4 Insulators

Both Pin & disc insulators shall conform to IS: 731. Depending on the materials, two types of insulators are used; Porcelain and Polymer Insulator.

4.1.1 Pin Insulators

Table 4.1: Minimum Specification for Porcelain Pin Insulators

Characteristics	Unit	11 kV	33 kV
Applicable Standard	IEC 60383-1 and IS 731		
Insulator Test Voltage			
Highest System Voltage	kV(RMS)	12	36
Visible Discharge Test	kV(RMS)	9	27
Wet-Power frequency withstand	kV(RMS)	28	70
Minimum power frequency flashover voltage Dry Wet	kV	 110 70	 140 95
Power frequency puncture withstand test	kV	145	185
Impulse voltage withstand test	kV Peak	75	170
Dimensions of insulator			
Nominal diameter	mm	229	305
Nominal height	mm	165	241
Nominal creepage distance	mm	25mm/kV	25mm/kV
Approximate weight	kg	4.5	11
Dimensions of pin heads			
Applicable standard	IS 2486 (Part II)		
Minimum Failing load in kN	As per IS 2486 (Part I)		
Minimum Failing load in kN	kN	5	100
Stalk length	mm	165	300
Type		Small head	Large head
Shank length	mm	150	150
Shank dia	mm	24	24
Threads on the shank	mm	Not less than 100 mm	Not less than 100 mm

Details are given on drawing no. BPC-DDCS-2022-20/1-7, 2-7

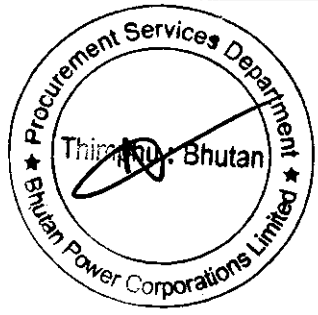


Table 4.2: Minimum Characteristics of Polymer Pin Insulators

Characteristics	**Unit**	**11 kV**	**33 kV**
Applicable Standard	IEC 61109-2008 and IS 731		
Type of insulators	Composite		
Material of the insulator	Silicon rubber		
Material of the core rod	ECR grade Boron free		
Material of the housing & weather sheds	Silicon Rubber		
Material of the end fittings	Spheroidal graphite cast Iron (SGCI) with hot dip galvanized		
Sealing compound of the end fitting	Silicon based sealant		
Type of sheds	Aerodynamic with **alternating sheds**		
Diameter of FRP rod	mm	24	
Insulator Test Voltage			
Highest System Voltage	kV(RMS)	12	36
Visible Discharge Test	kV(RMS)	9	27
Wet-Power frequency withstand	kV(RMS)	28	70
Power frequency puncture withstand test	kV	145	185
Impulse voltage withstand test	kV peak	75	170
Nominal creepage distance	mm	25mm/kV	25mm/kV
Mechanical Load			
Cantilever strength (Minimum failing load)	kN	5	10
Color	-	Grey	

4.2 Fittings for Pin Insulators

The top part of the porcelain & polymer insulators shall have necks and grooves suitable for fastening conductors with tie wire or preformed fitting. The insulators shall be suitable for using any of the covered conductors of sizes up to 150 sq.mm with 3mm thickness of XLPE insulation and ACSR conductor sizes up to 150 mm2. Insulators should thus be manufactured accordingly to fit with the above ranges of conductor sizes.

The pin of the porcelain insulator shall be supplied complete with a hot dip galvanised forged steel pin, complete with nut, lock nut and spring washer. The ultimate mechanical strength of the pin insulator assembly shall be equal or more than the above requirement of cantilever strength. The pin shall be fitted on the cross-arms, drilled with holes of 26 mm diameter. The pin shall be provided with bolt in length of 150 mm with 100 mm thread as per IS 2486 (II).

