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Electricity Specification 400 I4

Issue 6 June 2025

Overhead Line Insulators

Amendment Summary

ISSUE NO. DATE	DESCRIPTION
Issue 5 **December 2021**	New template applied. Prepared by: D M Talbot Approved by: Policy Approval Panel and signed on its behalf by Steve Cox, Engineering and Technical Director
Issue 6 **June 2025**	The following products have been added to Appendix A (and drawings added where applicable) : Table A2, Item 9: Polymeric tension insulator ball/socket 280mm Table A2, Item 10 Polymeric tension insulator ball/sock 420mm Table A2, Item 11: Polymeric tension insulator ball/ball 270mm Table A2, Item 14: Polymeric tension insulator ball/Heavy duty hook 270mm Table A4 . Items 7 to 10: Composite string insulators for 132kV steel tower lines Prepared by: Philip Howell & Updesh Chand Sharma Approved by: Policy Approval Panel and signed on its behalf by Paul Turner, PAP Chairperson

Contents

1 Introduction

This Specification comprises general requirements for the Approval and testing of insulators used on Overhead Lines in the electricity distribution network (Network) owned by Electricity North West Limited, as Distribution Licensee and Service Provider, followed by technical particulars relating to the constructional requirements of all insulators, and the markings that shall be applied to all insulators prior to delivery. The Appendices provide detailed Specification data for each insulator.

Appendix A is a schedule of all insulators, followed by associated drawings where required. The stated load appended to the title of each insulator is the minimum failing load (MFL) of that insulator.

Appendix B is a set of drawings of insulators.

Appendix C describes testing methods for polymeric insulators.

Appendix D is a clause-by-clause self-certification matrix to be filled in by Tenderers

2 Scope

This Specification covers insulators required by for the construction of newly built and refurbished overhead lines on wood poles and steel towers (from LV to 132kV) as identified in the appropriate ENWL or ENA overhead line Specification or Policy (e.g. ES400O2, ES400O3,CP421, ENA TS 43-7).

3 Definitions

Approval	Sanction by the Electricity North West Circuits Policy Manager that specified criteria have been satisfied
Composite Insulator	Insulator made of at least two insulating parts, namely a core and a housing equipped with metal fittings
MFL	Minimum Failing Load.
Pin Insulator	A rigid insulator consisting of an insulating component intended to be mounted rigidly on a supporting structure by means of a pin passing up inside the insulator.
Polymeric Insulator	Insulator whose insulating body consists of at least one organic based material
Specification	The Specifications and schedules (if any) agreed by the parties for the purpose of the Contract.
Supplier	Any person or person's firm or company who supplies goods to Electricity North West or to its Contractor.

Tender	An offer in writing to execute work or supply goods at a fixed price.
Tenderer	The person or person's firm or company, including personal representatives, successors and permitted assigns, invited by Electricity North West to submit a Tender.

4 General Requirements for Approvals and Testing

4.1 Product not to be Changed

Compliance with this clause shall be in accordance with ES001.

4.2 Electricity North West Limited Technical Approval

Compliance with this clause shall be in accordance with ES001.

4.3 Quality Assurance

Compliance with this clause shall be in accordance with ES001.

4.4 Formulation

Compliance with this clause shall be in accordance with ES001.

4.5 Identification Markings

Compliance with this clause shall be in accordance with ES001.

4.6 Minimum Life Expectancy

The minimum life expectancy of all products covered by this specification is 60 years.

4.7 Product Conformity

Compliance with this clause shall be in accordance with ES001.

4.8 Confirmation of Conformance

The Tenderer shall complete the conformance declaration sheets in Appendix D.

Failure to complete these declaration sheets may result in an unacceptable bid.

5 Requirements for Type and Routine Testing

5.1 Requirement for Type Tests at Suppliers Premises

Compliance with this clause shall be in accordance with ES001.

5.2 Requirement for Routine Tests at the Supplier's Premises

Compliance with this clause shall be in accordance with ES001.

The Tenderer shall submit, with the Tender, a list of tests and inspections which are carried out on the product prior to despatch which shall demonstrate, to the satisfaction of the Electricity North West Circuits Policy Manager, fitness for installation and service.

6 Constructional Requirements

6.1 General

Insulators shall conform to all requirements of this Specification and also ENA TS 43-93 (Line insulators) together with ENA TS 43-91 (Stay Strands and Stay Fittings for Overhead Lines), CP420 Part 1 Chapter 07 (Stay Arrangements for Wood Pole Overhead Lines).

The dimensions shown on the attached drawings are given for information purposes only. However, the length dimension of each individual insulator is critical to allow direct replacement of existing insulators without re-tensioning of lines.

Drawings of suitable alternatives shall be supplied with the Tender for evaluation if being offered.

The colour of ceramic insulators shall be brown.

Polymeric Insulators shall be manufactured from silicone rubber and the colour shall be grey.

6.2 Polymeric Pin-Mounted Insulators for Covered Conductors

Insulators shall comply with the electrical requirements of ENA TS 43-93 (and ENA TS 43-91 where applicable). In addition:

11kV insulator shall have a neck diameter of 78 $\pm$ 2mm.

33kV insulator shall have a neck diameter of 120 $\pm$ 4mm.

Drawings of insulators shall be supplied with the Tender for evaluation.

7 Documents Referenced

DOCUMENTS REFERENCED	
Health and Safety at Work Act 1974	
Control of Substances Hazardous to Health Regulations 2002	
Manual Handling Operations Regulations 1992	
BS EN ISO 9000	Quality Management Systems

BS EN ISO 14001	Environmental Management Systems.
BS 3288	Insulator and conductor fittings for overhead power lines.
IEC 60471	Dimensions of clevis and tongue couplings of string insulator units.
IEC 61109	Composite insulators for overhead power lines with a nominal voltage greater than 1000V.
ENA TS 43-30	Low Voltage Overhead Lines on Wood Poles.
ENA TS 43-50	132kV Single Circuit Overhead Lines on Wood Poles.
ENA TS 43-91	Stay strands and stay fittings for overhead lines.
ENA TS 43-93	Line insulators.
CP311:	Equipment Approval Process.
CP420 Part 1	Policy and Practice for Wood Pole Overhead Lines.
CP421-5	Fault work, maintenance and refurbishment of Overhead Lines – HV mains supported by poles
ES001	ENWL Main Specifications
ES400O2	Overhead-Lines of Compact-Covered-Construction for 11/6.6 kV: Design and Construction.
ES400O3	Bare-Wire Overhead-Lines on Wood Poles for 11/6.6 and 33 kV: Design and Construction.
ES400O4	LV ABC Overhead Lines and Services: Design and Construction.

8 Keywords

Insulator; OHL

Appendix A – Schedule of All OHL Insulators

Table A1 - Insulators for LV Lines

ITEM NO	APPROVED DESCRIPTION (FOR PURCHASING AND PRODUCT LABELLING)	DRAWING REFERENCE (DERIVED FROM)	USED IN SPEC:	CC NUMBER
1	Insulator, coach screw, service type, ceramic	Dwg I-400I4-INS-005 (ENA TS 43-93 Dwg 439305)	ENA TS 43-30 ES400O4	125205
2	Insulator, coach screw, service type, polymeric	Dwg I-400I4-INS-005	ENA TS 43-30 ES400O4	125230
3	Insulator, reel type, LV, 15kN MFL	Dwg I-400I4-INS-004 (ENA TS 43-93 Dwg 439304)	ENA TS 43-30	125204
4	Insulator, stay, LV (and 11kV), type 1,110kN MFL	Dwg I-400I4-INS-007 (ENA TS 43-91 Dwg 439107, type 1)	ENA TS 43-30 ES400O4	126470

Table A2 - Insulators for 11 – 33kV Lines

ITEM NO	APPROVED DESCRIPTION (FOR PURCHASING AND PRODUCT LABELLING)	DRAWING REFERENCE (DERIVED FROM)	USED IN SPEC:	CC NUMBER
1	Insulator, stay, 11kV (and LV), type 1, 110kN MFL	Dwg I-400I4-INS-007 (ENA TS 43-91 Dwg 439107, type 1)	ES400O2 ES400O3	126470
2	Insulator, stay, 33kV, type 2, 110kN MFL	Dwg I-400I4-INS-007 (ENA TS 43-91 Dwg 439107, type 2)	ES400O2 ES400O3	126489
3	Insulator, pin-mounted, 11kV, 10kN MFL	Dwg I-400I4-INS-001 (ENA TS 43-93 Dwg 439301)	ES400O2 ES400O3	125202
4	Insulator, pin-mounted, 33kV, 10kN MFL	Dwg I-400I4-INS-002 (ENA TS 43-93 Dwg 439302)	ES400O2 ES400O3	125199

5	Insulator, 11kV pin-mounted, polymeric, for compacted covered conductor lines	N/A	ES400O2	175270	
6	Insulator, 33kV pin-mounted, polymeric, compacted covered conductor lines	N/A	ES400O2	175271	
7	Insulator, post type, 33kV, 10kN MFL	Dwg I-400I4-INS-003 (ENA TS 43-93 Dwg 439303)	ES400O3	125203	
8	Insulator, string insulator unit, 70kN MFL	Dwg I-400I4-INS-006 (ENA TS 43-93 Dwg 439306)	ES400O3	125206	
9	Insulator, tension,polymeric,280mm ball/socket, 70kN MFL	Dwg I-400I4-INS-021	ES400O2 ES400O3	125238	June 25
10	Insulator, tension,polymeric,420mm ball/socket, 70kN MFL	Dwg I-400I4-INS-021	ES400O2 ES400O3	125241	
11	Insulator, tension,polymeric,270mm ball/ball, 70kN MFL	Dwg I-400I4-INS-010	ES400O2 ES400O3	125239	
12	Insulator, tension,polymeric,450mm ball/ball,70kN MFL	Dwg I-400I4-INS-010	ES400O2 ES400O3	125240	
13	Insulator, tension, polymeric, heavy duty, 560mm ball/hook,70kN MFL	Dwg I-400I4-INS-008	ES400O2 ES400O3	125232	
14	Insulator, tension, polymeric, heavy duty, 280mm ball/hook,70kN MFL	Dwg I-400I4-INS-008	ES400O2 ES400O3	125242	June 25
15	Insulator, tension, polymeric, light duty, 381mm ball/pigtail hook, 20kN MFL	Dwg I-400I4-INS-009	ES400O3	125237	

