

SPECIFICATION P-144: 80

MID SPAN JOINTS AND REPAIR SLEEVES
FOR TRANSMISSION LINES



PAKISTAN
WATER AND POWER DEVELOPMENT AUTHORITY
DESIGN DEPARTMENT (T&G) POWER

SPECIFICATION P-144: 80

MIDSPAN JOINTS AND REPAIR SLEEVES FOR
TRANSMISSION LINES

AMENDMENT NO. 1 DATED DEC. 1982.

1. Replace Table-I of subclause 2.1 with the following:

Description	Designation	Cond. OD (mm)
a) Mid span joint for DOG	MS-D	14.2
b) Mid span joint for LYNX	MS-L	19.5
c) Mid span joint for CUCKOO	MS-C	27.7
d) Mid span joint for RAIL	MS-R	29.6
e) Mid span joint for CARDINAL	MS-CA	30.4
f) Repair sleeves for DOG	RS-D	14.2
g) Repair sleeves for LYNX	RS-L	19.5
h) Repair sleeves for CUCKOO	RS-C	27.7
i) Repair sleeves for RAIL	RS-R	29.6
j) Repair sleeves for CARDINAL	RS-CA	30.4

2. The sub para (ii) of subclause 2.1 is substituted as follows:

ii) The next letter stands for the name of conductor for which the hardware is meant for i.e. 'D' for DOG, 'L' for LYNX, 'C' for CUCKOO, 'R' for RAIL and 'CA' for CARDINAL.

3. Replace Table-II of sub clause 3.1 with the following:

TABLE - II
Rating of Hardware

Sr. No.	Description	Failing load in Kg.
1.	MS-D	3300
2.	MS-L	8000
3.	MS-C	12000
4.	MS-R	12000
5.	MS-CA	16000
6.	RS-L	-
7.	RS-L	-
8.	RS-C	-
9.	RS-R	-
10.	RS-CA	-

4. The first sentence of sub para 1 of clause 11 is substituted as follows:
" The test current shall be that power frequency current which raises the surface temperature of the conductor 100 degC above 40°C ambient temperature and maintains the temperature at a steady value".
5. The last sentence of sub para 3 of clause 11 is substituted as follows:
" The sequence of operation shall be repeated so that 100 cycles of heating and cooling are applied".
6. The principal dimensions of Mid Span Joints and Repair Sleeves for ACSR CARDINAL Conductor are added on Dwg. No. PDW/DF-302.

C O N T E N T S

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2. Types of Mid Span Joints and Repair Sleeves
3. Rating of Hardware
4. General Requirements
5. Dimensions and Tolerances
6. Design and Material
7. Tests
8. Visual Examination
9. Verification of Dimensions
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14. Sampling Plan-Acceptance and Rejection
15. Marking and Packing
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17. Drawing

PRINTING HISTORY

First approved on 21st September, 1980.

AMENDMENT NO.1 DEC.1982

SPECIFICATION P-144: 80

MID SPAN JOINTS AND REPAIR SLEEVES FOR TRANSMISSION LINES

0 FOREWORD

- 0.1 This standard has been introduced by WAPDA and has been prepared by the Transmission Line Section of the office of the Chief Engineer (Designs).
- 0.2 This standard is intended only for the purpose of technical specification to facilitate procurement of materials and does not include provision of contract.
- 0.3 This specification is subject to periodic revision as and when required.

1 SCOPE

- 1.1 This specification covers the mid span joints and repair sleeves for ACSR Conductor intended to be used on Transmission Lines.

2 TYPES OF MID SPAN JOINTS AND REPAIR SLEEVES

- 2.1 The hardware described in this Specification are of the following types:

TABLE - 1

Description	Designation	Cond.OD(mm)
a) Mid span joint for DOG	MS - D	14.2
b) Mid span joint for LYNX	MS - L	19.5
c) Mid span joint for CUCKOO	MS - C	27.7
d) Mid span joint for RAIL	MS - R	29.6
e) Repair sleeves for DOG	RS - D	14.2
f) Repair sleeves for LYNX	RS - L	19.5
g) Repair sleeves for CUCKOO	RS - C	27.7
h) Repair sleeves for RAIL	RS - R	29.6

The hardware described above in this Specification has been designated by the code numbers. These codes have been

assigned in the following manner.