The other end of the polymer Insulators shall be of same size with porcelain pin type. (to offer interchangeability between the two insulators). The dimension of the end fitting of polymer pin insulator is given in the table below:

Table 4.3: Details of Pin-End Fittings for Fixing on the Channel

Sl#	Item	Length of end fittings to be fixed	Min. threaded portion of end fittings	Dia of rod
1	33 kV	150 mm	100 mm	24 mm
2	11 kV	150 mm	100 mm	24 mm

Details are given on drawing no. BPC-DDCS-2022-20/3-7

4. 3 Disc Insulator

Table 4.4: Minimum Characteristics applied to Porcelain Disc Insulators

Characteristics	**Unit**	**11 kV**
Applicable Standard	IEC 60383-1 and IS 731	
Insulator Test Voltage		
Highest System Voltage	kV(RMS)	12
Visible Discharge Test	kV(RMS)	9
Wet-Power frequency withstand	kV(RMS)	28
Minimum power frequency flashover voltage • Dry • Wet	kV	 78 45
Power frequency puncture withstand test	kV	145
Impulse voltage withstand test	kV peak	75
Dimensions		
Nominal diameter	mm	255
Nominal spacing	mm	146
Nominal creepage distance	mm	25mm/kV
Mechanical Load		
Approximate weight	kg	5.2
Cantilever strength (Minimum failing load)	kN	70
Color	-	Brown

Table 4.5: Minimum Characteristics applied to Polymer Disc Insulators

Characteristics	**Unit**	**11 kV**	**33 kV**
Applicable Standard		IEC 61109-2008 and IS 731	
Type of insulators		Composite	
Material of the insulator		Silicon rubber	
Material of the core rod		ECR grade Boron free	
Material of the housing & weather sheds		Silicon Rubber	
Material of the end fittings		spheroidal graphite cast Iron (SGCI) with hot dip galvanized	
Sealing compound of the end fitting		Silicon based sealant	
Type of sheds		Aerodynamic with **alternating sheds**	
Diameter of FRP rod	mm	24	
Insulator Test Voltage			
Highest System Voltage	kV(RMS)	12	36
Visible Discharge Test	kV(RMS)	9	27
Wet-Power frequency withstand	kV(RMS)	28	70
Minimum power frequency flashover voltage • Dry • Wet	kV	 110 70	 140 95
Power frequency puncture withstand test	kV	145	185
Impulse voltage withstand test	kV peak	75	170
Nominal creepage distance	mm	25mm/kV	25mm/kV
Mechanical Load			
Cantilever strength (Minimum failing load)	kN	70	70
Color	-	Grey	

Details are given on drawing no. BPC-DDCS-2022-20/4-7, 5-7

4. 4 Insulator Hardware Fittings

Fittings and accessories for polymer and porcelain disc insulator shall include a cross arm strap, a ball-eye, a socket-thimble, necessary end locking clips, nuts, and spring washers. The socket-thimbles shall be of aluminium alloy and suitable for preformed dead-end clevis terminations and shall be supplied with a hot-dip galvanized hexagon cross-section cotter pin fitted with a humpback stainless steel split pin. For coupling between the clevis-thimble and the ball of insulator, a socket-eye shall be provided. Ferrous parts are

to be galvanized and conform to IS: 2486. They shall be suitable for use with prescribed sizes of conductors. Details are given on drawing no. BPC-DDCS-2020-22/5-7, 22/6-7.

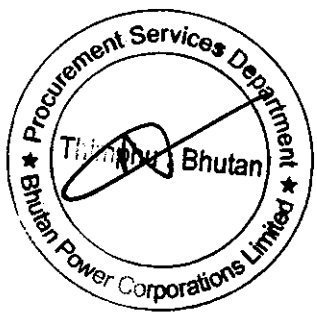
4.5 Stay Insulators

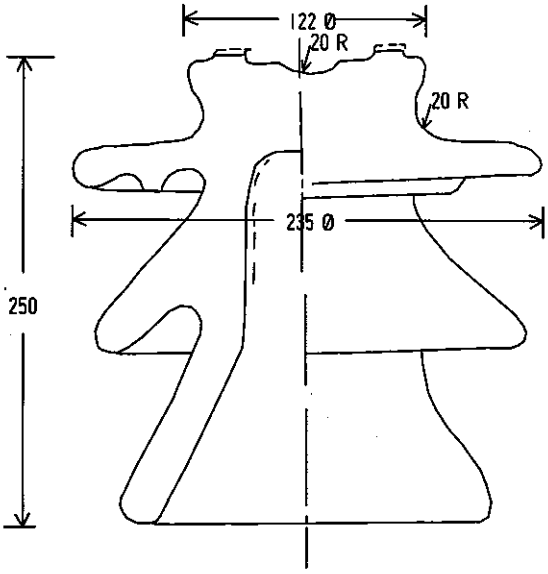
In case of uneventful conditions (like leakage due to breaking of conductors etc.) the stay/guy insulator is provided for safety. Stay insulator shall be provided for all HT lines with bare or covered conductor however LT lines with LV ABC is not required. Stay/guy insulators are fixed in the stay wire at a height of not less than 3 m above the ground level. The insulator shall be suitable for 7/8 SWG guy wire preformed terminations. The insulators shall comply with IS: 5300.