Table A3 - Insulators for 132kV Woodpole Lines

ITEM NO	APPROVED DESCRIPTION (FOR PURCHASING AND PRODUCT LABELLING)	DRAWING REFERENCE (DERIVED FROM)	USED IN SPEC:	CC NUMBER
1	Insulator, stay, 132kV wood pole line, 125kN MFL	Dwg I-400I4-INS-017 (ENA TS 43-91)	ENA TS 43-50	125215
2	Insulator, tension, 132kV wood pole line, 125kN MFL	Dwg I-400I4-INS-018	ENA TS 43-50	125228
3	Insulator, pilot, 132kV wood pole line 24kN MFL	Dwg I-400I4-INS-019	ENA TS 43-50	125226
4	Insulator, post type, 132kV wood pole line, 24kN MFL	Dwg I-400I4-INS-020	ENA TS 43-50	125227

Table A4 - Insulators for 132kV Steel Tower Lines/CP421-5 faults on 11kV and 33kV lines

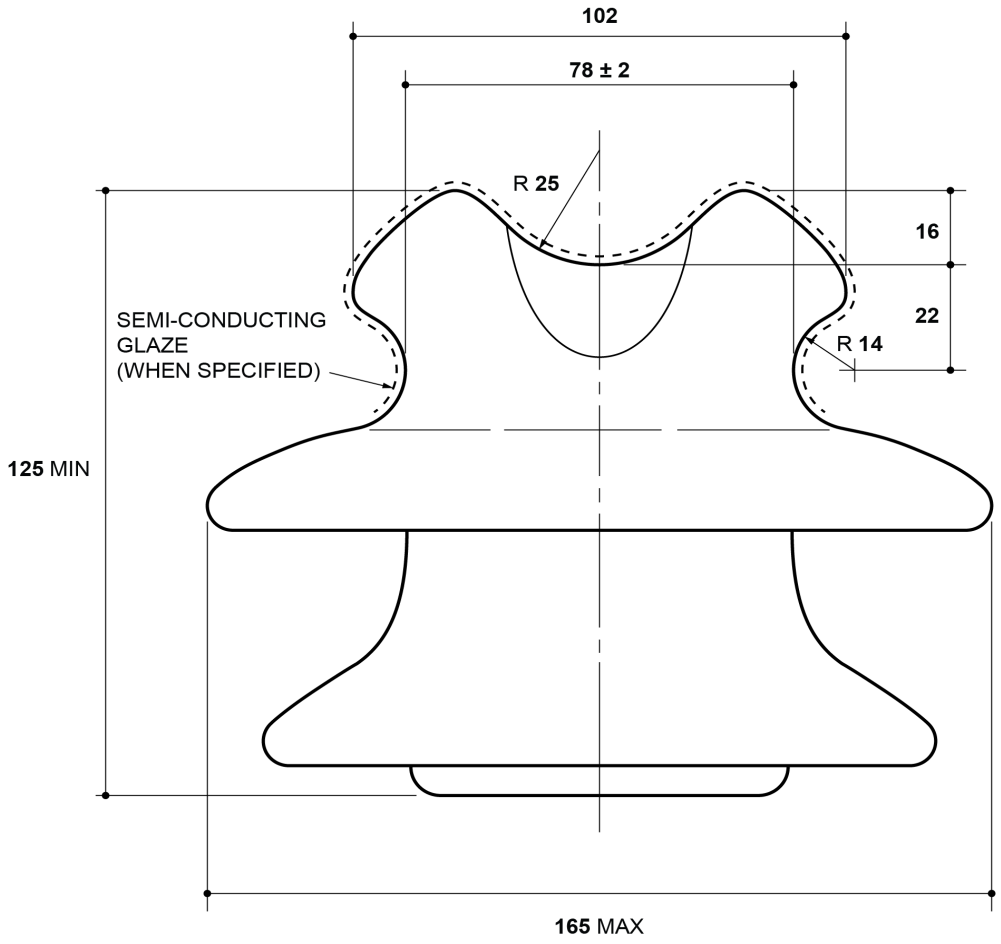
ITEM NO	APPROVED DESCRIPTION (FOR PURCHASING AND PRODUCT LABELLING)	DRAWING REFERENCE (DERIVED FROM)	USED IN SPEC:	CC NUMBER
1	Ceramic Insulator, disc, 70kN MFL	Dwg I-400I4-INS-016	ENA TS 43-7 ENA TS 43-9 CP421-5 see note 1	125214
2	Ceramic Insulator, disc, 125kN MFL	Dwg I-400I4-INS-014	ENA TS 43-7 ENA TS 43-9	125212
3	Ceramic Insulator, disc, 190kN MFL	Dwg I-400I4-INS-011	ENA TS 43-7 ENA TS 43-9	125208
4	Ceramic Insulator, disc, anti-fog, 70kN MFL	Dwg I-400I4-INS-013	ENA TS 43-7 ENA TS 43-9 CP421-5 see note 1	125211
5	Ceramic Insulator, disc, anti-fog, 125kN MFL	Dwg I-400I4-INS-015	ENA TS 43-7 ENA TS 43-9	125213
6	Ceramic Insulator, disc, anti-fog, 190kN MFL	Dwg I-400I4-INS-012	ENA TS 43-7 ENA TS 43-9	125209
7	Composite string insulator, 132kV Tower Line, Polymeric 70kN MFL see notes **1 & 2**	NA	ENA TS 43-7 ENA TS 43-9	TBA
8	Composite string insulator, 132kV Tower Line, Polymeric, 80kN MFL see notes **1 & 2**	NA	ENA TS 43-7 ENA TS 43-9	TBA
9	Composite string insulator, 132kV Tower Line, Polymeric, 125kN MFL see notes **2 & 3**	NA	ENA TS 43-7 ENA TS 43-9	TBA
10	Composite string insulator, 132kV Tower Line, Polymeric, 190kN MFL see notes **2 & 3**	NA	ENA TS 43-7 ENA TS 43-9	TBA

June 25

Notes:

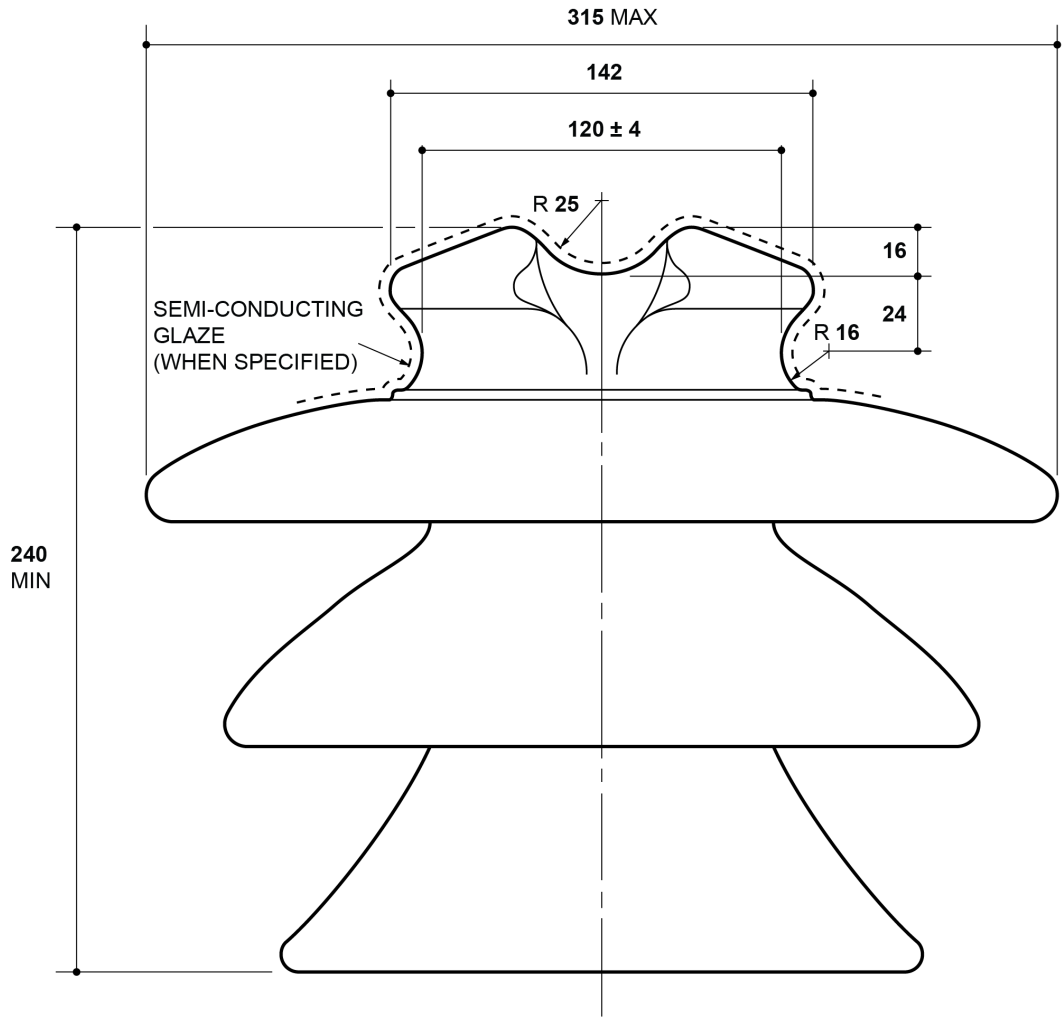
1. The Ceramic disc insluators can also be used for fault replacments on 11kv and 33kV lines where it is not practibable to change over to polymeric versions. See CP421-5
2. The required creepage distance / pollution level shall be decided in accordance with ENA TS 43-93 Clause 7.
3. Full Composite insulator sets supplied with a Polymeric insulator and relevant BS3288 fittings shall be purchased to allow direct replacement of conventional Glass/Porcelain Insulator sets.

