALE	A.D	DATE.21.5.69
CKD	DIR.	SCALE



NOTE:-

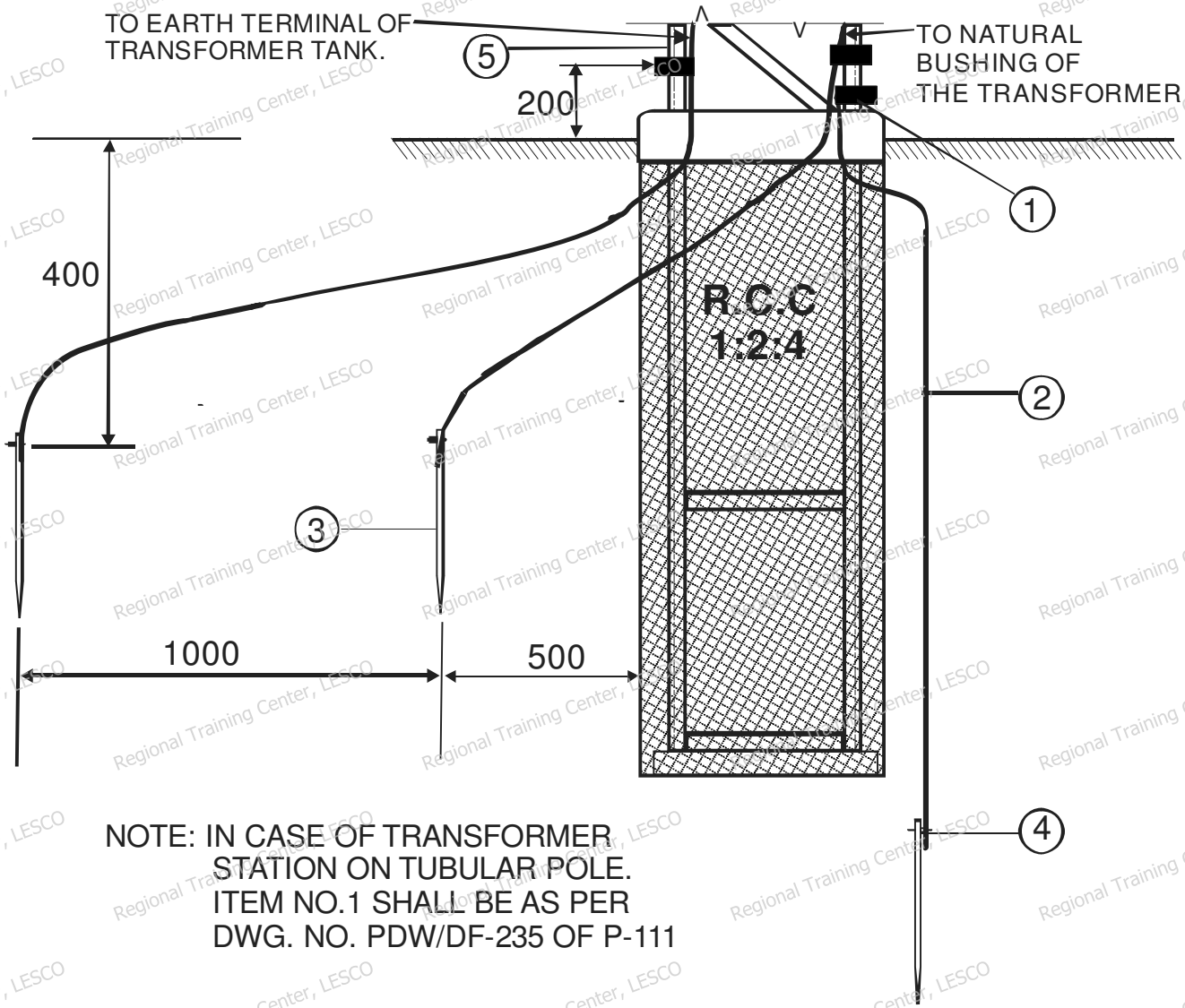
USE GROUND CONDUCTOR OF SIZE 7/3.2mm i.e 10mm dia GALVD: STEEL STRANDED WIRE. EARTH RESISTANCE OF L.T. SYSTEM CONNECTED TOGETHAR SHALL NOT EXCEED 0.5 ohms ON ANY POLE. INSTAL MORE EARTH RODS IF RESISTANCE EXCEEDS 0.5 ohms. THE LENGTH OF MILD STEEL GALVD,EARTH ROD WILL BE 3,000 mm INCLUDING 25 mm TAPERED PORTION.156 CFT OF DRY AGGREGATE WILL OCCUPY A VOLUME OF 100 CFT WET CONCRETS e.g. 7 CFT OF AGGREGATE WILL OCCUPY 4.487 CFT ONLY.

NOTE:

IN CASE OF TRANSFORMER SUB STATION ON TUBULAR POLES ITEM NO.1 SHALL BE AS PER DWG.NO.PDW/DF-235 OF P-111

NO	DESCRIPTION	SPEC	DWG.NO.
1	Ground Cond Clamp (S-Type)	P-111	PDW/DF-236
2	Gal. Steel wire (7/3.2mm - 10mm STRAND)	P-12	-
3	M.S Earth Rod	P-111	PDW/DF-237
4	Earth Rod. Clamp (R. Type)	P-111	PDW/DF-234
5	Lattice Steel Structure (H. Type)	P-34	PDW/DF-11
6	Lattice Steel Structure (L. Type)	P-34	PDW/DF-10

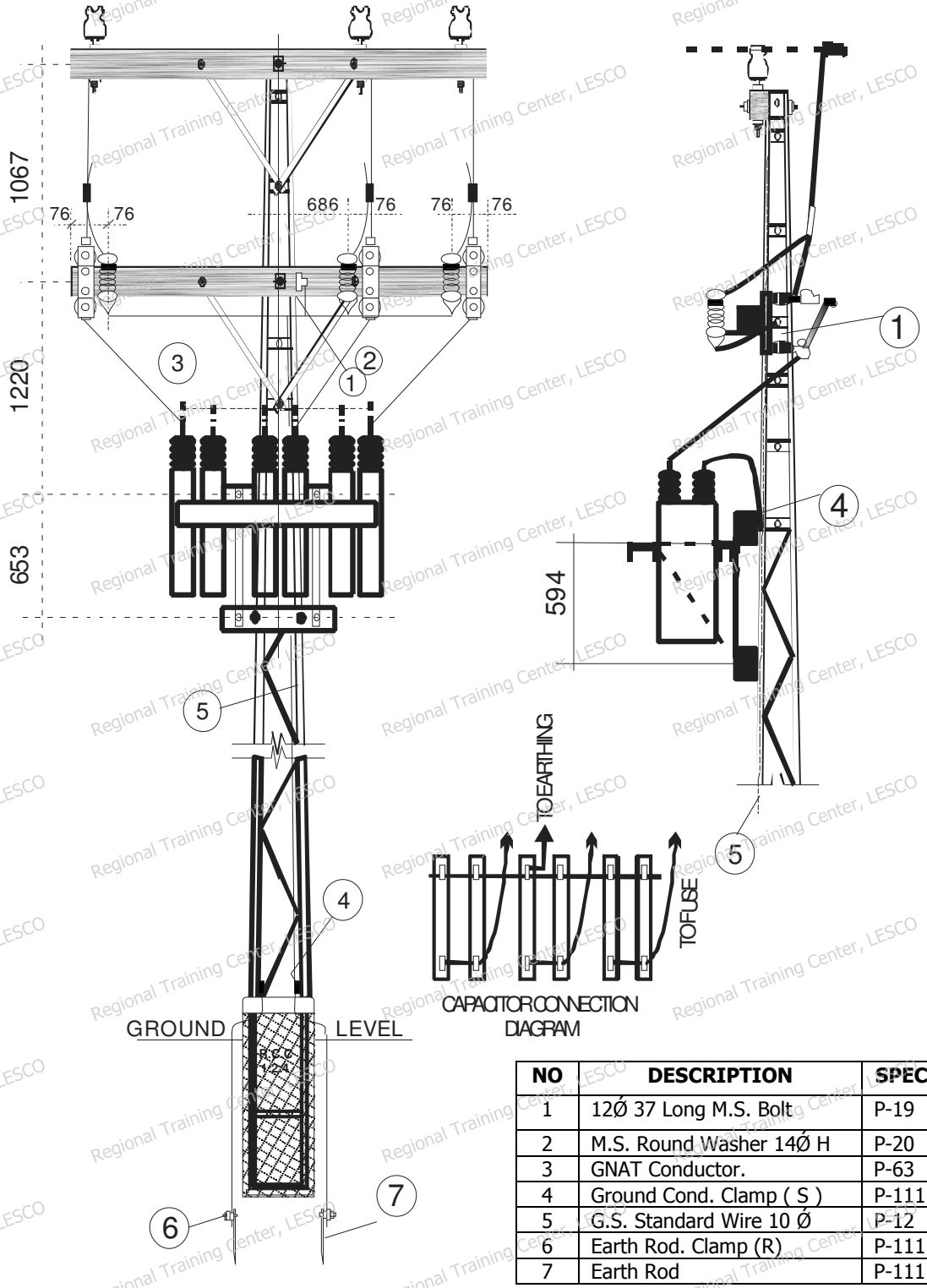
PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY		DESIGN DEPARTMENT
EARTH RODS CONFIGURATION FOR DISTRIBUTION TRANSFORMER SUB STATION ON DOUBLE STRUCTURES		
DWN.	A.E	SCALE
TCD.	A.D	DATE.31.3.1977
CKD.	DIR.	DWG.NO.PDW/DF-264



NOTE: IN CASE OF TRANSFORMER STATION ON TUBULAR POLE. ITEM NO.1 SHALL BE AS PER DWG. NO. PDW/DF-235 OF P-111

NO	DESCRIPTION	SPEC	DWG.NO.
1	Ground Cond. Clamp (S-Type)	P-111	PDW/DF-236
2	Gal. Steel wire (7/3.2mm – 10mm STRAND)	P-12	-
3	M.S Earth Rod	P-111	PDW/DF-237
4	Earth Rod. Clamp (R. Type)	P-111	PDW/DF-234
5	LATTIC STEEL STRUCTURE (H. Type)	P-34	PDW/DF-11

PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY		DESIGN DEPTT (POWER)	
EARTH RODS CONFIGURATION FOR DISTRIBUTION TRANSFORMER STATIONON SINGLE STRUCTURES			
DWN.	A.E	SCALE	DATE.29.3.77
TCD.	A.D	DWG.NO. PDW/DF-263	
CKD.	DIR.		

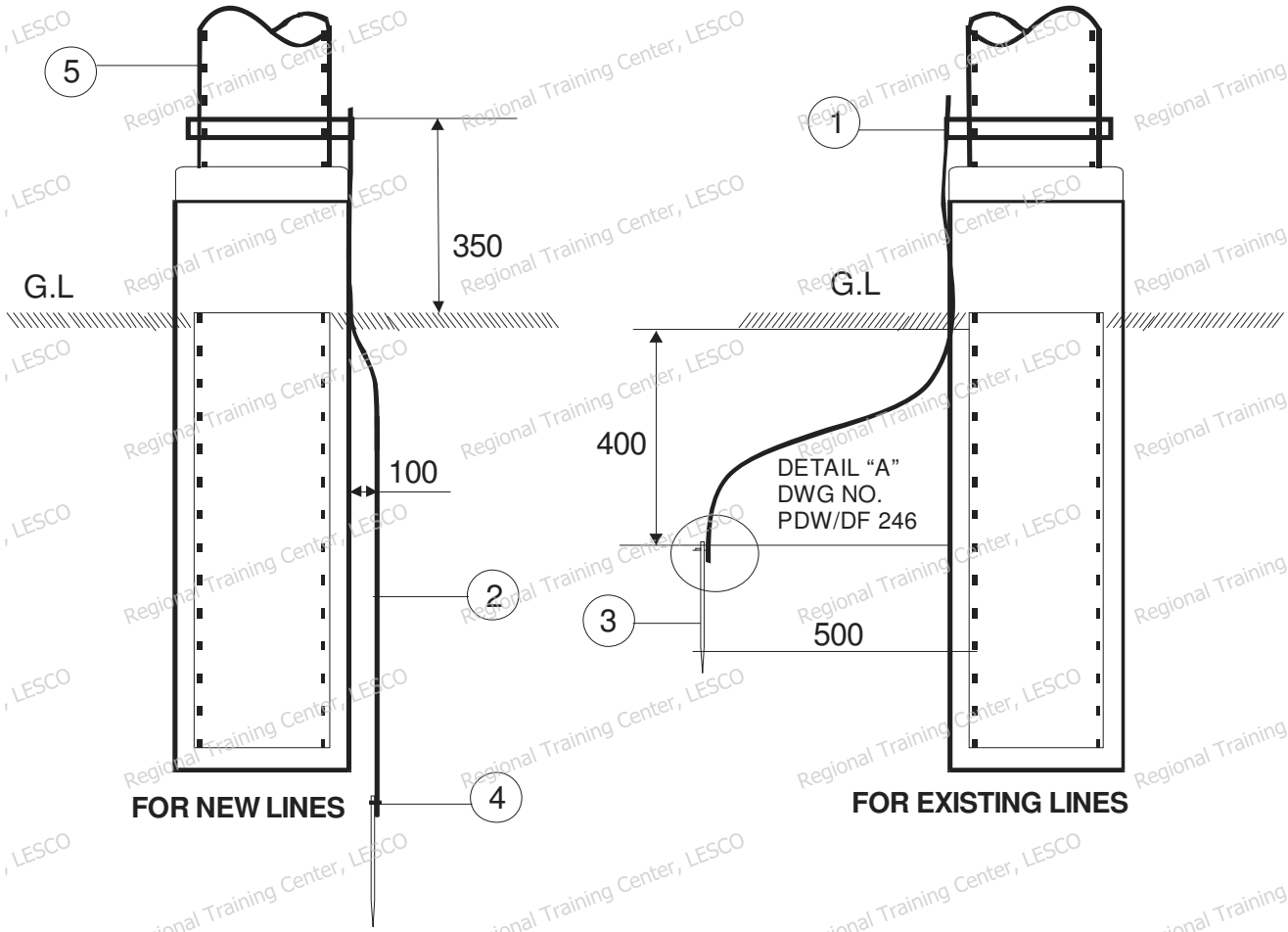


NO	DESCRIPTION	SPEC	DWG.NO.
1	12Ø 37 Long M.S. Bolt	P-19	EW/DF-286
2	M.S. Round Washer 14Ø H	P-20	EW/DF-268
3	GNAT Conductor.	P-63	-
4	Ground Cond. Clamp (S)	P-111	PDW/DF-236
5	G.S. Standard Wire 10 Ø	P-12	-
6	Earth Rod. Clamp (R)	P-111	PDW/DF-239
7	Earth Rod	P-111	PDW/DF-237

NOTE:

SIMILAR EARTHING ARRANGEMENT SHALL ALSO BE DONE IN CASE OF 300 KVAR CAPACITOR BANK.

PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY			**DESIGN DEPTT**
EARTHING ARRANGEMENT FOR 600 KVAR CAPACITOR BANK.			
DWN.	A.E	SCALE	DATE.22.1.77
TCD.	A.D	DWG.NO. PDW/DF-262	
CKD.	DIR.		

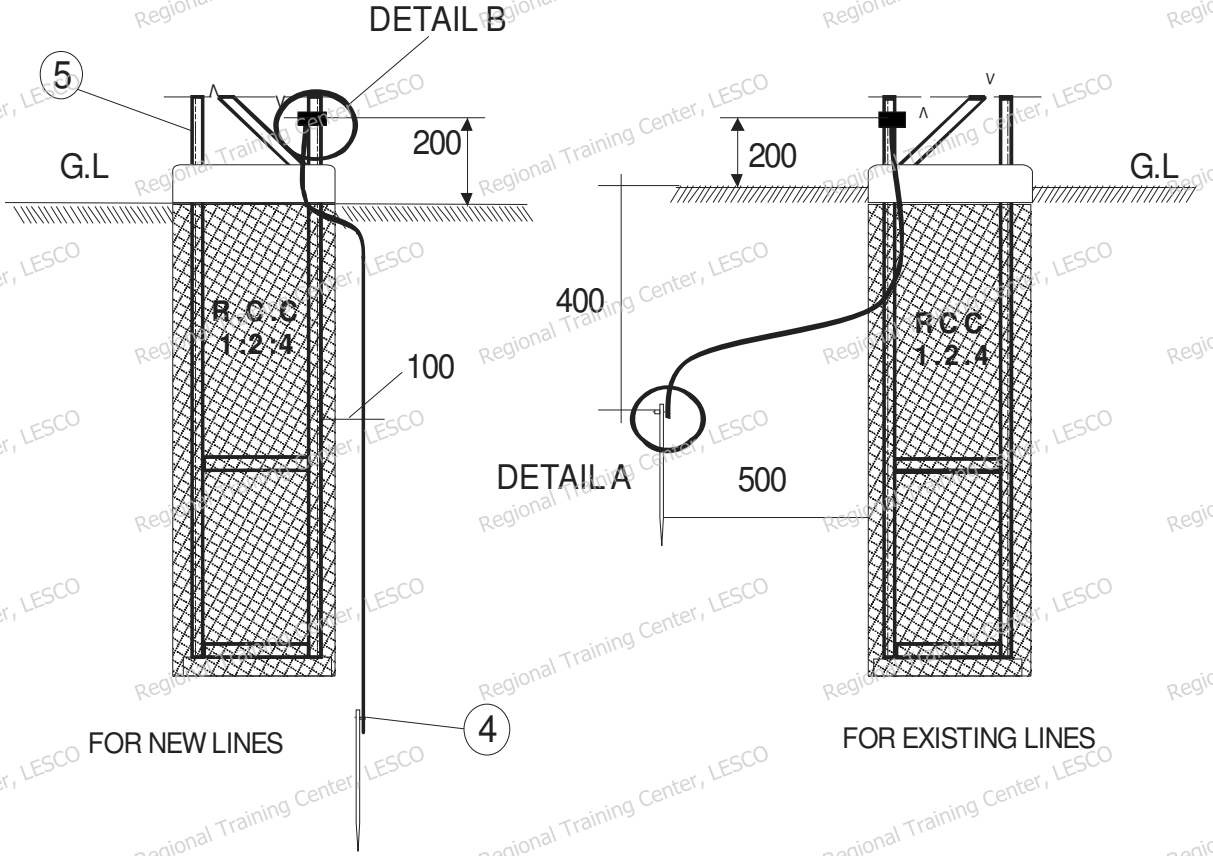


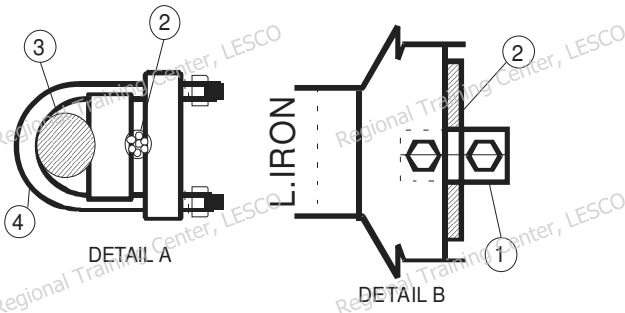
NOTE:

GROUND CONDUCTOR CLAMP PL&PH TYPE ARE USED FOR L&H TYPE TUBULAR POLES RESPECTIVELY.

NO	DESCRIPTION	SPEC	DWG.NO.
1	Ground Cond. Clamp (PL & PN Type)	P-111	PDW/DF-235
2	GAL. Steel wire (7/3.2mm- 10mm Strand)	P-12	-
3	M.S. Earth Rod.	P-111	PDW/DF-237
4	Earth Rod Clamp(R Type)	P-111	PDW/DF-234
5	Tubular Pole (L & N Type)	P-94	PDW/DF-153

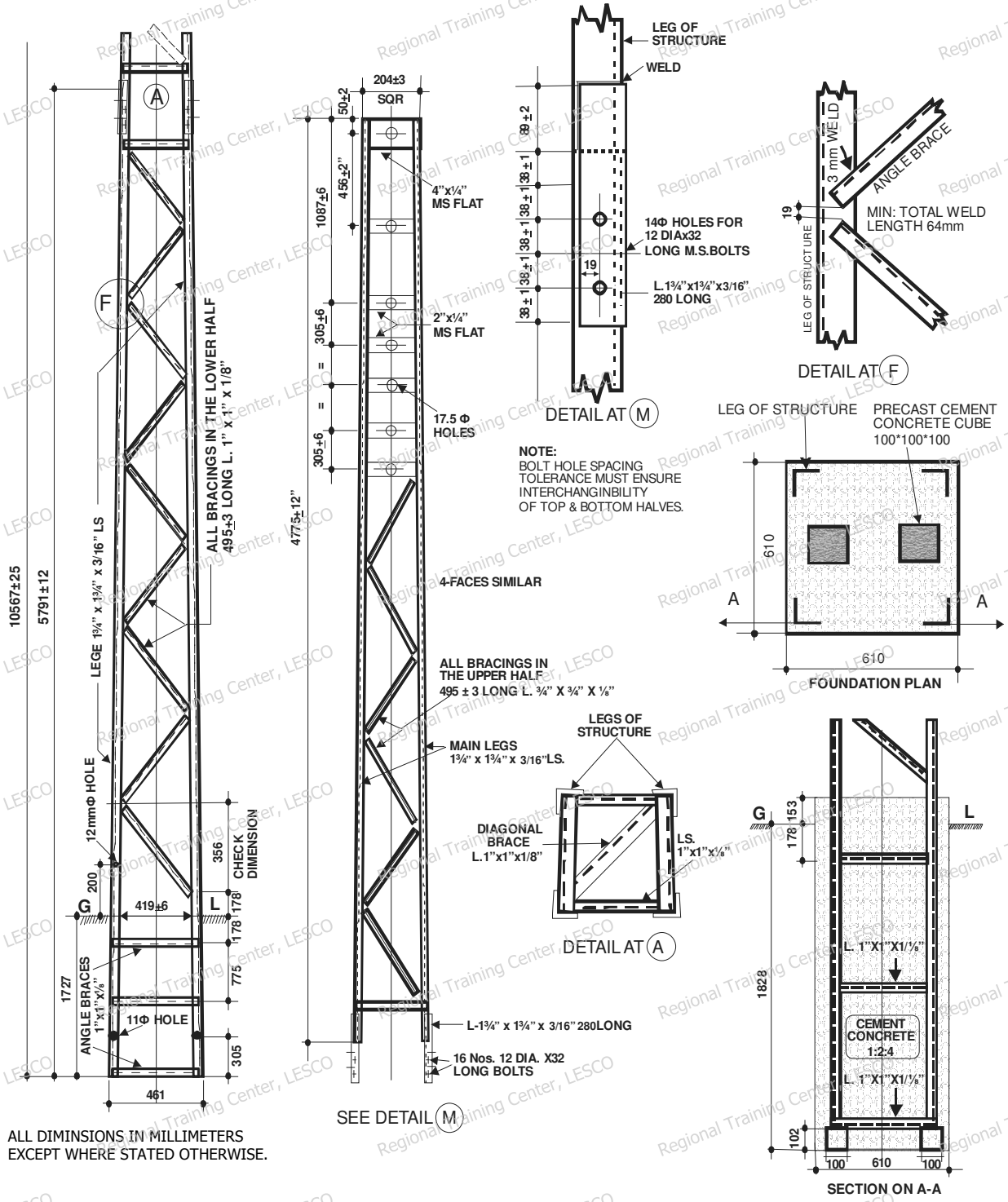
PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY			DESIGN DEPTT:(POWER)
EARTHING ARRANGEMENT FOR L.T & H.T TUBULAR POLES.			
DWN.	A.E	SCALE	DATE.19.3.1977
TCD.	A.D	DWG.NO. PDW/DF-247	
CKD. DWG NO.PDW/DF-247	DIR		





NO	DESCRIPTION	SPEC	DWG.NO.
1	Ground Cond. Clamp (S- Type)	P-111	PDW/DF-236
2	GAL. Steel wire (7/3.2mm -10mm Strand)	P-12	-
3	M.S. Earth Rod.	P-111	PDW/DF-237
4	Earth Rod Clamp(R Type)	P-111	PDW/DF-234
5	Lattice Steel Structure (L & H Type)	P-34	PDW/DF-10,11

PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY			DESIGN DEPARTMENT
EARTHING ARRANGEMENT FOR L.T & H.T LATTICE STEEL STRUCTURES.			
DWN.	A.E	SCALE	DATE
TCD.	A.D	DWG.NO. PDW/DF-246	
CKD.	DIR.		

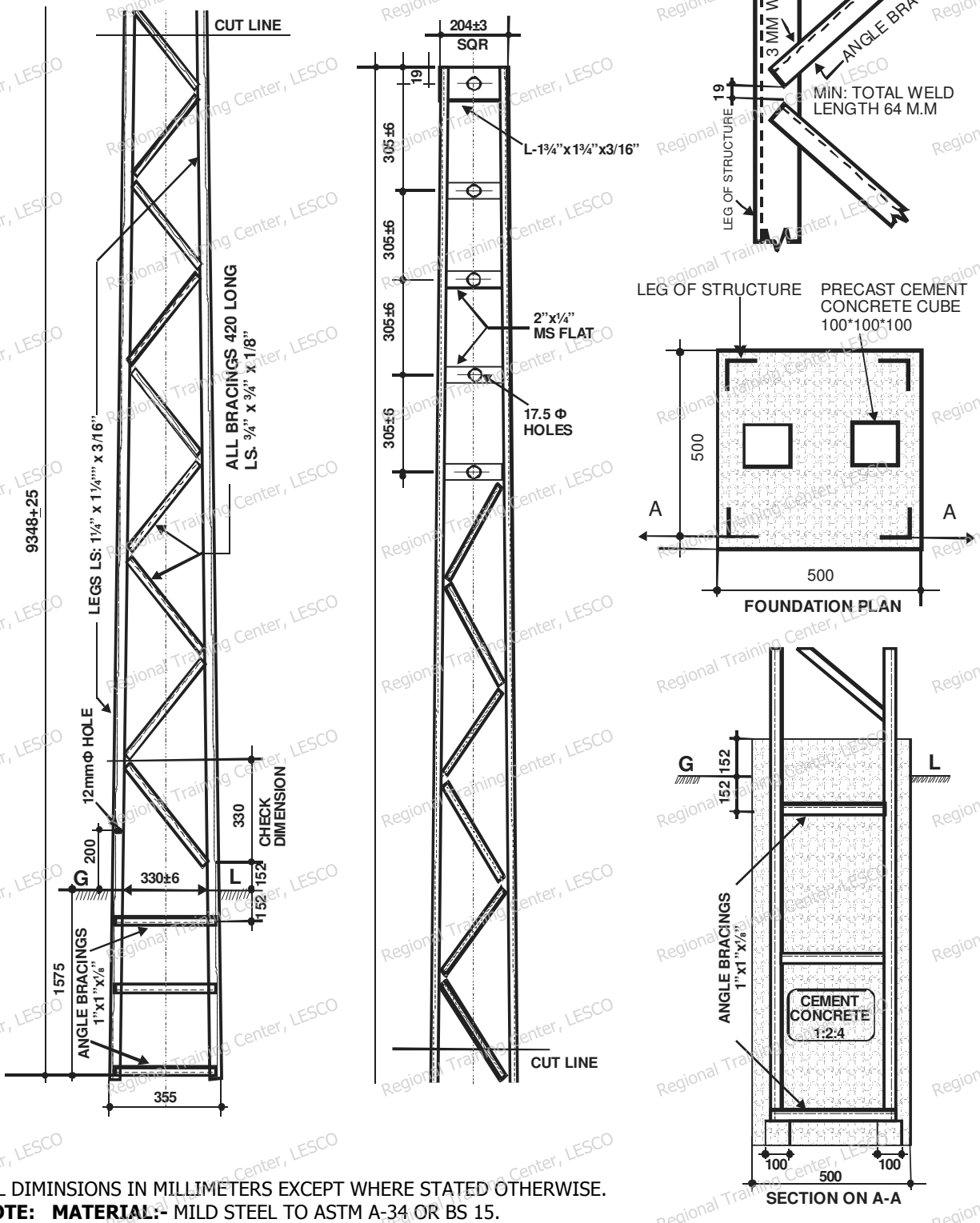


ALL DIMINSIONS IN MILLIMETERS
EXCEPT WHERE STATED OTHERWISE.

NOTE:
BOLT HOLE SPACING TOLERANCE MUST ENSURE INTERCHANGINBILITY OF TOP & BOTTOM HALVES.

NOTE:
MATERIAL:- MILD STEEL TO A.S.T.M A-36 OR BS 15.
BOLTS: TO A.S.T.M A-394. STRUCTURE TO BE MANUFACTURED AND TESTED TO WAPDA SPEC P-34.
DIMS: TAKEN FROM EW/ DF-290

PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY		DESIGN DEPARTMENT
TYPE H 35 FT,600 LBS LATTICE STEEL STRUCTURE		
DWN.	A.E	SCALE
TCD.	A.D	DATE.25.4.70
CKD.	DIR.	DWG.NO.PDW/DF-11

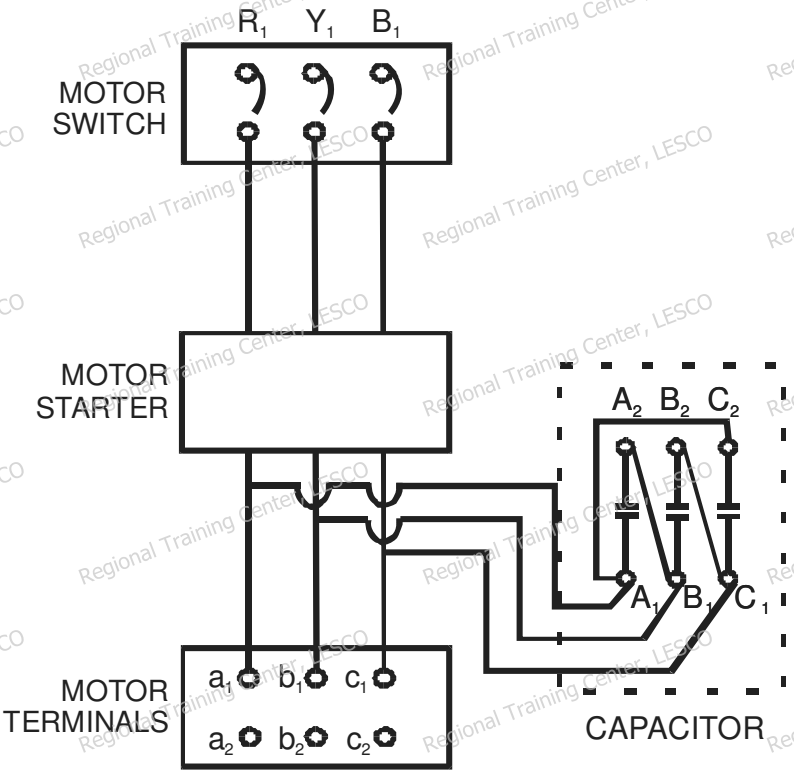


ALL DIMINSIONS IN MILLIMETERS EXCEPT WHERE STATED OTHERWISE.