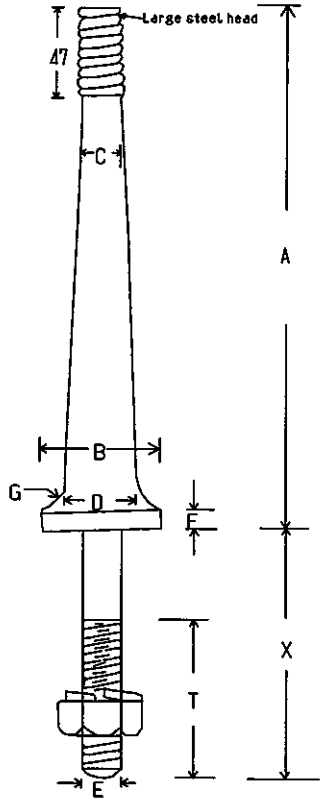
Table 4.6: Minimum Characteristics of the Stay/guy Insulators

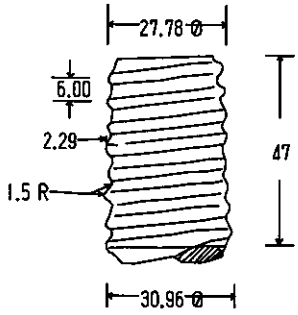
Characteristics	**Unit**	**33 kV & 11 kV**	**415/240[1]**
Minimum failing load	kN	88	44
Creepage Distance	mm	57	41
Dry one minute power frequency withstand voltage	kV(rms)	27	18
Wet one minute power frequency withstand voltage	kV(rms)	13	8
Length	mm	140	90
Diameter	mm	85	65
Cable hole dia	mm	25	16

Note 1: For LV bare conductor. Details are given on drawing no. BPC-DDCS-2022-20/7-7









All Dimensions in mm

Specification no. IS 2486 (Part II) 1974
Min. Failing Load.....1080 kg

A mm	B mm	C mm	D mm	E mm	F mm	G mm	T mm	X mm
300	67	27	44	24	6	12	100	150

TECHNICAL DETAILS:
(a) Highest System Voltage ..... 36kV (rms)
(b) Wet Power Frequency withstand Test ..... 75kV (rms)
(c) Power Frequency Puncture withstand Test ..... 180kV (rms)
(d) Impulse Voltage withstand Test ..... 170kV (peak)
(e) Minimum Failing Load ..... 1080 kg