- i) The first two letters stand for Mid Span joints or repair sleeves i.e. MS for mid span joint and RS for repair sleeves.
- ii) The next letter stands for the name of conductor for which the hardware is meant for i.e. 'D' for DOG, 'L' for LYNX, 'C' for CUCKOO and 'R' for RAIL.

3 RATING OF HARDWARE

- 3.1 The hardware shall be of the rating as specified in Table-II below:

TABLE - II
Rating of Hardware

Sr. No.	Description	Failing load in Kg
1.	MS-D	3300
2.	MS-L	8000
3.	MS-C	12000
4.	MS-R	12000
5.	RS-D	-
6.	RS-L	-
7.	RS-C	-
8.	RS-R	-

4 GENERAL REQUIREMENTS

- 4.1 Generally each mid span joint shall consist of:

- 1 Steel sleeve galvanised
- 1 Aluminium sleeve

- 4.2 The repair sleeve shall be made of 2 pieces. It shall be compression type and shall be made of all aluminium.

- 4.3 All ferrous parts shall be hot dip galvanised in accordance with WAPDA Specification P-82. (latest revision)

5 DIMENSIONS AND TOLERANCES

- 5.1 All hardware shall generally be in accordance with

drawings forming a part of this specification.

- 5.2 The dimensions of these parts of hardware that mate with other hardware or that determine the length of insulator string are binding and are shown enclosed on the drawing.
- 5.3 For dimensions that are fixed and binding the tolerance will be plus or minus 2 percent with a maximum of 0.8mm. For dimensions that are shown as MAX or MIN there shall be no plus and minus tolerance respectively. The tolerance in the opposite sense may however be 4%.

6 DESIGN AND MATERIAL

6.1 Mid Span Joints

Mid span joints shall be of the compression type. They shall be such that after compression they shall assume a hexagonal cross-section. The electrical conductivity and current carrying capacity shall not be less than an equal length of conductor.

Conductor joints shall be made of aluminium with a galvanised steel inner sleeve. Mid span joints shall be made according to Dwg. No. PDW/DF-302.

6.2 Repair Sleeves

Repair sleeves shall be designed to make good a conductor of which not more than one-fifth of the strands in the outer layer have been served.

- 6.3 Repair sleeve shall be composed of two aluminium pieces fitted into each other and forming an integral part. They shall be compressed on the damaged part of conductor by the same dies used for aluminium component of dead-end and mid-span joint and shall have un-installed length as indicated in Dwg. No. PDW/DF-302.

7 TESTS

7.1 Type Tests

- 7.1.1 Type tests are intended to verify and establish design characteristics. They shall be made once only on hardware identical in all essential details with those to be supplied.

- i) Mechanical Test)
- ii) Heat Cycle Test) On mid span joints only
- iii) Resistance Test)

- 7.1.2 The bidder shall supply heat cycle test result with the bid.

7.2 Sample Tests

Sample tests shall be made to verify the quality and workmanship. The number of samples shall be nearest whole number to one half of one percent of the batch offered for inspection.

The following sample test shall be performed in accordance with the clause:

- i) Visual examination
- ii) Verification of dimensions
- iii) Mechanical tests) On mid span joints
- iv) Resistance tests)
- v) Galvanising tests On ferrous parts.

8 VISUAL EXAMINATION

The test samples shall be examined visually for the following defects.

Visual Examination

Examination	Defects
Material	Not as specified in relevant clauses.
Construction	Not of the shape given in relevant Drawing. Any part missing.
Finish	Galvanising not proper. Presence of burrs, black and bare spots, dross and projections, which will interfere with proper use of the articles.

9 VERIFICATION OF DIMENSIONS

The binding dimensions of the hardware shall be measured and shall be as shown on the relevant approved drawings subject to the tolerance given in clause 5.

10 MECHANICAL TEST

- 10.1 Test piece shall be assembled in accordance with manufacturer's recommendations on conductor of the size and type with which it is to be used. The assembly shall be

mounted in a tensile testing machine and anchored in a manner approximating as nearly as possible to the arrangement to be used in service, precautions being taken to avoid birdcaging of the conductor. The length of conductor between the fitting under test and any other clamp or joint in the test assembly should preferably be not less than 100 times the overall diameter of the conductor.

- 10.2 A tensile load of about 80 percent of the failing load specified in Table-II shall be applied and the conductor shall be marked in such a way that movement relative to the fitting can easily be detected. Without any subsequent adjustment of the fitting, the load shall be steadily increased to 95% of the failing load and then reduced to 90% of the failing load and maintained for 1-minute. There shall be no movement of the conductor relative to the fitting due to slip during this 1-minute period and no failure of the fitting.