Appendix B - Drawings



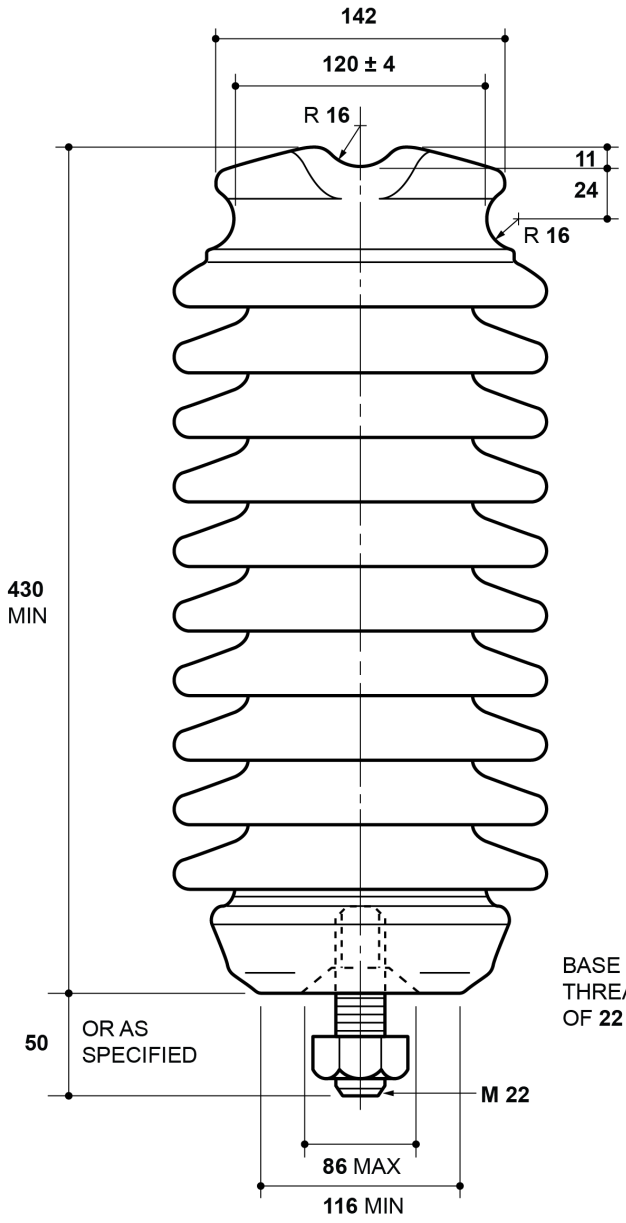
CC 125202

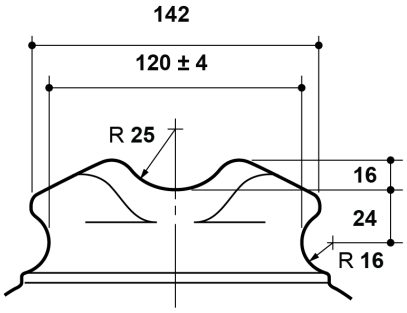
INSULATOR PIN MOUNTED 11kV, 10kN MFL	Change information for this issue N/A	Appears in ES400I4	electricity north west I-400I4-INS-001 Iss 2 sht 1 of 1 Scale: nts Auth: DMT Date: 15/5/2012



CC 125199

INSULATOR PIN MOUNTED 33kV, 10kN MFL	Change information for this issue N/A	Appears in ES400I4	electricity north west I-400I4-INS-002 Iss 2 sht 1 of 1 Scale: nts Auth: DMT Date: 15/5/2012



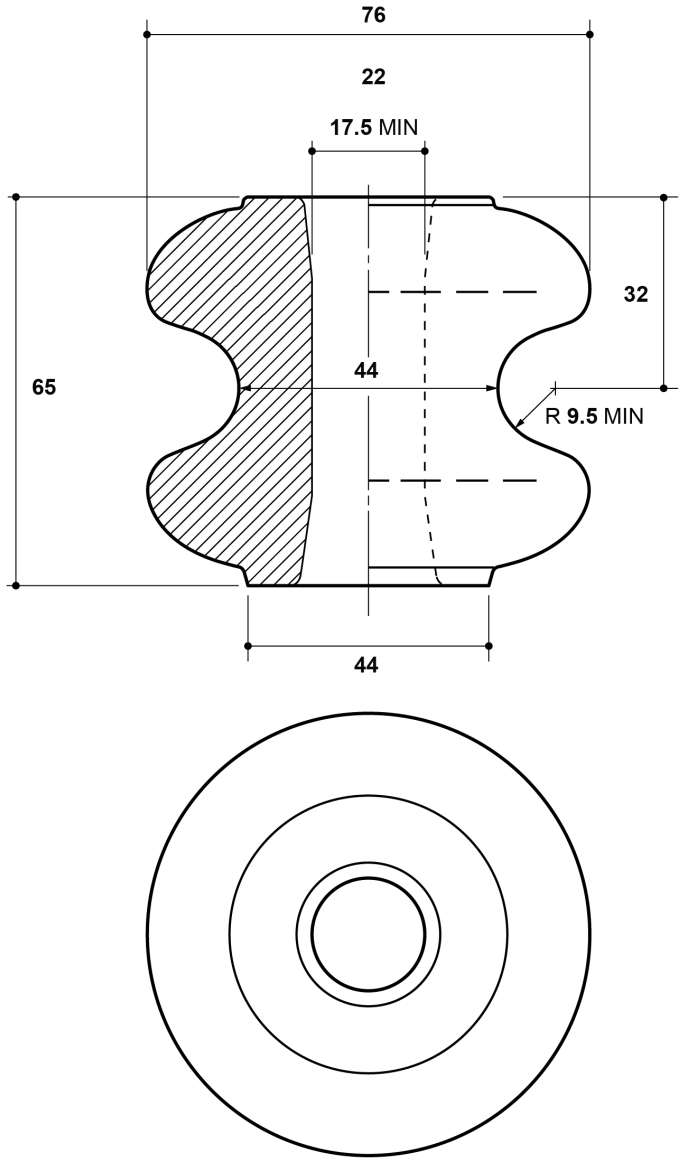


ALTERNATIVE HEAD DESIGN
WHICH MAY BE SPECIFIED
FOR USE WITH PREFABRICATED
TIES ON LARGE DIAMETER
CONDUCTORS ONLY

BASE OF INSULATOR
THREADED TO A DEPTH
OF **22** MINIMUM

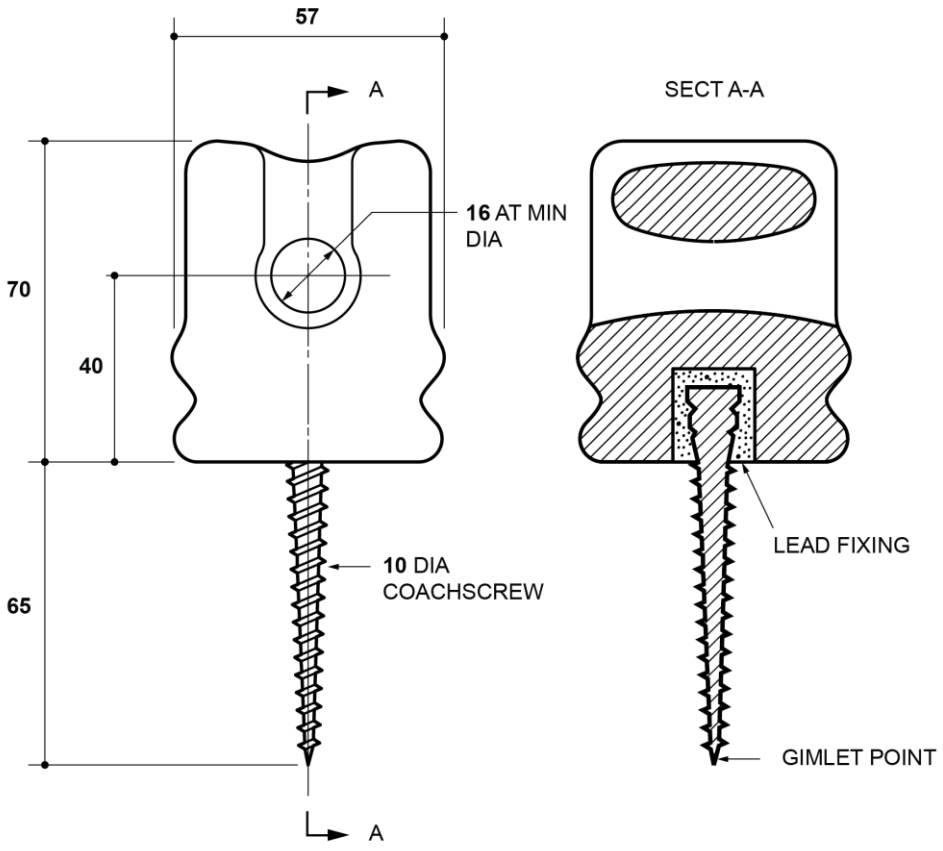
CC 125203

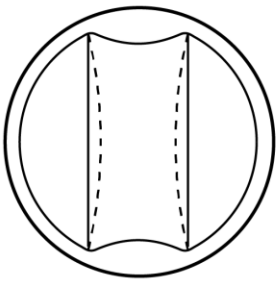
INSULATOR POST TYPE 33kV, 10kN MFL	Change information for this issue N/A	Appears in ES400I4	electricity north west I-400I4-INS-003 Iss 2 sht 1 of 1 Scale: nts Auth: DMT Date: 15/5/2012



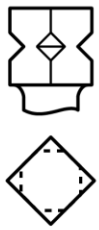
CC 125204

INSULATOR REEL TYPE LV, 15kN MFL	Change information for this issue N/A	Appears in ES400I4	electricity north west I-400I4-INS-004 Iss 2 sht 1 of 1 Scale: nts Auth: DMT Date: 15/5/2012