Large Steel Head Pin for 33kV Pin Insulator

BHUTAN POWER CORPORATION LIMITED

ENGINEERING AND RESEARCH DEPARTMENT

DISTRIBUTION DESIGN & CONSTRUCTION STANDARD

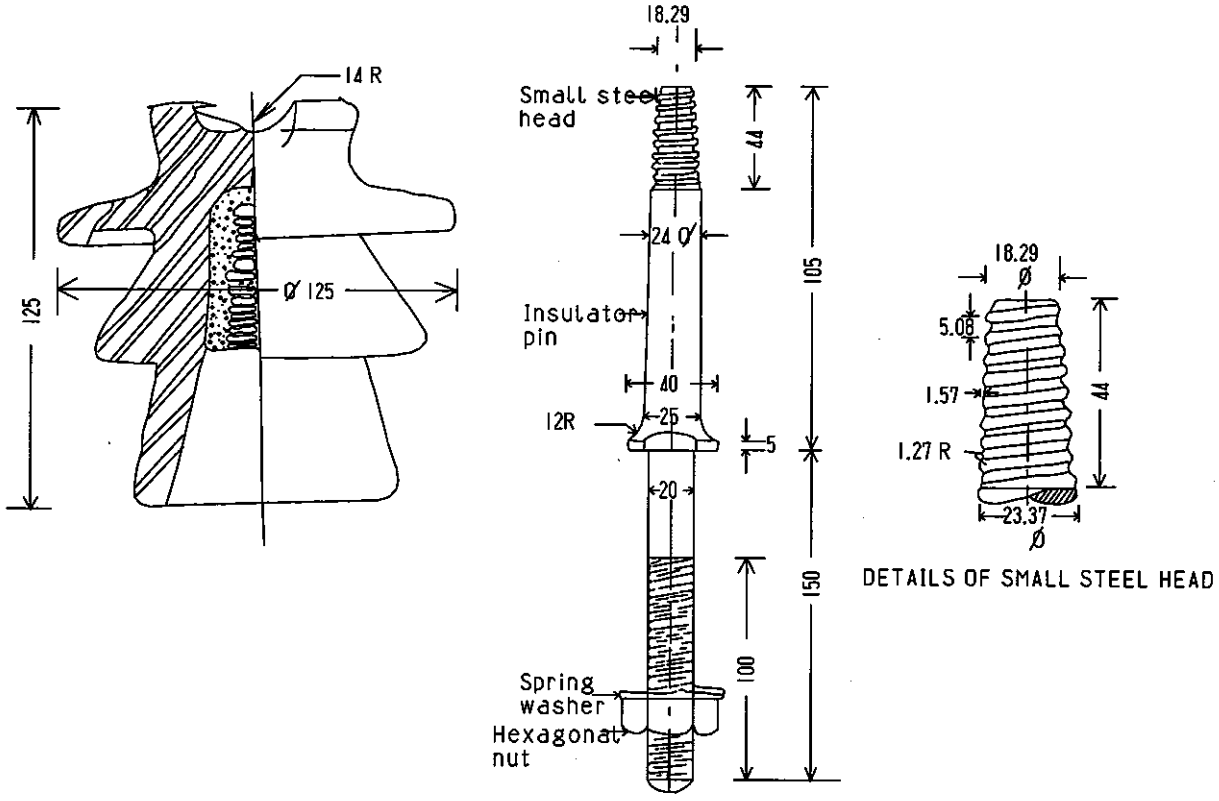
33kV - 10 kN PIN INSULATOR - LARGE HEAD

TITLE	NAME	DATE
DESIGNED BY		
CHECKED BY		
APPROVED BY		

DRAWING NO. BPC-DDCS-2022-20/1-7

REVISION 1
2022

Procurement Services Department ★ Bhutan Power Corporation Limited ★ Thimphu, Bhutan



DETAILS OF SMALL STEEL HEAD

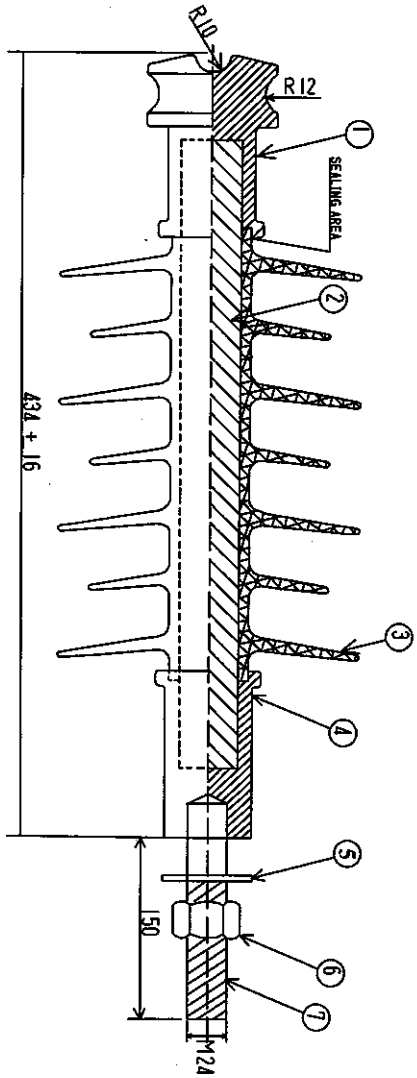
Small Steel Head Pin for 11kV Pin Insulator