11 HEAT CYCLE TEST

The test current shall be 40°C that power frequency current which raises the surface temperature of the conductor 40 degC above 40 degC ambient temperature and maintains the temperature at a steady value. The minimum length of conductor used for determining this current shall be 2 meters and the conductor temperature shall be measured near the centre of the test length.

The joint shall be assembled in accordance with the manufacturer's recommendations on conductor of the size and type with which it is to be used. (The assembly, to which a tensile load not exceeding 20% of the rated minimum failing load as specified in Table-II may be applied, shall be directed indoors so that the conductor is roughly horizontal). Air shall be able to circulate freely round line assembly which shall not however, be exposed to draughts. The minimum length of conductor on each side of the fitting shall be 2 meters.

The test current shall be passed continuously through the assembly for a period of 30 min. The current shall then be interrupted, and the assembly shall be allowed to cool to within 5 degC above the ambient temperature. The sequence of operation shall be repeated so that 250 cycles of heating and cooling are applied.

During the last five cycles, the maximum temperature measured when the test current is flowing at any points on the surface of the fittings, shall not exceed that of the conductor. At the end of the test the joint

shall meet the requirements of the resistance test specified above. There shall be no sign of local heating, burning or fusing of any part of the joint or of the conductor.

12 RESISTANCE TEST

12.1 The fitting shall be assembled in accordance with the manufacturer's recommendations on conductors of the size and type with which it is to be used. The electrical resistance shall be measured between points on the conductor on either side and just clear of the fitting and shall not exceed 75% of the measured resistance of the equivalent length of conductor.

12.2 The test may be made with direct current or with alternating current at any convenient power frequency. The current connections shall be at a distance not less than 50 times the diameter of the conductor from the fitting and shall be so made that effective contact is made with all these strands of the conductor which would be taken into account in calculating its equivalent resistance.

13 GALVANISING TEST

This test shall be carried out on all ferrous parts complying with the following requirements.

- i) Weight of zinc coating
- ii) Uniformity of zinc coating
- iii) Adherence of zinc coating

This test shall be performed in accordance with WAPDA Specification P-82.(latest revision)

14 SAMPLING PLAN - ACCEPTANCE AND REJECTION

- i) Sampling sizes are designated by code letters. Table-III shall be used to find the applicable code letter for the particular lot or batch size for various tests specified in this Specification. While the number of units of product from each lot or batch which are to be inspected (sample size) and the criteria for determining the acceptability of the lot or batch (acceptance & rejection numbers) for different code letters can be obtained from the table-IV given below.
- ii) The number of sample units inspected shall be equal to the first sample size given in Table-IV. If the number of defective units founding the first sample is equal

to less than the first acceptance number, the lot shall be acceptable. If the number of defectives found in the first sample is equal to or greater than the first rejection number, the lot shall be rejected. If the number of defectives found in the first sample is between the first acceptance and rejection number, a second sample of the size given by the plan shall be inspected. The number of defectives found in the first and the second samples shall be a cumulated. If the cumulative number of defectives is equal to or less than the second acceptance number, the lot shall be acceptable. If the cumulative number of defectives is equal to or greater than the second rejection number, the lot shall be rejected.

TABLE - III Sample Size

Lot of Batch Size	Sample size for Test specified in Clause 10,12 & 13	Sample size for dimensional and finish defects
2 to 8	A	A
9 to 15	A	B
16 to 25	A	C
26 to 50	A	D
51 to 90	B	E
91 to 150	B	F
151 to 280	B	G
281 to 500	B	H
501 to 1200	C	J

TABLE - IV

Sample acceptance criteria

Sample size code letters	Sample	Sample size	Cumula- tive sample size	Acceptance number	Rejection number
A	First	1	1	0	1
	Second	-	-	-	-
B	First	2	2	0	2
	Second	2	4	1	2
C	First	3	3	0	2
	Second	3	6	1	2
D	First	5	5	0	2
	Second	5	10	1	2
E	First	8	8	0	2
	Second	8	16	1	2

F	First	13	13	0	3
	Second	13	26	3	4
G	First	20	20	1	4
	Second	20	40	4	5
H	First	32	32	2	5
	Second	32	64	6	7
J	First	50	50	3	7
	Second	50	100	8	9

15 MARKING AND PACKING

The material shall be packed in wooden crates for export shipment to permit convenient handling and to protect against loss or damage to final destination. Containers (wooden crates) shall be designed for handling by fork-lift, truck and by slings around the container. The weight of each package should be between 100 and 150 kg.