NOTE: MATERIAL:- MILD STEEL TO ASTM A-34 OR BS 15.
BOLTS:- TO ASTM A-394. STRUCTURE TO BE MANUFACTURED AND TESTED IN ACCORDANCE WITH SPEC P-34.
STRUCTURE DIMS:- TAKEN FROM EW/ DF-290

PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY		**P&D DEPARTMENT**
TYPE L 31 FT,300 LBS LATTICE STEEL STRUCTURE.		
DWN.	A.E	SCALE
TCD.	A.D	DATE.27-4-64
CKD.	DIR.	DWG.NO.PDW/DF-10

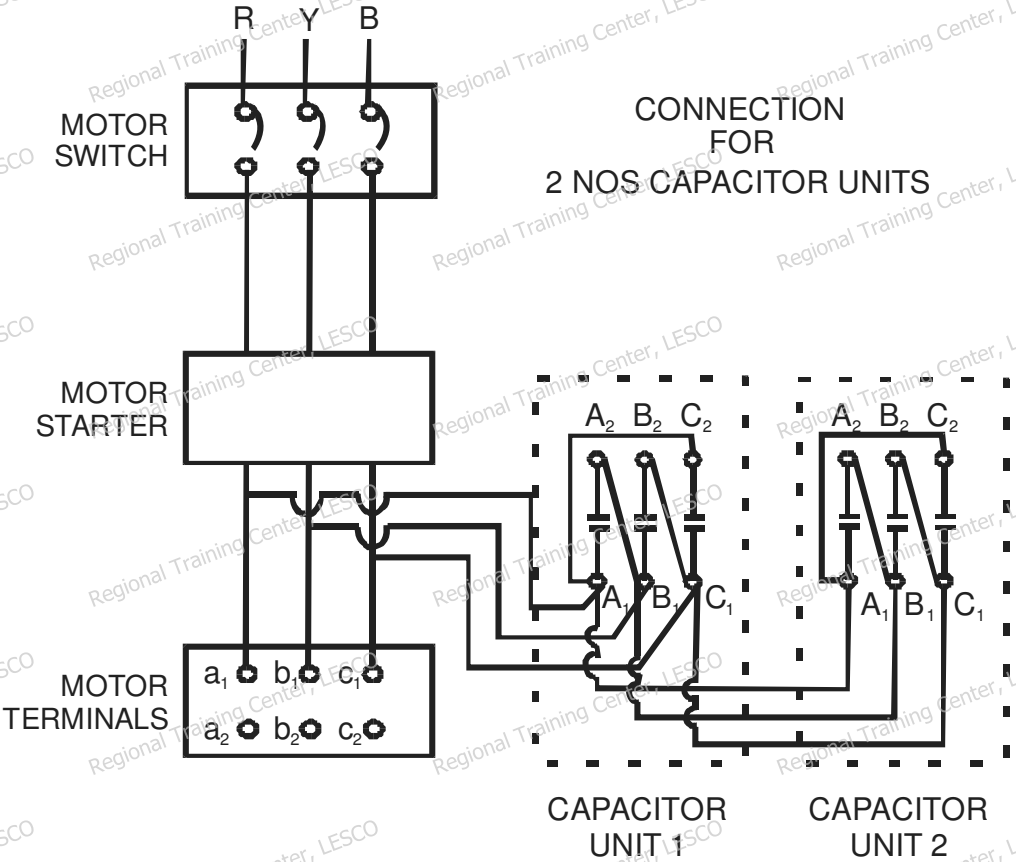
CONNECTION
FOR
SINGLE CAPACITOR UNIT



NOTE:-

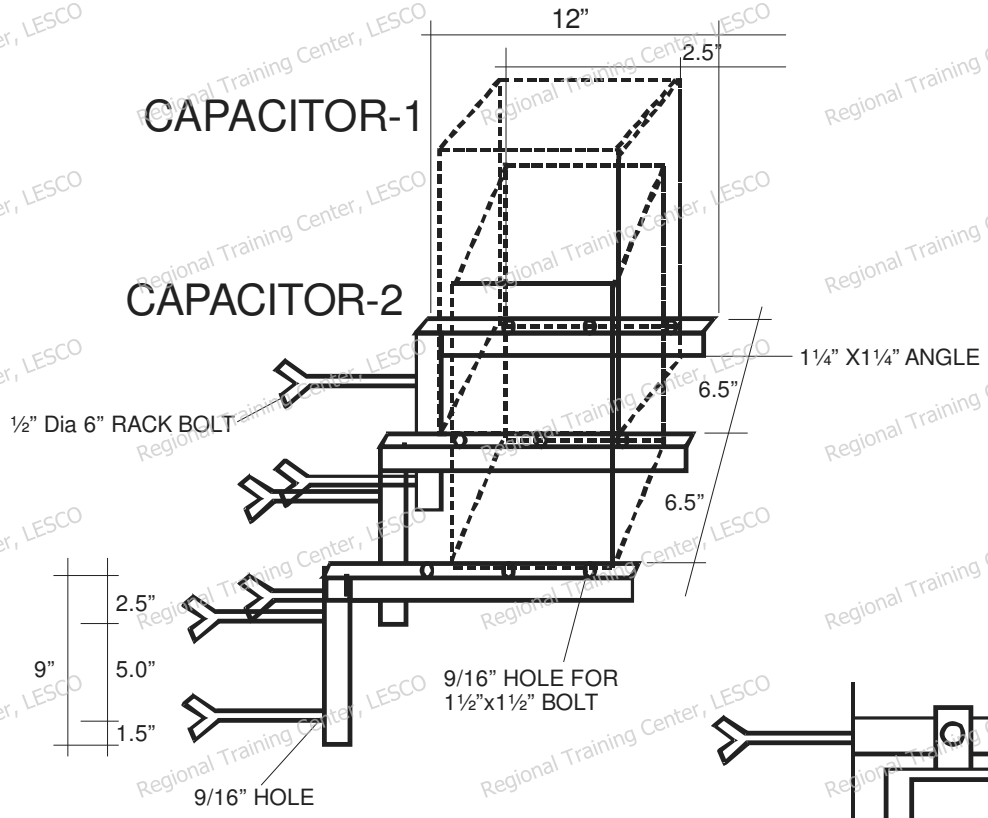
1. USE 7/.036 INSTULATED PVC SINGLE CORE CABLE FOR CAPACITOR CONNECTION.
2. EARTH TERMINAL ON THE BODY OF THE CAPACITOR SHOULD BE CONNECTED TO CONSUMERS EARTH.

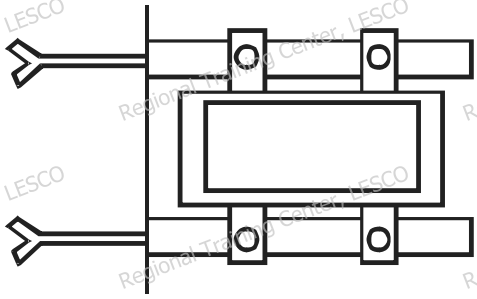
CONNECTION
FOR
2 NOS CAPACITOR UNITS



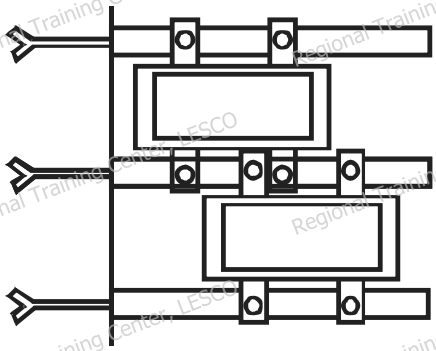
PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY			DESIGN DEPARTMENT
L.T CAPACITOR CONNECTION DIAGRAM			
DWN.	A.E	SCALE	DATE.
TCD.	A.D	DWG.NO. CE/DD-2	
CKD.	DIR.		

CAPACITOR INSTALLATION RACK





PLAN FOR SINGLE CAPACITOR UNIT



PLAN FOR DOUBLE CAPACITOR UNIT

NOTE:-

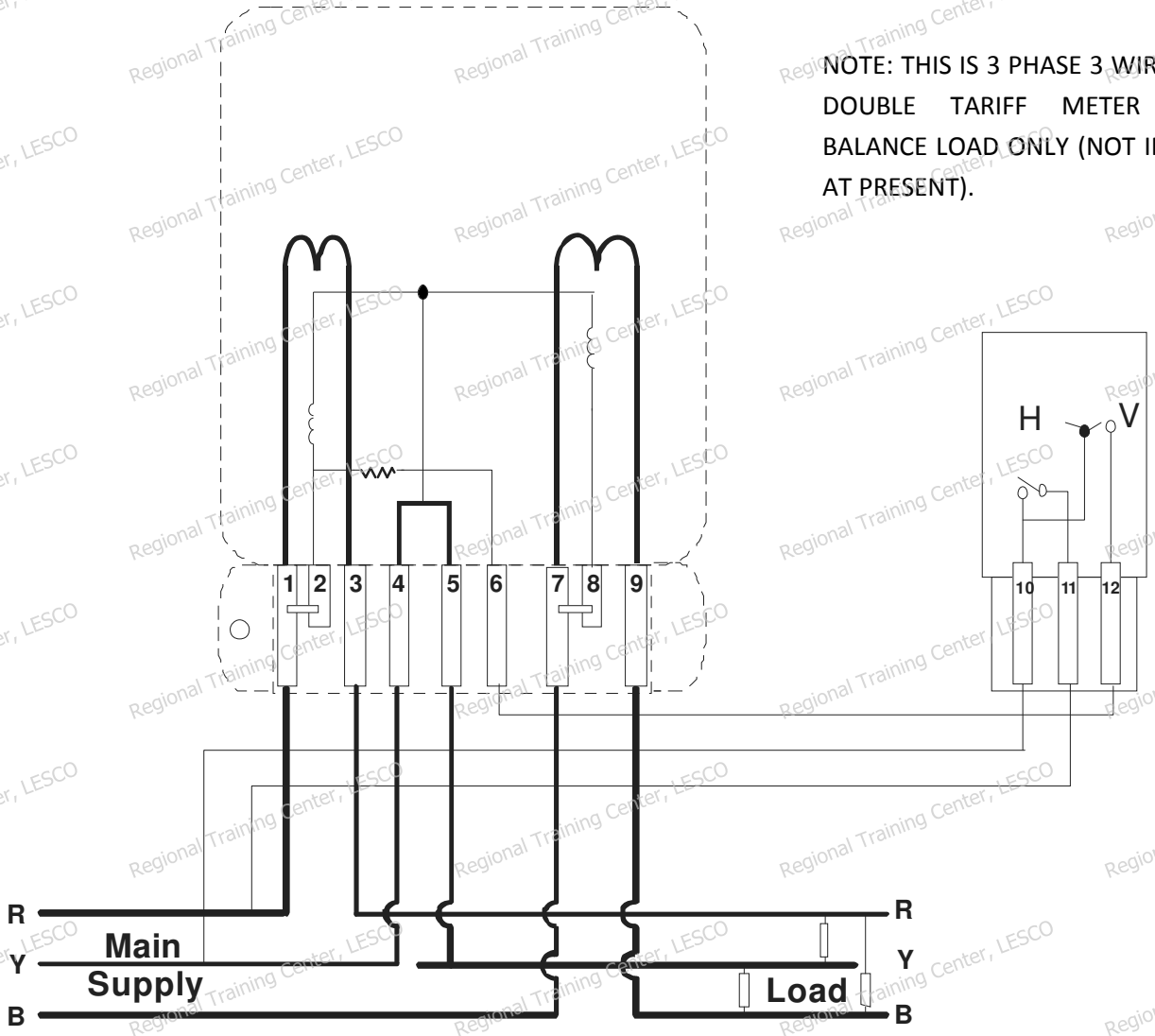
1. 2 ANGLE IRON PIECES FOR CAPACITR UNIT
2. USE 3 ANGLE IRON PIECES FOR DOUBLE CAPACITOR UNIT

PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY			DESIGN DEPARTMENT
L.T CAPACITOR INSTALATION RACK			
DWN	A.E	SCALE	DATE
TCD	A.D	DWG.NO.	
CKD	DIR		

WEST PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY (ENGINEERING DEPARTMENT)	NO. EW/DM-14

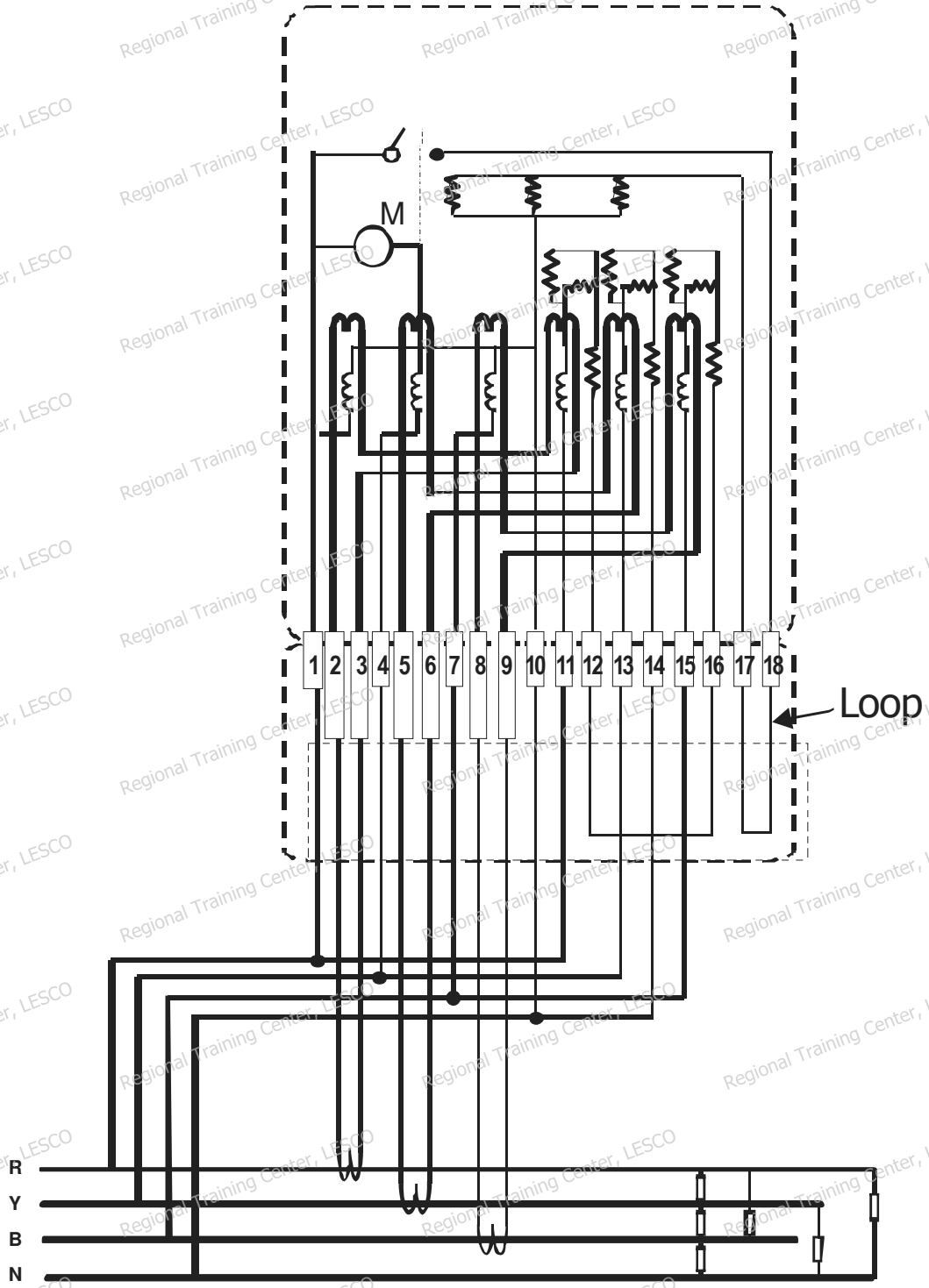
3- PHASE 3 - WIRE METER

NOTE: THIS IS 3 PHASE 3 WIRE 400 DOUBLE TARIFF METER FOR BALANCE LOAD ONLY (NOT IN USE AT PRESENT).



METER CONNECTION ARRANGEMENT 3 PHASE 3 WIRE 400 VOLTS		
DWN.	A.E.	DATE.13.7.66
CKD.	A.D.	DIR.

WEST PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY (ENGINEERING DEPARTMENT)	NO. EW/DM-13



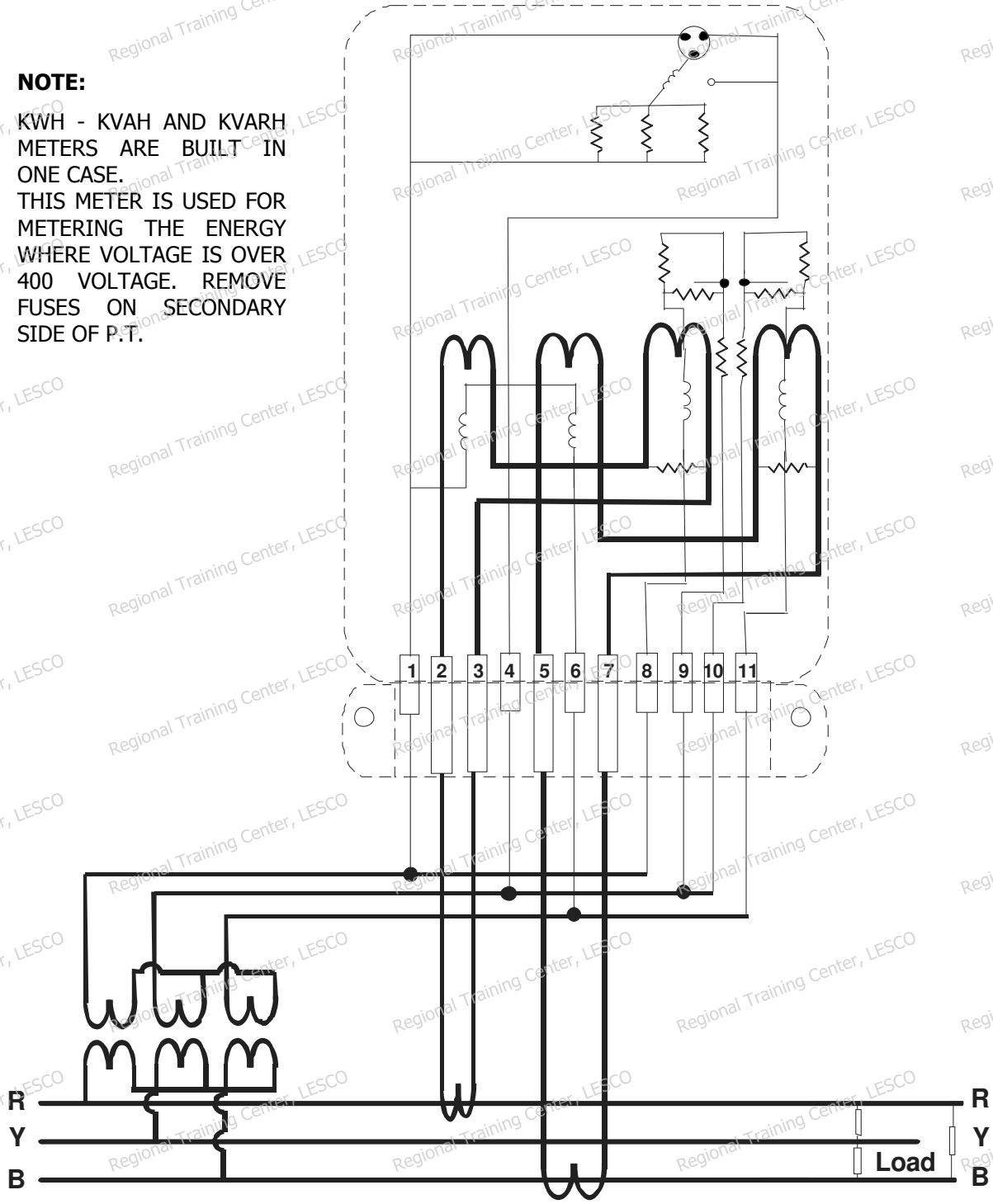
NOTE : THE KWH AND MDI RECORDE ENERGY CONSUMPTION AND MAXIMUM DEMAND
THE KVAH/KILO VOLTS –AMPS HOURS AND KVARH REGISTER THE REACTIVE ENERGY.

METER CONNECTIONS ARRANGEMENT 3 PHASE 4 WIRE C.T OPERATED TRIVECTOR METER		
DWN.	A.E	DATE.14.7.66
CKD.	A.D	DIR.

WEST PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY (ENGINEERING DEPARTMENT)	NO. EW/DM-12

NOTE:

KWH - KVAH AND KVARH METERS ARE BUILT IN ONE CASE.
THIS METER IS USED FOR METERING THE ENERGY WHERE VOLTAGE IS OVER 400 VOLTAGE. REMOVE FUSES ON SECONDARY SIDE OF P.T.



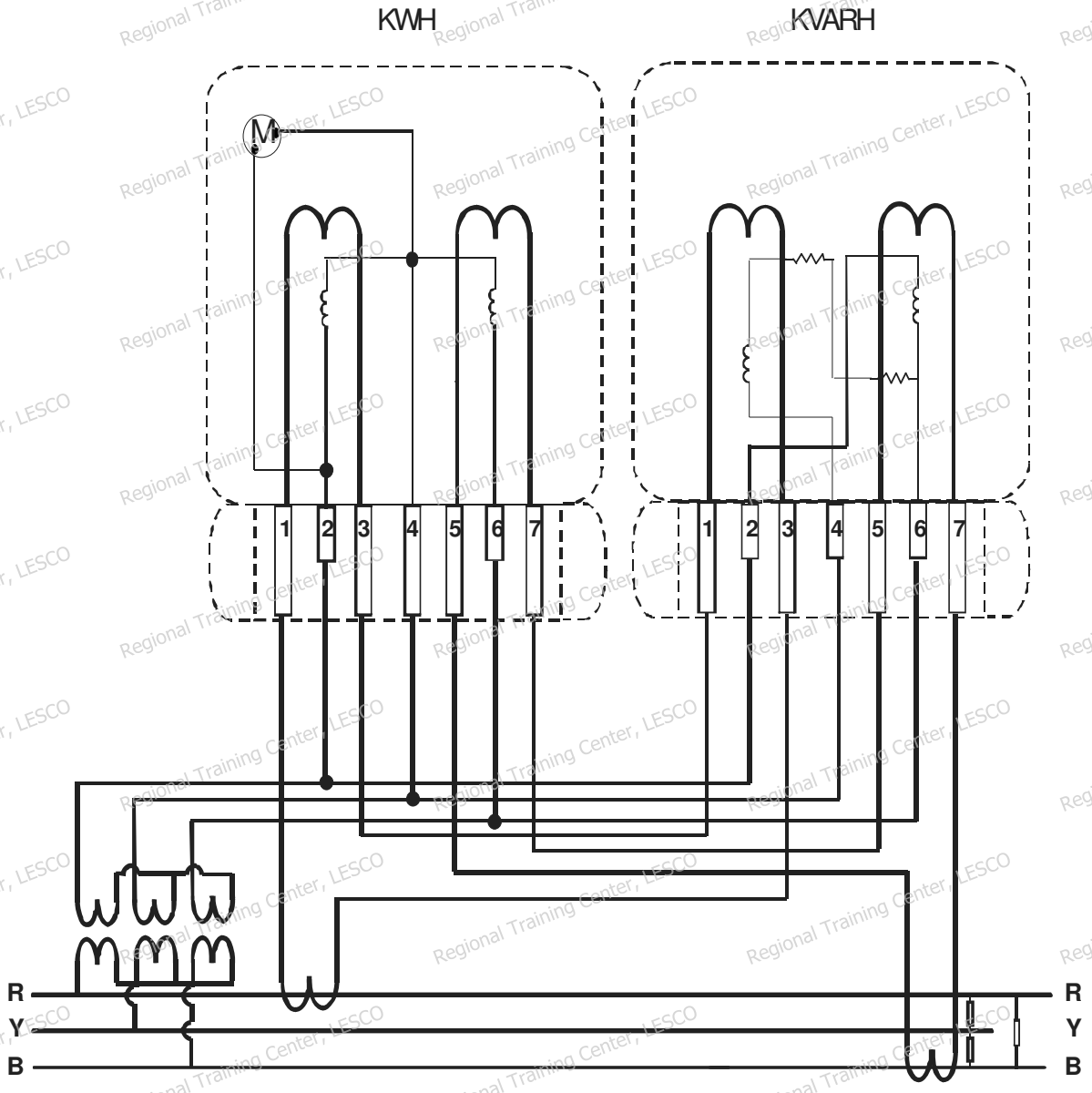
METER CONNECTIONS ARRANGEMENT L&G 3 PHASE 3 WIRE C.TS AND P.T OPERATED TRIVECTOR METER WITH KWH,KVAH,KVARH & MDI (KW)		
DWN.	A.E	DATE.12.7.66
CKD.	A.D.	DIRECTOR.

WEST PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY (ENGINEERING DEPARTMENT)	NO. EW/DM-11

NOTE:-

POWER Factor = Kwh /$\sqrt{KWH^2 + KVARH^2}$

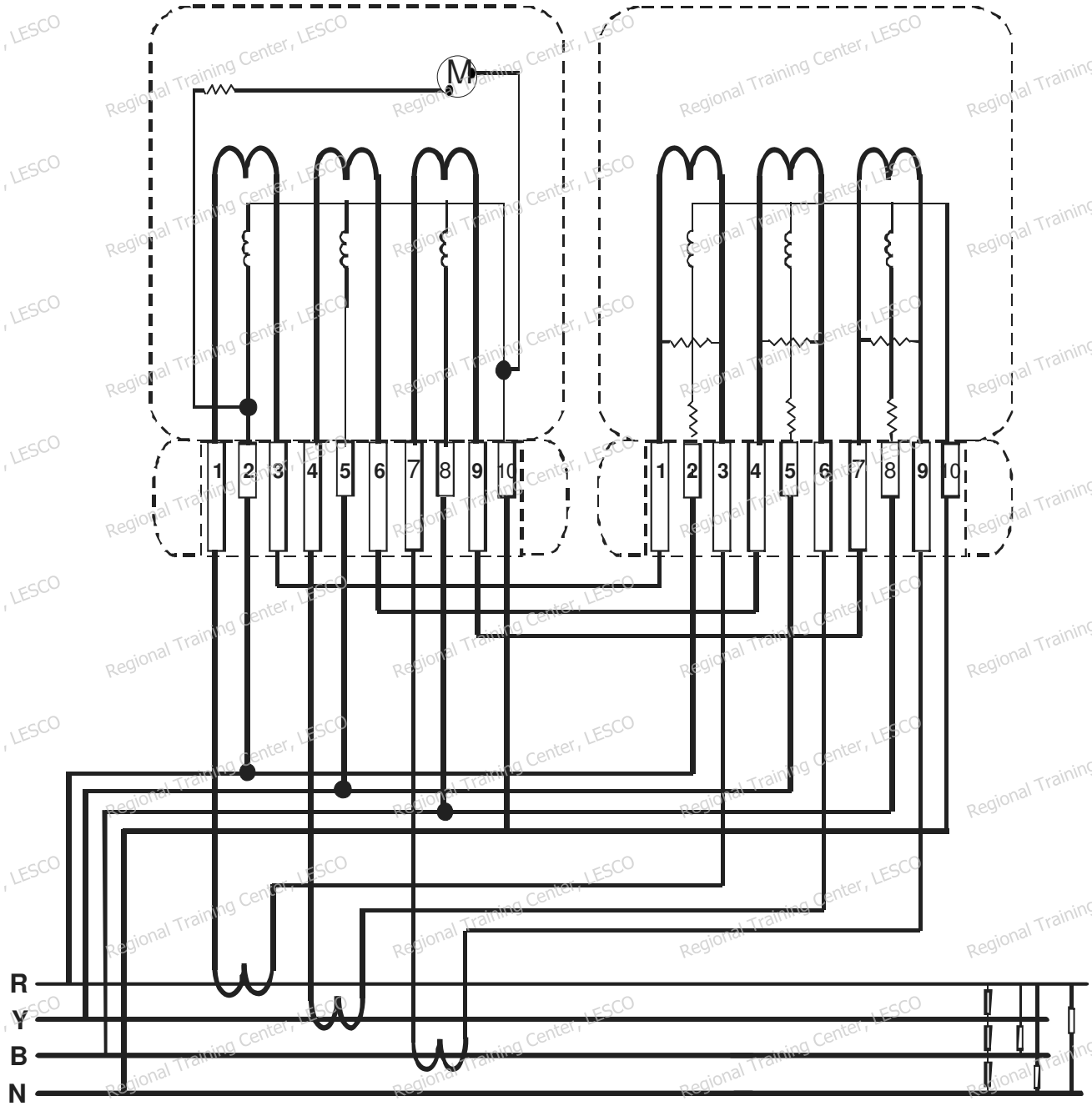
USE FOR BALANCE LOAD ONLY



METER CONNECTIONS ARRANGEMENT L & G 3 PHASE 3 WIRE C.T & P.T OPERATED METER WITH KWH,KVARH & MDI (KW)		
DWN.	A.E	DATE.11.7.66
CKD.	A.D	DIR.

WEST PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY (ENGINEERING DEPARTMENT)	NO. EW/DM-10

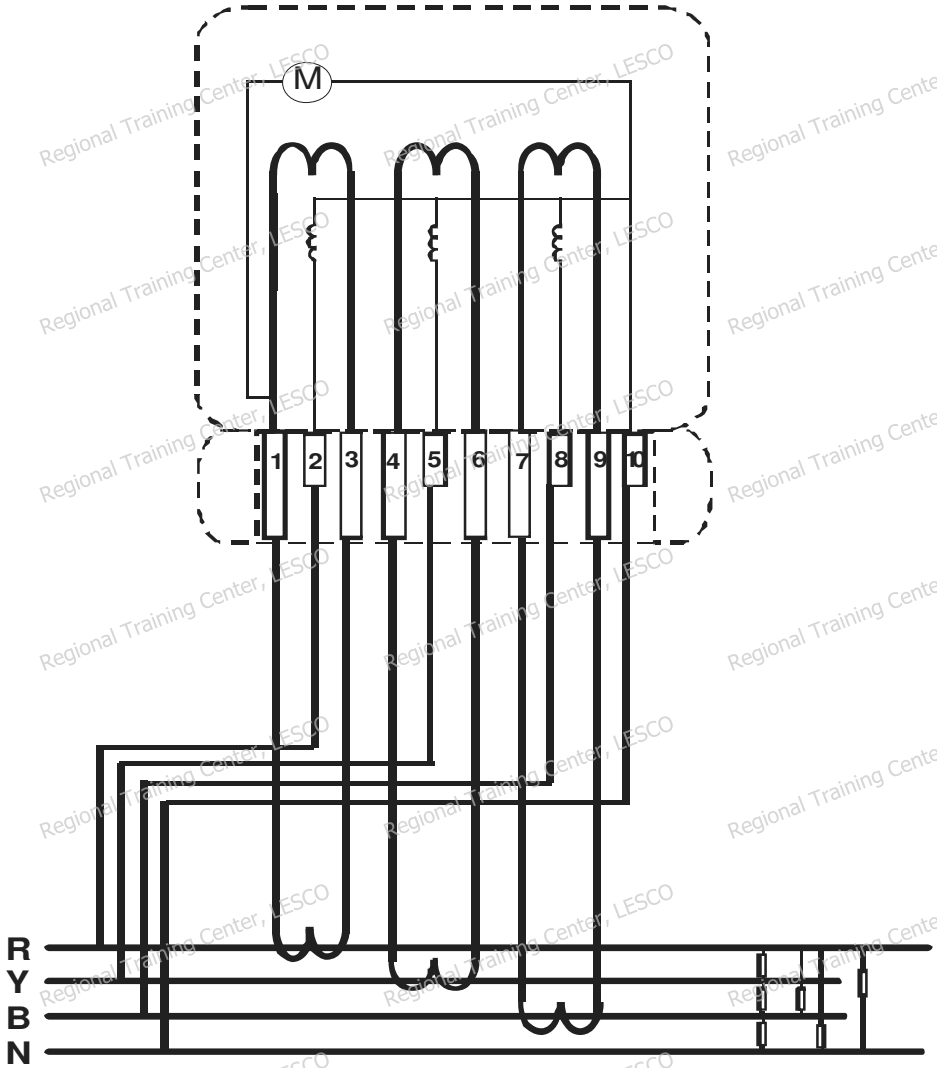
NOTE:- THIS MAY BE USED FOR RECORDING CONSUMPTION OF INDUSTRIAL AND LIGHT LOAD.



METER CONNECTIONS ARRANGEMENT AEG 3 PHASE 4 WIRE 230/400 VOLTS C.T OPERATED METER WITH KWH,KVARH & MDI (KW)		
DWN.	A.E	DATE.5.7.66
CKD.	A.D.	DIR.