Note:

1. Specification no. IS 2486 (Part II)
2. All Dimensions in mm
3. Minimum Failing Load 5 kN

BHUTAN POWER CORPORATION LIMITED			ENGINEERING AND RESEARCH DEPARTMENT
			DISTRIBUTION DESIGN & CONSTRUCTION STANDARD
TITLE	NAME	DATE	11kV-5kN PIN INSULATOR-SMALL HEAD
DESIGNED BY			
CHECKED BY			DRAWING NO. BPC-DDCS-2022-20/2-7
APPROVED BY			REVISION 2022

Procurement Services Department ★ Bhutan Power Corporations Limited ★ Thimphu : Bhutan



Sl.no	Description
1	Top Metal Fitting
2	Core Rod
3	Polymer Housing
4	Bottom Metal Fitting
5	Plain Washer
6	Nut
7	Stud

Guaranteed Technical Parameters

1. Min. Creepage Distance : 900 mm
2. Arcing Distance (Approximate) : 320 mm
3. Cantilever Failure Load : 10 kN
4. Nominal System Voltage : 33 kV
5. Highest System Voltage : 36 kV
6. System Frequency : 50 Hz
7. 1 Min. Power Freq. Wtihstand Voltage (Wet) : 75 kV (rms)
8. Dry Lightning Impulse Withstand Voltage : 170 kVp