Packages shall be designed for rough handling. All wooden crates shall be clearly marked to indicate.

1. Quantity
2. Name of hardware item
3. Manufacturer's Name

All packages shall be numbered consecutively so that total shipment can be readily determined.

16 INFORMATION TO BE SUPPLIED

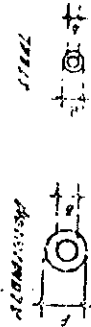
The following information shall be supplied with the bid and failure to supply the same may subject the bid to disqualifications:

- i) Detailed fully dimensioned drawings of midspan joints and repair sleeves
- ii) Specification giving material grade & composition of all items of hardware
- iii) Catalogues/literature of standardised items
- iv) Test certificates
- v) One complete sample of all types of midspan joints and repair sleeves
- vi) Detail of manufacturing & testing facilities available with manufacturers.

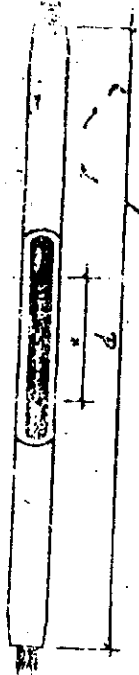
17 DRAWING:

The following drawing form the part of this specification:

- a) Mid span joint & repair sleeve PDW/DF-302



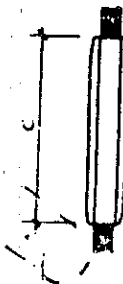
(STEEL COMPRESSION JOINT)



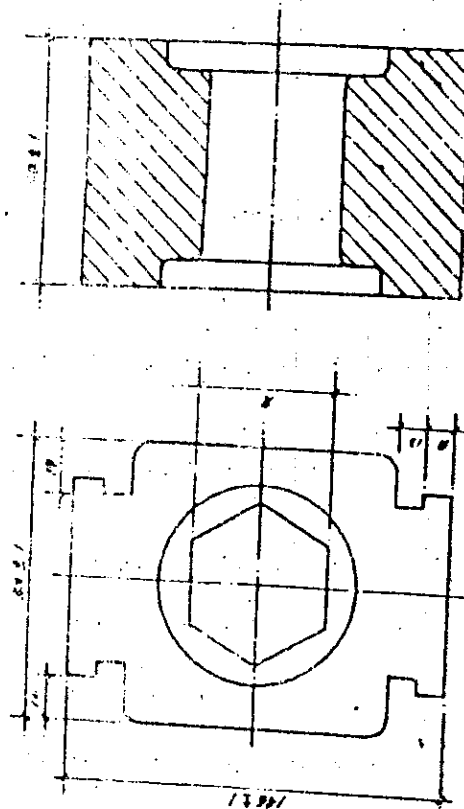
(ALUMINUM COMPRESSION JOINT WITH SPAN JOINT)



(STEEL COMPRESSION JOINT)



(CONDUCTOR REPAIR SLEEVE)



(DIET FOR COMPRESSION JOINTS)

DESCRIPTION	DOG IN IN	LYNX IN IN	CUCERO IN IN	RAIL IN IN
CONDUCTOR DIA				
OUTER COMPLETE COND.	14.8	19.5	27.7	28.4
IN OF STEEL COSE	9.7	8.5	9.2	7.4
AL JOINT				
OUTSIDE DIA (A)	22.8	34.5	45.5	50.5
INSIDE DIA (B)	15.5	21.0	29.0	31.0
LENGTH (C)	275	600	850	850
STEEL JOINT				
OUTSIDE DIA (A)	19.5	24.5	30.5	35.0
INSIDE DIA (B)	5.5	8.75	9.75	8.0
LENGTH (C)	180	220	230	220
REPAIR SLEEVE				
OUTSIDE DIA (A)	22.5	34.5	45.5	50.5
INSIDE DIA (B)	15.5	21.0	29.0	31.0
LENGTH (C)	300	200	250	250
COMPRESSOR DIA				
FOR AL (A)	21.5	30.0	39.5	44.0
FOR STEEL (A)	18.0	17.0	17.0	16.0