PLAN

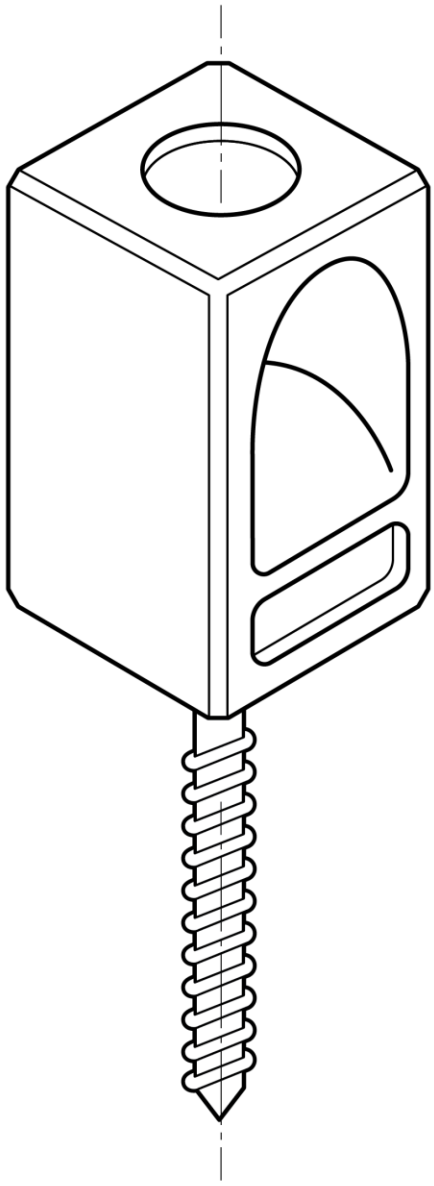


TYPICAL COACHSCREW HEAD

Ceramic insulator

CC 125205

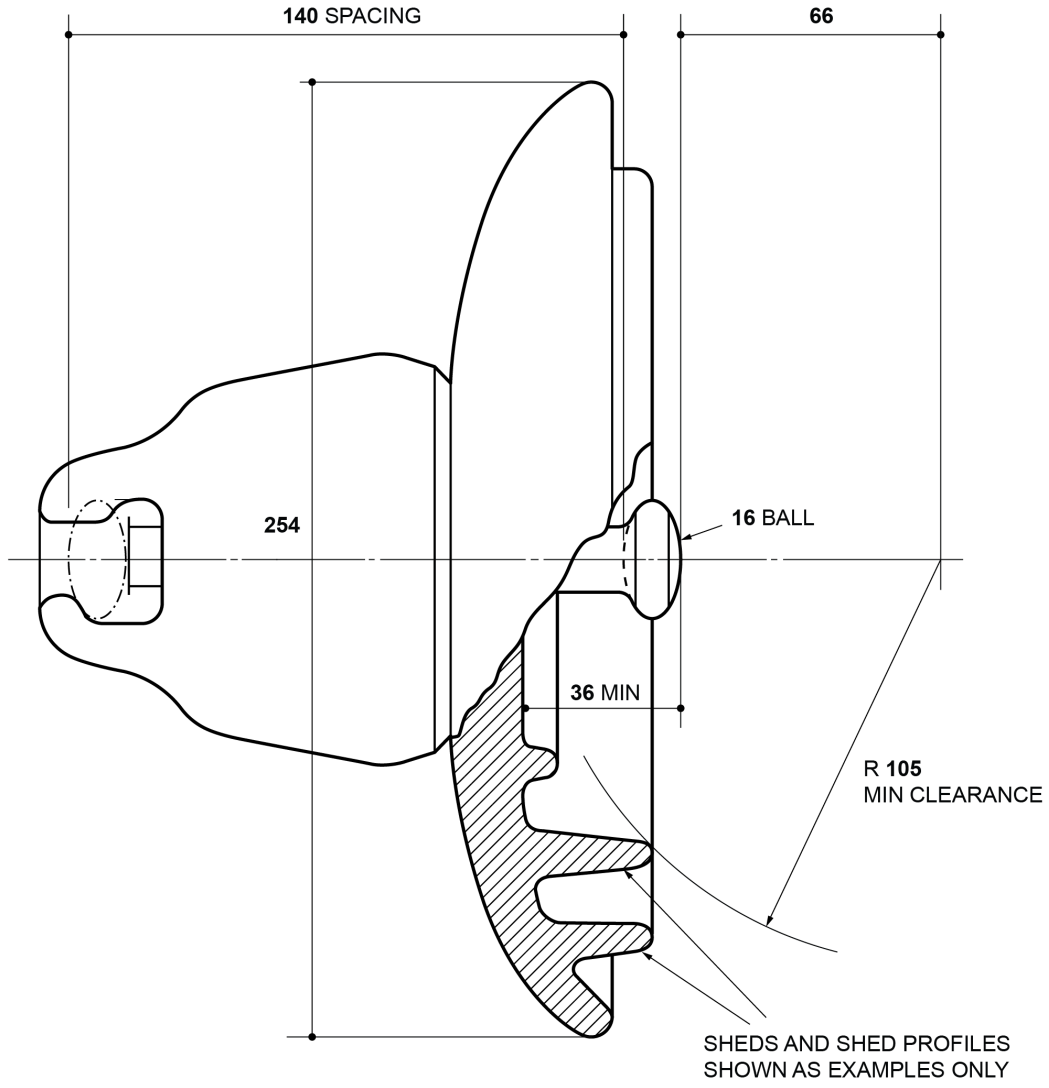
INSULATOR COACH SCREW SERVICE TYPE	Change information for this issue Sheet 2 created for new polymeric insulator. Sheet 1 identified as ceramic insulator.	Appears in ES400I4	electricity north west I-400I4-INS-005 Iss 3 sht 1 of 2 Scale: nts Auth: DMT Date: 16/10/2015



Example polymeric insulator

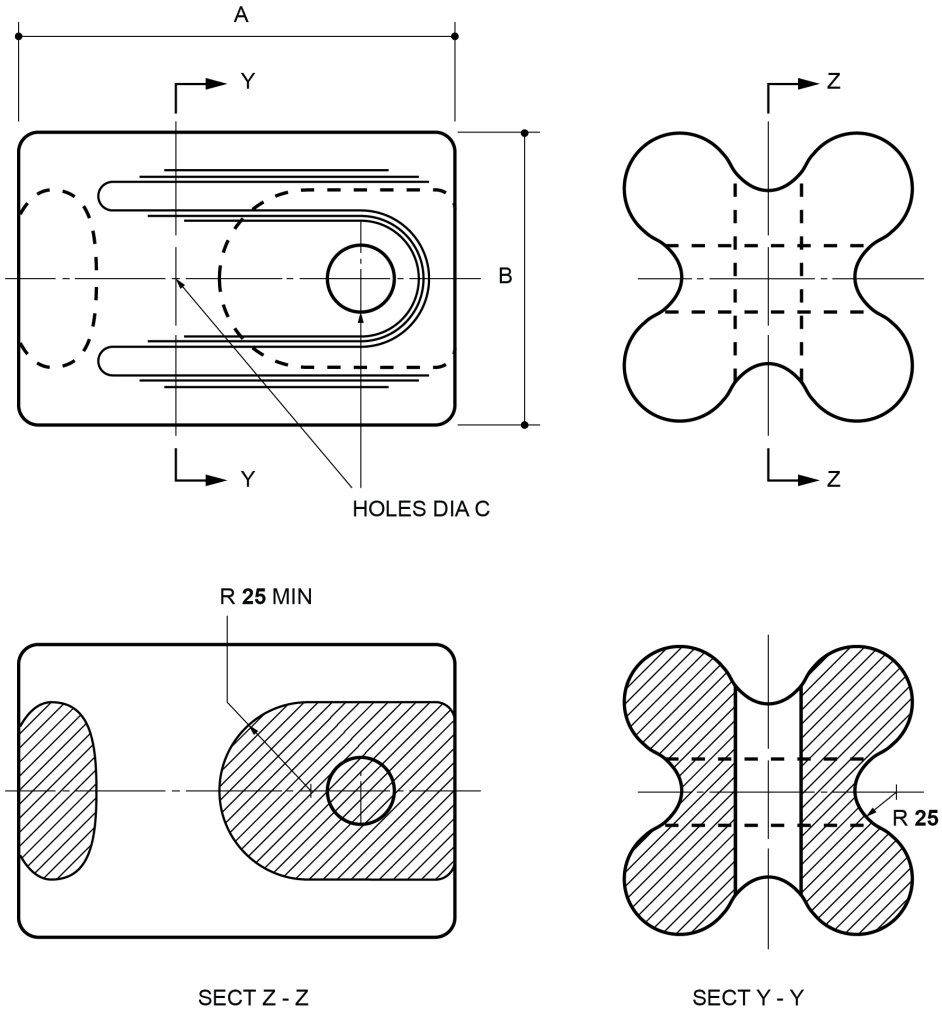
CC 125230

INSULATOR COACH SCREW SERVICE TYPE	Change information for this issue Sheet 2 created for new polymeric insulator. Sheet 1 identified as ceramic insulator.	Appears in ES400I4	I-400I4-INS-005 Iss 3 sht 2 of 2 Scale: nts Auth: DMT Date: 16/10/2015



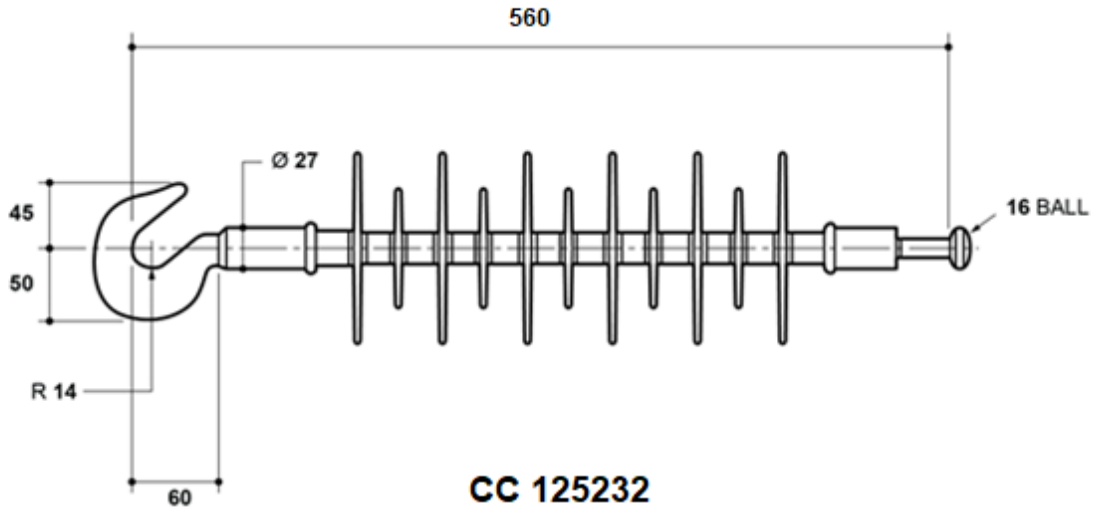
CC 125206

INSULATOR STRING INSULATOR UNIT 70kN MFL	Change information for this issue N/A	Appears in ES400I4	electricity north west I-400I4-INS-006 Iss 2 sht 1 of 1 Scale: nts Auth: DMT Date: 15/5/2012