BHUTAN POWER CORPORATION LIMITED

ENGINEERING AND RESEARCH DEPARTMENT

DISTRIBUTION DESIGN & CONSTRUCTION STANDARD

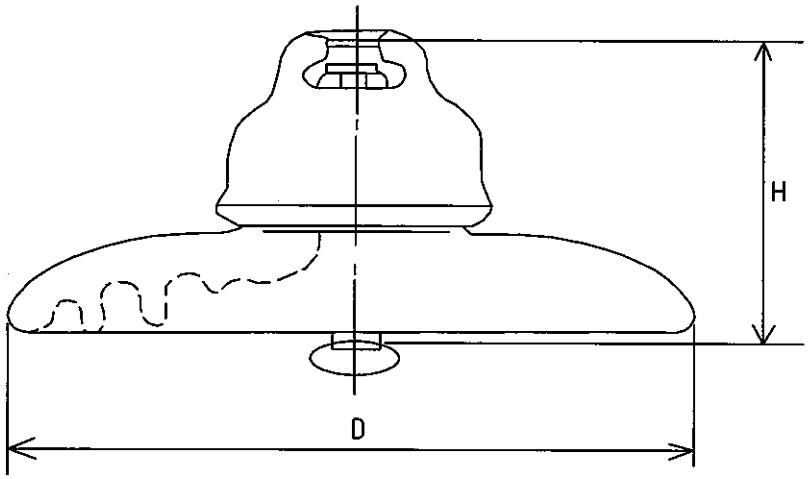
33kV & 11kV - 10 kN COMPOSITE SILICONE RUBBER PIN INSULATORS

TITLE	NAME	DATE
DESIGNED BY		
CHECKED BY		
APPROVED BY		

DRAWING NO. BPC-DDCS-2022-20/3-7

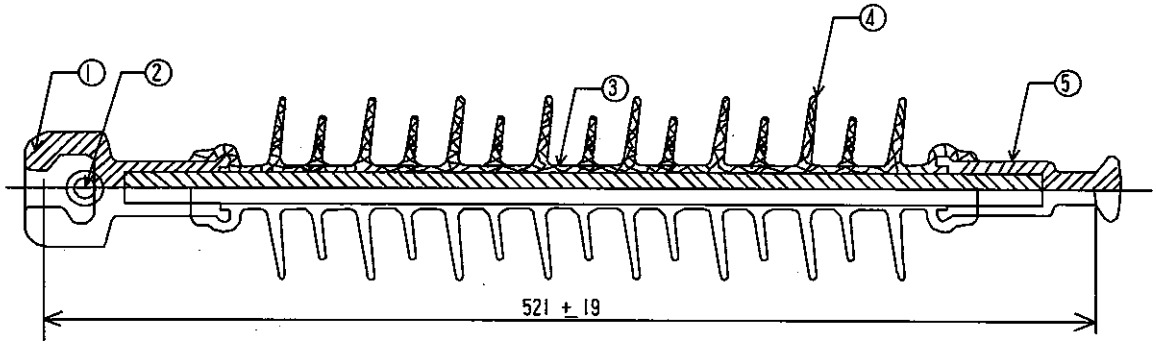
REVISION 2022

Porcelain Disc Insulator



Item	Dimensions (mm)		Rate Failure Load (kN)	Weight (kg)
	D	H		
11kV	255	146	70	5.2
33kV	255	146	70	5.2x3

33 kV & 11 kV - 70 kN COMPOSITE SILICONE RUBBER LONG ROD INSULATOR



Sl.no	Description
1	Socket Fitting
2	Security clip (R)
3	Core Rod
4	Polymer Housing
5	Ball fitting

BHUTAN POWER CORPORATION LIMITED

ENGINEERING AND RESEARCH DEPARTMENT

DISTRIBUTION DESIGN & CONSTRUCTION STANDARD

PORCELAIN AND COMPOSITE SILICON RUBBER DISC INSULATOR

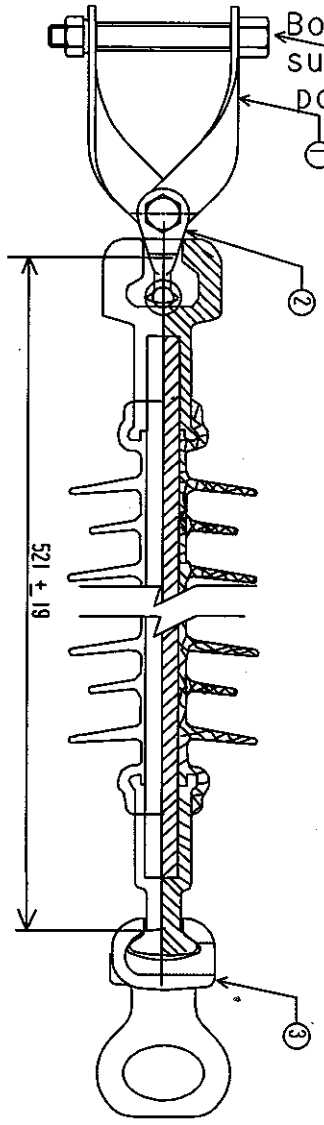
TITLE	NAME	DATE
DESIGNED BY		
CHECKED BY		
APPROVED BY		

DRAWING NO. BPC-DDCS-2022-20/4-7

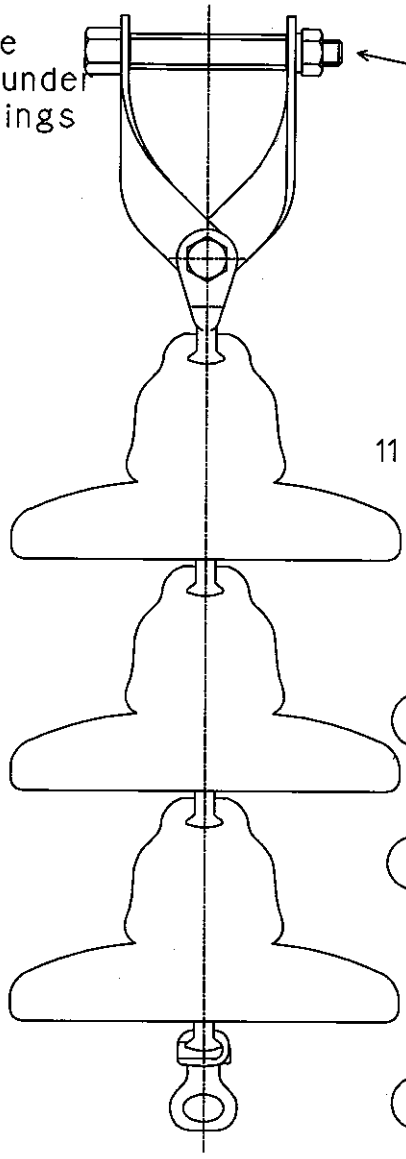
REVISION 2022

Procurement Services Department ★ Bhutan Power Corporations Limited ★ Thimphu : Bhutan