PAKISTAN				DESIGN
WATER AND POWER DEVELOPMENT AUTHORITY				DEPARTMENT
MANAGER	ASSISTANT MANAGER	ENGINEER	INSPECTOR	DATE 8 2 1960
MANAGER	ASSISTANT MANAGER	ENGINEER	INSPECTOR	
MID SPAN JOINT AND REPAIR SLEEVE				
SCALE				
DWG. NO. PDW/DF-302				

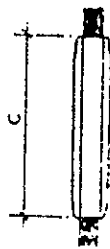
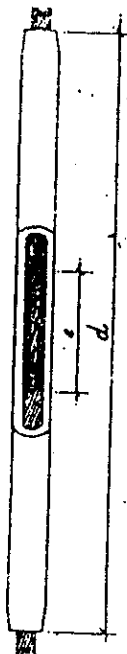


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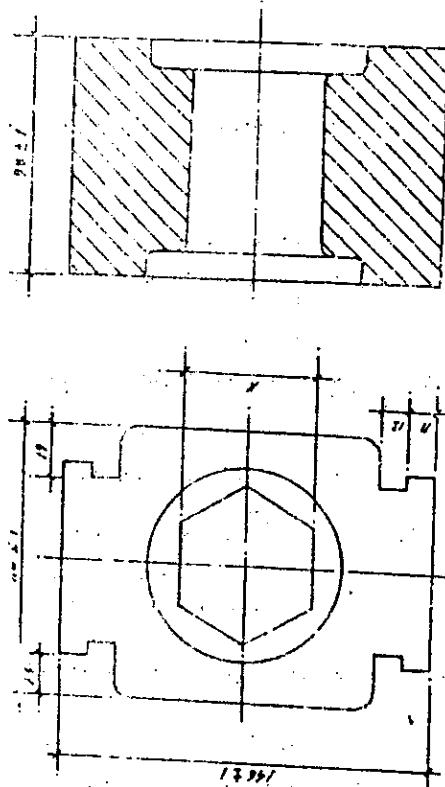
(continued)

(S. 1000: 1000)



MINIMUM COMPLETION DATE 12-1-77

(CONDUCTOR REPAIR SLEEVE)



DESCRIPTION	ODD IN	LYNCH IN	CUMMINS IN	RAIL IN	CIA-JUNE IN
<u>CONDUCTOR DIA.</u>					
DIA OF COMPLETE COND:	14.2	19.5	27.7	22.5	30.4
DIA OF STEEL CORE	4.7	8.5	9.2	7.4	10 1/4
<u>AL JOINT</u>					
OUTSIDE DIA (A)	22.5	34.5	45.5	50.5	54.0
INSIDE DIA (B)	15.5	27.0	29.0	31.0	32.5
LENGTH (d)	225.0	600.0	850.0	850.0	740.0
<u>STEEL JOINT</u>					
OUTSIDE DIA (A)	16.5	26.5	30.5	19.0	20.5
INSIDE DIA (B)	5.5	8.75	9.75	8.0	10.75
LENGTH (C)	150.0	220.0	250.0	200.0	250.0
<u>REPAIR SLEEVE</u>					
OUTSIDE DIA (A)	22.5	34.5	45.5	50.5	54.0
INSIDE DIA (B)	15.5	27.0	29.0	32.0	32.0
LENGTH (C)	240.0	200.0	350.0	250.0	275.0
<u>COMPRESSOR DIA</u>					
FOR AL (A)	21.5	30.0	38.5	44.0	48.0
FOR STEEL (A)	10.0	17.0	17.0	16.0	17.0

PAKISTAN		DESIGN DEPARTMENT	
HAIR AND POWER DEVELOPMENT AUTHORITY			
BAHR	ETHAIR SHAN	Yash	
CHECKED	AMALYAL ALJIL	Complete	
DRAWN	HAZAR ADAS	Not	
ENGINEER	SHAH WALI-A-	Not	
FLAVOR	SHAH	Not	
INSPECTOR	J. GUTHAP		
CHIEF	PROJEN		
ENGINEER	DAVID ANHAR		
MID SPAN JOINT AND REPAIR SLEEVE		SCALE	DATE 5.2.1960
		DWG. NO. PDW/DF - 302	

NO	DATE	REVISIONS	
1	08-06-97	CORRECTED DRAWING FOR INSTALLATION OF SUBSTITUTION	X

(Dies for compression joints)