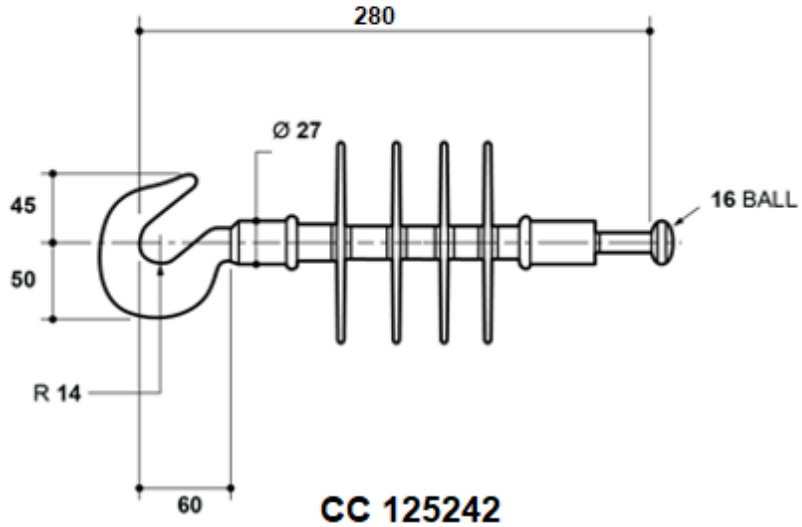


TYPE	VOLTAGE	MINIMUM DIMENSIONS			CC No
		A	B	C	
1	LV & 11kV	115	75	20	126470
2	33kV	220	120	20	126489

INSULATOR STAY LINES UP TO 33kV	Change information for this issue N/A	Appears in ES400I4	electricity north west I-400I4-INS-007 Iss 2 sht 1 of 1 Scale: nts Auth: DMT Date: 15/5/2012



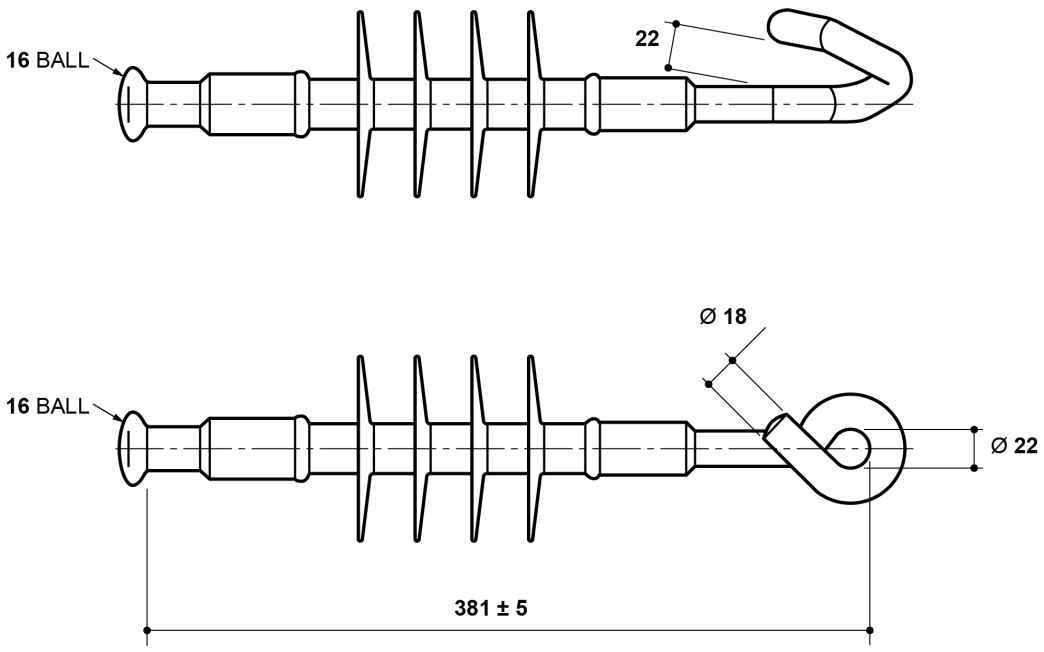
CC 125232

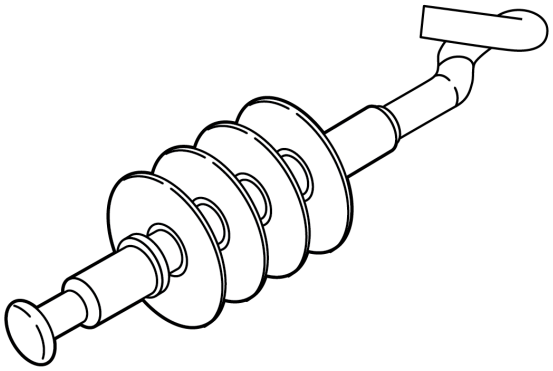


CC 125242

INSULATOR TENSION, SILICONE, HEAVY DUTY, BALL / HOOK, 70kN MFL	Change information for this issue N/A	Appears in ES400I4	electricity north west I-400I4-INS-008 Iss 2 sht 1 of 1 Scale: nts Auth: PPH Date: 12/5/25

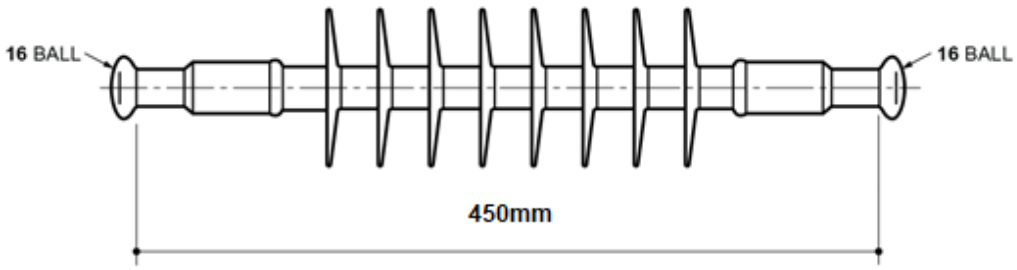
June 25





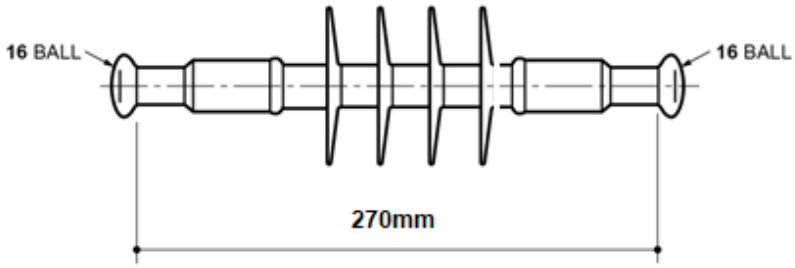
CC 125237

INSULATOR TENSION, SILICONE, LIGHT DUTY BALL / PIGTAIL HOOK, 20kN MFL	Change information for this issue N/A	Appears in ES400I4	electricity north west I-400I4-INS-009 Iss 2 sht 1 of 1 Scale: nts Auth: DMT Date: 15/5/2012

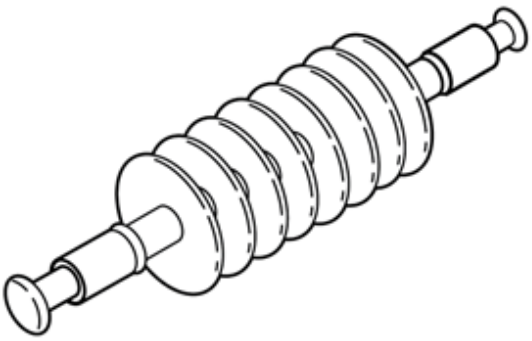


CC 125240

June 25

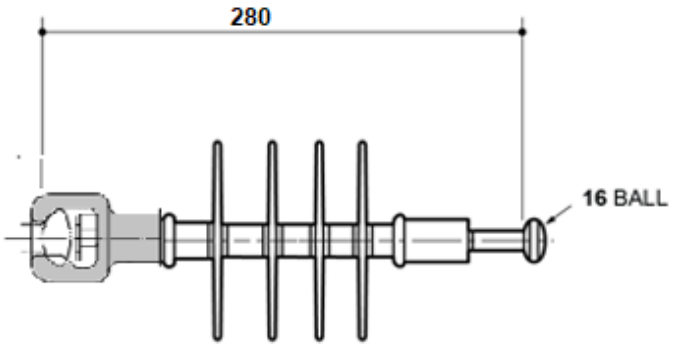


CC 125239



INSULATOR TENSION SILICONE, HEAVY DUTY BALL / BALL, 70kN MFL	Change information for this issue N/A	Appears in ES400I4	electricity north west I-400I4-INS-010 Iss 2 sht 1 of 1 Scale: nts Auth: PPH Date: 12/5/25