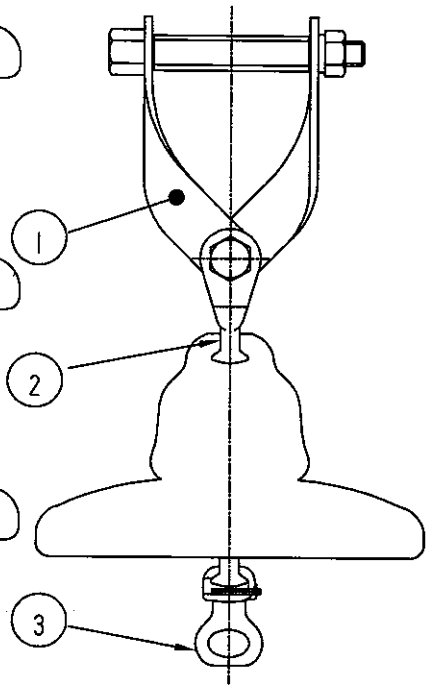
SINGLE TENSION STRING



33 kV SINGLE TENSION STRING



11 kV SINGLE TENSION STRING



Notes:
1. All fittings shall be galvanised according to relevant standard

ITEM	NAME OF ITEM	QTY	MATERIAL
3	SOCKET THIMBLE	1	ALUMINIUM ALLOY
2	BALL EYE	1	FORGED STEEL
1	CROSSARM STRAP (TOGETHER, NOT SEPARATE)	1	GALVANISED IRON

BHUTAN POWER CORPORATION LIMITED

ENGINEERING AND RESEARCH DEPARTMENT

DISTRIBUTION DESIGN & CONSTRUCTION STANDARD

ASSEMBLY FOR DISC INSULATOR ARRANGEMENT

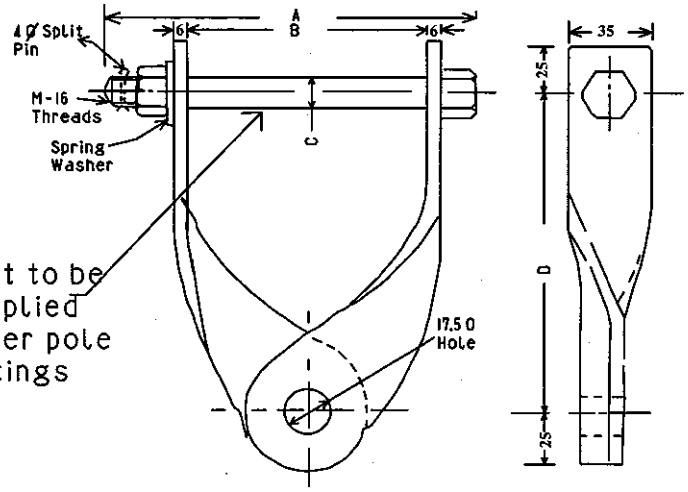
TITLE	NAME	DATE
DESIGNED BY		
CHECKED BY		
APPROVED BY		

DRAWING NO. BPC-DDCS-2022-20/5-7

REVISION 2022

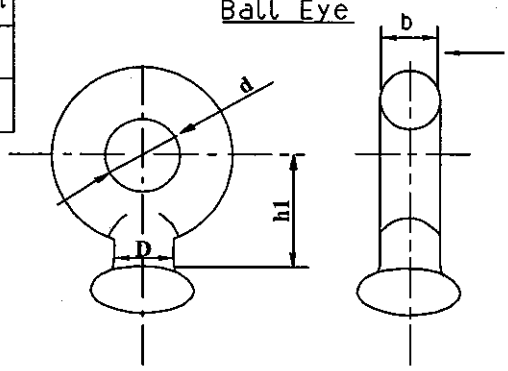
Procurement Services Department ★ Bhutan Power Corporations Limited ★ Thimphu, Bhutan