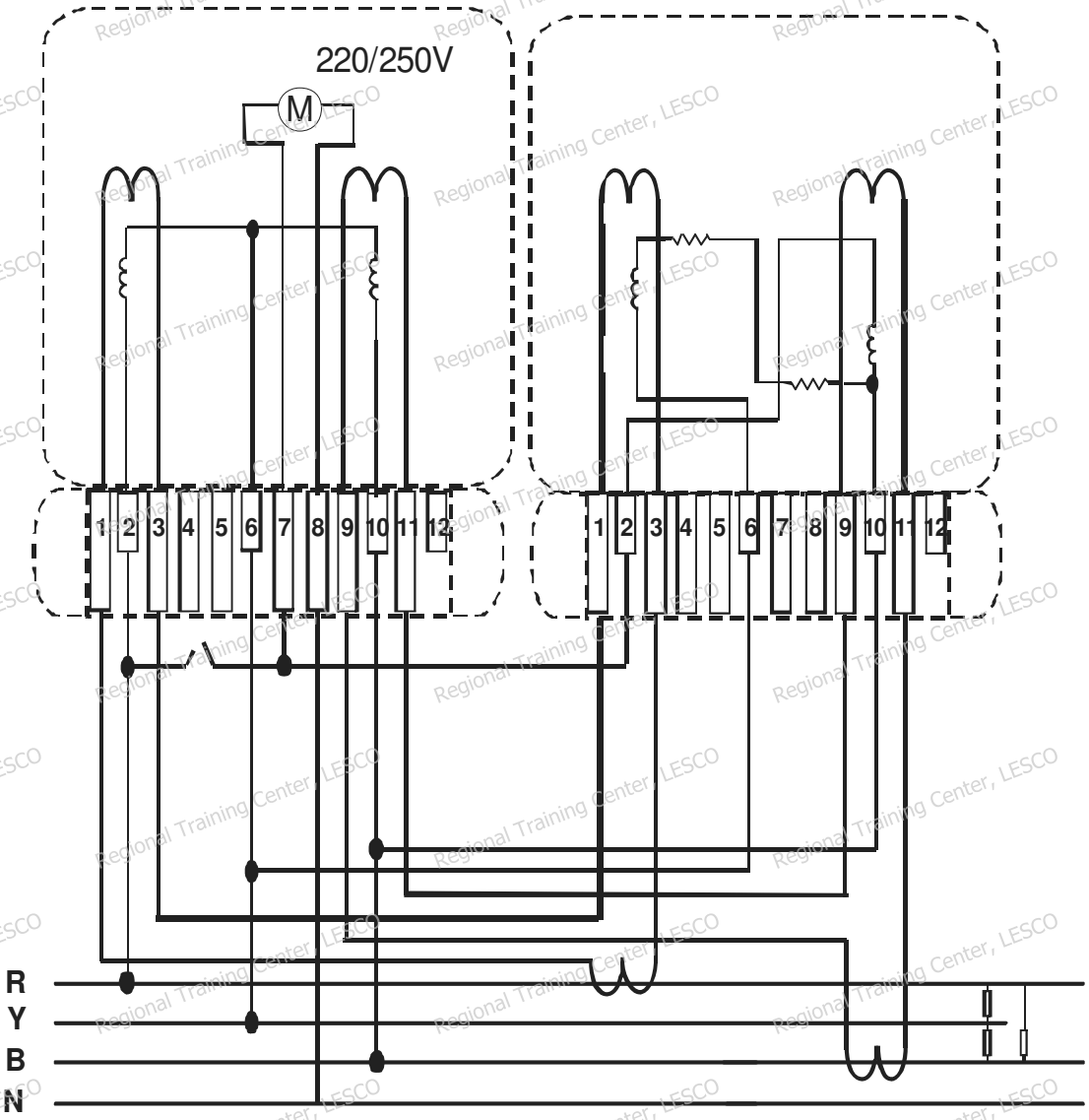
WEST PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY (ENGINEERING DEPARTMENT)	NO. EW/DM-9

NOTE:- MAY BE USED FOR RECORDING CONSUMPTIONOF BOTH 3 PHASE AND SINGLE PHASE LOAD



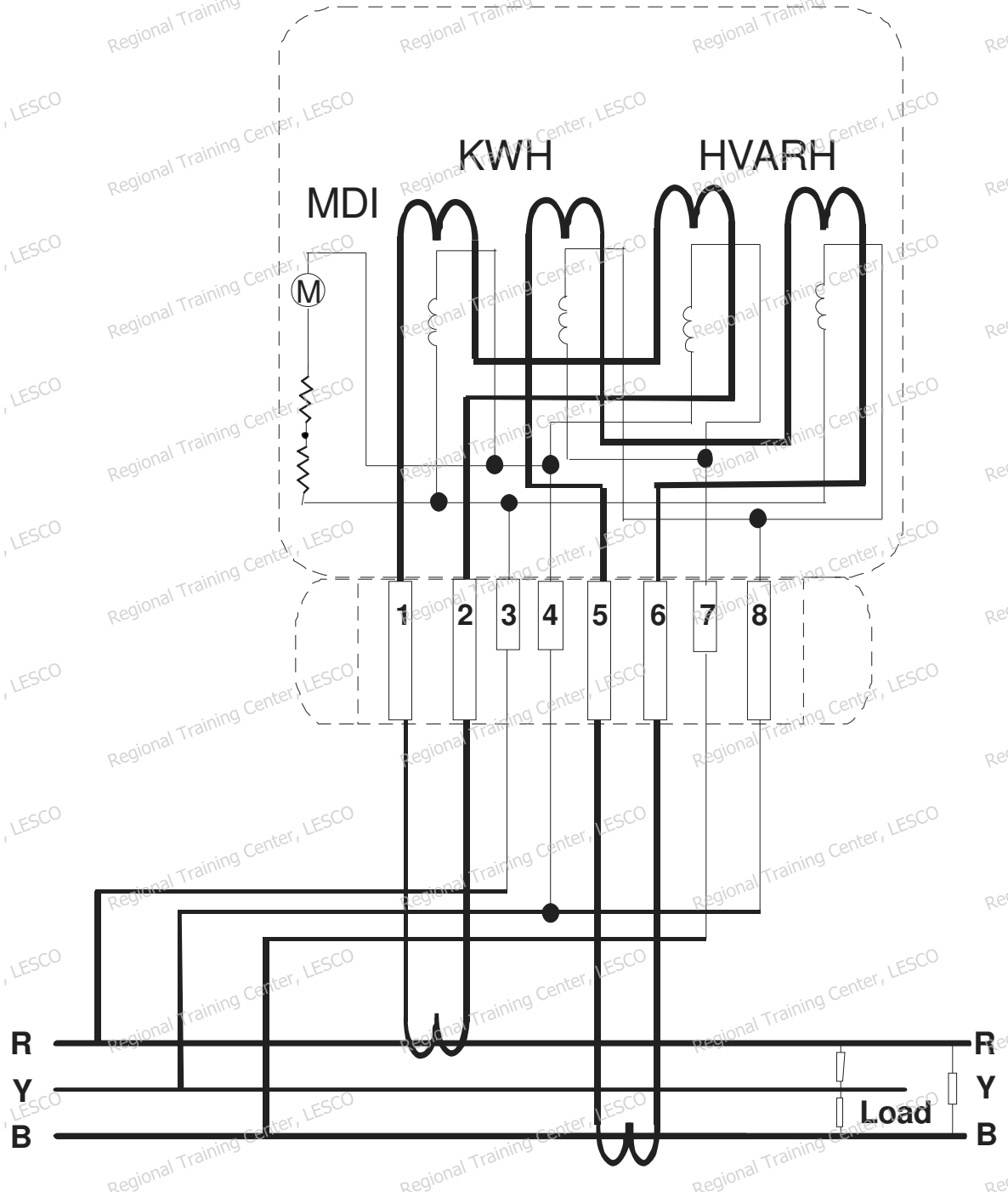
METER CONNECTIONS ARRANGEMENT L & G 3 PHASE 4 WIRE 230/400 VOLTS C.T. OPERATED METER WITH KWH & MDI (KW)		
DWN.	A.E.	DATE.4.7.66
CKD.	A.D.	DIR.

WEST PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY (ENGINEERING DEPARTMENT)	NO. EW/DM-8



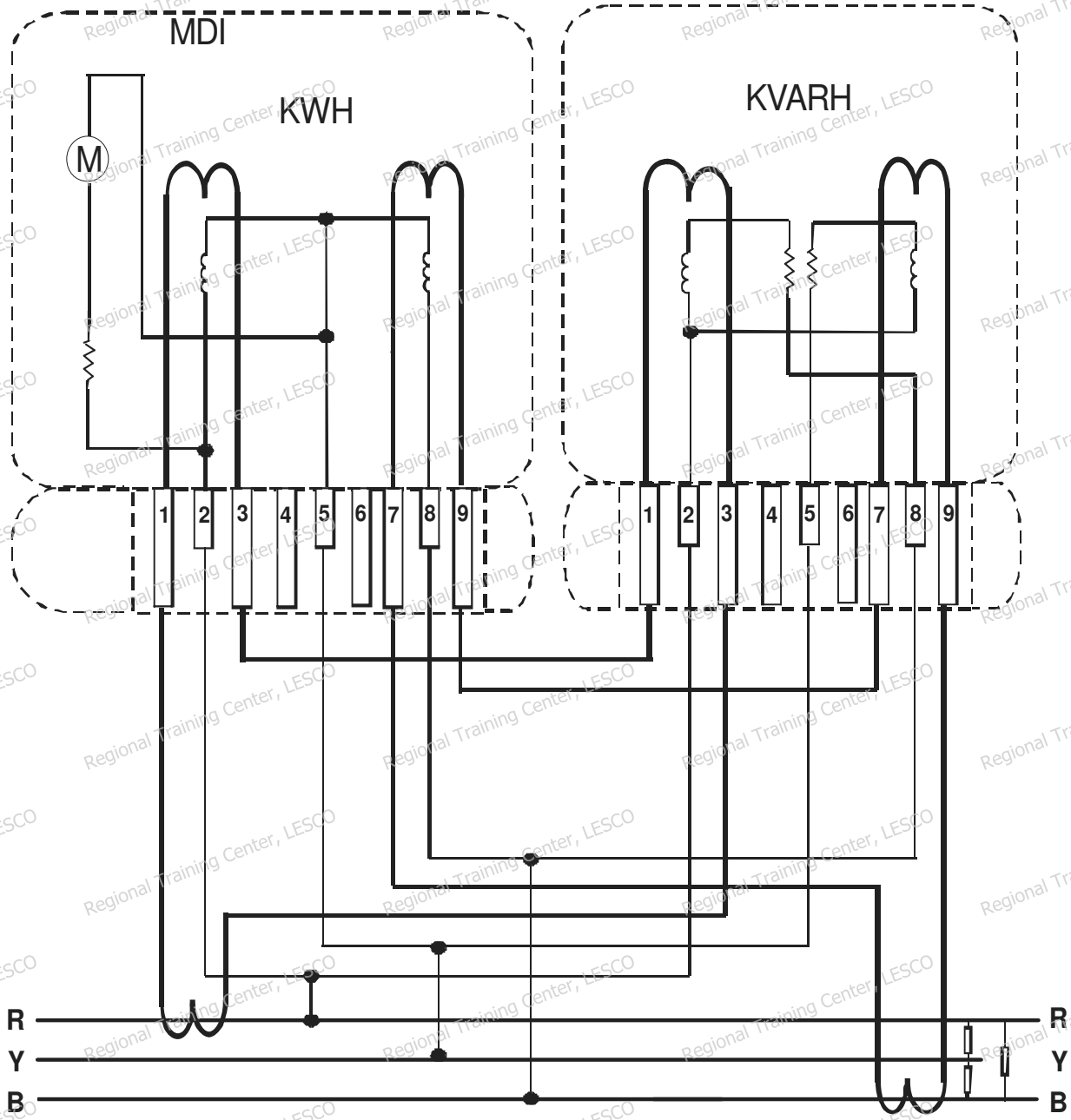
METER CONNECTIONS ARRANGEMENT L&G 3 PHASE 3 WIRE 400 VOLTS C.T. OPERATED METER WITH KWH,KVARH & MDI (KW)		
DWN.	A.E.	DATE.1.7.66
CKD.	A.D.	DIR.

WEST PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY (ENGINEERING DEPARTMENT)	NO. EW/DM-7



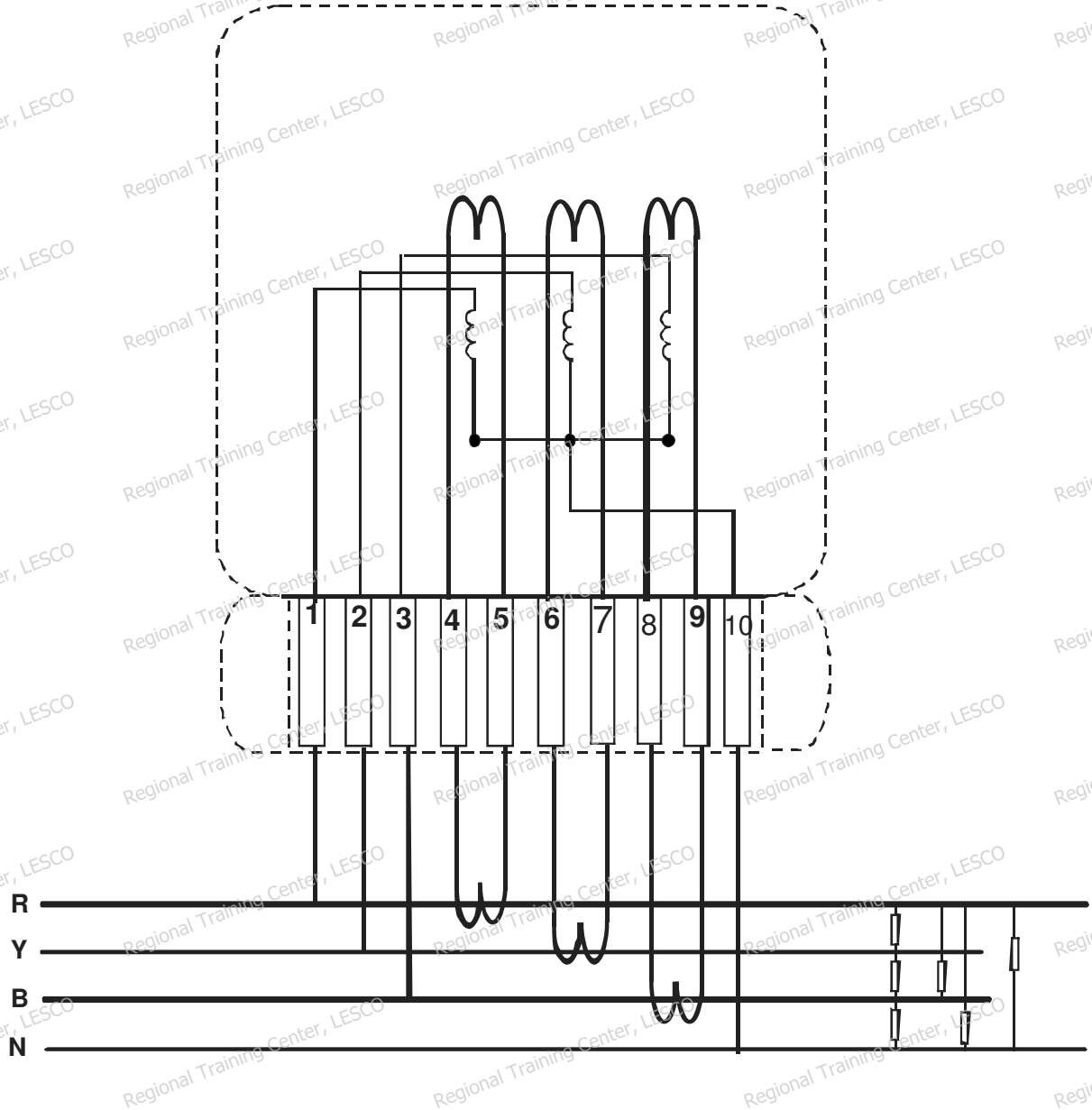
METER CONNECTIONS ARRANGEMENT 3 PHASE 3 WIRE 400 VOLTS CHAMBERLAIN-HOOKHAM COMBINATION C.T. OPERATED METER WITH KWH,KVARH & MDI (KW)		
DWN.	A.E.	DATE.29.6.66
CKD.	A.D	DIR.

WEST PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY (ENGINEERING DEPARTMENT)	NO. EW/DM-6



METER CONNECTIONS ARRANGEMENT AEG 3 PHASE, 3 WIRE, 400 VOLTS C.T. OPERATED METER WITH KWH,KVAH & MDI (KW)		
DWN.	A.E	DATE.28.6.66
CKD.	A.D.	DIR.

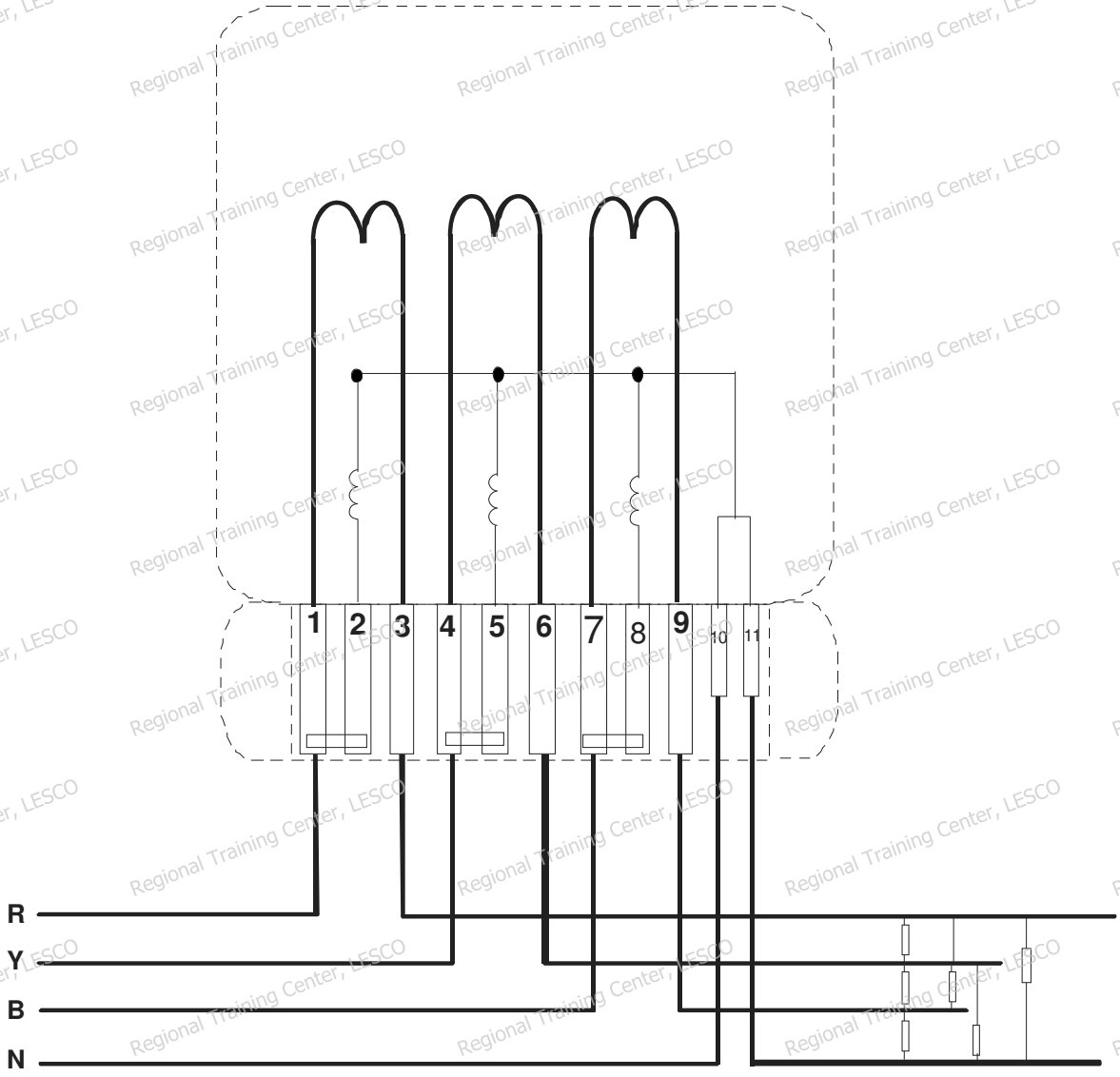
WEST PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY (ENGINEERING DEPARTMENT)	NO. EW/DM-5



METER CONNECTIONS ARRANGEMENT L & K 3 PHASE 4 WIRE 230/400 VOLTS, KWH C.T. OPERATED METER WITH OUT MDI		
DWN.	A.E	DATE.25.6.66
CKD.	A.D.	DIR.

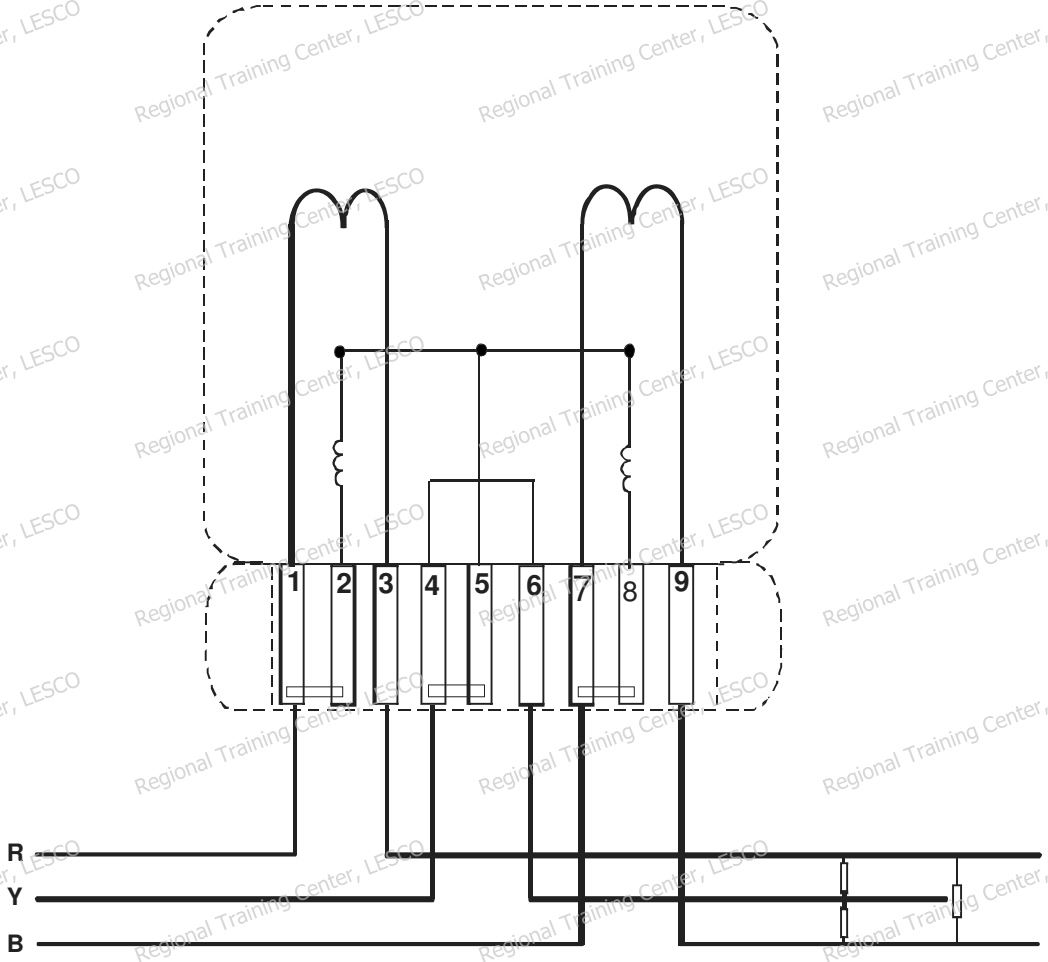
WEST PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY (ENGINEERING DEPARTMENT)	NO. EW/DM-4

NOTE:- AS THIS IS FOUR WIRE METER IT CAN BE USED TO RECORD THE CONSUMPTION OF COMBINED LOAD.



METER CONNECTIONS ARRANGEMENT 3 PHASE 4 WIRE 230/400 VOLTS (DIRECT) METER		
DWN.	A.E.	DATE.24.6.66
CKD.	A.D.	DIR.

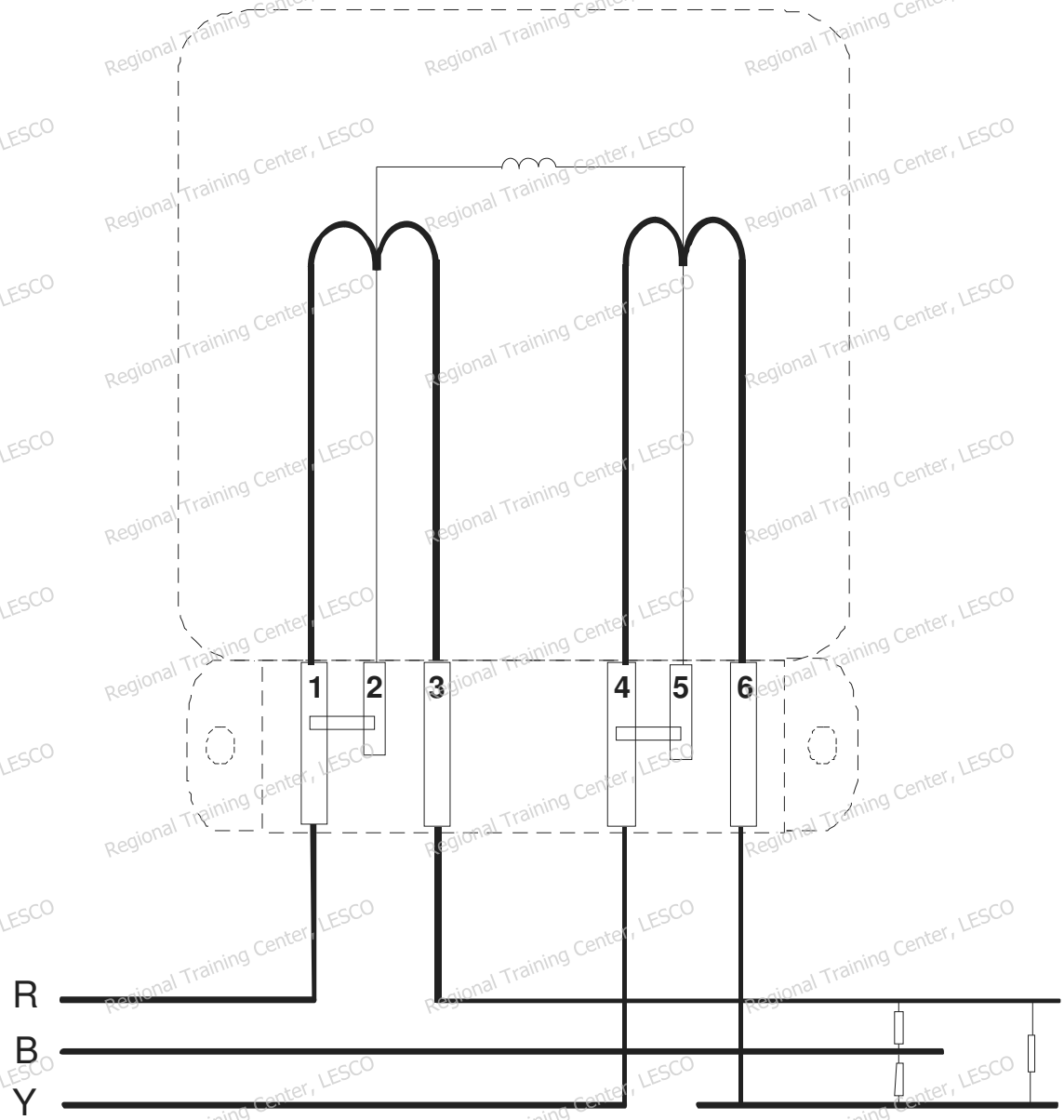
WEST PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY (ENGINEERING DEPARTMENT)	NO. EW/DM-3



NOTE:- THIS METER IS ONLY MEANT FOR BALANCED 3 PHASE LOAD. THE SINGLE PHASE LOAD CONNECTED TO THE YELLOW PHASE WILL NOT BE RECORRED.

METER CONNECTIONS ARRANGEMENT 3 PHASE 3 WIRE 400 VOLTS (DIRECT) METER		
DWN.	A.E.	DATE.23.6.66
CKD.	A.D.	DIR.

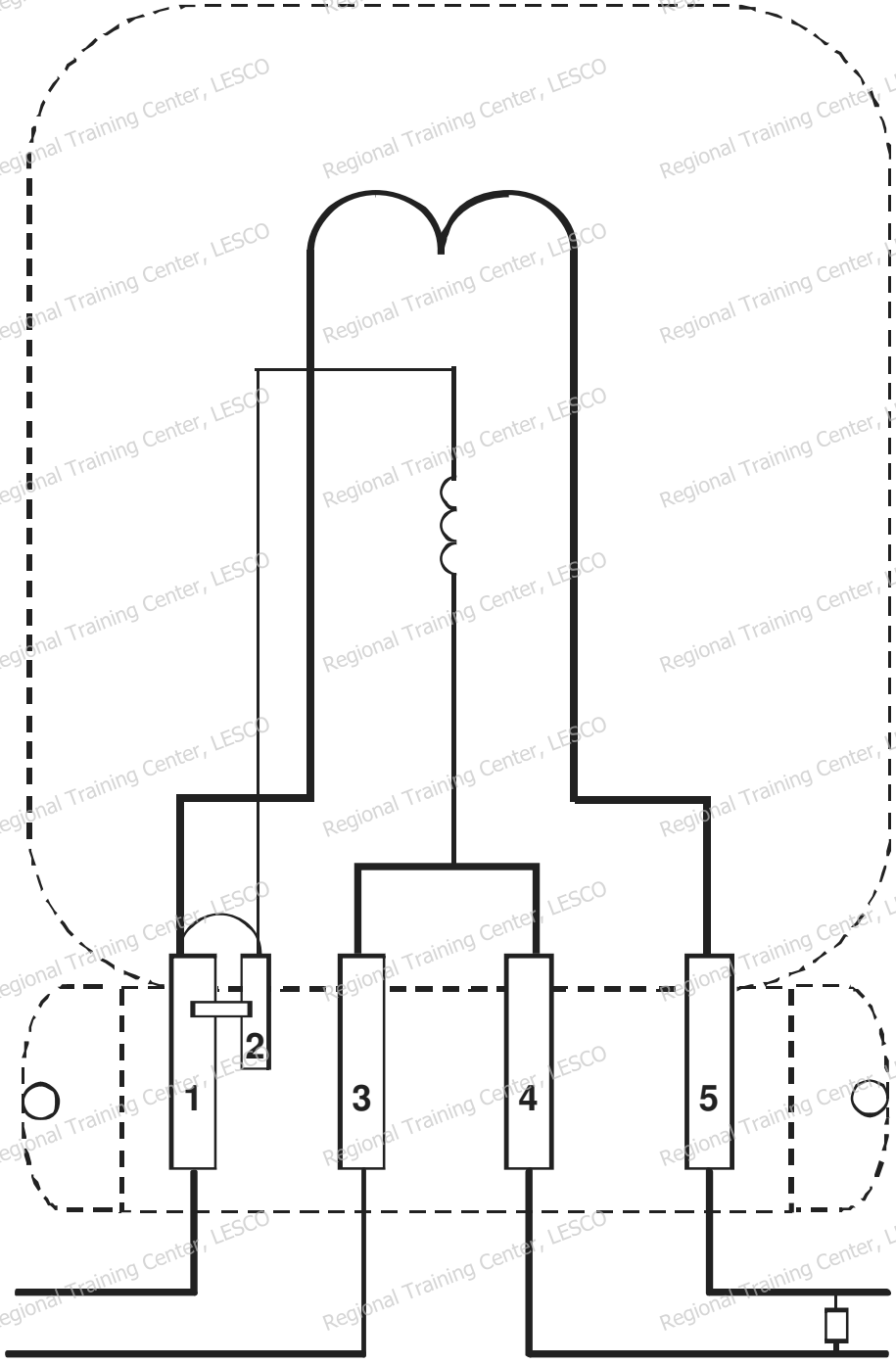
WEST PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY (ENGINEERING DEPARTMENT)	NO. EW/DM-2



NOTE:- IT IS ONLY MEANT FOR BALANCED 3 PHASE LOAD.

METER CONNECTIONS ARRANGEMENT AEG 3 PHASE 3 WIRE, 400 VOLTS BALANCE LOAD METER		
DWN.	A.E.	DATE.22.6.66
CKD.	A.D.	DIR.