June 25



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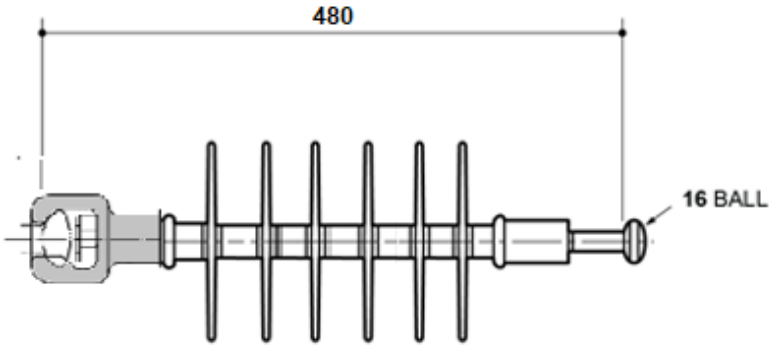
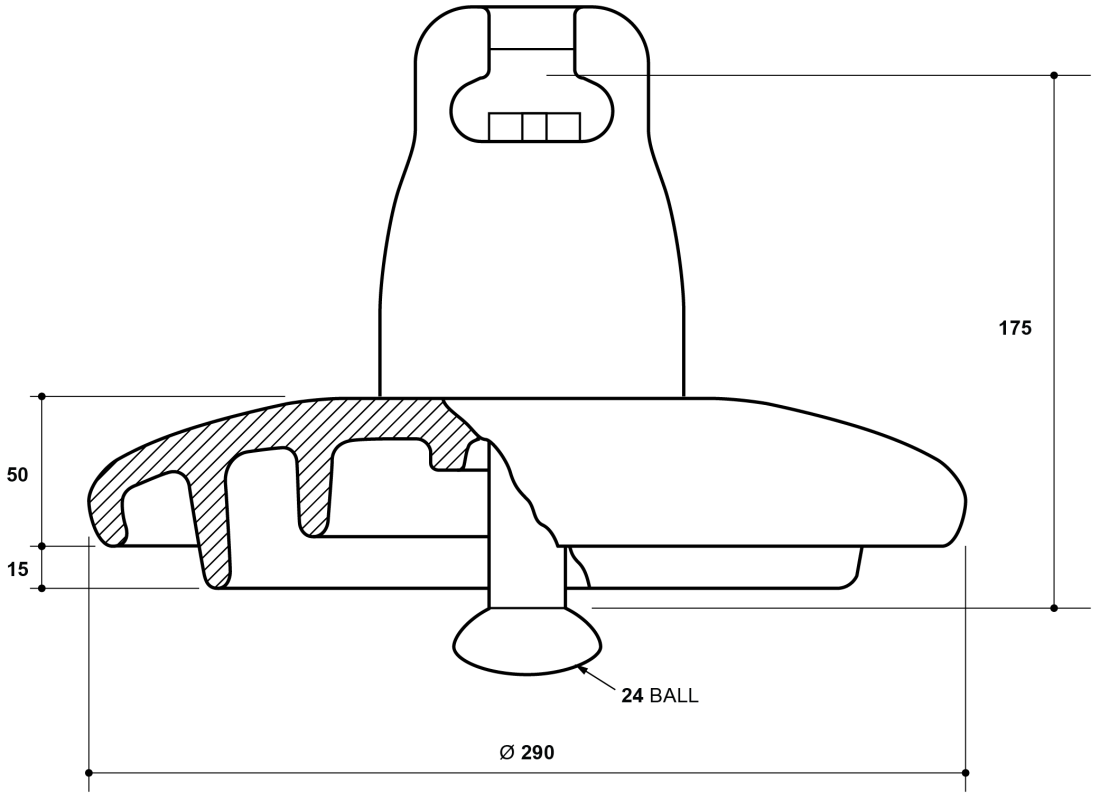


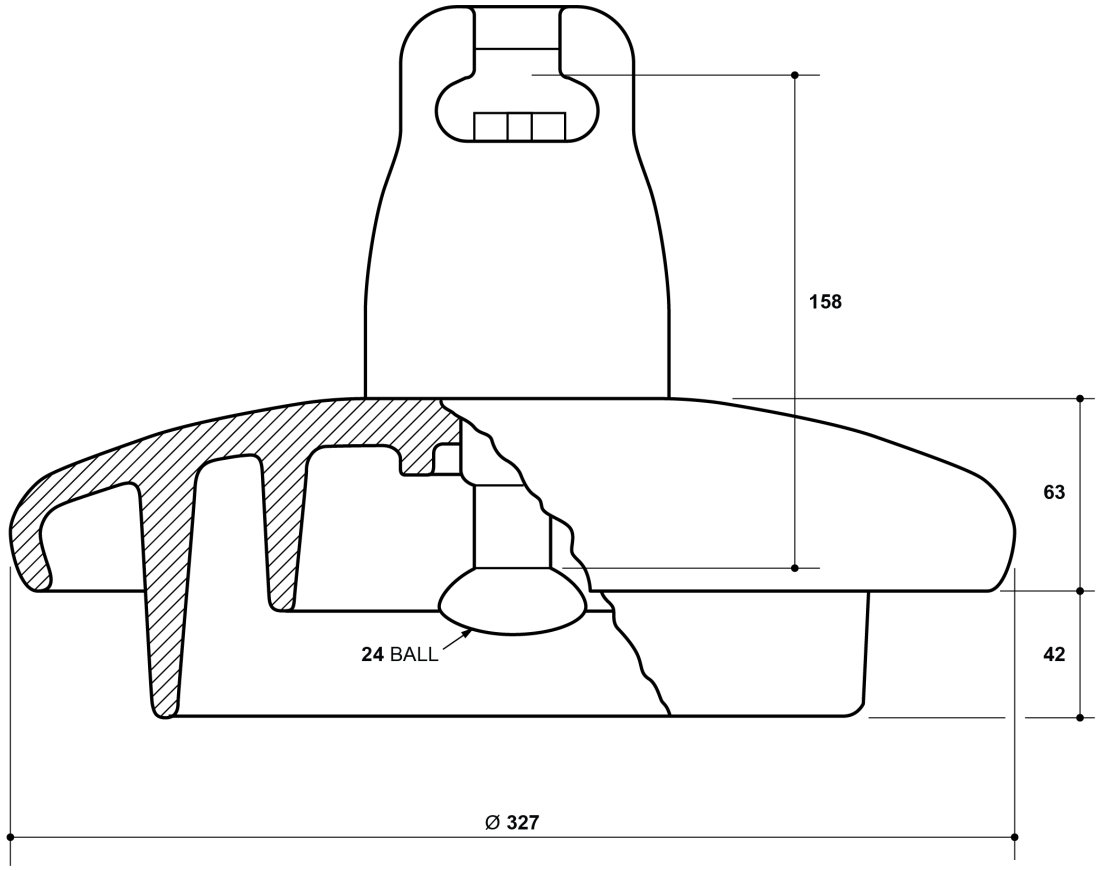
CC 125241

INSULATOR TENSION SILICONE, HEAVY DUTY BALL / BALL, 70kN MFL	Change information for this issue N/A	Appears in ES400I4	electricity north west I-400I4-INS-021 Iss 1 sht 1 of 1 Scale: nts Auth: PPH Date: 12/5/25



CC 125208

INSULATOR DISC 190kN MFL	Change information for this issue N/A	Appears in ES400I4	electricity north west I-400I4-INS-011 Iss 2 sht 1 of 1 Scale: nts Auth: DMT Date: 15/5/2012



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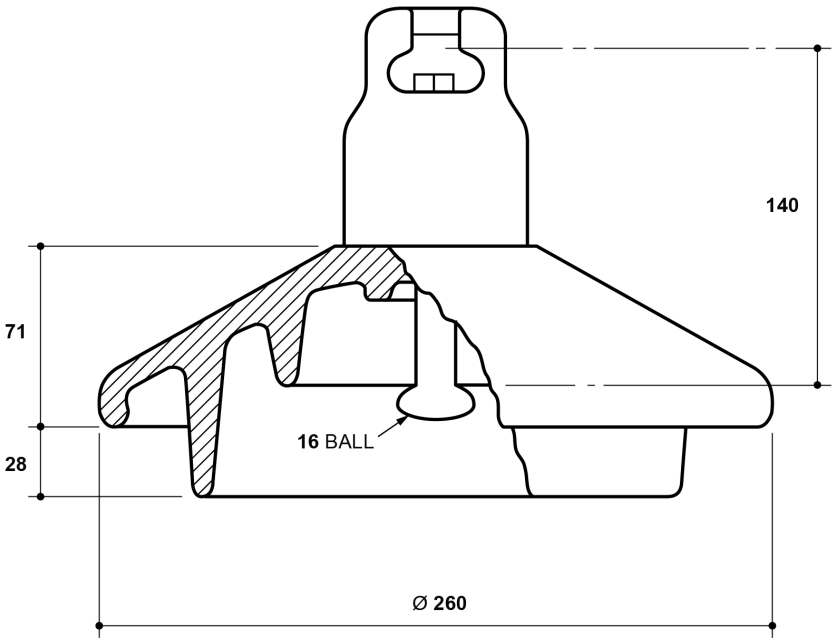
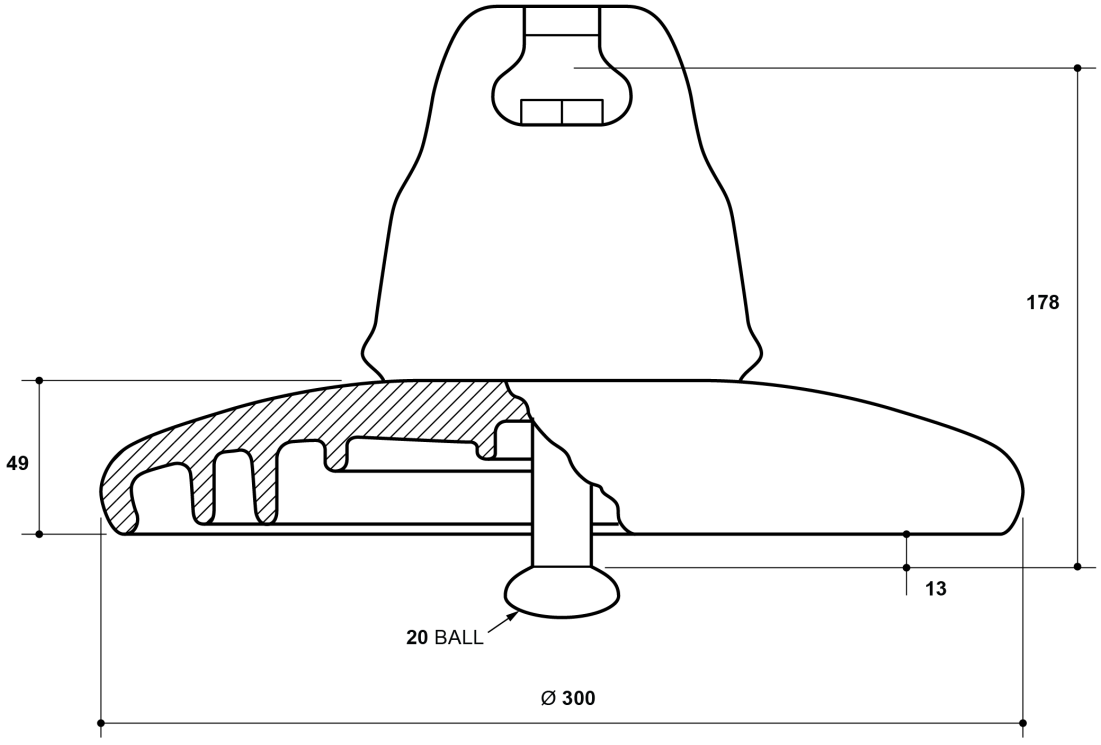