CROSS ARM STRAP



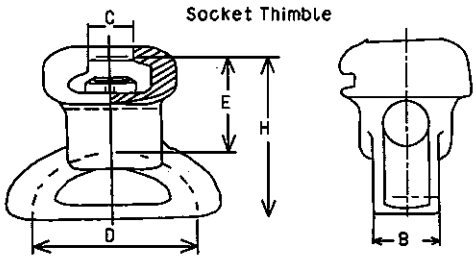
Dimensions (mm)				Rate Failure Load	Weight
A	B	C	D	(kN)	(kg)
150	100	16	140	70	-

Ball Eye



Dimensions (mm)				Rate Failure Load	Weight
D	h1	b	d	(kN)	(kg)
17	50	16	18	70	-

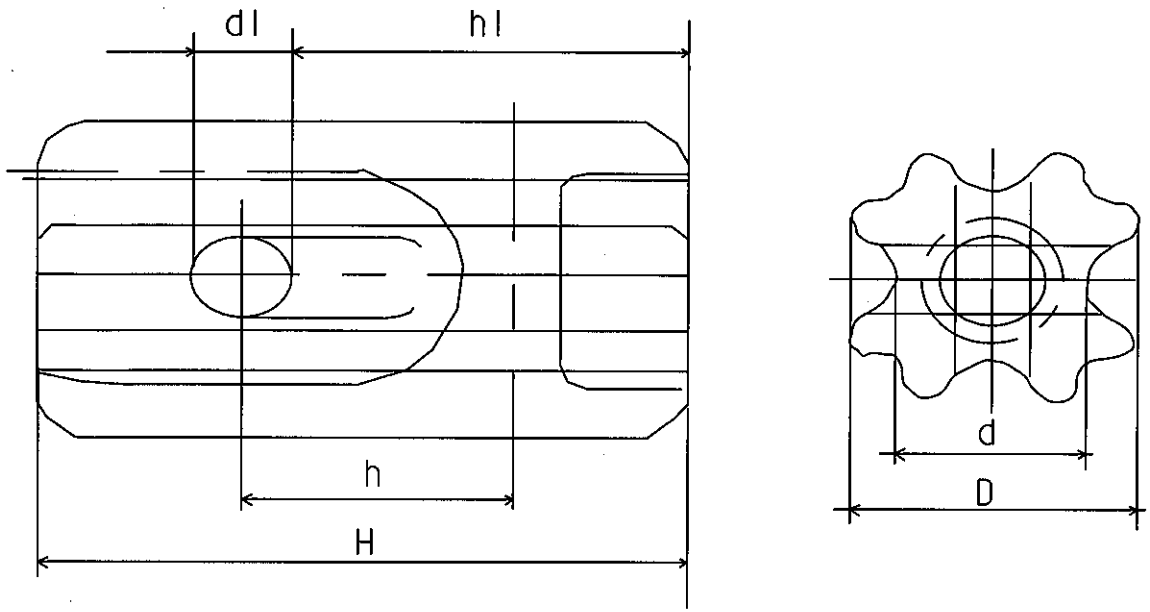
Socket Thimble



Dimensions (mm)					Rate Failure Load	Weight
B	C	D	E	H	(kN)	(kg)
32	17.6	60	60	95	70	1.20

Notes:
1. All fittings shall be galvanised according to relevant standard

BHUTAN POWER CORPORATION LIMITED	ENGINEERING AND RESEARCH DEPARTMENT	
	DISTRIBUTION DESIGN & CONSTRUCTION STANDARD	
	HARDWARE FITTINGS FOR DISC INSULATOR ARRANGEMENT	
TITLE / NAME / DATE	DRAWING NO. BPC-DDCS-2022-20/6-7	Revised 2022
DESIGNED BY		
CHECKED BY		
APPROVED BY		



Item	Dimensions						Rated Failure Load(KN)	Weight (kg)
	H	h	(mm) D	d	hl	dl		
11&33kV	171	67	89	60.3	114.3	25.4	89	1.95

BHUTAN POWER CORPORATION LIMITED			ENGINEERING AND RESEARCH DEPARTMENT
TITLE	NAME	DATE	DISTRIBUTION DESIGN & CONSTRUCTION STANDARD
DESIGNED BY			HT STAY INSULATOR
CHECKED BY			DRAWING NO. BPC-DDCS-2022-20/7-7 REVISION 2022
APPROVED BY			

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