WEST PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY (ENGINEERING DEPARTMENT)	NO. EW/DM-1



METER CONNECTIONS ARRANGEMENT SINGLE PHASE METER			
DWN.	ASSTT. ENGR.	DATE.13.5.66	
CKD.	ASSTT. DIR.	APPVD.	DIRECTOR

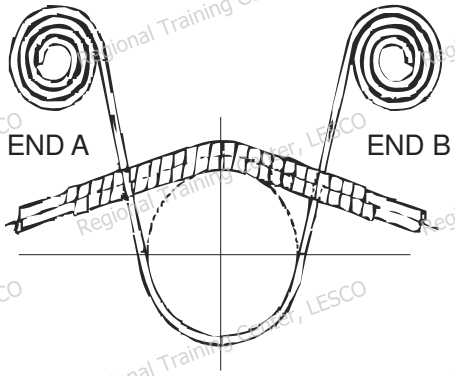


FIG 1

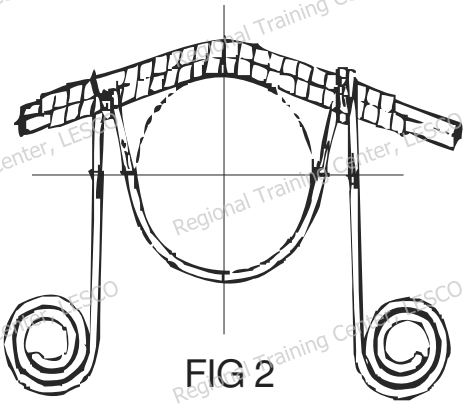


FIG 2

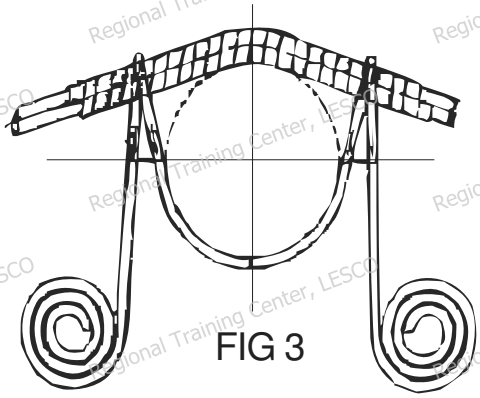


FIG 3

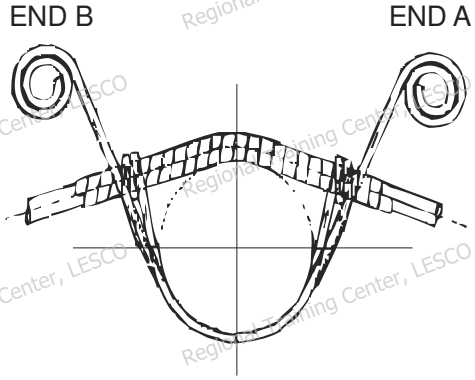


FIG 4

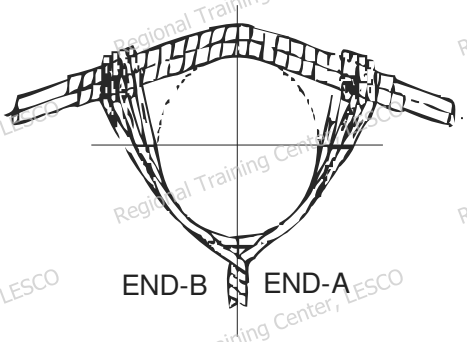


FIG 5

PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY			DESIGN DEPARTMENT
PIG TAIL TIE FOR ANGLE CONDUCTOR ON PIN INSULATOR			
DWN	A.E	SCALE	DATE
TCD	A.D	DWG NO. GW/DF-12	
CKD	DIR		

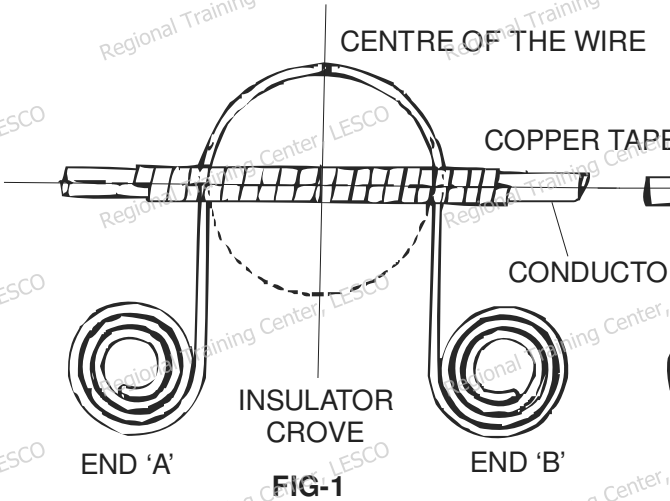


FIG-1

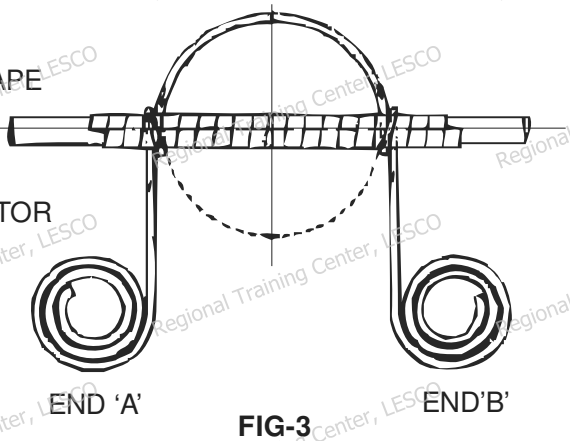


FIG-3

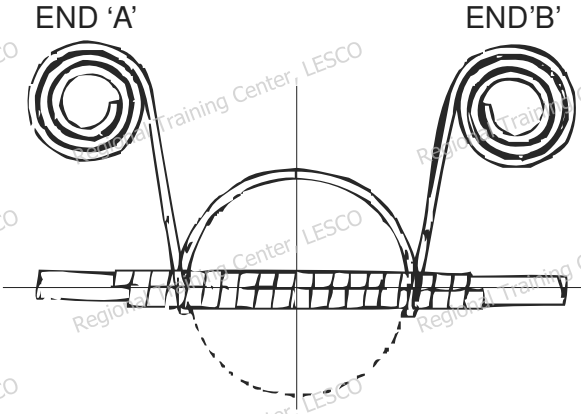


FIG-2

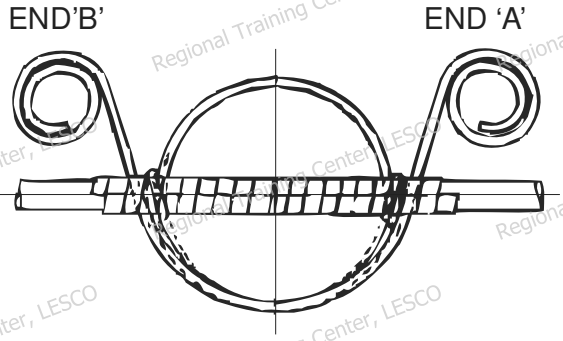


FIG-4

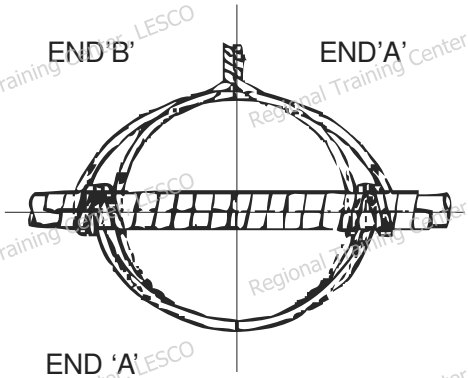
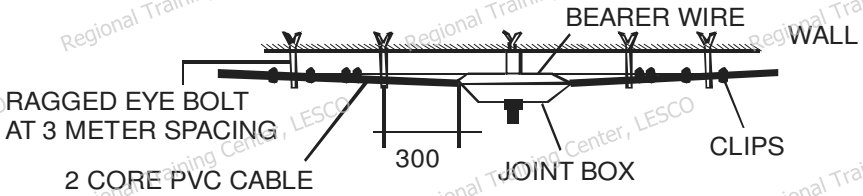
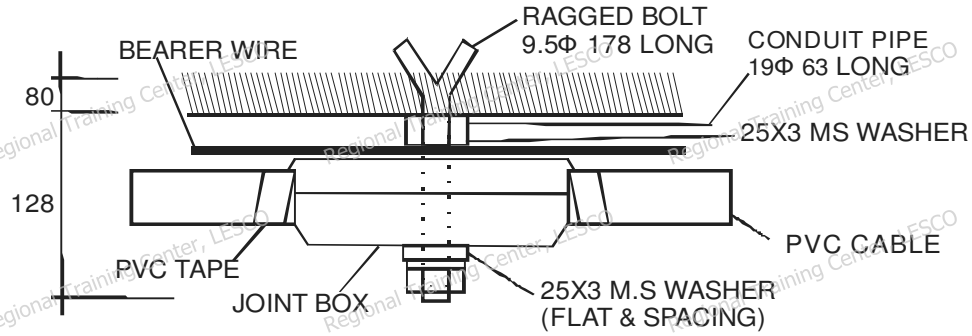


FIG-5

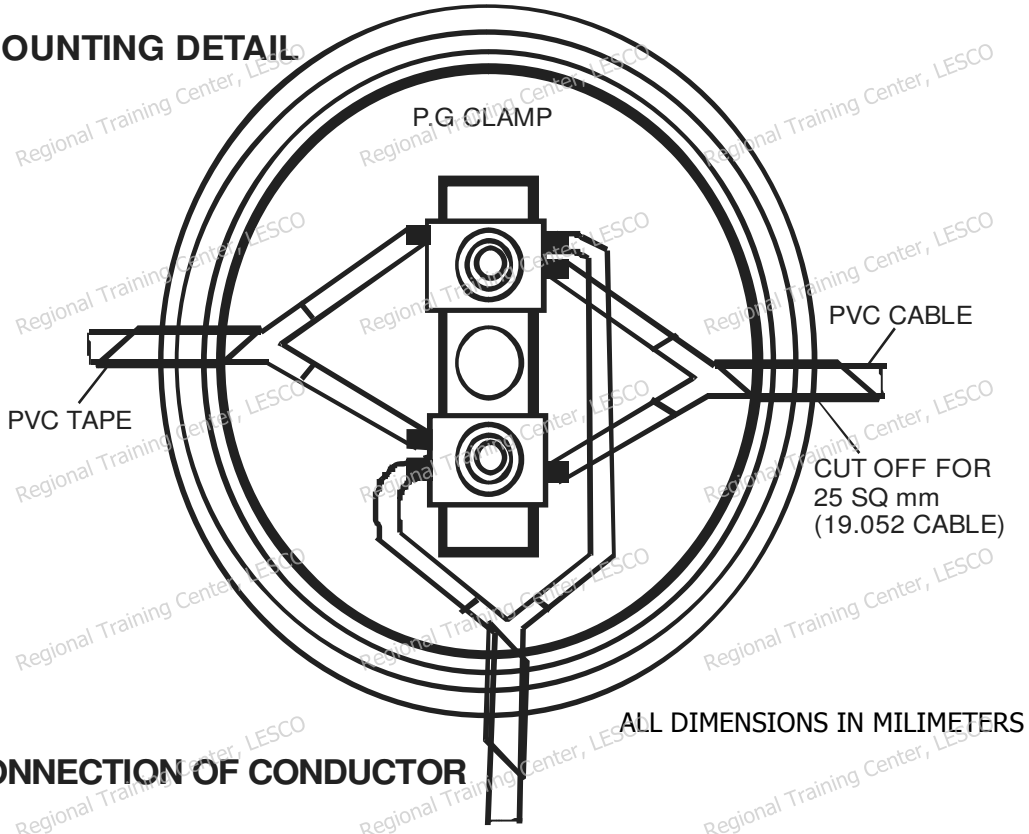
THE ENDS ARE TO BE THIRSTED WITH A PER OF PLEBS AFTER EACH HALF TURN OF THE PLEBS 1 DIA TEST SHOULD BE IN THE DIRECTION OF THE ARROW TO PROPER TEST ENDING

PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY			DESIGN DEPARTMENT
PIG TAIL TIE FOR STRAIGHT LINE PIN INSULATOR			
DWN	A.E	SCALE	DATE
TCD	A.D	DWG NO. GW/DF-11	
CKD	DIR		





MOUNTING DETAIL



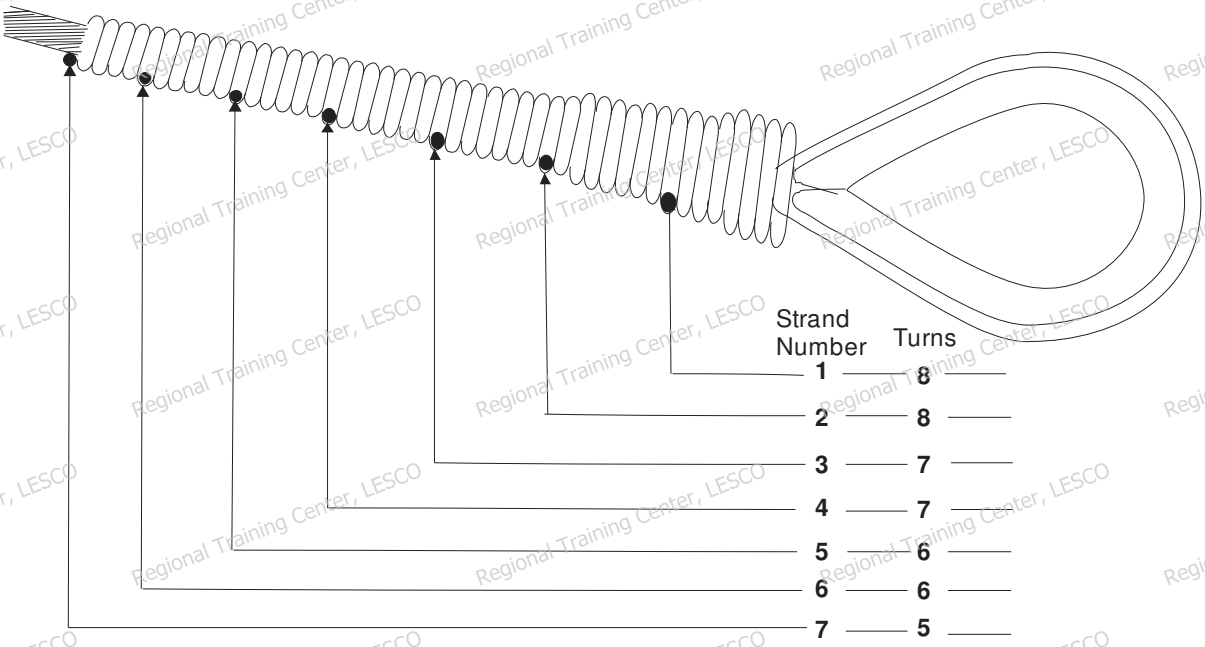
ALL DIMENSIONS IN MILIMETERS

CONNECTION OF CONDUCTOR

NOTE:-

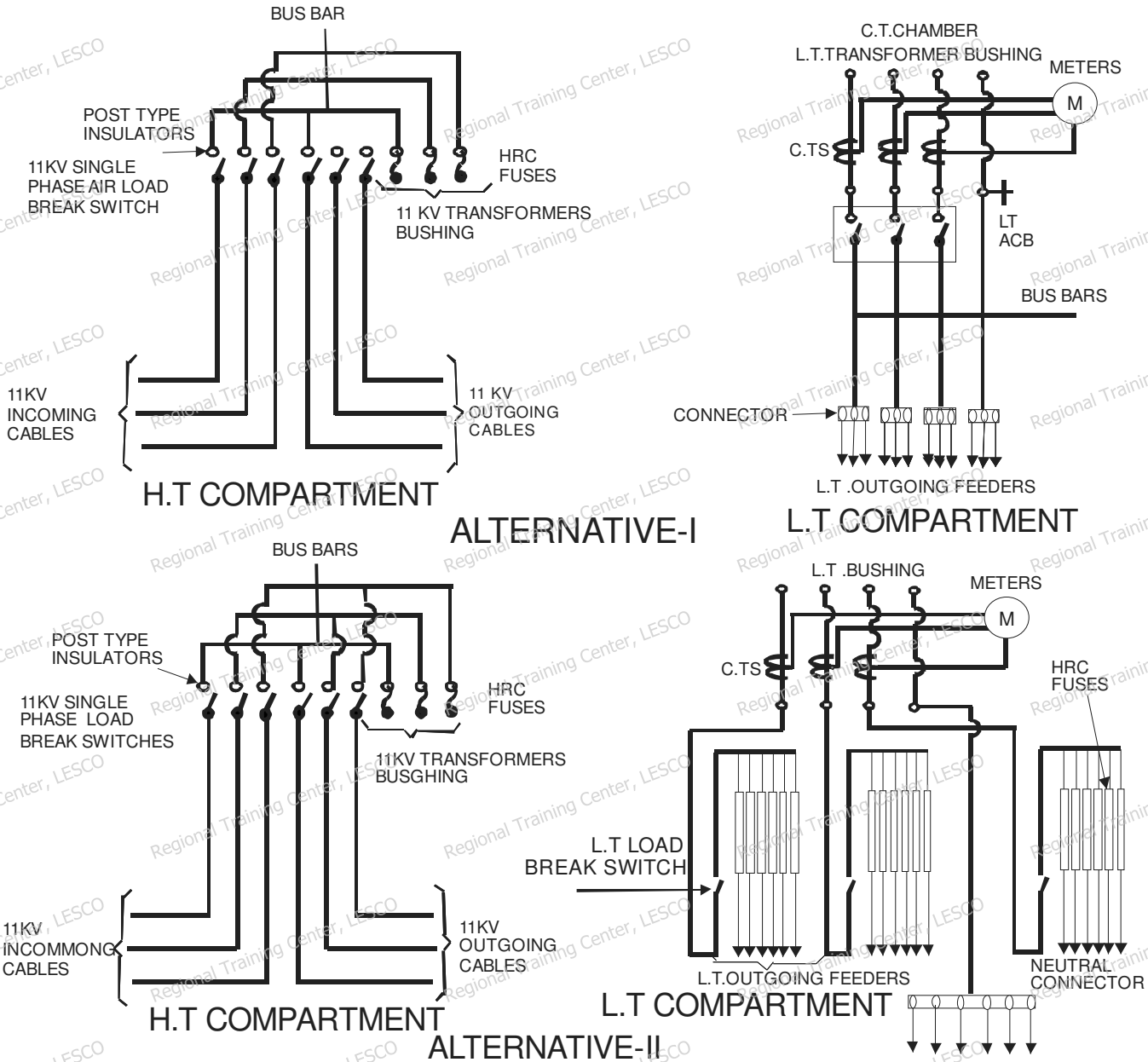
CORRECT 19/.025 TO READ AS 19/.052. THE JOINT BOX IS MENT FOR ALUMINIUM PVC CABLES AND IS SUITABLE FOR BOTH THE SIZES 7/.052 AND 19/.052 2 CORE CABLES.THE JOINT BOX HAS BEEN PROVIDED WITH STEPPED OUT LETS SO WHEN 19.052 CABLE IS TO BE USED THE FIRST STEP OF THE OUTLET SHALL BE CUT OFF FOR PROPER ENTRY OF THE CABLES. FOR MAKING TEMPORARY DISCONNECTION OF CONSUMERS. THE CONNECTORS IN THE JOINT BOX SHOULD BE REMOVED.USE THE JOINT BOX FOR TAPING SINGLE PHASE SERVICES FROM EXISTING CABLES.THE SIDE OPENINGS WILL BE USED FOR MAIN CABLE AND THE TEE OFF SHOULD BE TAKEN FROM THE LOWER OPENING.BEFORE CONNECTING THE CABLE REMOVE PVC INSULATION AND APPLY OXIDE INHIBITING COMPOUND AFTER BRUSHING THE CONDUCTOR. PROVIDE PVC ADHESIVE TAP,AT BOTH THE SIDE OPENINGS TO PREVENT ENTRY OF WATER AND MOISTUR.

PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY			DESIGN AND STANDARD
INSTALLATION OF PVC JOINT BOX FOR TWIN CORE L.T CABLE			
DWN	A.E	SCALE	DATE: 19-1-70
TCD	A.D	DWG NO.	
CKD	DIR		



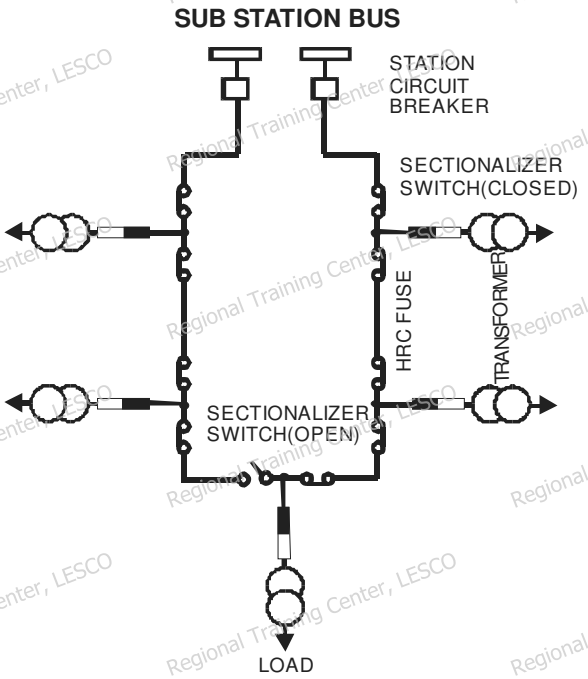
PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY			DESIGN DEPARTMENT
DETAIL SHOWING THE NOZZLING OF STAY WIRE ON TO AN ORDNARY THIMBLE			
DWN	A.E	SCALE	DATE
TCD	A.D	DWG NO. GW/DF-10	
CKD	DIR		

PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY	DWG.NO. PDW/DF-72

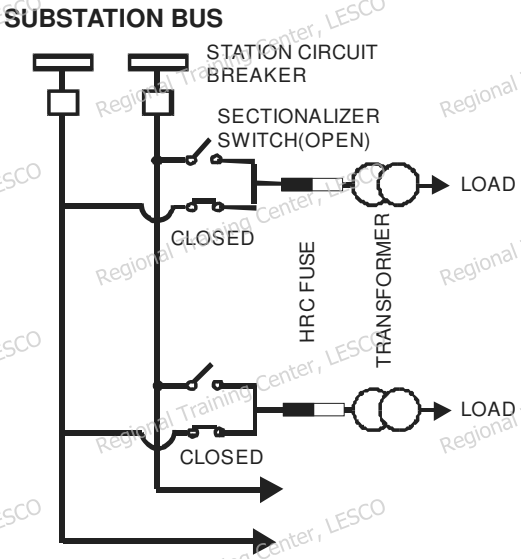


PICTORIAL REPRESENTATION OF 3 PHASE PADMOUNTED TRANSFORMER		
DWN	A.E	P & D DEPARTMENT
TCD	A.D	SCALE:
CKD	DIR	DATE:06.11.1970

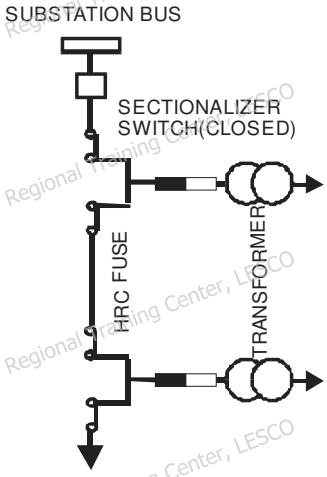
PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY	NO. PDW/DF-71



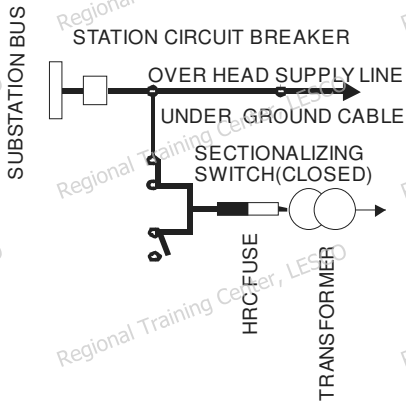
OPEN LOOP SYSTEM



DOUBLE SUPPLY SYSTEM

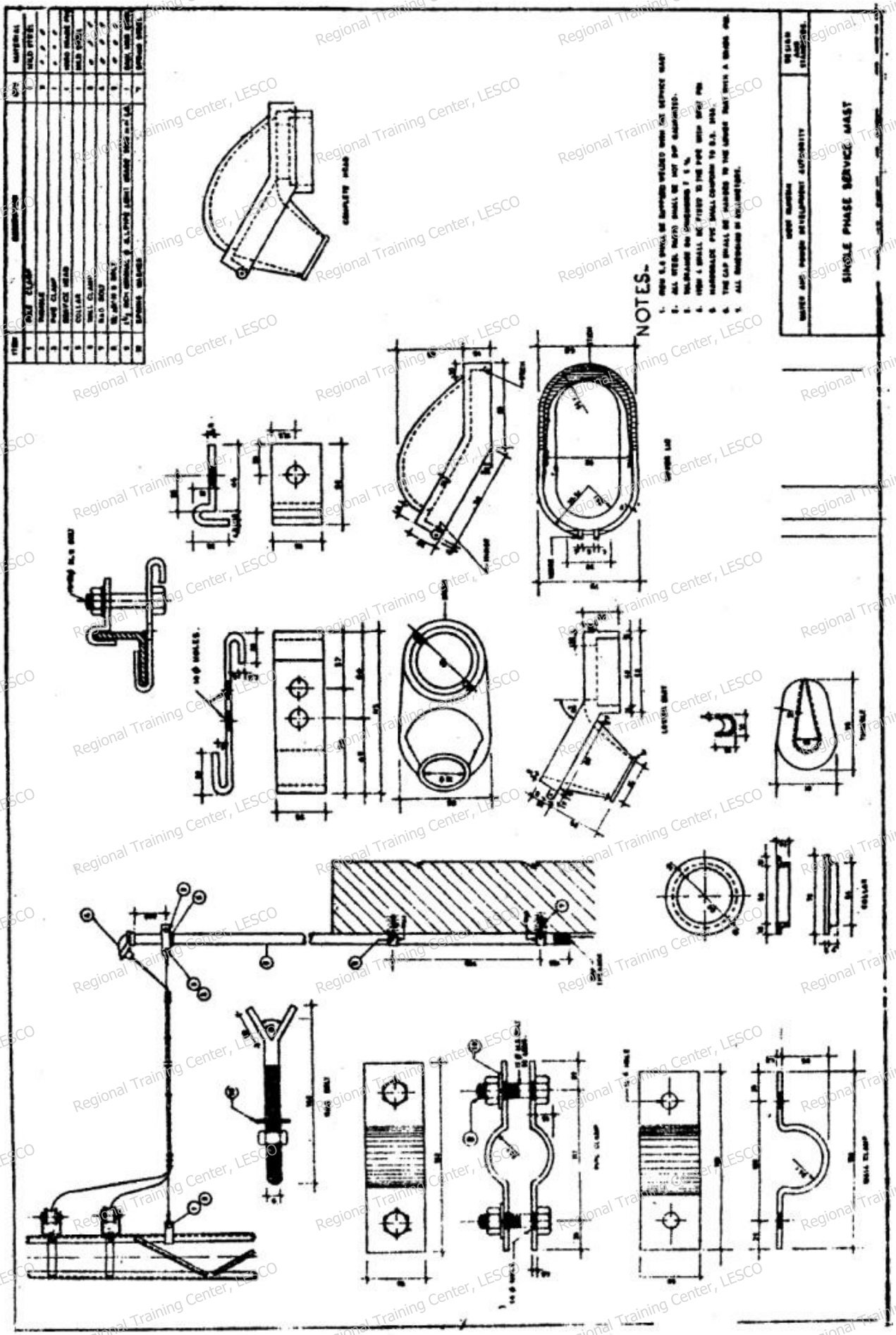


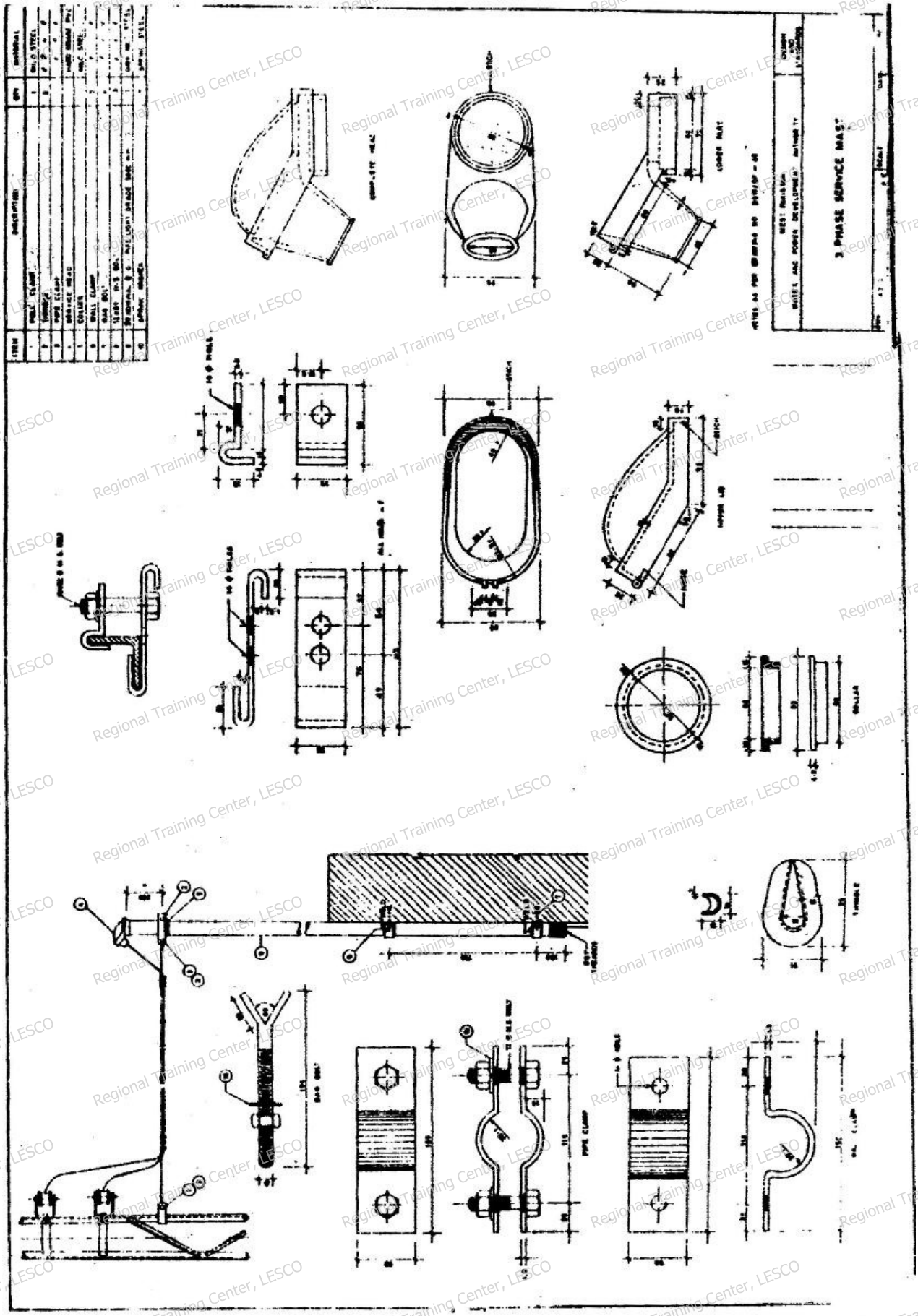
RADIAL SYSTEM
(UNDER GROUND)

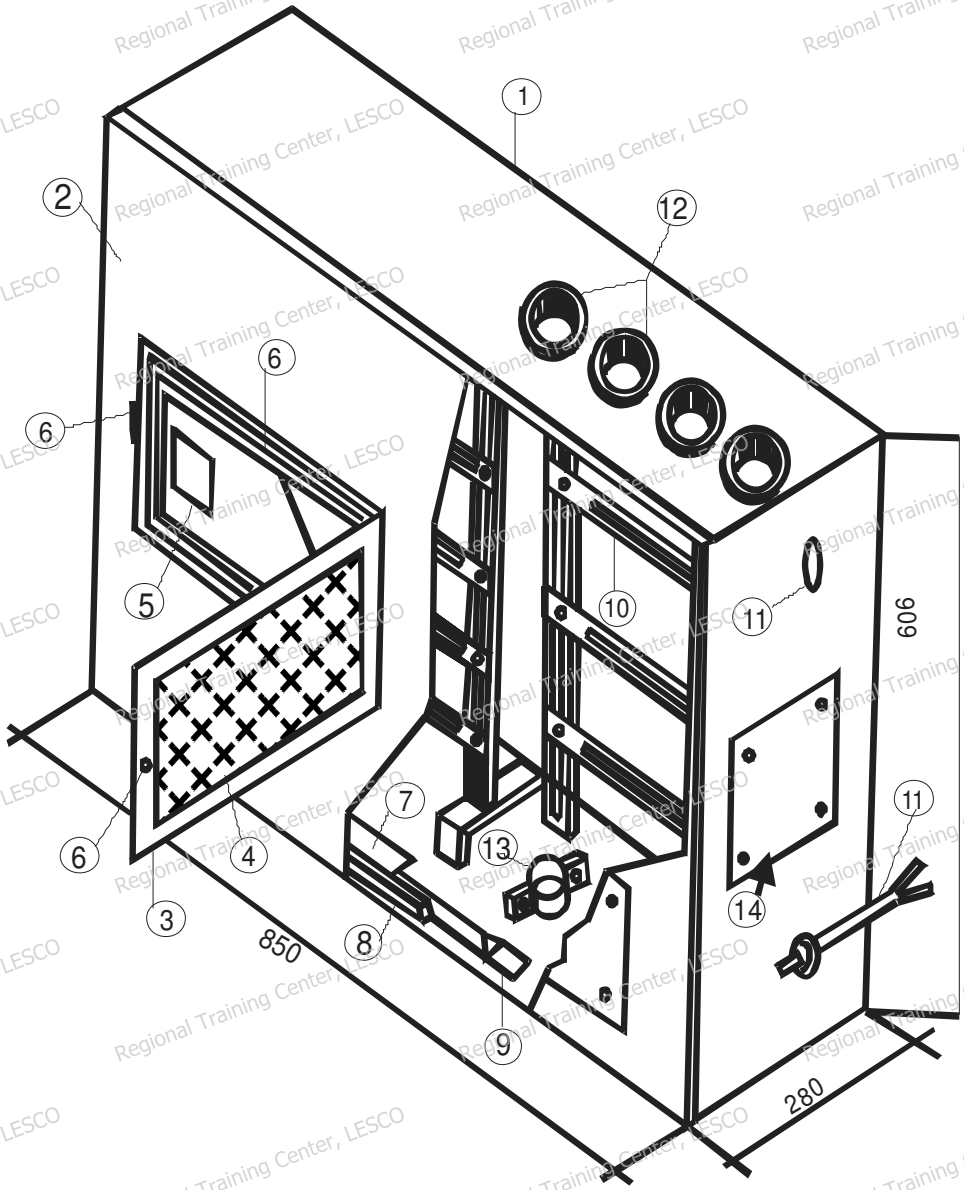


OVERHEAD SUPPLY SYSTEM

POWER SUPPLY SYSTEM		
DWN	A.E	PLANNING AND DESIGNS
TCD	A.D	SCALE
CKD	DIRECTOR	DATE:19.07.1971
CKD	DIRECTOR	

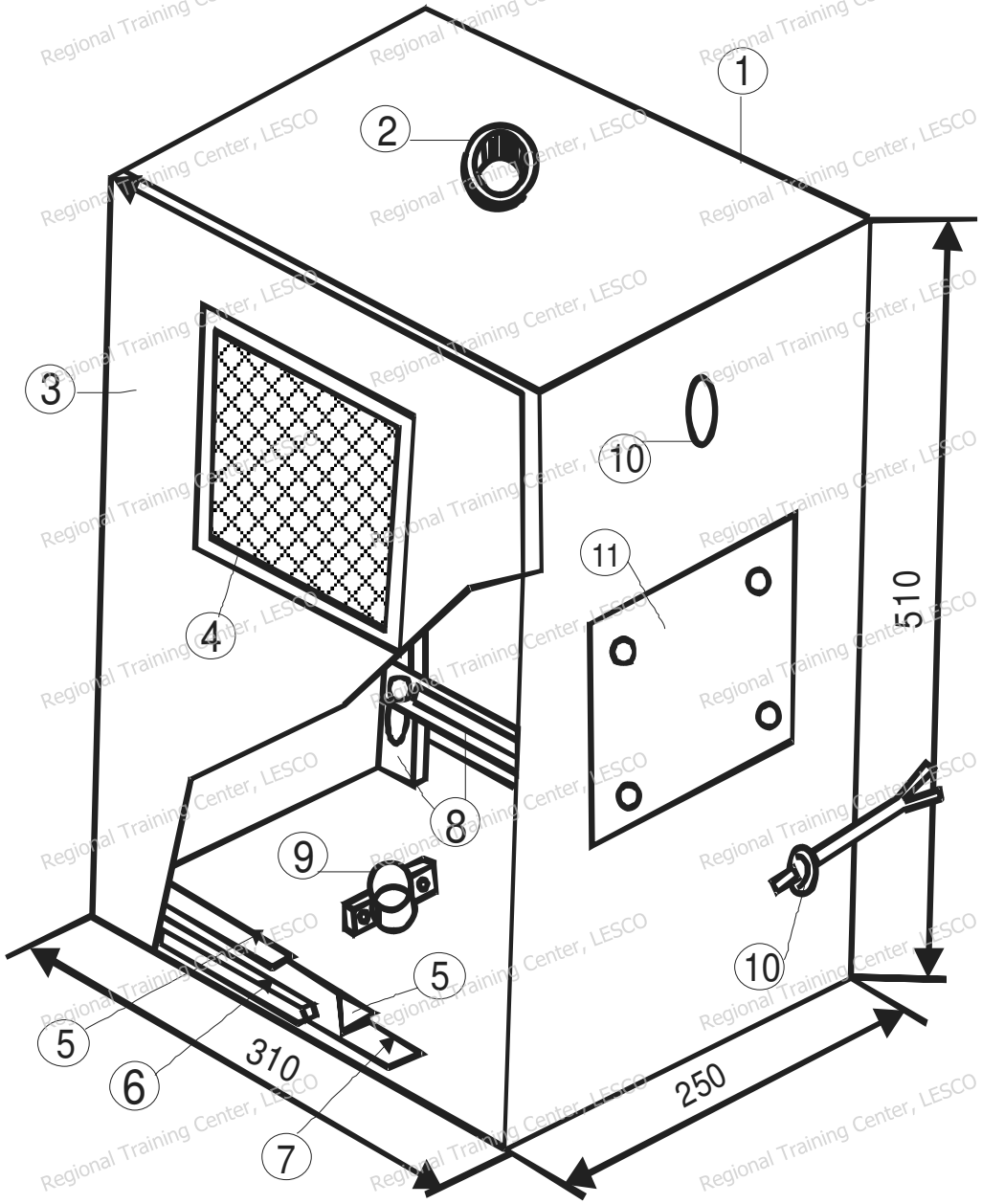



3 PHASE SERVICE MAST



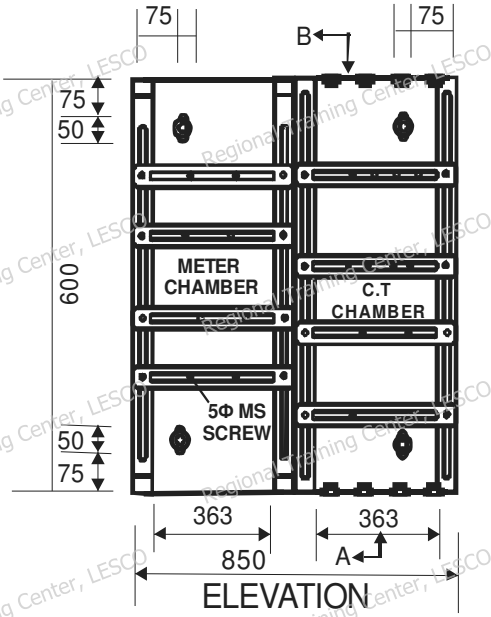
1.	MAIN BODY	8.	RUBBER LINING
2.	FRONT COVER	9.	M.S. FLAT
3.	HINGED DOOR	10.	EQUIPMENT MOUNTING ARRENGEMENT
4.	WINDOW	11.	RAG SCREW BOLTS
5.	GLASS SHEET WITH OPENING FOR M.D.I	12.	RUBBER BUSH STEEL CLAMP FOR INCOMING CABLES
6.	SEALING AND LOOKING ARRENGEMENT	13.	RUBBER BUSH STEEL CLAMP FOR OUT GOING CABLES
7.	LATCHING ARRENGEMENT	14.	CELLUEOID COVER RUBBER RING