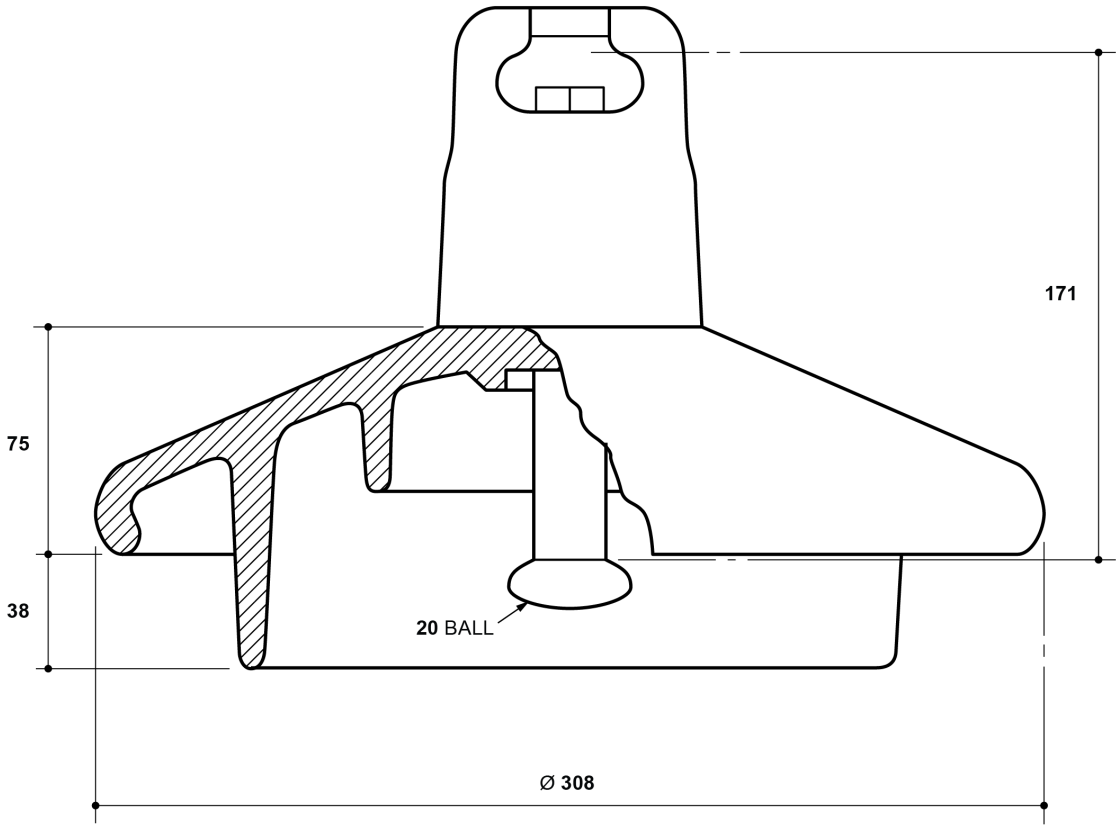
CC 125211

INSULATOR DISC ANTI-FOG 70kN MFL	Change information for this issue N/A	Appears in ES400I4	electricity north west I-400I4-INS-013 Iss 2 sht 1 of 1 Scale: nts Auth: DMT Date: 15/5/2012



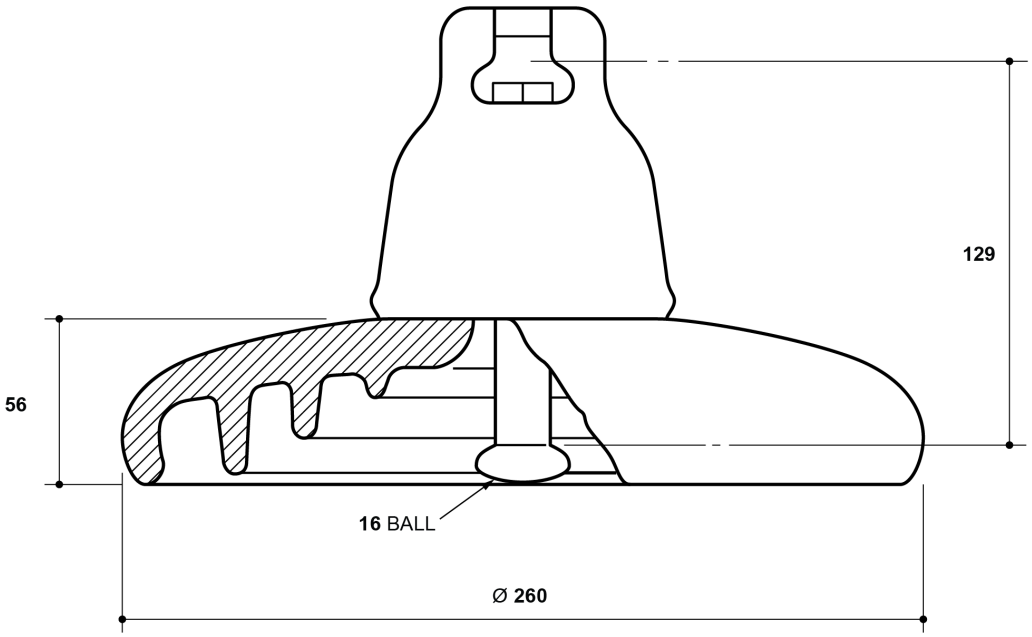
CC 125212

INSULATOR DISC 125kN MFL	Change information for this issue N/A	Appears in ES400I4	electricity north west I-400I4-INS-014 Iss 2 sht 1 of 1 Scale: nts Auth: DMT Date: 15/5/2012



CC 125213

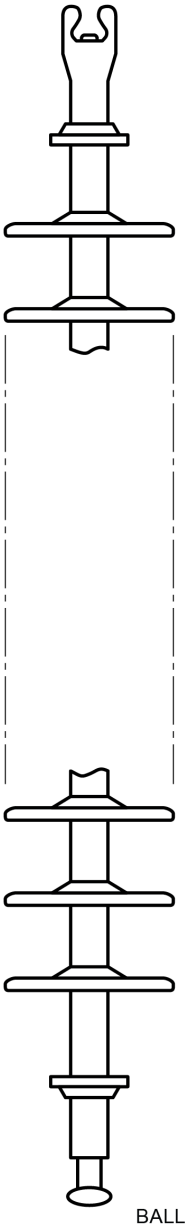
INSULATOR DISC ANTI-FOG 125kN MFL	Change information for this issue N/A	Appears in ES400I4	electricity north west I-400I4-INS-015 Iss 2 sht 1 of 1 Scale: nts Auth: DMT Date: 15/5/2012



CC 125214

INSULATOR DISC 70kN MFL	Change information for this issue N/A	Appears in ES400I4	electricity north west I-400I4-INS-016 Iss 2 sht 1 of 1 Scale: nts Auth: DMT Date: 15/5/2012

SOCKET AS
IEC 60120



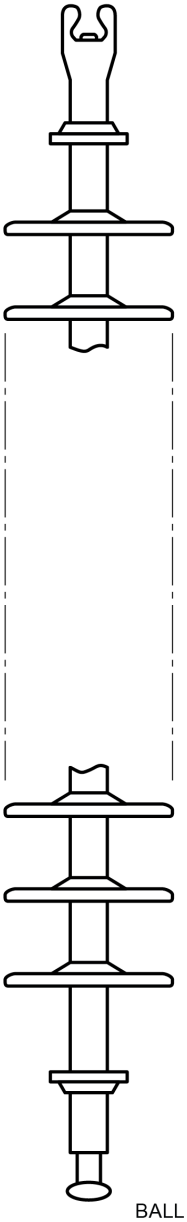
CREEPAGE DISTANCE
TO COMPLY WITH THE
REQUIREMENTS OF
ENATS 43-91

BALL AS
IEC 60120

CC 125215

INSULATOR STAY 132kV WOOD POLE LINE 125kN MFL	Change information for this issue N/A	Appears in ES400I4	electricity north west I-400I4-INS-017 Iss 1 sht 1 of 1 Scale: nts Auth: DMT Date: 15/5/2012