PAKISTAN WATER AND POWER DEEVELOPMENT AUTHORITY			**DESIGN DEPARTMENT**
SECURITY METER BOX TYPE 'A'			
DWN	A.E	SCALE	DATE
TCD	A.D	DWG.NO. PDW/DF-	
CKD	DIRECTOR		

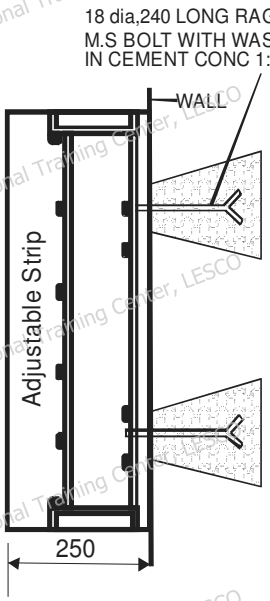


1.	MAIN BODY.	7.	M.S FLAT.
2.	RUBBER BUSH.	8.	METER MOUNTING ARRANGEMENT.
3.	FRONT COVER.	9.	STEEL CLAMP.
4.	WINDOW.	10.	RAG SCREW BOLTS.
5.	LATCHING ARRANGEMENT.	11.	CELLULOID COVER FITTED WITH BOLTS.
6.	RUBBER LINING.		

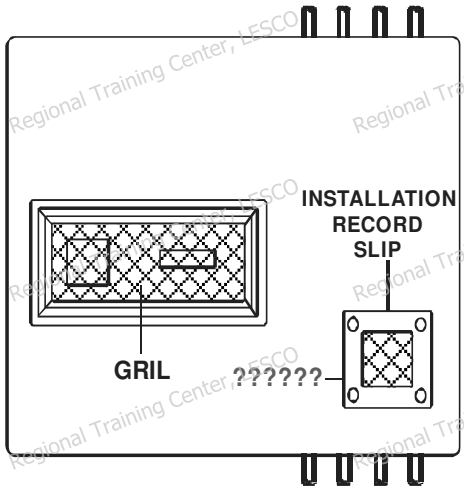
PAKISTAN WATER AND POWER DEEVELOPMENT AUTHORITY			**DESIGN DEPARTMENT**
SECURITY METER BOX TYPE 'B'			
DWN	A.E	SCALE	DATE .06.76
TCD	A.D	DWG.NO. PDW/DF-162	
CKD	DIRECTOR		



ELEVATION

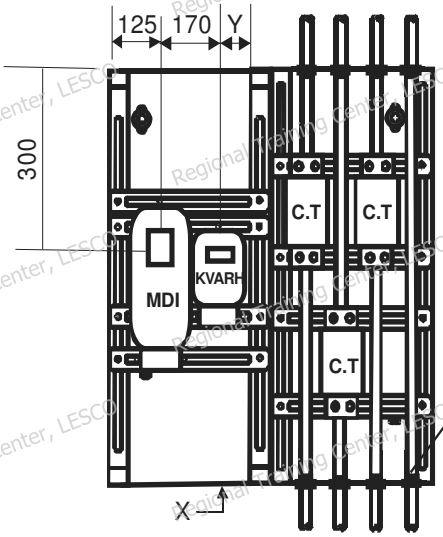


SECTION A-B

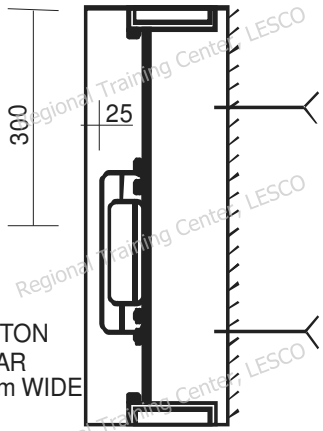


SEALING ARRANGEMENTS AFTER INSTALLING THE COVER

Z WALL MOUNTING ARRANGEMENT



ELEVATION

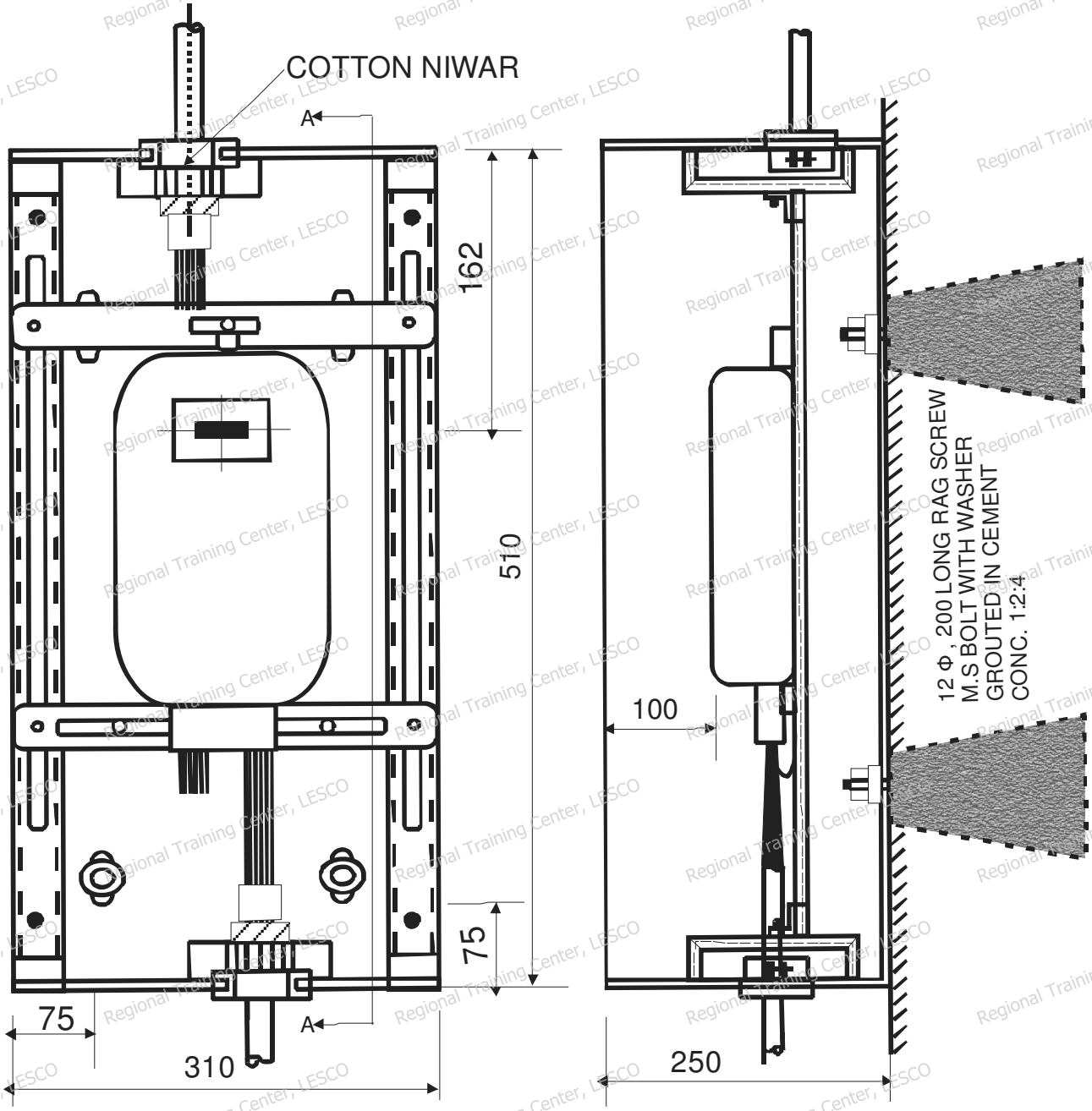


SECTION X-Y

NOTE:
METERS & C.Ts CONNECTION NOT SHOWN FOR CLARIFICATION. THESE SHALL BE IN ACCORDANCE WITH T.O-7

INSTALLATIONS OF METERS & C.Ts

PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY			DESIGNS DEPARTMENT
INSTALLATION OF TYPE 'A' METER BOX			
DWN	A.E	SCALE	DATE
TCD	A.D	DWG.NO. PDW/DF-259	
CKD	DIR.		



NOTE: FRONT COVER NOT SHOWN FOR CLARIFICATION.

WEST PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY			DESIGN DEPARTMENT
INSTALLATION OF TYPE ' B ' METER BOX			
DWN.	A.E.	SCALE	DATE.24.3.77
TCD.	A.D	DWG.NO.	
CKD.	DIR.	PDW/DF-260	

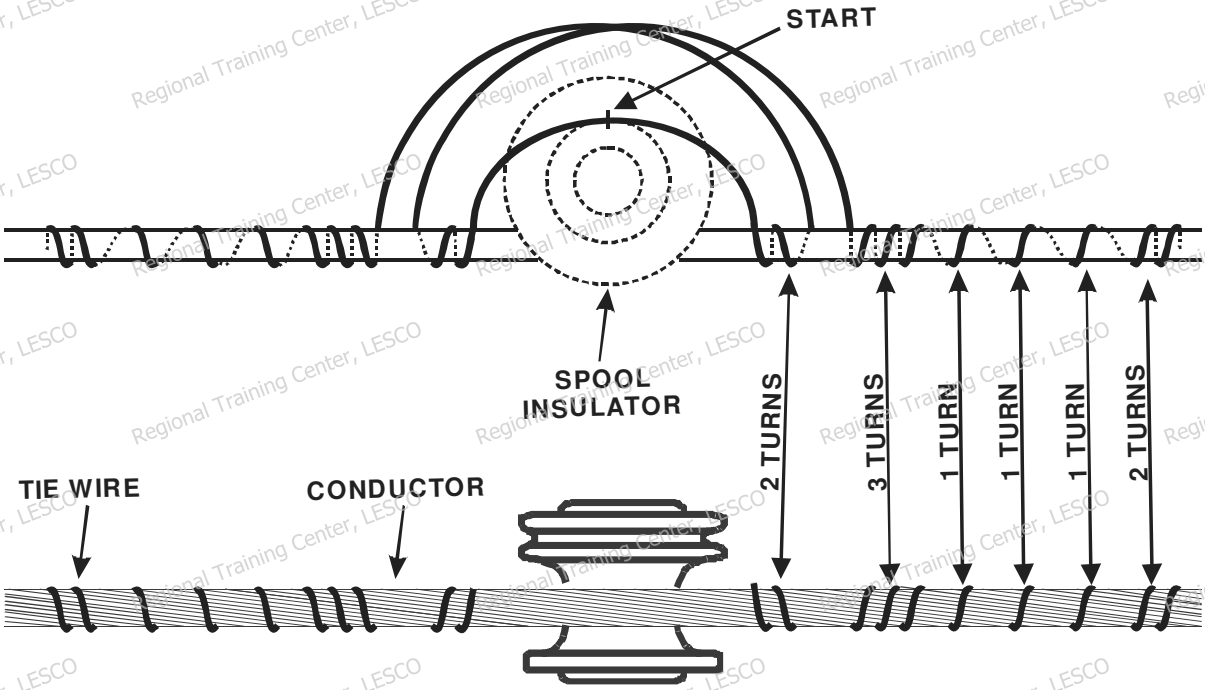
WATER AND POWER DEVELOPMENT AUTHOIRTY						
INSTALLATION RECORD SLIP						
Ref #	C.T Factor	C.T Meter		Signature & Name General or Connection Covering on meters/CTs		
		No.	MRN	Consumer		Meter Check by M&T
5	10	10	10	20	20	20

Material:-

Equivalent or better than ledger paper of 80 gsm

WEST PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY			DESIGN DEPARTMENT
INSTALLATION RECORD SLIP FOR SECURTIY MERTER BOXES			
DWN.	A.E.	SCALE	DATE.09-02-77
TCD.	A.D	DWG.NO. PDW/DF-261	
CKD.	DIR.		

WEST PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY	No EW/DF-263



Conductor	Length
Wasp	7 ft
Ant	6 ft
GNat	5 ft

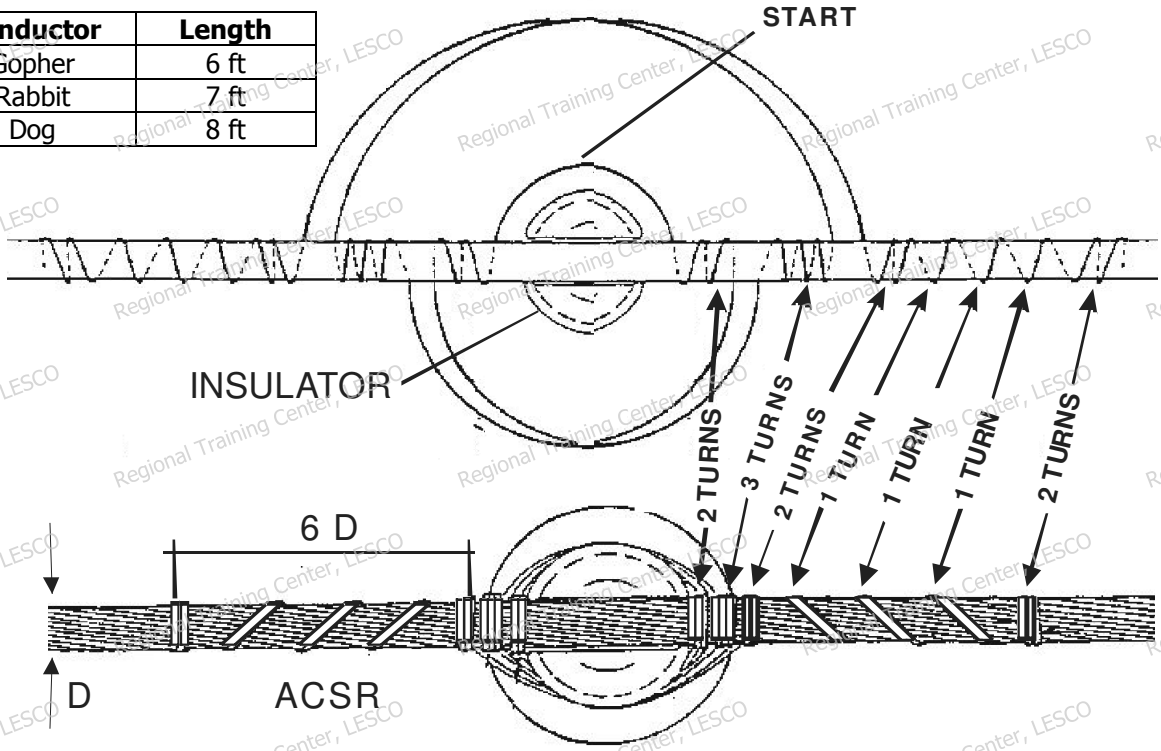
NOTE:

1. Starting Point For Making Ties is Middle Of Length Of The Tie Wire.
2. Make Tie As Snug And Tight As Possible.
3. The Wire Ends Should Not Be Left Protruding But Should Be Finished Tightly On The Conductor.
4. Used On Salvaged Tie Wire Should Not Be Re-used.
5. Tie Wire Material - All Aluminum Annealed 4 mm Dia.

TIE WIRE APPLICATION GUIDE FOR LT INSULATOR			
DWN.	A.E.	SCALE	DATE: 12-8-67
TCD.	A.D	DWG.NO.	
CKD.	DIR.	EW/DF-263	

DOUBLE TOP TIE FOR STRAIGHT LINE POSITION

Conductor	Length
Gopher	6 ft
Rabbit	7 ft
Dog	8 ft

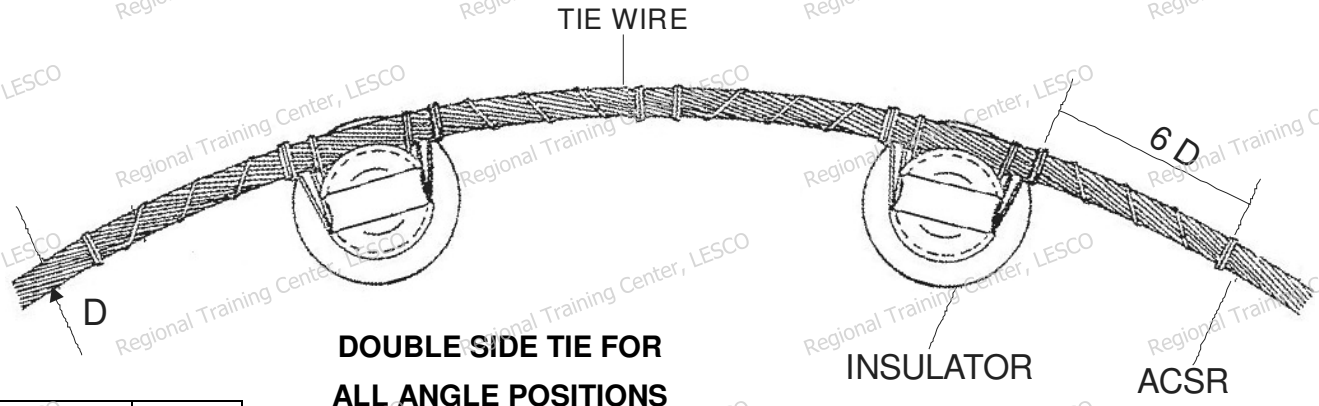


SINGLE TOP TIE FOR STRAIGHT LINE POSITION

NOTE :

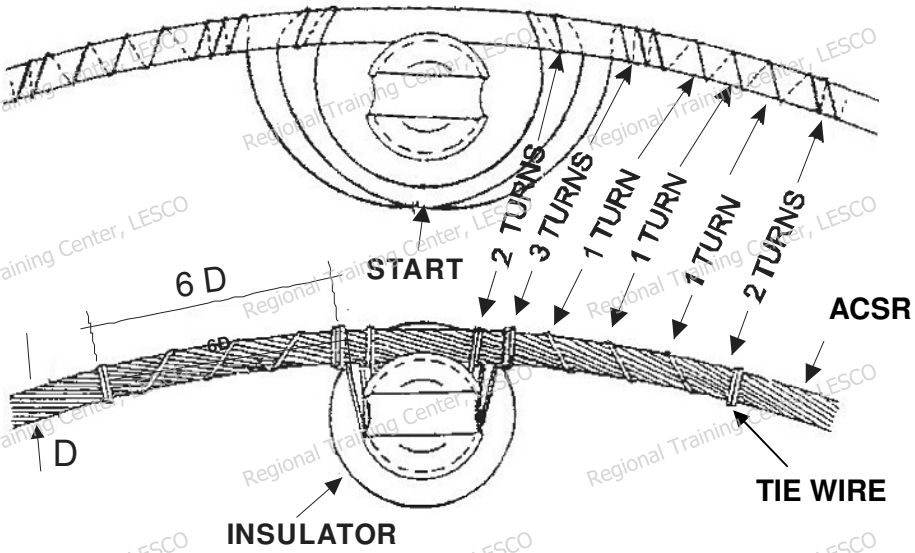
1. Starting Point For Making Ties is Middle of Length of Tie Wire.
2. Avoid tie wire crossover in neck of insulator
3. Make Tie As Snug And Tight As Possible
4. Tie Wire Ends Should Not Be Left Protruding But Should Be Finished Tightly On The Conductor
5. Used or Salvaged Tie Wire Should Not Be Re-used.
6. Tie Wire Material - All Aluminum Annealed 4mm Dia.

WEST PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY			ENGINEERING DEPARTMENT
TIE WIRE APPLICATION GUIED FOR TOP TIE ON 11KV PIN INSULATOR			
DWN.	A.E.	SCALE	DATE.16-08
TCD.	A.D	DWG.NO. EW/DF-264	
CKD.	DIR.		



DOUBLE SIDE TIE FOR
ALL ANGLE POSITIONS

Conductor	Length
Gopher	5 ft
Rabbit	6 ft
Dog	7 ft



SINGLE SIDE TIE FOR ALL ANGLE POSITIONS

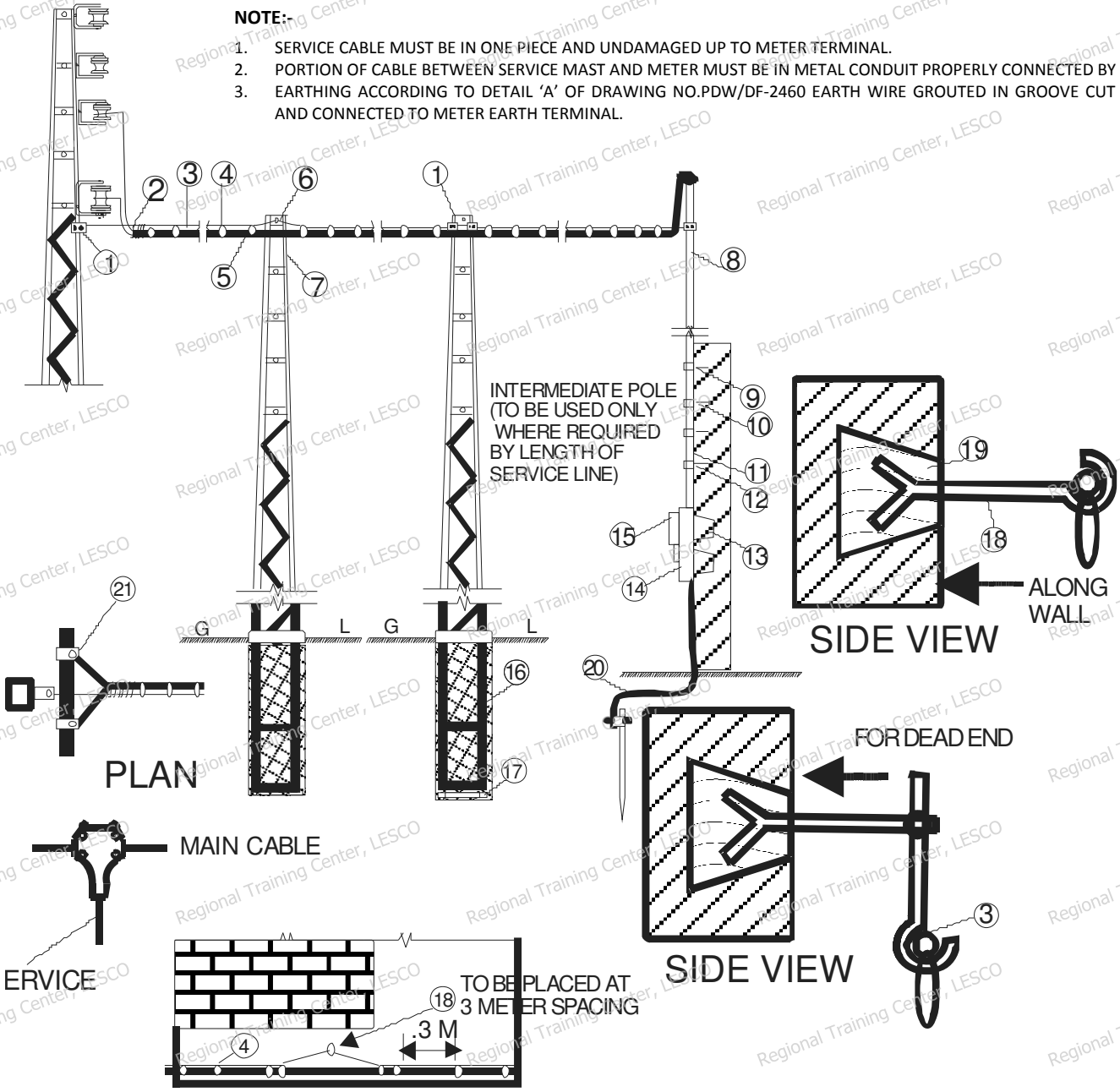
NOTE:

1. STARTING POINT FOR MAKING TIES IS MIDDLE OF LENGTH OF THE TIE WIRE.
2. AVOID TIE WIRE CROSSOVER IN NECK OF INSULATOR
3. MAKE TIE AS SNUG AND TIGHT AS POSSIBLE
4. 4.TIE WIRE ENDS SHOULD NOT BE LEFT PROTRUDING BUT SHOULD BE FINISHED TIGHTLY ON THE CONDUCTOR
5. USED OR SALVAGED TIE WIRE SHOULD NOT BE RE-USED.
6. TIE WIRE MATERIAL - ALL ALUMINUM ANNEALED 4mm DIA.

WEST PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY			**ENGINEERING DEPARTMENT**
TIE WIRE APPLICATION GUIED FOR SIDE TIES ON 11KV PIN INSULATOR			
DWN.	A.E.	SCALE	DATE.16-08-67
TCD.	A.D	DWG.NO. EW/DF-265	
CKD.	DIR.		

NOTE:-

1. SERVICE CABLE MUST BE IN ONE PIECE AND UNDAMAGED UP TO METER TERMINAL.
2. PORTION OF CABLE BETWEEN SERVICE MAST AND METER MUST BE IN METAL CONDUIT PROPERLY CONNECTED BY SLEEVES.
3. EARTHING ACCORDING TO DETAIL 'A' OF DRAWING NO.PDW/DF-2460 EARTH WIRE GROUTED IN GROOVE CUT IN WALL AND CONNECTED TO METER EARTH TERMINAL.



CABLE ALONG WALL

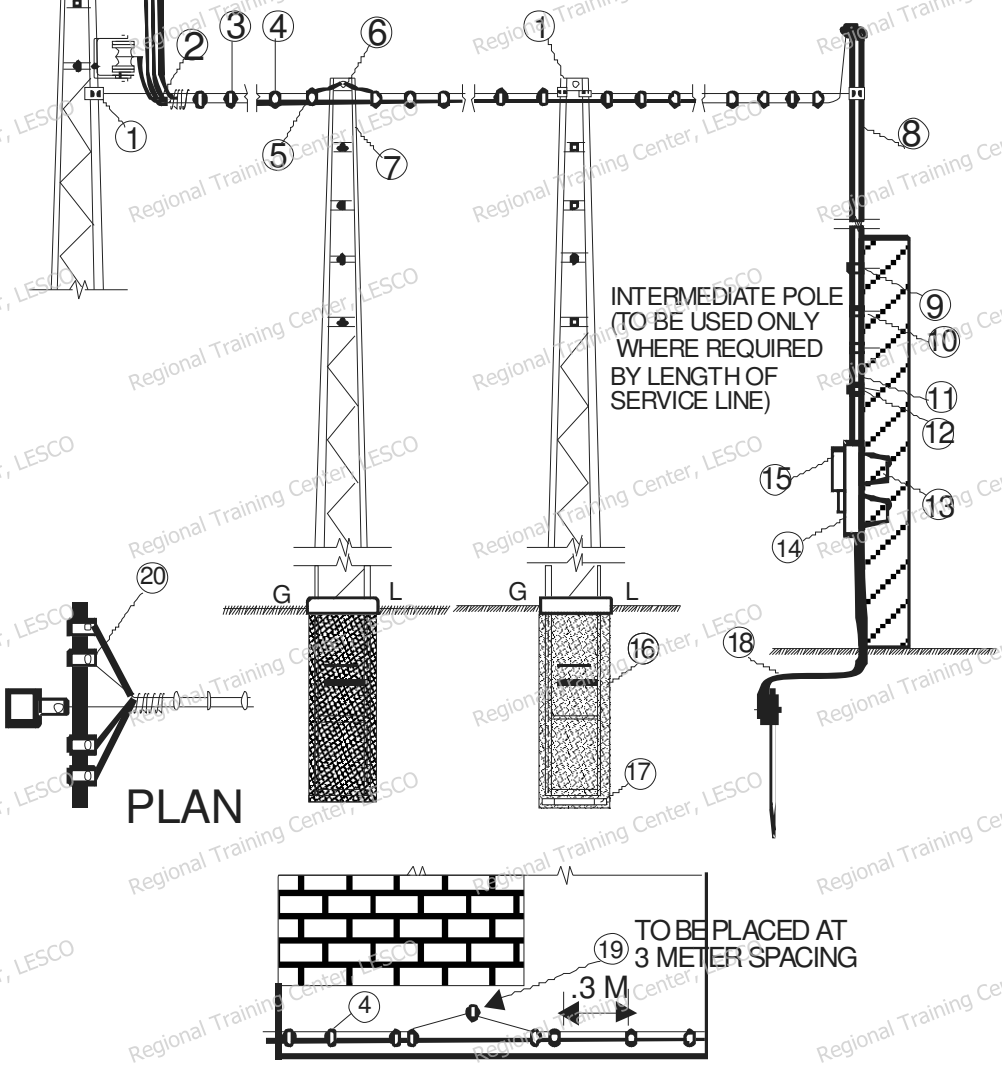
Sr#	Description	Drawing No
1	POLE CLAMP WITH THIMBLE	
2	TIE WIRE	SPEC P-22
3	BEARER WIRE	SPEC P-12
4	CLIPS	
5	2 CORE L.T. CABLE	PD-27
6	EYE SCROW BOLT 16X50 mm	
7	LATTICE STEEL STRUCTURE 9.4M	SPEC P-34
8	SERVICE MAST PIPE.	SDI-55
9	WALL CLAMP	SDI -55
10	RAG BOLT	SDI - 55
11	METAL CONDUIT PIPE 37 mm DIA	

Sr#	Description	Drawing No
12	HOOKS	
13	WOODEN GATTIES	
14	METER BOARD	PD-100 D
15	1 PHASE METER	SPEC P-2
16	FOUNDATION FOR STRUCTURE	
17	PAD	
18	EYE RAG BOLTS 16 X 250 mm	
19	CONCRETE	
20	EARTHING ARRANGEMENT	SDI-59 & NOTE.3
21	P.G CONNECTOR	SPEC P-25

PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY		ENGINEERING DEPARTMENT	
SINGLE PHASE CABLE SERVICE			
DWN.	A.E.	SCALE	DATE: 1-4-79
TCD.	A.D.	DWG.NO. PDW/DF-290	
CKD.	DIR.		

NOTE:-

1. SERVICE CABLE MUST BE IN ONE PIECE AND UNDAMAGED UP TO METER TERMINAL.
2. PORTION OF CABLE BETWEEN SERVICE MAST AND METER MUST BE IN METAL CONDUIT PROPERLY CONNECTED BY SLEEVES.
3. EARTHING ACCORDING TO DETAIL 'A' OF DRAWING NO.PDW/DF-2460 EARTH WIRE GROUTED IN GROOVE CUT IN WALL AND CONNECTED TO METER EARTH TERMINAL.

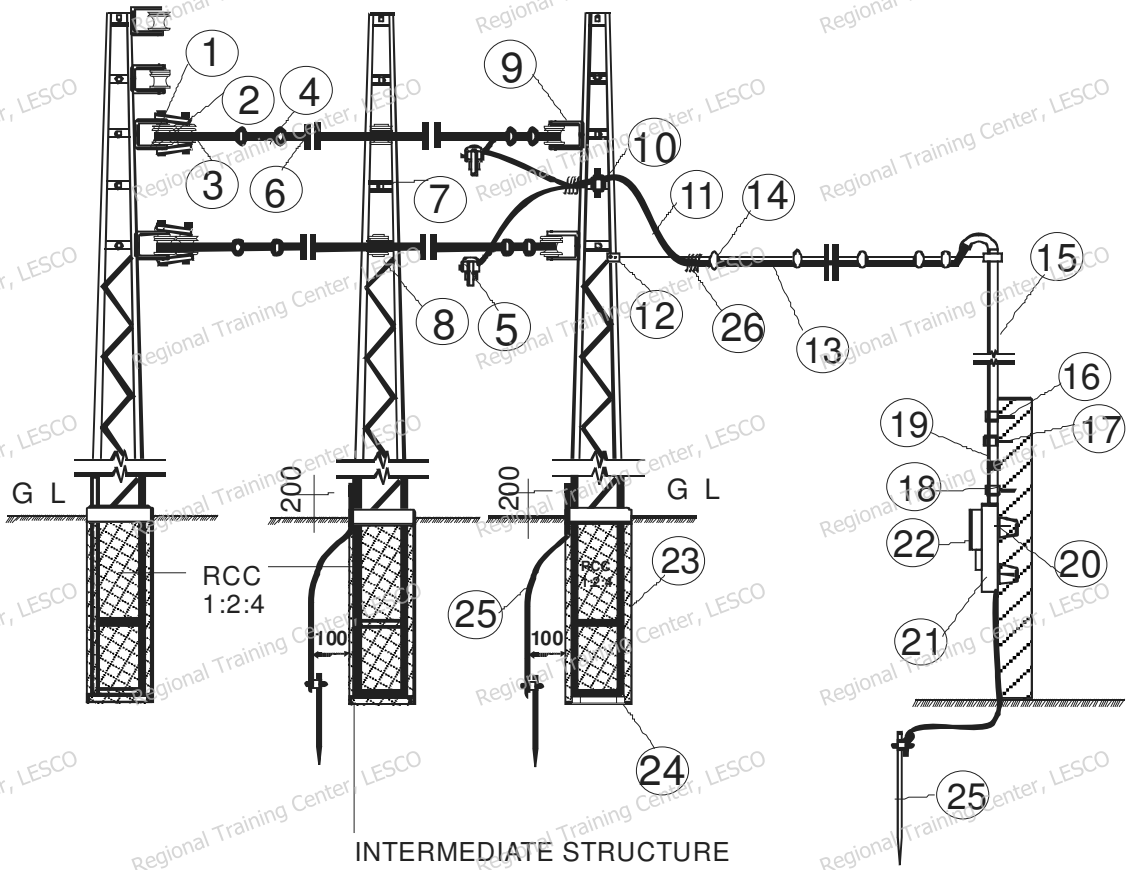


CABLE ALONG WALL

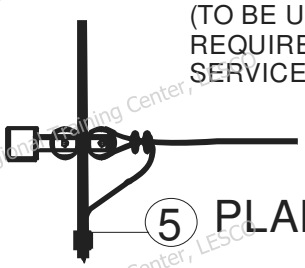
Sr#	Description	Drawing No
1	POLE CLAMP WITH THIMBLE	
2	TIE WIRE	SPEC P-22
3	BEARER WIRE	SPEC P-12
4	CLIPS	
5	4 CORE L.T. CABLE	PD-28d
6	EYE SCROW BOLT 16X50 mm	
7	LATTICE STEEL STRUCTURE 9.4M	SPEC P-34
8	SERVICE MAST PIPE.	SDI-55
9	WALL CLAMP	SDI -55
10	RAG BOLT	SDI - 55

Sr#	Description	Drawing No
11	METAL CONDUIT PIPE 50 mm DIA	
12	HOOKS	
13	WOODEN GATTIES	
14	METER BOARD	PD-100 A
15	3 PHASE 4 WIRE METER	SPEC P - 9
16	FOUNDATION FOR STRUCTURE	
17	PAD	
18	EARTHING ARRANGEMENT	SDI-59 & NOTE.3
19	EYE RAG BOLTS.	
20	P.G CONNECTOR	SPEC P-25

PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY		ENGINEERING DEPARTMENT	
THREE PHASE CABLE SERVICE			
DWN.	A.E.	SCALE	DATE: 1-4-1979
TCD.	A.D.	DWG.NO.PDW/DF-289	
CKD.	DIR.		



INTERMEDIATE STRUCTURE
(TO BE USED ONLY WHERE REQUIRED BY LENGTH OF SERVICE LINE)



NOTE:-

1. SERVICE CABLE MUST BE IN ONE PIECE AND UNDAMAGED UP TO METER TERMINAL.
2. PORTION OF CABLE BETWEEN SERVICE MAST AND METER MUST BE IN METAL CONDUIT PROPERLY CONNECTED BY SLEEVES.
3. EARTHING ACCORDING TO DETAIL 'A' OF DRAWING NO.PDW/DF-2460 EARTH WIRE GROUTED IN GROOVE CUT IN WALL AND CONNECTED TO METER EARTH TERMINAL.

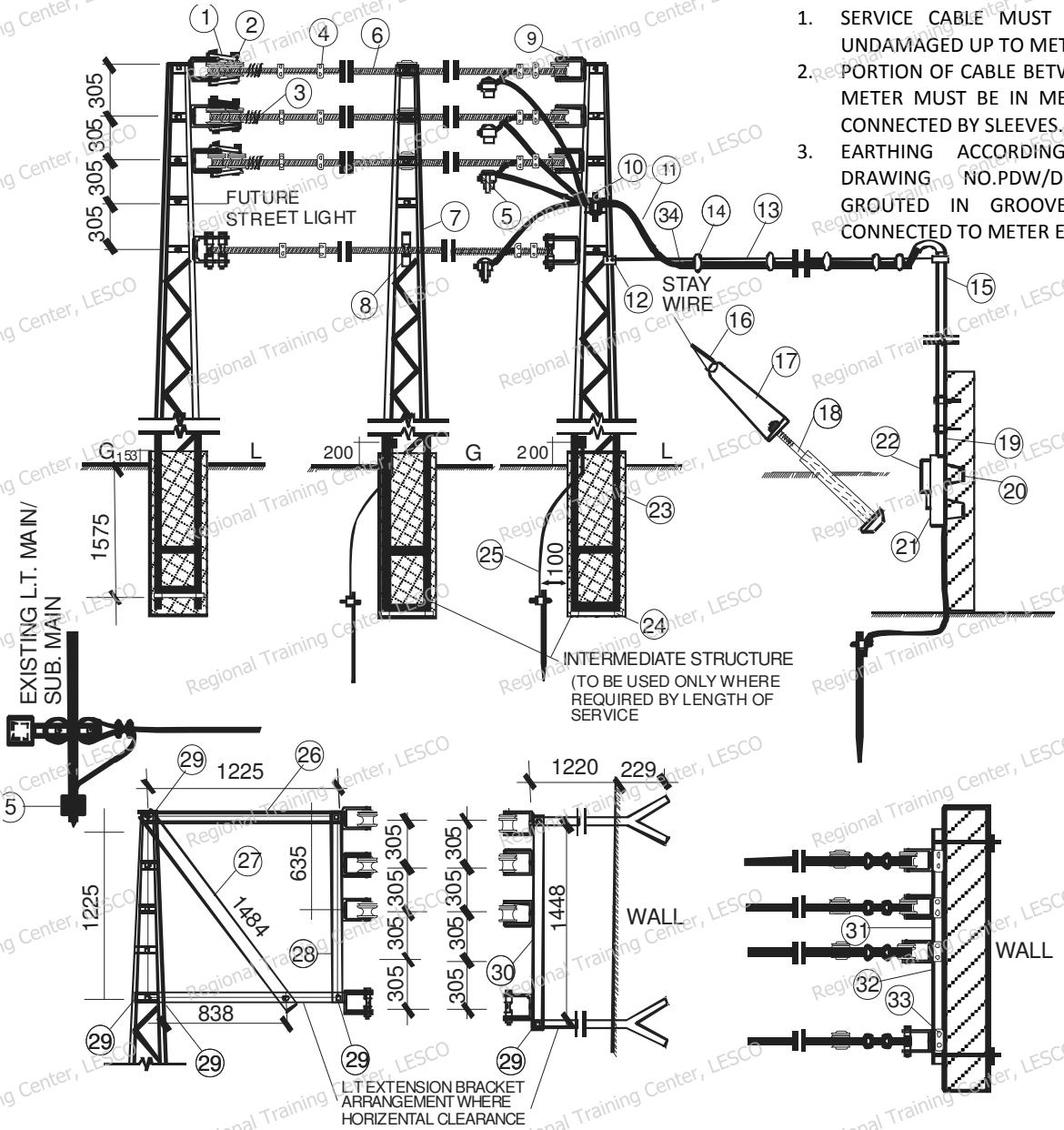
Sr#	Description	Drawing No
1	D-SHACKLE EXTENSION PIECE	
2	SHACKLE INSULATOR	SPEC P-4
3	TIE WIRE	SPEC P-22
4	LOOP DEAD END CLAMP	PD 111a
5	P.G CONNECTOR	SPEC P-25
6	BARE ALUMINIUM CONDUCTOR	SDI -13a
7	LATTICE STEEL STRUCTURE 9.4 M	SPEC P-34
8	ALUMINIUM REEL WITH BOLT	SPEC P-113
9	D-SHACKLE	
10	EYE SCREW BOLT 16X50 mm & TIE WIRE	
11	2 CORE L.T CABLE	PD-27
12	POLE CLAMP WITH THIMBLE	
13	BEARER WIRE	SPEC P-12

Sr#	Description	Drawing No
14	CLIPS	
15	SINGLE PHASE SERVICE MAST PIPE	SDI-55
16	WALL CLAMP	SDI-55
17	RAG.BOLT	SDI-55
18	HOOKS	
19	METAL CONDUIT PIPE 37 mm DIA	
20	WOODEN GATTIES	
21	METER BOARD	PD-100 A
22	SINGLE PHASE METER	SPEC P-2
23	FOUNDATION FOR STRUCTURE	
24	PAD	
25	EARTHING ARRANGEMENT	SDI–59 & NOTE 3
26	TIE WIRE	SDI - 41

PAKISTAN WATERAND POWER DEVELOPMENT AUTHORITY		DESIGN DEPARTMENT	
SINGLE PHASE BARE CONDUCTOR SERVICE			
DWN.	A.E.	SCALE	DATE: 1-4-1979
TCD.	A.D.	DWG.NO. PDW/DF-288	
CKD.	DIR.		

NOTE:-

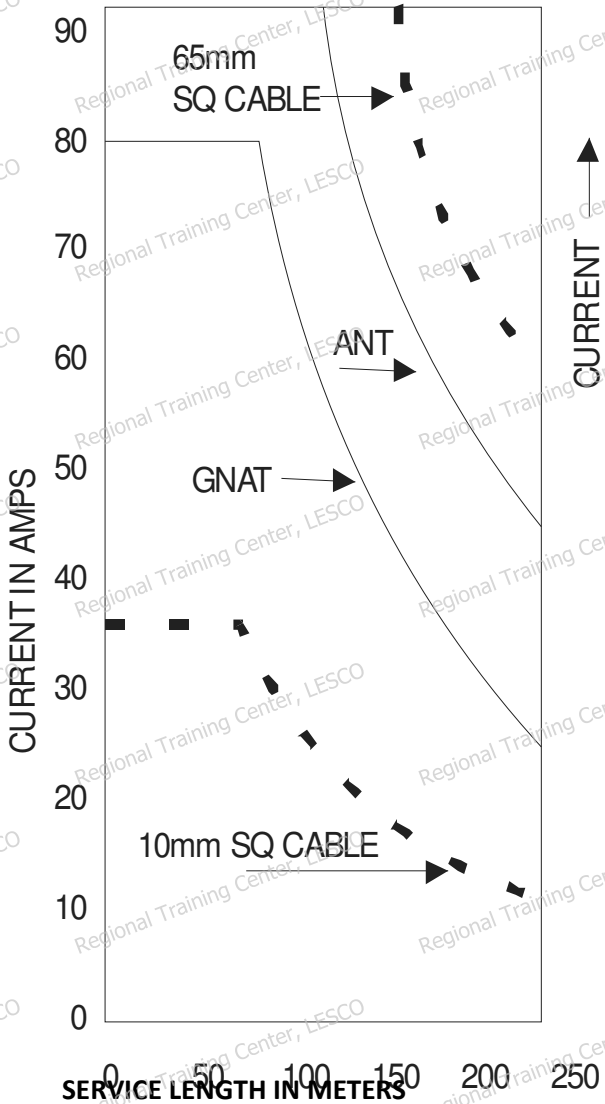
1. SERVICE CABLE MUST BE IN ONE PIECE AND UNDAMAGED UP TO METER TERMINAL.
2. PORTION OF CABLE BETWEEN SERVICE MAST AND METER MUST BE IN METAL CONDUIT PROPERLY CONNECTED BY SLEEVES.
3. EARTHING ACCORDING TO DETAIL 'A' OF DRAWING NO.PDW/DF-2460 EARTH WIRE GROUTED IN GROOVE CUT IN WALL AND CONNECTED TO METER EARTH TERMINAL.



Sr#	Description	Drawing No
1	D-SHACKLE EXTENSION PIECE	
2	SHACKLE INSULATOR	SPEC P-4
3	TIE WIRE	SPEC P-22
4	LOOP DEAD END CLAMP	PD 111a
5	P.G CONNECTOR	SPEC P-25
6	BARE ALUMINIUM CONDUCTOR	SDI -13 A
7	LATTICE STEEL STRUCTURE	SPEC P-34
8	ALUMINIUM REEL WITH BOLT	SPEC P-113
9	D-SHACKLE	
10	EYE SCREW BOLT 16X50 mm & TIE WIRE	
11	4 CORE L.T CABLE	PD-28a
12	POLE CLAMP WITH THIMBLE	
13	BEARER WIRE (7/2.0 mm)	SPEC P-12
14	CLIPS	
15	3Φ SERVICE MAST PIPE	SDI-55
16	THIMBLE	SDI-22
17	ELBOW	SPECP-107 & SDI-8

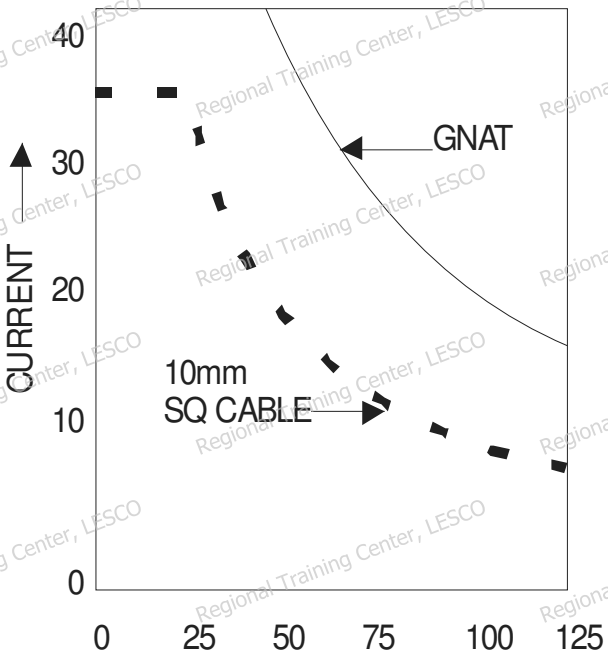
Sr#	Description	Drawing No
18	STAY ROD	SPEC P-107
19	METAL CONDUIT PIPE 50 mm DIA	
20	WOODEN GATTIES	
21	METER BOARD	PD-100 A
22	3 PHASE 4 WIRE METER	SPEC P-9
23	FOUNDATION STRUCTURE	
24	CUBE	
25	EARTHING ARRANGEMENT	SDI.59 & NOTE 3
26	CHANNEL 101X41X1320 mm LONG	
27	ANGLE IRON BRACE 51X51X6.3X1525 LONG	
28	CHANNEL 101X41X1270 mm LONG	
29	NUT & BOLTS WITH WASHER 38X9.5 Φ	
30	ANGLE IRON BRACE 63X63X18X1448mm LONG	
31	ANGLE IRON 150X63X63X 8 mm	
32	ANGLE IRON BRACE 63X63X8X1448 LONG	
33	NUT & BOLTS WITH WASHER 38X9.5 Φ	
34	TIE WIRE	S.D.I 41

PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY		ENGINEERING DEPARTMENT	
THREE PHASE BARE CONDUCTOR SERVICE			
DWN.	A.E.	SCALE	DATE.1.4.79
TCD.	A.D.	DWG.NO.	
CKD.	DIR.	PDW/DF-287	



SERVICE LENGTH IN METERS

THREE PHASE SERVICES



SERVICE LENGTH IN METERS

SINGLE PHASE SERVICES

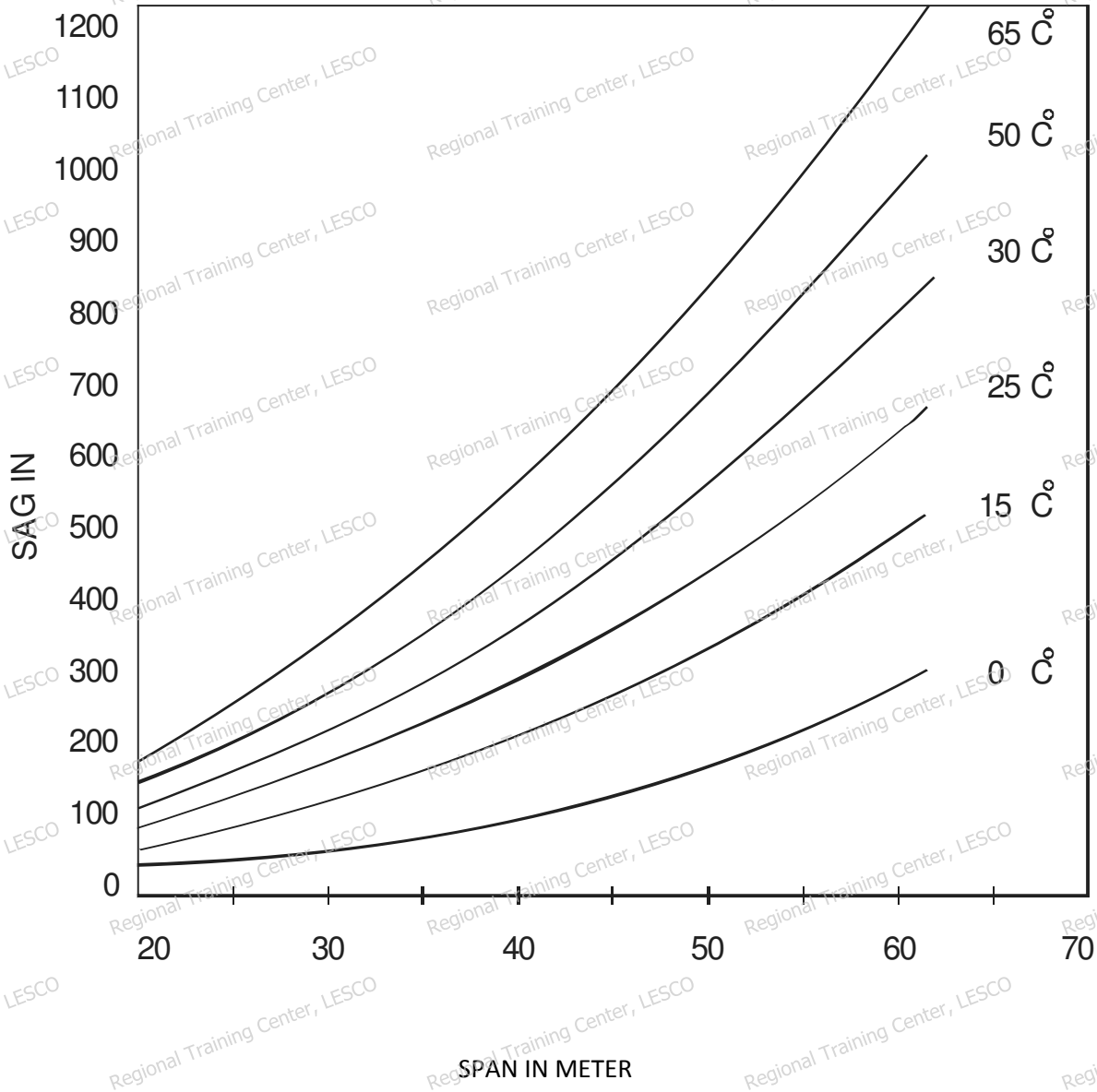
NOTES:

FOR SELECTING APPROPRIATE CABLE OR CONDUCTOR

1. READ ACTUAL SERVICE LENGTH AGAINST LOAD CURRENT CONSIDERED
2. IF POINT LIES ON A CURVE SELECT THE SIZE OF CABLE OF BARE CONDUCTOR AS REQURIED
3. IF POINT DOES NOT FALL ON CURVE SELECT NEAREST HIGHER SIZE

PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY			ENGINEERING DEPARTMENT
CABLE SELECTION CHART			
DWN.	A.E.	SCALE	DATE.1.4.79
TCD.	A.D.	DWG.NO. PDW/TD-5	
CKD.	DIR.		

TEMPERATURE IN C°
SAG AT INTIAL UNLOADED CONDETION
READ SAGS DIRECT FOR ANY SPAN



PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY			ENGINEERING DEPARTMENT
UNIVERSAL SAG CHART FOR ALL ALUMINIUM CONDUCTORS			
DWN.	A.E.	SCALE	DATE.1.4.79
TCD.	A.D.	DWG.NO. PDW/TD-6	
CKD.	DIR.		

.025 ACSR 11KV	H.T FEEDER	CU-COPPER AA-ALUMINUM ST-STEEL ACSR (ALUM AREA ONLY) NOTE:- GIVE AREA IN SQ.INCHES,TYPE OF CONDUCTOR AND VOLTAGE	#689	ISOLATOR, SINGLE POLE	NUMBER
.05 AA 400V	L.T FEEDER		#1218	THREE POLE GANG OPERATED ISOLATOR	NUMBER
66KV	TRANSMISSION LINE		IQO #2O	THREE POLE ON LOAD ISOLATOR	AMPS NUMBER

	CROSSING NOT CONNECTED	#1195	POWER OPERATED ON LOAD ISOLATOR	NUMBER
	LINE CONNECTION CROSSING ELECTRICALLY CONNECTED AND TEE-OFF	SUPPLY SIZE SO	FUSE	AMPS
	NORMALLY OPEN	5Q #115	FUSE SWITCH	AMPS NUMBER
11KV 400V	LT LINE SHOWN THROUGH CENTER OF POLE, H.T LINE SHOWN OUT SIDE OF POLE	300 #71	CAPACITOR BANK	KVAR NUMBER
	SERVICE DROP FROM POLE	600 #85	CAPACITOR BANK SWITCHED T-TIME CONTROL V-VOLTAGE CONTROL O-VAR CONTROL	KVAR NUMBER
	POLE OR STRUCTURE	200/250 MVA #718	OIL CIRCUIT BREAKER	AMPS/MVA NUMBER
S0/7171	TRANSFORMER 3 PHASE INDICATE PHASE IF SUCH IS THE CASE KVA/NUMBER	6H100 R #212	AUTOMATIC CIRCUIT RECLOSER	TYPE NUMBER
	LIGHTNING ARRESTER AWAY FROM TRANSFORMER OR CABLE TERMINATION	PDR-S0/#240S	VOLTAGE REGULATOR	TYPE NUMBER
.025 0.05	CHANGE IN SIZE OF CONDUCTOR	(NAME) 66/11 KV 1500	GRID STATION	Voltage KVA
UG/OH .05 PILC	CABLES:- U.G:- UNDER GROUND OH:- OVER HEAD			

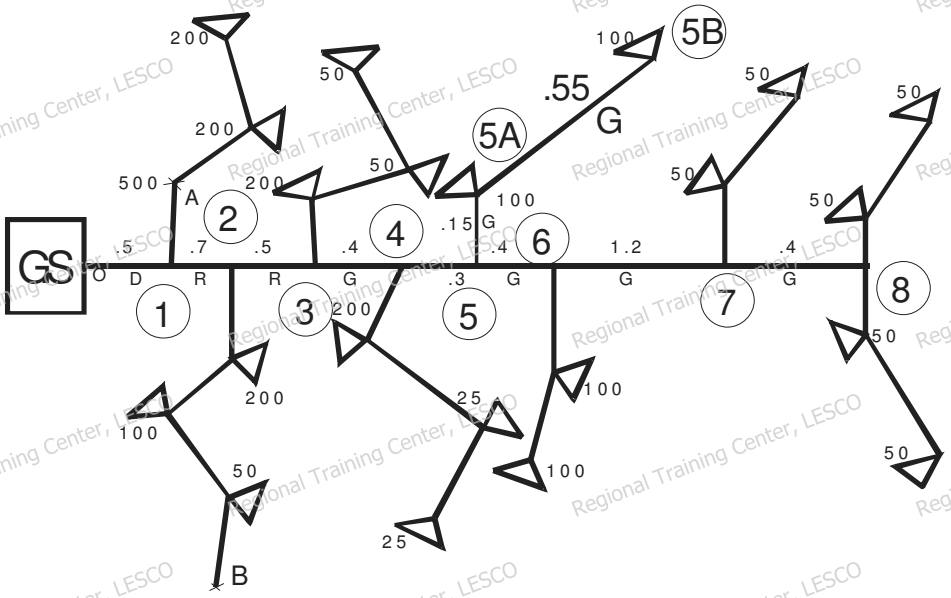
NOTE: 1. ALL FUTURE EXTENSION SHOULD BE SHOWN DOTTED.
2. # REFFERES TO WAPDA EQUIPMENT NO.
3. INDICATION OF:-
1-PHASE —/—
3-PHASE —///—

PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY			ENGINEERING DEPARTMENT
STANDARD MAPPING SYMBOLS FOR DISTRIBUTION			
DWN	A.E	SCALE	DATE 22.2.66
TCD	A.D	DWG NO. EW/DZ-1	
CKD	DIR		

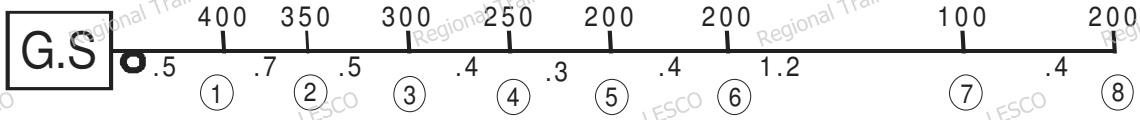
EXHIBIT
SHEET 5 OF 6

EXAMPLE NO. 2 OF H.T VOLTAGE DROP CALCULATION PROCEDURE

ACTUAL MAP



AMPLIFIED MAP



LEGEND

G.S ..... GRID STATION.
Δ ..... DISTRIBUTION TRANSFORMER.
A & B ..... H.T. METERED CONSUMERS.
D,G&R..... ACSR CONDUCTORS DOG,GOPHER & RABBIT.

NOTES

i. TOTAL FEEDER PEAK DEMAND 1500 KVA, 0.8 P.F.
ii. THE PEAK DEMAND OF CONSUMER 'A' 500 KVA AND THAT OF B ZERO DURING PEAK HOURS P.F 0.8

Exhibit 7

Sheet 6 of 6

PAKISTAN
WATER AND POWER DEVELOPMENT AUTHORITY
H.T VOLTAGE DROP CALCULATIONS

Sheet _____
Date _____
Made By _____

CIRCLE **HYPOTHETICAL** GRID STATION **TYPICAL** CIRCUIT **SAMPLE**

1. MAXIMUM LOAD ON CIRCUIT 78.8 AMP 11K.V 1500KVA
2. ESTIMATED DEMAND OF H.T CUSTOMERS 500KVA
3. ESTIMATED DEMAND OF L.T (1)–(2) 1000KVA.
4. L.T DEMOND FACTOR (3) DIVIDED BY TOTAL OF TRANSF. KVA CONN. (2000) – 0.5
5. NOMINAL CIRCUIT VOLTAGE 11K.V
6. GRID STATION TRANSFORMER SUCH CAPACITY ..... KVA.
7. REGULATER ..... CAPACITY ..... AMP ..... KVA.

CALCULATED VOLTAGE DROP
GRID STATION TO FIRST TRANSF. 0.5 PERCENT
FIRST TO LAST TRANSFORMER. 1.97 PERCENT

SECTION NO	CIRCUIT DATA				DATA FOR EACH SECTION				TOTAL KVA DEMAND OVER SECTION	SECTION VOLTAGE DROP (PERCENT) /(CXDXJ) 1000	SUB TOTAL VOLTAGE DROP (PERCENT)	TOTAL VOLTAGE DROP FROM GRID STATION (PERCENT)
	CONDUCTOR		DISTANCE MILES	PERCENT DROP PER 1000 KVA MILES	TRANSF K V A CONN.	DEMAND FACTOR	L.T KVA DEMAND (E X F)	H.T KVA DEMAND				
	PHASE	SIZE										
A	B		C	D	E	F	G	H	J	K	L	P
01	3	D	0.5	0.66	400	0.5	200	500	1500	0.50		0.50
12	-	R	0.7	1.02	350	=	175		800	0.57		1.07
23	-	R	0.5	-	300	=	150		625	0.32		1.35
34	-	G	0.4	1.75	250	=	125		475	0.33		1.75
45	-	G	0.3	=	200	=	100		350	0.18		1.92
56	-	G	0.4	=	200	=	100		250	0.18		2.00
67	-	G	1.2	=	100	=	50		150	0.32		2.00
78	-	G	0.4	=	200	=	100		100	0.07		2.47
5A	3	G	0.15	1.75	100	0.5	50		100	0.03	0.03	1.92
5B	-	G	0.55	=	100	=	50		50	0.05	0.06	1.90

TABLE 1
PERCENT VOLTAGE DROP FOR
1,000 KVA FOR ONE MILE
11 KV, 50 CYCLES, 54" SPACING

EXHIBIT 6
SHT 3 OF 4

Conductor Code Name	Copper or aluminum area (Sq Inches)	0.95 Leading	1.00	0.95	Circuit Power Factor 0.90	0.85	0.80	0.75	0.70
All Aluminum conductor (AAC)									
GNAT	0.042	1.48	1.74	1.83	1.81	1.78	1.73	1.98	1.62
WEEVIL	0.049	1.23	1.47	1.56	1.55	1.53	1.49	1.85	1.41
ANT	0.082	0.68	0.88	1.01	1.03	1.03	1.92	1.81	1.80
FLY	0.098	0.54	0.74	0.86	0.89	0.90	0.90	0.99	0.88
EARWING	0.122	0.41	0.60	0.73	0.76	0.78	0.76	0.70	0.78
WASP	0.164	0.26	0.44	0.57	0.61	0.63	0.64	0.68	0.65
HORNET	0.245	0.13	0.30	0.43	0.48	0.51	0.53	0.54	0.55
CHAFER	0.331	0.07	0.22	0.36	0.41	0.44	0.46	0.48	0.49
Aluminum conductor Steel Reinforced (ACSR).									
SQUIRREL	0.032	1.87	2.15	2.21	2.18	2.12	2.05	1.98	1.90
GOPHER*	0.041	1.51	1.77	1.85	1.83	1.80	1.75	1.69	1.63
WEASEL	0.048	1.22	1.46	1.56	1.55	1.53	1.50	1.46	1.41
FERRET	0.077	0.88	1.10	1.21	1.22	1.21	1.18	1.18	1.14
RABBIT*	0.082	0.66	0.88	1.00	1.02	1.03	1.02	1.01	1.00
RACOON	0.121	0.39	0.59	0.72	0.76	0.78	0.79	0.79	0.79
DOG*	0.163	0.27	0.45	0.58	0.62	0.65	0.66	0.67	0.67
TIGER	0.199	0.20	0.36	0.48	0.51	0.54	0.55	0.56	0.57
LYNX	0.239	0.11	0.26	0.38	0.42	0.45	0.47	0.48	0.49
PANTHER	0.320	0.08	0.22	0.35	0.39	0.42	0.44	0.45	0.46
Copper Conductor.									
8 SWG	0.020	1.90	2.19	2.26	2.22	2.16	2.09	2.02	1.94
5 SWG	0.035	1.02	1.25	1.36	1.36	1.35	1.33	1.30	1.26
3 SWG	0.050	0.68	0.88	1.01	1.03	1.03	1.02	1.01	1.00
3/.104	0.025	1.49	1.75	1.84	1.82	1.78	1.73	1.68	1.62
3/.147	0.050	0.68	0.88	1.00	1.02	1.03	1.02	1.01	0.99
7/.116	0.075	0.42	0.61	0.74	0.77	0.79	0.80	0.80	0.79
7/.136	0.100	0.26	0.44	0.57	0.61	0.63	0.65	0.66	0.66
7/.166	0.150	0.13	0.30	0.43	0.48	0.51	0.53	0.54	0.55
7/.193	0.200	0.06	0.21	0.35	0.40	0.43	0.45	0.47	0.48

- Standard conductor for 11 KV construction

EXHIBIT 6
SHT 4 OF 4

TABLE 3

PERCENT VOLTAGE DROP FOR 1,000 KVA FOR ONE MILE 11 KV, 50 CYCLE, 54" SPACING

Conductor Code Name	Copper or aluminum area (Sq Inches)	0.95 Leading	Circuit Power Factor					
			1.00	0.95	0.90	0.85	0.80	0.75	0.70
All Aluminum conductor (AAC)									
GNAT	0.042	1.56	1.74	1.93	2.02	2.09	2.17	2.24	2.32
WEEVIL	0.049	1.30	1.47	1.64	1.73	1.80	1.87	1.94	2.01
ANT	0.082	0.71	0.88	1.06	1.14	1.21	1.28	1.35	1.42
FLY	0.098	0.57	0.74	0.90	0.90	1.05	1.12	1.19	1.26
EARWING	0.122	0.43	0.60	0.76	0.84	0.91	0.98	1.05	1.12
WASP	0.164	0.28	0.44	0.60	0.67	0.74	0.80	0.87	0.94
HORNET	0.245	0.14	0.30	0.45	0.53	0.59	0.66	0.72	0.79
CHAFER	0.331	0.67	0.22	0.38	0.45	0.52	0.58	0.64	0.70
Aluminum conductor Steel Reinforced (ACSR).									
SQUIRREL	0.032	1.97	2.15	2.33	2.42	2.49	2.56	2.64	2.71
GOPHER*	0.041	1.59	1.77	1.95	2.04	2.11	2.18	2.26	2.33
WEASEL	0.048	1.28	1.46	1.64	1.73	1.80	1.87	1.94	2.02
FERRET	0.077	0.85	1.10	1.27	1.35	1.41	1.46	1.55	1.65
RABBIT*	0.082	0.70	0.88	1.05	1.14	1.21	1.28	1.35	1.42
RACOON	0.121	0.41	0.59	0.76	0.84	0.91	0.98	1.05	1.13
DOG*	0.163	0.28	0.45	0.61	0.69	0.76	0.82	0.89	0.96
TIGER	0.199	0.21	0.36	0.50	0.57	0.63	0.69	0.75	0.81
LYNX	0.239	0.11	0.26	0.40	0.47	0.53	0.58	0.64	0.70
PANTHER	0.320	0.08	0.22	0.36	0.43	0.49	0.55	0.60	0.66
Copper Conductor.									
No. 8 SWG	0.020	2.00	2.19	2.38	2.47	2.54	2.62	2.69	2.77
5 SWG	0.035	1.07	1.25	1.43	1.51	1.59	1.66	1.73	1.80
3 SWG	0.050	0.71	0.88	1.06	1.14	1.21	1.28	1.35	1.42
3/.104	0.025	1.57	1.75	1.93	2.02	2.10	2.17	2.24	2.32
3/.147	0.050	0.71	0.88	1.06	1.14	1.21	1.27	1.34	1.42
7/.116	0.075	0.44	0.61	0.78	0.86	0.93	1.00	1.86	1.13
7/.136	0.100	0.28	0.44	0.60	0.68	0.75	0.81		0.94
7/.166	0.150	0.14	0.30	0.45	0.53	0.59	0.66		0.79
7/.193	0.200	0.06	0.21	0.37	0.44	0.50	0.56	0.52	0.69

- Standard conductor for 11 KV construction

EXHIBIT 8
SHT 1 OF 2

ALUMINUM AND ACSR

CODE NAME

Aluminum conductor	Stranding	Conductor diameter Inches	Aluminum Sq Inch	Area Mcm	Copper Equiv. sq Inch	Resistance Per Mile Per Phase (2)	Reactance Per Mile per Phase 54"/15" GMD	Capacity (3) Amps
GNAT**(1)	7/.087	0.261	0.042	52.9	0.025	2.11	0.68/0.48	80/130
WEEVIL	3/.144	0.310	0.049	62.2	0.030	1.78	0.64/0.46	95/140
ANT **	7/.122	0.366	0.082	104.2	0.050	1.07	0.64/0.45	135/200
FLY	7/.134	0.402	0.098	125.7	0.060	0.89	0.62/0.44	155/200
EARWING	7/.149	0.447	0.122	155.4	0.075	0.72	0.62/0.43	180/260
WASP **	7/.173	0.519	0.164	209.5	0.100	0.53	0.59/0.42	230/315
HORNET	19/.128	0.640	0.245	311.3	0.150	0.36	0.58/0.39	310/410
CHAFER	19/.149	0.745	0.331	421.8	0.200	0.27	0.57/0.39	390/500
ACSR CONDUCTOR								
SQUIRREL	6/1.083	0.249	0.032	40.8	0.020	2.60	0.67/0.49	80/120
GOPHER *	6/1.093	0.279	0.041	51.2	0.025	2.14	0.67/0.49	95/140
WEASEL	6/1.102	0.306	0.048	61.6	0.030	1.77	0.66/0.48	110/150
RABBIT*	6/1.132	0.396	0.082	103.2	0.050	1.06	0.65/0.47	145/205
RACCOON	6/1.161	0.471	0.121	153.5	0.075	0.71	0.64/0.45	185/255
DOG *	6/7.186 0.62	0.558	0.163	204.9	0.100	0.54	0.61/0.42	250/300
TIGER	30/7.093	0.651	0.199	253.2	0.125	0.43	0.54/0.35	290/380
LYNX	30/7.110	0.770	0.239	354.3	0.150	0.31	0.53/0.34	340/470
PANTHER	30/7.118	0.826	0.320	407.7	0.200	0.27	0.52/0.34	430/510

EXHIBIT 8
SHT 2 OF 2

CHARACTERISTICS OF CONDUCTOR IN USE BY WAPDA (1)
COPPER

CODE NAME	CONDUCTOR DIAMETER INCHES	COPPER SQ IN	AREA Mcm	RESISTANCE PER MILE PER PHASE (2)	REACTANCE PER MILE PER PHASE 54" GMD	CAPACITY (4) AMPS
8 SWG	0.160	0.020	25.6	2.65	0.69	60
5 SWG	0.212	0.035	44.9	1.51	0.66	90
3 SWG	0.250	0.050	63.5	1.07	0.64	120
3/.104	0.224	0.025	32.5	2.12	0.67	75
3/.147	0.317	0.050	64.8	1.07	0.63	125
7/.116	0.348	0.075	94.2	0.74	0.62	160
7/.136	0.408	0.100	129.4	0.53	0.60	200
7/.166	0.498	0.150	192.9	0.36	0.58	270
7/.193	0.579	0.200	260.7	0.26	0.56	340

Notes:

1. Single asterisk (*) indicates WAPDA standard sizes for HT construction.
   Double asterisk (**) indicates WAPDA standard sizes for LT construction.
2. Based on conductor temperature of 75 degrees centigrade.
3. Capacity based on 40 C ambient, 35 C rise in still air/air at 2' per second.
4. Capacity based on 30 C temperature rise, no air movement.

SIZE		Area		Weight lbs				CURRENT AMPS 20°	AWG EQUIV: SIZE
		SQ.IN	C.M	1000	MILE	GLI LBS			
12	0.104	.0085	10.800	32.8	173	528	5.23	75	10+
10	0.128	.0129	16.380	49.6	262	816	3.45	110	8-
8	0.160	.0201	25.600	77.5	409	1.270	2.20	140	6-
6	0.192	.0790	36.860	111.6	588	1.550	1.53	180	5+
5	0.212	.0353	44.940	136.0	718	2.080	1.25	200	4+
4	0.232	.0423	53.820	162.9	860	2.420	1.05	220	3+
3	0.252	.0499	63.500	192.2	1.015	2.875	0.89	250	2-
2	0.276	.0598	76.180	230.6	1.220	3.350	0.73	280	1-
1	0.300	.0707	90.000	272.4	1.430	3.880	0.63	320	1+
STRANDED NO/DIA									
7/.064	.192	.0220	28.670	87.3	461	1.370	1.97	140	5+
7/.069*	.206	.0260	33.330	102.0	540	1.542	1.70	155	5
3/.104	.224	.0250	32.450	100.0	529	1.518	1.74	155	5-
3/.114	.246	.0300	39.000	119.0	628	1.810	1.45	175	4-
3/.131	.282	.0400	51.480	157.0	829	2.350	1.10	205	3-
3/.147	.317	.0500	64.830	198.0	1.046	2.920	0.87	240	2-
7/.104	.312	.0595	75.710	231.0	1.220	3.540	0.74	260	1-
7/.116	.348	0.740	94.050	290.0	1.531	4.353	0.60	295	1/0-
7/.136	.408	.1020	129.470	400.0	2.105	5.872	0.44	360	2/0-
7/.140*	.420	.1080	137.200	410.0	2.170	5.950	0.41	375	2/0+
7/.152*	.456	.1270	161.700	500.0	2.640	7.232	0.35	420	3/0-
7/.166	.498	.1520	192.900	590.0	3.116	8.526	0.29	480	4/0-
7/.186*	.558	.1900	242.200	700.0	3.696	10.500	0.23	530	4/0+
7/.193	.597	.2050	260.700	800.0	4.239	11.270	0.22	350	250
									MCM

4/0+ indicates S.W.G wire is larger than 4/0 A.W.G

Non-British Standard

Date	Revision	WEST PAKISTAN WATER AND POWER DEVELOPMENT AUTHORITY WIRE CHARACTERISTIC TABLE BRITISH STANDARD HARD-DRAWN COPPER	
Wapda Approval		Miner and miner International incorporated	Aprd

INITIAL SAG TABLES

(FOR STRINGING OF NEW CONDUCTORS)

Prepared on basis of 200' Ruling Span with final maximum tension not to exceed 50% of breaking strength.

I. ALL ALUMINUM WITH DIAMETER OF .325" OR LESS (7/.087 AL.GNAT) MAXIMUM TENSION NOT TO EXCEED 550 POUNDS.

SPAN FEET	75'	100'	125'	150'	175'	200'	225'	250'
TEMPERATURE SAG IN FEET AND INCHES								
30°F	0'-1"	0'-2"	0'-4"	0'-5"	0'-7"	0'-10"	1'-0"	1'-3"
45°	0' -2"	0'-3"	0' -5"	0' -7"	0' -9"	1' -0"	1' -3"	1' -6"
60°	0' -2"	0'-4"	0'-6"	0'-8"	0'-11"	1'-2"	1'-6"	1'-10"
75°	0' -2"	0'-4"	0' -7"	0'-10"	1'-1"	1'-5"	1'-10"	2'-3"
90°	0' -3"	0'-5"	0'-8"	1'-0"	1'-5"	1'-10"	2'-3"	2'-10"
105°	0' -4"	0'-7"	0'-10"	1'-3"	1'-8"	2'-2"	2'-9"	3'-5"
120°	0' -4"	0'-8"	1' -0"	01'-6"	2'-0"	2'-7"	3'-4"	4'-1"

II. ALL ALUMINUM WITH DIAMETER OF OVER .325" OR (7/.122 AI.ANT)

MAXIMUM TENSION NOT TO EXCEED 1.850 POUNDS. 7/.173 AI. WASP

SPAN FEET	75'	100'	125'	150'	175'	200'	225'	250'
TEMPERATURE SAG IN FEET AND INCHES								
30°F	0'-2"	0'-3"	0'-5"	0'-7"	0'-10"	1'-1"	1'-5"	1'-9"
45°	0' -2"	0'-4"	0' -6"	0' -8"	0' -11"	1' -2"	1' -6"	1' -10"
60°	0' -3"	0'-4"	0'-7"	0'-10"	1'-1"	1'-6"	1'-11"	2'-4"
75°	0' -3"	0'-6"	0' -10"	1'-1"	1'-5"	1'-11"	2'-5"	2'-11"
90°	0' -4"	0'-7"	0'-11"	1'-3"	1'-9"	2'-4"	2'-11"	3'-7"
105°	0' -5"	0'-8"	1'-1"	1'-7"	2'-2"	2'-10"	3'-7"	4'-4"
120°	0' -5"	0'-10"	1' -3"	1'-10"	2'-5"	3'-2"	4'-1"	5'-0"

INITIAL SAG TABLES

(FOR STRINGING OF NEW CONDUCTORS)

Prepared on basis of 200' Ruling Span with final Maximum tension not to exceed 50% of breaking strength.

I. ACSR CONDUCTORS ALL SIZES

SPAN FEET	75'	100'	125'	150'	175'	200'	225'	250'
TEMPERATURE SAG IN FEET AND INCHES								
30°F	0'-1"	0'-2"	0'-3"	0'-5"	0'-6"	0'-8"	0'-11"	1'-1"
45°	0' -1"	0'-2"	0' -4"	0' -5"	0' -7"	0' -10"	1' -0"	1' -3"
60°	0' -2"	0'-3"	0'-4"	0'-7"	0'-8"	08'-11"	1'-2"	1'-5"
75°	0' -2"	0'-3"	0' -5"	0'-7"	1'-9"	1'-0"	1'-3"	1'-7"
90°	0' -2"	0'-4"	0'-5"	1'-9"	1'-0"	1'-4"	1'-8"	2'-0"
105°	0' -3"	0'-5"	0'-7"	0'-10"	1'-2"	1'-7"	2'-0"	2'-5"
120°	0' -3"	0'-5"	0' -8"	1'-0"	1'-5"	1'-10"	2'-3"	2'-10"

II. COPPER CONDUCTOR – ALL SIZES

SPAN FEET	75'	100'	125'	150'	175'	200'	225'	250'
TEMPERATURE SAG IN FEET AND INCHES								
30°F	0'-2"	0'-3"	0'-3"	0'-5"	0'-9"	1'-0"	1'-3"	1'-5"
45°	0' -2"	0'-4"	0' -5"	0' -8"	0' -11"	1' -2"	1' -6"	1' -10"
60°	0' -2"	0'-4"	0'-6"	0'-9"	1'-0"	1'-4"	1'-8"	2'-0"
75°	0' -2"	0'-4"	0' -7"	0'-10"	1'-1"	1'-5"	1'-10"	2'-3"
90°	0' -3"	0'-5"	0'-8"	0'-11"	1'-3"	1'-7"	2'-0"	2'-6"
105°	0' -3"	0'-6"	0'-9"	1'-0"	1'-5"	1'-10"	2'-4"	2'-11"
120°	0' -4"	0'-6"	0' -10"	1'-2"	1'-7"	2'-1"	2'-7"	3'-2"

FINAL SAG TABLES

(FOR STRINGING OF OLD OR PRESTRETCHED CONDUCTORS)

Prepared on basis of 200' Ruling Span with final maximum tension not to exceed 50% of breaking strength.

I. ALL ALUMINIUM WITH DIAMETER OF .325" OR LESS (7/.087 Al. GNAT)

SPAN FEET	75'	100'	125'	150'	175'	200'	225'	250'
TEMPERATURE SAG IN FEET AND INCHES								
30°F	0'-2"	0'-3"	0'-5"	0'-7"	0'-9"	1'-00"	1'-3"	1'-7"
45° F	0' -2"	0'-4"	0' -6"	0' -8"	0' -11"	1' -3"	1' -7"	1' -11"
60° F	0' -3"	0'-5"	0'-7"	0'-11"	1'-3"	1'-7"	2'-0"	2'-6"
75° F	0' -3"	0'-6"	0' -9"	1'-1"	1'-6"	2'-0"	2'-6"	3'-1"
90° F	0' -4"	0'-7"	1'-0"	1'-4"	1'-11"	2'-6"	3'-2"	3'-11"
105° F	0' -5"	0'-9"	1'-2"	1'-8"	2'-3"	2'-8"	3'-9"	4'-7"
120° F	0' -6"	0'-10"	1' -3"	1'-10"	2'-6"	3'-4"	4'-2"	5'-2"

II. ALL ALUMINUM WITH DIAMETER OF OVER .325"(7/.122 Al. ANT

(7/.173 Al. WASP

SPAN FEET	75'	100'	125'	150'	175'	200'	225'	250'
TEMPERATURE SAG IN FEET AND INCHES								
30°F	0'-2"	0'-4"	0'-6"	0'-8"	0'-11"	1'-2"	1'-8"	1'-10"
45°	0' -2"	0'-4"	0' -7"	0' -10"	1' -1"	1' -5"	1' -10"	2' -3"
60°	0' -3"	0'-5"	0'-7"	1'-0"	1'-5"	1'-10"	2'-3"	2'-10"
75°	0' -4"	0'-7"	0' -10"	1'-03"	1'-8"	2'-2"	2'-10"	3'-6"
90°	0' -5"	0'-8"	1'-1"	1'-6"	2'-1"	2'-8"	3'-5"	4'-3"
105°	0' -5"	0'-8"	1'-3"	1'-9"	2'-6"	3'-2"	4'-0"	4'-11"
120°	0' -6"	0'-10"	1' -4"	1'-11"	2'-8 "	3'-6"	4'-5"	5'-5"

FINAL SAG TABLES
(FOR STRINGING OF OLD OR PRESTRETCHED CONDUCTORS)

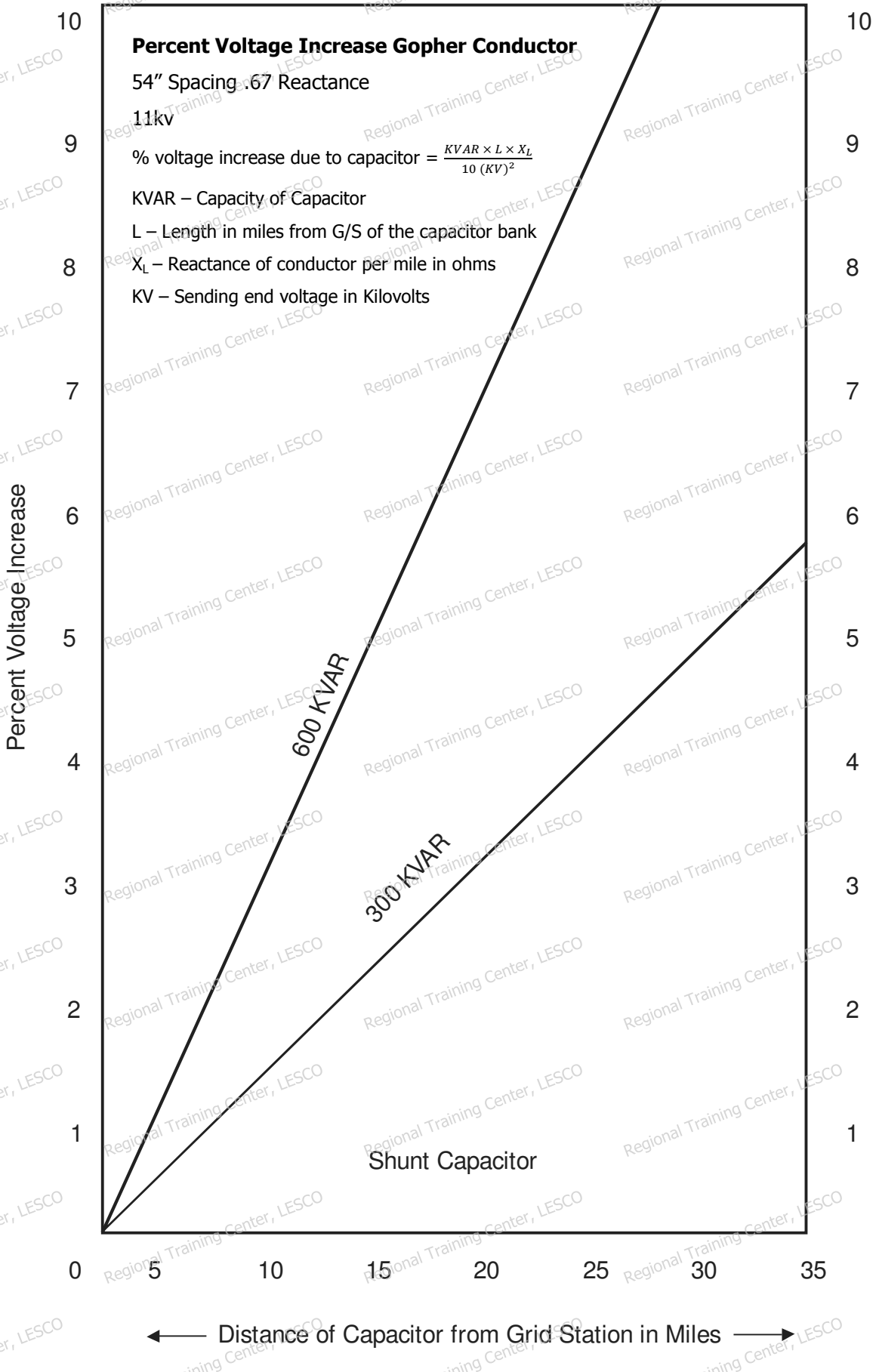
Prepared on basis of 200' Ruling Span with final maximum tension not to exceed 50% of breaking strength.

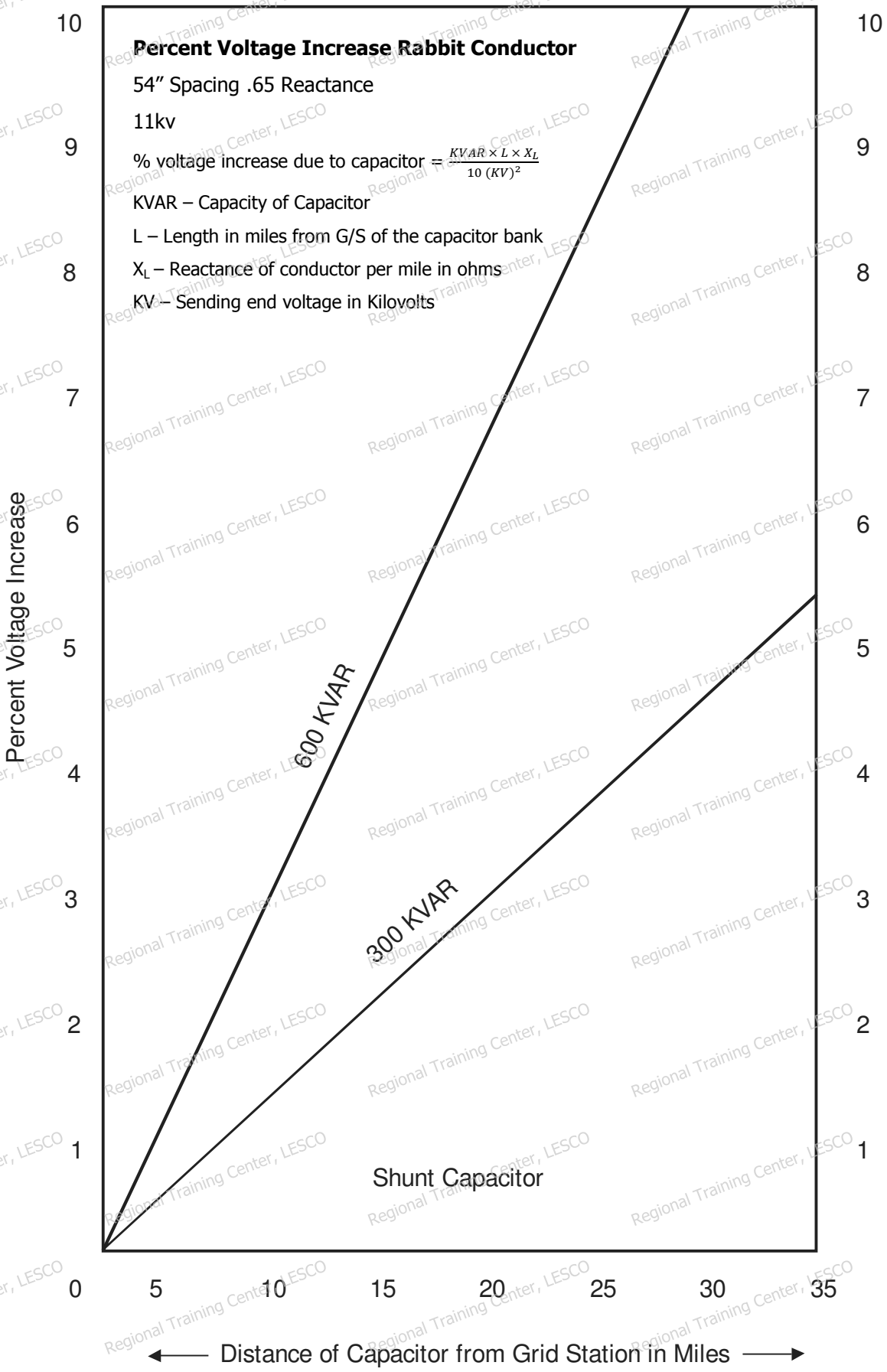
I. ACSR CONDUCTORS ALL SIZES.

SPAN FEET	75'	100'	125'	150'	175'	200'	225'	250'
TEMPERATURE SAG IN FEET AND INCHES								
30°F	0'-1"	0'-2"	0'-3"	0'-5"	0'-6"	0'-8"	0'-11"	1'-1"
45° F	0' -2"	0'-3"	0' -4"	0' -6"	0' -8"	0' -10"	1' -1"	1' -4"
60° F	0' -2"	0'-3"	0'-5"	0'-7"	0'-9"	1'-0"	1'-3"	1'-7"
75° F	0' -2"	0'-3"	0' -5"	0'-8"	0'-11"	1'-2"	1'-6"	1'-10"
90° F	0' -2"	0'-4"	0'-7"	0'-9"	1'-1"	1'-5"	1'-9"	2'-2"
105° F	0' -3"	0'-5"	0'-8"	1'-0"	1'-4"	1'-9"	2'-3"	2'-9"
120° F	0' -4"	0'-7"	0' -10"	1'-3"	1'-8"	2'-2"	2'-9"	3'-5"

II. COPPER CONDUCTORS – ALL SIZES.

SPAN FEET	75'	100'	125'	150'	175'	200'	225'	250'
TEMPERATURE SAG IN FEET AND INCHES								
30°F	0'-2"	0'-3"	0'-5"	0'-7"	0'-10"	1'-1"	1'-5"	1'-9"
45°	0' -2"	0'-4"	0' -5"	0' -8"	1' -11"	1' -3"	1' -6"	1'-11"
60°	0' -2"	0'-4"	0'-7"	0'-9"	1'-1"	1'-5"	1'-9"	2'-2"
75°	0' -3"	0'-5"	0' -8"	0'-11"	1'-3"	1'-8"	2'-1"	2'-6"
90°	0' -3"	0'-6"	0'-9"	1'-1"	1'-5"	1'-11"	2'-5"	2'-11"
105°	0' -4"	0'-6"	0'-10"	1'-2"	1'-8"	2'-2"	2'-9"	3'-4"
120°	0'-4"	0'-7"	0'-11"	1'-4"	1'-10 "	2'-5"	3'-0"	3'-9"


Percent Voltage Increase Gopher Conductor
54" Spacing .67 Reactance
11kv
% voltage increase due to capacitor = $\frac{KVAR \times L \times X_L}{10\ (KV)^2}$
KVAR – Capacity of Capacitor
L – Length in miles from G/S of the capacitor bank
X_L – Reactance of conductor per mile in ohms
KV – Sending end voltage in Kilovolts
600 KVAR
300 KVAR
Shunt Capacitor
Percent Voltage Increase
Percent Voltage Increase
0
1
2
3
4
5
6
7
8
9
10
5
10
15
20
25
30
35
Distance of Capacitor from Grid Station in Miles


Percent Voltage Increase Rabbit Conductor
54" Spacing .65 Reactance
11kv
% voltage increase due to capacitor = $\frac{KVAR \times L \times X_L}{10\ (KV)^2}$
KVAR – Capacity of Capacitor
L – Length in miles from G/S of the capacitor bank
X_L – Reactance of conductor per mile in ohms
KV – Sending end voltage in Kilovolts
Percent Voltage Increase
Percent Voltage Increase
600 KVAR
300 KVAR
Shunt Capacitor
0
1
2
3
4
5
6
7
8
9
10
5
10
15
20
25
30
35
Distance of Capacitor from Grid Station in Miles

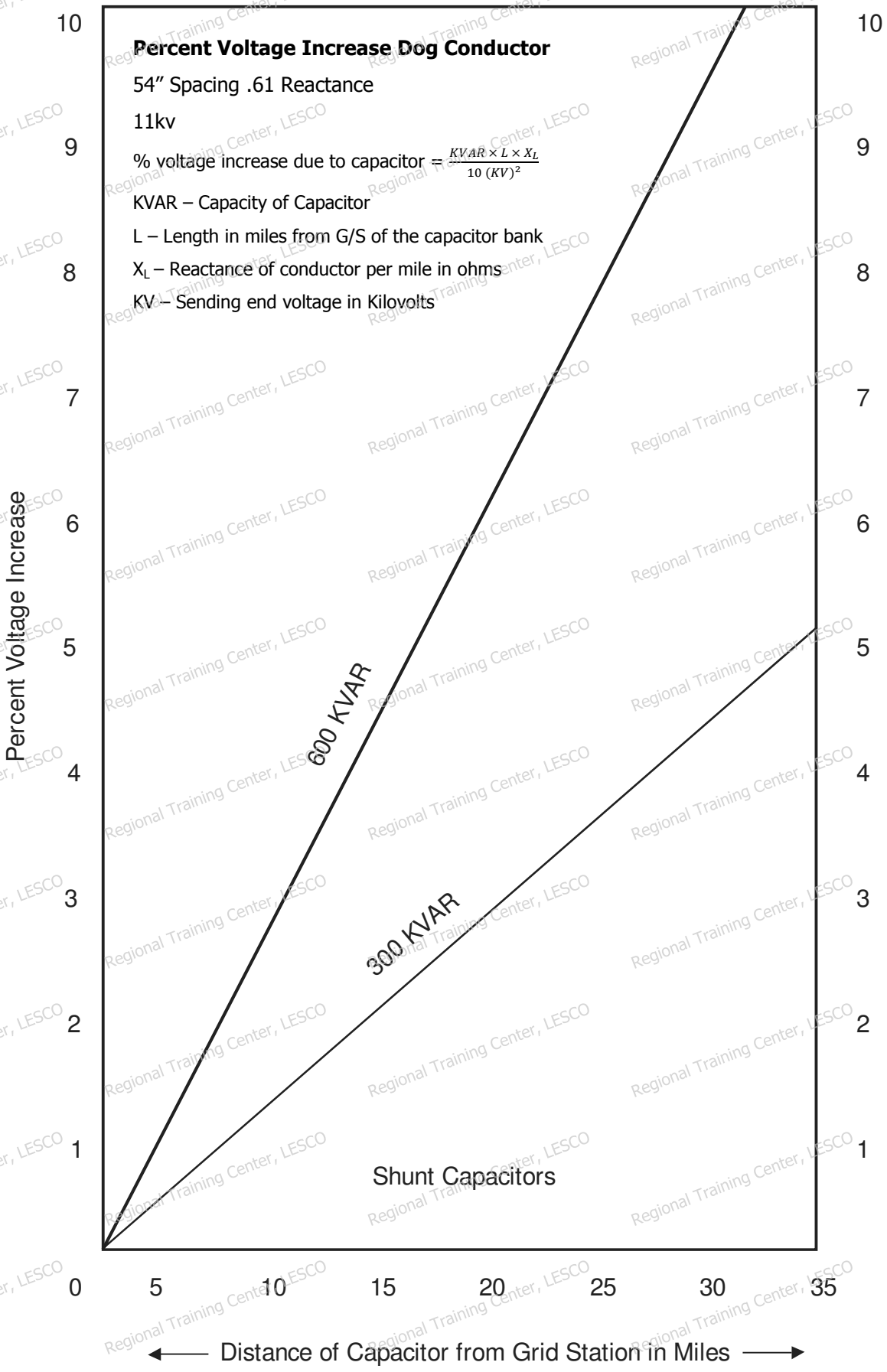

Percent Voltage Increase Dog Conductor
54" Spacing .61 Reactance
11kv
% voltage increase due to capacitor = $\frac{KVAR \times L \times X_L}{10\ (KV)^2}$
KVAR – Capacity of Capacitor
L – Length in miles from G/S of the capacitor bank
X_L – Reactance of conductor per mile in ohms
KV – Sending end voltage in Kilovolts
600 KVAR
300 KVAR
Shunt Capacitors
Percent Voltage Increase
Percent Voltage Increase
0
1
2
3
4
5
6
7
8
9
10
0
5
10
15
20
25
30
35
Distance of Capacitor from Grid Station in Miles

TABLE-I
SELECTION OF BOLTED CONNECTORS

	Dog	Rabbit	Gopher	Wasp	Ant	Gnat	7/.052	19/.052	19/.083	37/.083
Dog	T150	T155	S157	T150	T155	S157	S157	S157	T155	T150
			T155			T155		T155	T150	
Rabbit	T155	T110	S155	T155	T110	S117	S117	S117	T110	T155
			S157			S157	S157	S157	T155	
			T110			T110		T110		
Gopher	S157	S117	S117	S157	S117	S117	S117	S117	T155	S157
	T155	T110	T110	T155	T110	T110		T110	S117	T155
		S157							T110	
Wasp	T150	T155	S157	T150	T155	S157	S157	S157	T155	T150
			T155			T155		T155	T150	
Ant	T155	T110	S117	T155	T110	S117	S117	S117	T110	T155
			T110			T110		T110	T155	
Gnat	S157	S117	S117	S157	T117	S117	S117	S117	T155	S157
	T155	S157	T110	T155		T110		T110	S117	T155
		T110							T110	
7/.052	S157	S117	S117	S157	S117	S117	-	S117	S117	S157
		S157								
19/.052	S157	S117	S117	S157	T117	S117	S117	S117	T110	S157
	T155	S157	T110	T155	T110	T110		T110	S117	T155
		T110							T155	T150
19/.083	T155	T110	S117	T155	T110	S117	S117	S117	T150	T155
	T150	T155	T110	T150	T-155	T155		T155	T155	
			T155			T110		T110	T110	
37/.083	T150	T155	S157	T150	T155	S157	S157	S157	T155	T150
			T155			T155		T155		
								T150		

PREPARED BY

-SD-

(KHALID SAIFULLAH)
DIRECTOR (DIST:DESIGN)
O/O GENERAL MANAGER (ST) POWER WAPDA WAPDA HOUSE LAHORE

Line and Service Tap (Tee off)
Compression connector

	Dog	Rabbit	Gopher	Wasp	Ant	Gnat	7/.052	19/.052	19/.083	37/.083
Dog	YPC28U28	YPC28U26	-	YPC28U28	YP28U26	YPC28U4	YPC28U4	YPC28U4	YPC28U26	-
									YPC28U28	
Rabbit	YPC28U26	YP25U25	YP26AU2	YPC28U26	YP25U25	YP26AU2	YP26AU2*	YP26AU2	YP25U25	-
Gopher	-	YP26AU2	YP26AU2	-	YP26AU2	YP26AU2	YP26AU2*	YP26AU2	YP26AU2	-
Wasp	YPC28U28	YPC28U28	-	YPC28U28	YPC28U28	YPC28U4	YPC28U4*	YPC28U4	YPC28U28	-
Ant	YP28U26	YP25U25	YP26AU2	YPC28U26	YP25U25	YP26AU2	YP26AU2*	YP26AU2	YP25U25	-
Gnat	YPC28U4	YP26AU2	YP26AU2	YPC28U4	YP26AU2	YP2U3	YP2U3*	YP2U3	YP26AU2	-
7/.052	YPC28U4	YP26AU2*	YP26AU2*	YPC28U4*	YP26AU2*	-	YP2U3*	YP2U3*	-	-
19/.052	YPC28U4	YPC26AU2	YP26AU2	YPC28U4	YP26AU2	YP2U3	YP2U3*	YP2U3	YP26AU2	YPC28U4*
19/.083	YPC28U26	YP25U25	YP26AU2	YPC28U28	YP25U25	YP26AU2		YP26AU2	YP25U25	YPC28U28*
	YPC28U28									
37/.083	-	-	-	-	-	-	-	YPC28U4*	YPC28U28	-

* To be confirmed experimentally.

PREPARED BY

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(KHALID SAIFULLAH)

DIRECTOR (DIST:DESIGN)I

O/O GENERAL MANAGER (ST) POWER WAPDA WAPDA

HOUSE LAHORE

Table-III
Type of sleeves and dies for sleeve joints

Conductor	Wapda Sleeve Designation		Burndy Co .Sleeve		Burndy Co. Die Number	
	Inner	Outer	Inner	Outer	Inner	Outer
ACSR						
Dog	MS2S-Dog	MS2A-Dog	Yds.28	Yds.28	W-248	W-249
			RP2	RP-1		
Gopher	-	MS1A-Gopher	-	Yds.3	-	W-243
				RL		
Rabbit	-	MS1A-Rabbit	-	Yds.25	-	W-247
				RL		
A.A.C						
Gnat	-	MS1A-Gnat	-	Yds.2	-	W-163
				WA		
Ant	-	MS1A-Ant	-	Yds.25	-	W-243
				AT		
Wasp	-	MS1A-Wasp	-	Yds.28	-	W-249
				AT		

Table-IV
Type of repair sleeve and dies

Conductor	Wapda Sleeve Designation	Burndy Co. Repair Sleeve	Burndy co. Die No.
ACSR			
Gopher	RIA-Gopher	YCU2R	W-239
Rabbit	RIA-Rabbit	YCU25R	W-243
Dog	RIA-Dog	YCU28R	W-249
AAC			
Gnat	RIA-Gnat	YCU2CA	W-163
Ant	RIA-Ant	YCU25A	W-243
Wasp	RIA-Wasp	YCU28R	W-249

PREPARED BY

-sd-

Director (Dist.) Design, Power

O/O General Manager (Dist.) Power, Wapda

Wapda House, Lahore

DIMENSION AND CHARACTERISTICS OF STANDARD LT PVC INSULATED ALUMINUM CABLES

No.	SIZE			Nominal Conductor weight (Lbs:/1000 yds: per Conductor	Resistance in ohms at 20 deg:C, ohms/1000 yds.	Overall Conductor dia of each core		Approx: Current rating (Amps)	Voltage drop at cables rated current per 100ft (Volts)
	Nominal	Area	Stranding			Inch	mm		
	Sq:in	Sq:in	No./inch						
SINGLE CORE L.T CABLE, NON ARMOURED									
1	0.10	64.52	19/.083	368.2	0.397	.415	10.50	115	4.5
2	0.20	129.03	37/.083	717.4	0.204	.581	14.80	170	3.5
SINGLE CORE UNDER GROUND LT CABLE									
1	0.04	25.0	19/.052	144.5	1.031	.260	6.60	65	5.5
2	0.10	64.52	19/.083	368.2	0.397	.415	10.5	165	4.5
3	0.20	129.03	37/.083	717.4	0.204	.581	14.8	250	3.5
4	0.50	322.58	61/.103	1821.0	0.08	.927	23.5	455	3.8
TWO CORE LT CABLE NON ARMOURED									
1.	0.0145	9.36	7/.052	53.15	2.795	.156	3.96	32	7.1
	0.04	25.0	19/.052	144.5	1.031	.26	6.60	77	6.5
FOUR CORE LT CABLE NON ARMOURED									
1	0.0145	9.36	7/.052 inch or 7/1.32mm	53.15	3.118	.156	3.96	32	5.2

No.	SIZE			Nominal Conductor weight (Lbs:/1000 yds: per Conductor	Resistance in ohms at 20 deg:C, ohms/1000 yds.	Overall Conductor dia of each core		Approx: Current rating (Amps)	Voltage drop at cables rated current per 100ft (Volts)
	Nominal	Area	Stranding			Inch	mm		
	Sq:in	Sq:in	No./inch						
2	0.10	64.52	19/.083 in or 19/2.11 mm	368.2	0.452	.415	10.5	115	3.4
3.	0.20	129.03	37/.083 in or 37/2.11 mm	217.4	0.232	.498	12.6	175	2.7
4	0.50	322.58	61/.103 in or 61/2.62	1821.0	0.091	.927	23.5	320	2.3

LOAD CARRYING CAPABILITY OF STANDARD CONDUCTORS IN KVA-KIILOMETRES FOR 11KV, AND KVA METRES FOR L.T. AT DIFFERENT POWER FACTORS AND PRESENT VOLTAGE DROPS

Conductor Code Name	CAPACITY IN KVA KILOMETERS FOR 11KV, AND KVA METERS FOR L.T CONDUCTOR																			
	At 0.7 p.f and at voltage Drop				At 0.8 p.f and at voltage Drop				At 0.9 p.f and at voltage Drop				At 1 p.f and at voltage Drop				At .95 p.f loading & V.D.			
	3%	4%	5%	6%	3%	4%	5%	6%	3%	4%	5%	6%	3%	4%	5%	6%	3%	4%	5%	6%
L.T																				
1. GNAT	4261	5681	7102	8522	3909	5212	6515	7818	3664	4886	6106	7328	3661	4882	6102	7323	4165	5553	6942	8330
2. ANT	7260	9681	12100	14521	6861	9148	11435	13721	6664	8885	11107	13328	7219	9626	12032	14438	8818	11756	14696	17635
3. WASP	16617	15489	19361	23233	11427	15237	19045	22855	11702	15603	19504	23405	14576	19434	24293	29151	20740	27654	34567	41481
11 KV																				
4. GOPHER	2962	3951	4938	5926	2760	3679	4600	5519	2636	3518	4397	5278	2729	3639	4548	5458	3199	4265	5332	6398
5. RABBIT	4830	6440	8050	9660	4735	6313	7892	9470	4735	6313	7892	9470	5490	7321	9150	10980	7317	9757	12196	14635
6. DOG	7210	9612	12015	14418	7317	9757	12196	14635	7791	10388	12985	15582	10734	14311	17889	21486	17887	23849	29812	35774

NOTE:

The KVA Kilometer capacities of 11 KV conductor and KVA Meter capacities of l.T Conductor for any permissible Voltage Drop will be Subject to their respective Thermal Ratings in amperes. The load to be supplied at a known distance and a given voltage drop must no exceed the current caring capacity of the conductor.

LOAD CARRYING CAPABILITY OF STANDARD CONDUCTORS IN KVA-KIILO MILES FOR 11KV, AND KVA YARDS FOR L.T. AT DIFFERENT POWER FACTORS AND PRESENT VOLTAGE DROPS

Conductor Name	Code	CAPACITY IN KVA KILOMETERS FOR 11KV, AND KVA YARD FOR L.T CONDUCTORS																			
		At 0.70 p.f and at voltage Drop				At 0.8 p.f and at voltage Drop				At 0.9 p.f and at voltage Drop				At 1 p.f and at voltage Drop				At .95 p.f loading & V.D.			
		3%	4%	5%	6%	3%	4%	5%	6%	3%	4%	5%	6%	3%	4%	5%	6%	3%	4%	5%	6%
11 KV																					
1. GOPHER		1840	2454	3067	3681	1714	2285	2857	3428	1639	2185	2731	3278	1695	2260	2625	3390	1973	2649	3312	3974
2. RABBIT		3000	4000	5000	6000	2041	3921	1902	5885	2941	3921	4902	5882	3410	4547	5683	6820	4545	6060	7575	9090
3. DOG		4478	5970	7463	8955	4545	6060	7575	9090	4839	6452	8065	9678	6007	8889	11111	13334	11110	14813	18517	22220
L.T																					
4. GNAT		4660	6213	7767	9320	4275	5700	7125	8550	4007	5343	6678	8014	4004	5339	5373	8008	4555	6073	7592	9110
5. ANT		7940	10587	13233	15880	7503	10004	12505	15006	7288	9717	12147	14576	7895	10527	13158	15790	9643	12857	16072	19286
6. WASP		12704	16939	21173	25408	12497	16668	20823	24994	12798	17064	21330	25596	15940	21253	26567	31830	22692	30243	37803	45364

PREPARED BY
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S. Noor Ul Haq Shah
Deputy Director Design
(Distribution)

MINIMUM CLEARANCES FOR OVERHEAD LINES

(In Feet/Millimeters)

Sr. No.	Description			LINE VOLTAGE					
				400V	11KV	33KV	66KV	132KV	220KV
1	2			3	4	5	6	7	8
1	Minimum Clearance from Ground in Feet/mm	Across a Street or intersection or road		19/5791	20/6096	20/6096	26/7925	26/7925	26/7925
		Along a Street		17/5182	20/6096	20/6096	-	-	-
		Across private property and cross country		15/4572	15/4572	15/4572	20/6096	22//6706	23/7010
		Over rivers & major canals		-	-	-	30/9144	30/9144	30/9144
2	Minimum Clearance from Building Ft./mm	Vertical clearance over roofs etc		8/2438	12/3658	12/3658	15/4572	17/5182	20/6096
		Horizontal clearance from walls and parts of a building		4/1219	6/1829	6/1829	15/4572	20/6096	25/7620
3	Minimum clearance from railway installations Ft./mm	From Railway track of 5'-6" gauge	Inside Station Limits	31.5/9601	33/10058	34/10363	35/10668	36/10973	37/11278
			Outside Station Limits	23.5/7163	25/7620	26/7925	27/8230	28/5434	29/8839
		From Railway track of 2'-6" gauge	Inside Station Limits	28.5/8687	30/9144	31/9449	32/9754	33/10058	34/10363
			Outside Station Limits	20.5/6248	22/6706	23/7010	24/7315	25/7620	26/7925
		From railway power line or other railway structures		10.5/3200	10.5/3200	10.5/3200	10.5/3200	12.5/3810	13.5/4115

Sr. No.	Description			LINE VOLTAGE					
				400V	11KV	33KV	66KV	132KV	220KV
1	2			3	4	5	6	7	8
4	Minimum Clearance Between Two Lines At Crossing	The Line being crossed	Insulated services guys, earth wire etc	2/610	6/1829	6/1829	9/2743	11/3353	13/3962
			Telegraph Lines	4/1219	6/1829	6/1829	9/2743	11/3353	13/3962
			400V Lines	2/610	6/1829	6/1829	7/2134	9/2743	11/3353
			11KV Lines	-	4/1219	6/1829	7/2134	9/2743	11/3353
5	Minimum Clearance Between different circuits Mounted on the same Pole	Horizontal Clearance	Between Circuits of same voltage	0.75/229	4/1219	4/1219	14/4267	19/5791	29/8839
6	Minimum Clearance Between Conductors of the same circuits	Vertical Clearance	400V	4/1219	4/1219	4/1219	-	-	-
			11KV Line	4/1219	4/1219	4/1219	-	-	-
		Horizontal Clearance	Between phases of same circuit	1.33/405	3.67/813	3.17/966	11/335	16/487	26/7925
		Vertical Clearance	Between phases of same circuit	1/305	2.5/762	3.2/975	8/2438	12/3658	16/4877
			Between 11KV Line & T-off conductor below	-	2.75/838	-	-	-	-

Sr. No.	Description	LINE VOLTAGE						
		400V	11KV	33KV	66KV	132KV	220KV	
1	2	3	4	5	6	7	8	
7	Miscellaneous clearance between circuits, conductors or objects Not coverned above	a. Clearance between insulated service and open telegraph line					=	2'/610mm
		b. Clearance between 11KV Line and open telegraph Line.					=	1'/305mm
		c. Clearance between open telegraph Line & cable communication.					=	2'/610mm
		d. Clearance between street light brackets & 400V Line or telegraph line.					=	1'/305mm
		e. Clearance between guy wire at pole attachment & open telegraph line					=	2'/610mm
		f. Clearance between guy wire at pole attachment & 400V Line or cable					=	0'.25/76mm
		g. Clearance between guy wire at pole attachment & 11KV Line or cable					=	0'.75/229mm
	For Lines of 66KV and above, generally two circuits will be mounted on the same pole and will be in vertical formation. At these voltages circuits of different voltages are not to be installed on the same pole. The horizontal clearance for circuits of the same voltage are given at Sr.No.5. these are preferred design values for the conductors now used and spans of 900 ft. and 1200ft. for 66KV, 132KV Lines respectively. For other spans or heavy conductor the clearance may have to be changed.							

CHECKED BY

DIAMETER (DIST.DESIGN) I
O/0 GENERAL MANAGER (DIST.) POWER, WAPDA
WAPAD HOUSE, LAHORE

PREPARED

S.NOOR UL HAQ SHAH
DEPUTY DIRECTOR DESIGN
(DISTRIBUTION)

USERFUL INFORMATION (GNERAL)

The unit of current is the Ampere (C)

The Unit of pressure is the Volt (E) $C = \frac{E}{R}$

The unit of resistance is the Ohm (R)

The unit of power is the watt=C x E=Amperes x Volts

746 Watts = 1 Horse Power=33.000 foot/pounds per unit

1 Horse Power English=1.01385 Horse Power French (Force de cheval)

1 Horse Power French =4,500 Kilogrames per minute=.9863 Horse Power English

The large unit of power is the kilowatt=1,000 Watts

The Board of Trade unit (B.T.U)= 1Kilowatt hour=1,000 Watt hours=1.34 Horse Power Hours

1 watt = 00134 Hours Power, Kilowatt=1.34 Horse Power

1 Gallon of water =10 pounds = 0.1605 cubic foot

The pressure of the Atmosphere=14.7 pounds per square inch

Circumference of circle=diameter x 3.1416

Diameter of Circle =circumference x 0.31831

Area of Circle diameter squared x 0.7854

Diameter of Circle = square foot of area x 1.12837

Area of Ellipse long axis short axis x 7854

Area of Triangle = base x ½ perpendicular height.

Diameter of Circle x 8862= side of an equal square (equal area)

Side of Square x1.283=diameter of an equal circle (equal area)

Surface of a cylinder=area of both ends I (length x circumference)

Surface of a Cone = area of base x ½ (slant height x circumference of base)

Surface of Sphere= diameter squared X 3.1416

Contents of a Cylinder =area of one and x length

Contents of a Cone = area of base x 1/3 perpendicular height

Contents of Sphere = diameter cubed x 0.5236

Drum capacity in feet =(A+B) A x W x $\pi/12D^2$

Where A=depth of flange in inches
B=diameter of barrel in inches
W=width of reel between flanges inches.
D=diameter of material in inches

CONVERSION FACTORS

(British system to Metric System)

To CONVERT	MULTIPLY BY
mm to in	.03937
mm^2 to in^2	.00155
cm^3 to in^3	.06102
cm^4 to in^4	.02403
M to ft	3.2808
m^2 to ft^2	10.7639
M^3 to ft^3	35.3147
m to yd	1.0936
m^2 to yd^2	1.1960
m^3 to yd^3	1.3080
Kg. to Ib.	2.2046
Kg. to cwt	.01968
Kg. to tons	.0009842
Ib. to tons	.0004464
Short tons to tons	.8929
Tonnes (metric) to tons	.9852
Kg/mm^2 to lb/in^2	1422.33
$Tons/in^2$ to $lb./in^2$	2240
$gr./cm^3$ to lb/in^3	.03613
Kg./m to lb./ft.	.6720
$Kg./m^2$ to $lb./ft^2$	.2048
$Kg./mm^2$ to $tons/in^2$	.6350

To CONVERT	MULTIPLY BY
In to mm	25.4
in^2 to mm^2	645.16
in^3 to cm^3	16.3871
in^4 to cm^4	41.6231
Ft to m	.3048
ft^2 to m^2	.09290
ft^3 to m^3	.02832
Yd to m	.9144
yd^2 to m^2	.8361
yd^3 to m^3	.7646
Ib. to Kg.	.4536
Cwt to Kg.	50.8023
Tons to Kg.	1016.0461
Tons to Ib.	2240
Tons to short tons	1.12
Tons to tonnes (metric)	1.0160
lb/in^2 to Kg/mm^2	.0007031
$lb./in^2$ to $Tons/in^2$	.0004464
lb /in^3 to $gr./cm^3$	27.6799
lb./ft. to Kg./m	1.4882
$lb./ft^2$ to $Kg./m^2$	4.8824
$tons/in^2$ to $Kg./mm^2$	1.5749

No.	S.W.G		B.W.G		A.W.G or B&S	
	inch	m/m	inch	m/m	inch	m/m
40	.400	10.160	.454	11.532	4600	11.684
30	.372	9.449	.425	10.795	.4096	10.404
20	.348	8.839	.380	9.652	.3648	9.266
0	.324	8.230	.340	8.636	.3249	8.252
1	.300	7.620	.300	7.620	.2893	7.348
2	.276	7.010	.284	7.214	.2576	6.543
3	.252	6.401	.259	6.579	.2294	5.827
4	.232	5.983	.238	6.045	.2043	5.189
5	.212	5.385	.220	5.588	.1819	4.620
6	.192	4.877	.203	5.156	.1620	4.115
7	.176	4.470	.180	4.572	.1443	3.665
8	.160	4.064	.165	4.191	.1285	3.264
9	.144	3.658	.148	3.759	.1144	2.906
10	.128	3.251	.134	3.404	.1019	2.588
11	.116	2.946	.120	3.048	.0907	2.304
12	.104	2.642	.109	2.769	.0808	2.052
13	.092	2.337	.095	2.413	.720	1.829
14	.080	2.32	.083	2.108	.0641	1.628
15	.072	1.829	.072	1.829	.0571	1.450
16	.064	1.626	.065	1.651	.0508	1.290
17	.056	1.422	.058	1.473	.453	1.151
18	.048	1.219	.049	1.245	.0403	1.024
19	.040	1.016	.042	1.067	.0359	.912
20	.036	.914	.035	.889	.0320	.813
21	.032	.813	.032	.813	.0285	.724
22	.028	.711	.028	.711	.0253	.643
23	.024	.610	.025	.635	0.226	.574

No.	S.W.G		B.W.G		A.W.G or B&S	
	inch	m/m	inch	m/m	inch	m/m
24	.022	.559	.022	.559	.0201	.511
25	.020	.508	.020	.508	.0179	.455
26	.018	.457	.018	.457	.0159	.404
27	.0164	.417	.016	.406	.0142	.361
28	.0148	.376	.014	.356	.0126	.320
29	.0136	.345	.013	.330	.0113	.287
30	.0124	.315	.012	.305	.0100	.254
31	.0116	.295	.010	.254	.0089	.226
32	.0108	.274	.009	.229	.0080	.203
33	.0100	.254	.008	.203	.0071	.180
34	.0092	.334	.007	.178	.0063	.160
35	.0084	.213	.005	.127	.0056	.142
36	.0076	.193	.004	.102	.0050	.127
37	.00068	.173			.0045	.114
38	.0060	.152			.0040	.102
39	.0052	.132			.0035	.090
40	.0048	.122			.0031	.079
41	.0044	.112			.0028	.071
42	.0040	.102			.0025	.063
43	.0036	.091			.0022	.056
44	.0032	.081			.0020	.051
45	.0028	.071			.00176	.045
46	.0024	.061			.00157	.040
47	.0020	.051			.00140	.036
48	.0016	.041			.00124	.031
49	.0012	.030			.00111	.028
50	.0010	.025			.0099	.025

CONVERSION FACTORS (GENERAL)

To convert	Multiply by
Mils to millimeters (mm) 1000 (mils=I inch)	0.0254
Inches to centimeters (cm)	2.54
Centimeters to inches	0.3937
Feet to meters (m)	0.3048
Meters to feet (ft)	3.2808
Yards to meters (m)	0.9144
Meters to yards (yd)	1.0936
Miles to kilometers (Km)	1.6093
Kilometers to miles	0.6214
Square inches to circular mils (circ mils)	1,273.240
Square inches to square millimeters (mm^2)	645.16
Square millimeters to square inches ($inch^2$)	0.00155
Square yards to square meters (m^2)	0.8361
Square meters to square yards (yd^2)	1.196
Hectares to acres	2.471
Acres to hectares	0.4047
Cubic inches to cubic centimeters (cm^3)	16.387
Cubic centimeters to cubic inches ($inch^3$)	0.061
Cubic yards to cubic meter (m^3)	0.7646
Cubic meters to cubic yards (yd^3)	1.308
Pounds to kilograms (kg)	0.4536
Kilograms to pounds (Ib)	2.205
Tons (2240 Ib) to kilograms (kg)	1016
Kilograms to tons (2240 Ib)	0.00098
Ounces (avoirdupois) to grammas	28.35
Grammas to ounces (avoirdupois)	0.0353
Grains (troy) to grammas	0.0648
Grammas to grains (troy)	15.432
Gallons to liters	4.546
Liters to gallons	0.220
Horsepower to foot pound per minute (ft lb/min)	33.000
Watts to foot pounds per minute (ftlb/min)	44.24
Horsepower to kilowatts (KW)	0.746
Kilowatts to horsepower (h.p)	1.34
Atmospheres to lb per square inch ($lb/inch^2$)	14.68
Miles per hour to feet per minute (ft/min)	88.0
Land miles to nautical miles	0.868
Nautical miles to land miles	1.152
Temperature:	
F to C subtract 32 and multiply by 5/9	
C to f Multiply by 9/5 and add 32	

Sizes of fuse elements composed of plain or tinned copper wire for use in semi enclosed fuses.

Current rating of fuse	Nominal diameter of wire
Amp	**MM**
3	0.15
5	0.20
10	0.35
15	0.50
20	0.60
25	0.75
30	0.85
45	1.23
60	1.93
80	1.80
100	2.00

Note:

The use of cartridge fuses to the appropriate British Standard is normally recommended, but where a rewireable fuse is used the figures given in the above table will in the absent of recommendations made by the maker of the fuse, provide an approximate guide to the size of wire required. These figures represent the current which the fuse will carry continuously; the value at which the fuse will below is approximately twice, depending on the type and construction of the fuse.

This table is taken from Table A.IM of the IEE Regulations, 14th Edition.

Calculation of capacitor size (for line)

The following table has been prepared to simplify kVAr calculations for power factor improvement. The size of capacitor in kVAr load in KW multiplied by factor given in table to improve from existing power factor to proposed power factor.

Existing Power Factor	Proposed Power Factor					Existing Power Factor	Proposed Power Factor				
	1.0	0.95	0.90	0.85	0.80		1.0	0.95	0.90	0.85	0.80
0.20	4.809	4.570	4.415	4.279	4.149	0.61	1.299	0.970	0.815	0.679	0.549
0.21	4.656	4.327	4.171	4.036	3.906	0.62	1.266	0.937	0.781	0.646	0.515
0.22	4.433	4.104	3.949	3.813	3.683	0.63	1.233	0.904	0.748	0.613	0.482
0.23	4.231	4.902	3.747	3.611	3.483	0.64	1.201	0.872	0.716	0.581	0.450
0.24	4.0.45	3.716	3.561	3.425	3.295	0.65	1.169	0.840	0.685	0.549	0.419
0.25	3.873	3.544	3.389	3.253	3.123	0.66	1.138	0.810	0.654	0.518	0.388
0.26	3.714	3.385	3.229	3.094	2.264	0.67	1.108	0.779	0.624	0.488	0.358
0.27	3.566	3.238	3.082	2.946	2.816	0.68	1.078	0.750	0.594	0.458	0.328
0.28	3.429	3.100	2.944	2.809	2.679	0.69	1.049	0.720	0.565	0.429	0.298
0.29	3.300	2.971	2.816	2.680	2.550	0.70	1.020	0.691	0.536	0.400	0.270
0.30	3.180	2.851	2.696	2.560	2.430	0.71	0.992	0.663	0.507	0.372	0.241
0.31	3.067	2.738	2.583	2.447	2.317	0.72	0.964	0.635	0.480	0.344	0.214
0.32	2.961	2.632	2.476	2.341	2.211	0.73	0.936	0.608	0.452	0.316	0.186
0.33	2.861	2.532	2.376	2.241	2.111	0.74	0.909	0.580	0.425	0.289	0.158
0.34	2.766	2.437	2.282	2.146	2.016	0.75	0.882	0.553	0.398	0.262	0.132
0.35	2.676	2.347	2.192	2.056	1.926	0.76	0.855	0.527	0.371	0.235	0.105
0.36	2.592	2.263	2.107	1.972	1.842	0.77	0.829	0.500	0.344	0.209	0.078
0.37	2.511	2.182	2.027	1.891	1.761	0.78	0.802	0.474	0.318	0.182	0.052
0.38	2.434	2.105	1.950	1.814	1.684	0.79	0.776	0.447	0.292	0.157	0.026
0.39	2.361	2.032	1.877	1.741	1.611	0.80	0.750	0.421	0.266	0.130	-
0.40	2.291	1.963	1.807	1.671	1.541	0.81	0.724	0.395	0.240	0.104	-
0.41	2.225	1.896	1.740	1.605	1.475	0.82	0.698	0.369	0.214	0.074	-
0.42	2.161	1.832	1.676	1.541	1.410	0.83	0.672	0.343	0.188	0.058	-
0.43	2.100	1.771	1.615	1.480	1.349	0.84	0.646	0.317	0.162	0.026	-
0.44	2.041	1.712	1.557	1.421	1.291	0.85	0.620	0.291	0.136	-	-
0.45	1.985	1.656	1.501	1.365	1.235	0.86	0.593	0.265	0.109	-	-
0.46	1.930	1.602	1.446	1.310	1.180	0.87	0.567	0.238	0.82	-	-
0.47	1.877	1.548	1.392	1.257	1.128	0.88	0.540	0.211	0.56	-	-
0.48	1.828	1.499	1.343	1.208	1.077	0.89	0.512	0.183	0.028	-	-
0.49	1.779	1.450	1.295	1.159	1.029	0.90	0.484	0.155	-	-	-
0.50	1.732	1.403	1.248	1.112	0.982	0.91	0.456	0.127	-	-	-
0.51	1.687	1.358	1.202	1.067	0.936	0.92	0.426	0.97	-	-	-
0.52	1.643	1.314	1.158	1.023	0.892	0.93	0.395	0.066	-	-	-
0.53	1.600	1.271	1.116	0.980	0.850	0.94	0.363	0.034	-	-	-
0.54	1.559	1.230	1.074	0.939	0.801	0.95	0.326	-	-	-	-
0.55	1.518	1.189	1.034	0.898	0.768	0.96	0.292	-	-	-	-
0.56	1.479	1.150	0.995	0.859	0.729	0.97	0.251	-	-	-	-
0.57	1.448	1.113	0.95	0.822	0.601	0.98	0.203	-	-	-	-
0.58	1.425	1.07	0.92	0.785	0.654	0.99	0.142	-	-	-	-
0.59	1.368	1.040	0.884	0.748	0.618	0.100	-	-	-	-	-
0.60	1.333	1.004	0.847	0.713	0.582	-	-	-	-	-	-

inch Fractions
decimals and millimeter

Inch		Millimeters	inch		Millimeters
Fraction	Decimal		Fraction	Decimal	
1/44	0.015625	0.3969	33/64	0.515625	13.0696
1/32	0.03125	0.7938	17/32	0.53125	13.04938
3/64	0.046875	1.1906	35/64	0.546875	13.8906
1/16	0.0625	1.5875	9/16	0.5625	14.2875
5/64	0.078125	1.9844	37/64	0.578125	14.6844
3/32	0.09375	2.3812	19/32	0.59375	15.0812
7/64	0.109375	2.7781	39/64	0.609375	15.4781
1/8	0.125	3.175	5/8	0.625	15.875
9/64	0.140624	3.5719	41/64	0.640625	16.2719
5/32	0.15625	3.9688	21/32	0.65625	16.6688
11/64	0.171875	4.3636	43/64	0.671875	17.0636
3/16	0.1875	4.7625	11/16	0.6875	17.4625
13/64	0.203125	5.1594	45/64	0.703125	17.8594
7/32	0.21875	5.5562	23/32	0.71875	18.2562
15/64	0.234375	5.9531	47/64	0.734375	18.6531
¼	0.25	6.35	3/4	0.75	19.05
17/64	0.265625	6.7469	49/64	0.765625	19.4469
9/32	0.28125	7.1438	25/32	0.78125	19.8438
19/64	0.296875	7.5406	51/64	0.796875	20.2406
5/16	0.3125	7.9375	13/16	0.8125	20.6375
21/64	0.328125	8.3344	53/64	0.888125	21.0344
11/32	0.34375	8.7312	27/32	0.84375	21.4312
23/64	0.359375	9.1281	55/64	0.859375	21.8281
3/8	0.375	9.525	7/8	0.875	22.225
25/64	0.390625	9.9219	37/64	0.890625	22.6219
13/32	0.40625	10.3188	29/32	0.90625	23.0188
27/64	0.421875	10.7156	59/64	0.921875	23.4156
7/16	0.4375	11.1125	15/16	0.9375	23.8125
29/64	0.453125	11.5094	61/64	0.953125	24.2094
15/32	0.46875	11.9062	31/32	0.96875	24.6062
31/64	0.484373	12.3031	63/64	0.984375	25.0031
½	0.5	12.7	1	1.0	25.4

Loading of Distribution Transformers

Recurrent daily loading for operating conditions of transformers Expressed as percent age of rated K.V.A.

Cooling Air Temperature		24 Hrs. loading all day.	Long Periods		Medium Periods		Short Periods	
C°	F°		16 Hrs H.Loads	Recovery 8 hrs L. load	6 Hrs. H.load	Recov: 16 hrs. L.Load	3 Hrs L.Load	Recovery 21 Hrs L.Load
5	41	115%	120%	100%	125%	100%	145%	100%
10	50	110%	115%	94%	120%	94%	140%	94%
20	68	100%	105%	82%	110%	82%	130%	82%
25	77	94%	100%	76%	105%	76%	125%	76%
30	86	88%	94%	70%	100%	70%	120%	70%
35	95	82%	88%	64%	94%	64%	115%	64%
40	104	76%	82%	57%	88%	57%	110%	57%
45	113	70%	76%	49%	82%	49%	105%	49%
50	122	64%	70%	40%	76%	40%	100%	40%

Note: -

light load means a loading which keeps the windings temperature not exceeding 70°C. The table clarifies that loading in % of K.V.A should be controlled as per above table or a higher capacity transformer installed accordingly.