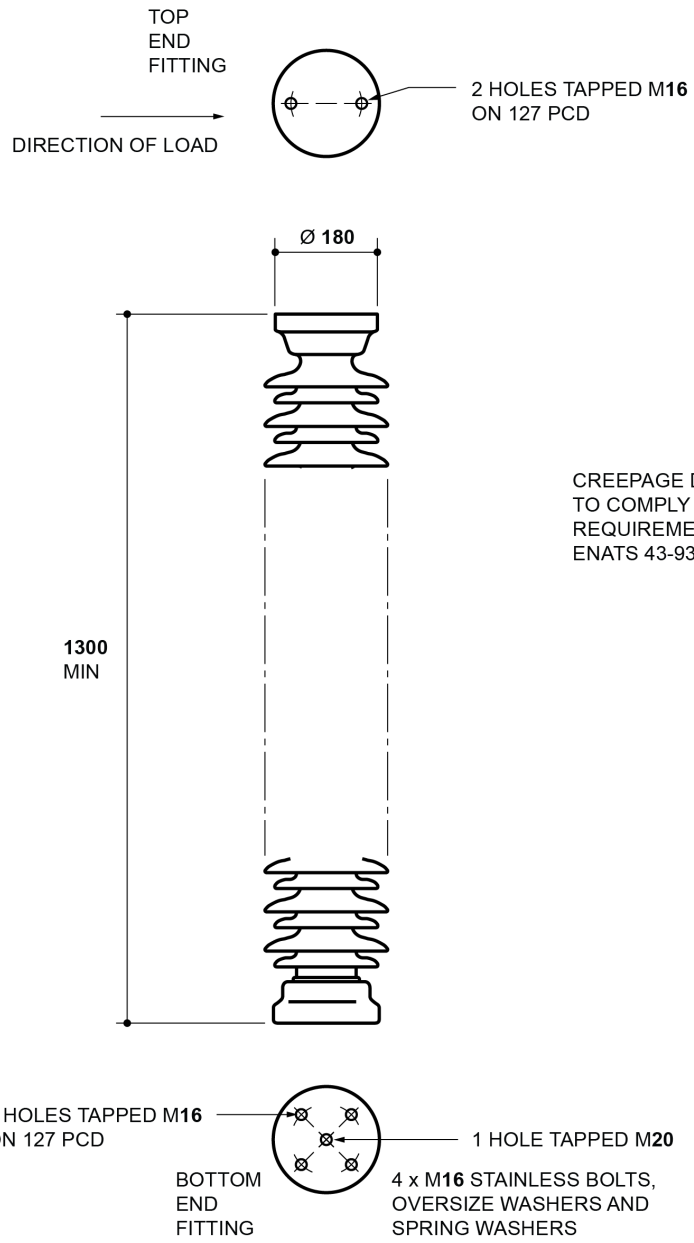
SOCKET AS
IEC 60120



BALL AS
IEC 60120

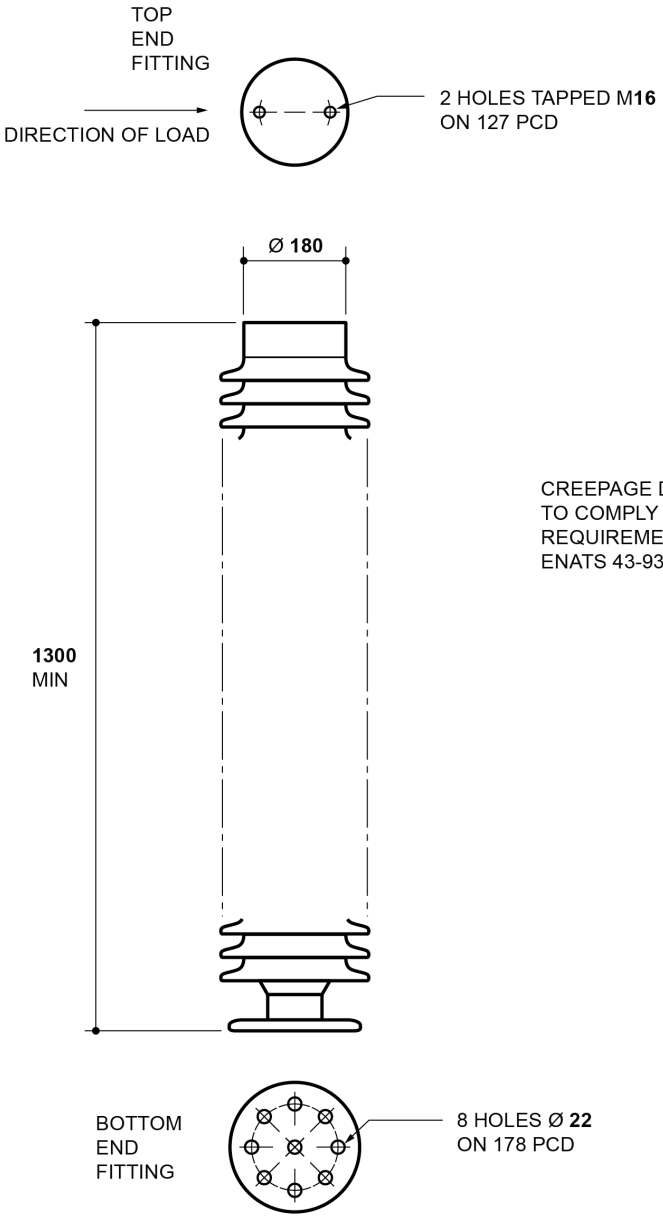
CC 125228

INSULATOR TENSION 132kV WOOD POLE LINE 125kN MFL	Change information for this issue N/A	Appears in ES400I4	electricity north west I-400I4-INS-018 Iss 1 sht 1 of 1 Scale: nts Auth: DMT Date: 15/5/2012



CC 125226

INSULATOR PILOT 132kV WOOD POLE LINE 24kN MFL	Change information for this issue N/A	Appears in ES400I4	electricity north west I-400I4-INS-019 Iss 1 sht 1 of 1 Scale: nts Auth: DMT Date: 15/5/2012



CC 125227

INSULATOR POST TYPE 132kV WOOD POLE LINE 24kN MFL	Change information for this issue N/A	Appears in ES400I4	electricity north west I-400I4-INS-020 Iss 1 sht 1 of 1 Scale: nts Auth: DMT Date: 15/5/2012

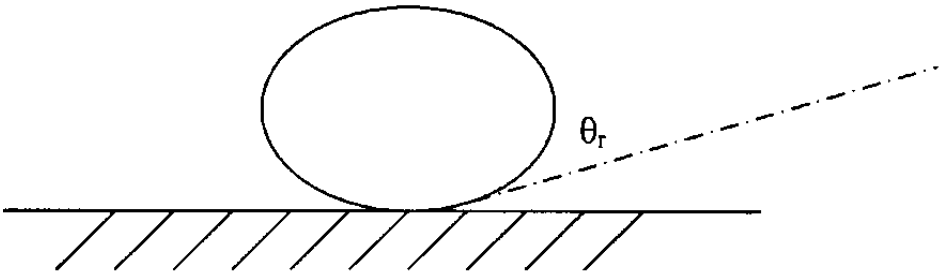
Appendix C – Test Requirements for the Ageing of Polymeric Insulators

Polymeric insulators shall be subjected to the IEC 61109 saline fog 5000 hour test.

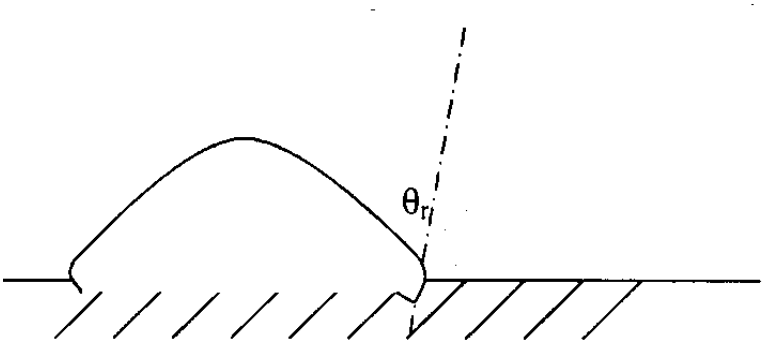
A measurement of the insulator's hydrophobicity shall be taken by measurement of the static contact angle as shown in the Figure 1 below.

Alternatively, the hydrophobicity of the insulator surface may be defined by using the classification guide shown on following pages.

Figure 1 – Measurement of static contact angle

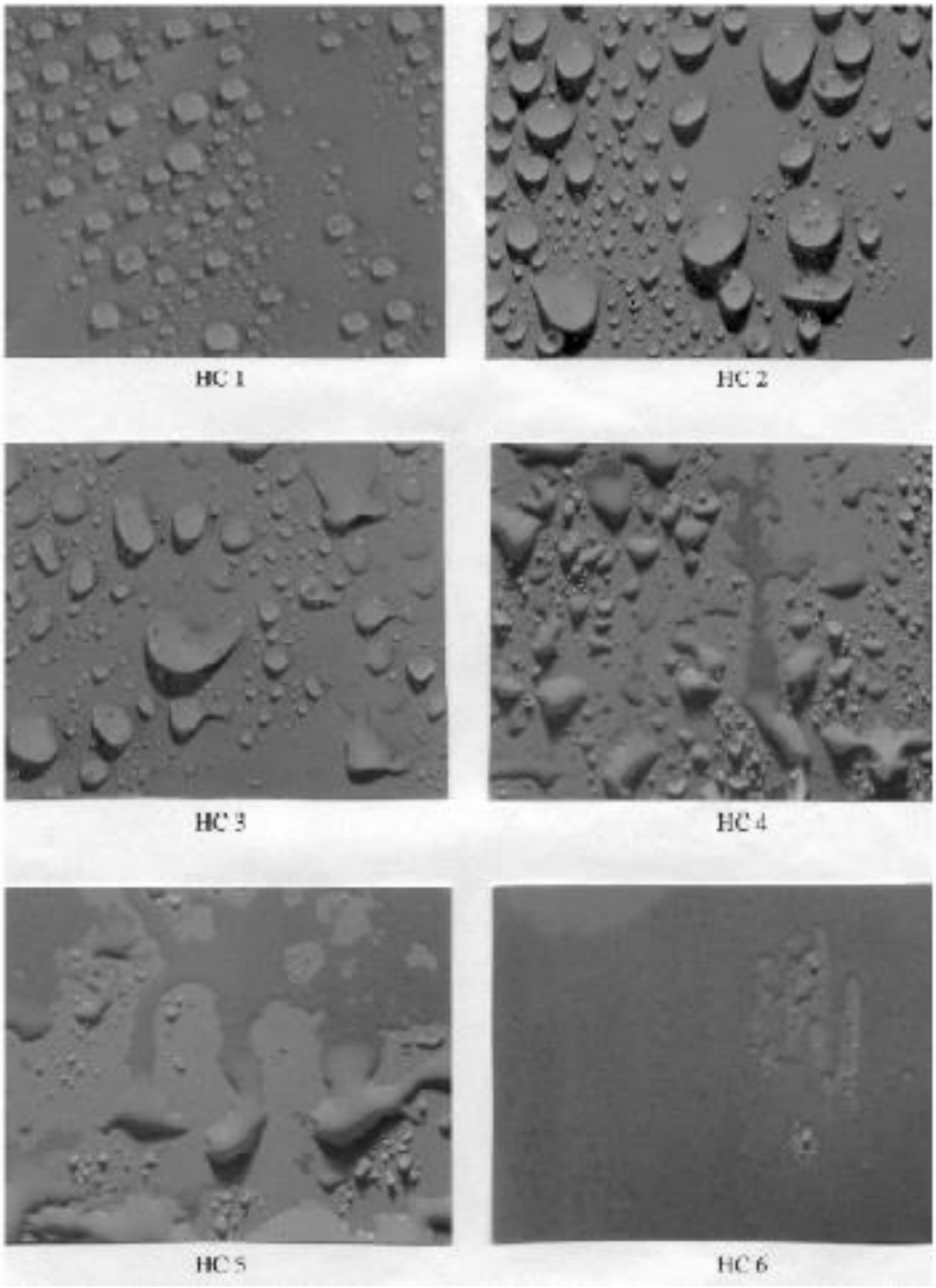


(a). Contact Angle of Water Droplet on Hydrophobic Surface



(b). Contact Angle of Water Droplet on Hydrophilic Surface

Photographic Categorisation of Hydrophobicity Class



SEE NEXT PAGE FOR DESCRIPTIONS OF EACH CLASS

Description of Hydrophobicity Class

Hydrophobicity Class	Description (see photos on previous page)
1	Only discrete droplets are formed. $\theta_r = 80°$ or larger for the majority of droplets.
2	Only discrete droplets are formed. $50° < \theta_r < 80°$ for the majority of droplets.
3	Only discrete droplets are formed. $20° < \theta_r < 50°$ for the majority of droplets. Usually, they are no longer circular.
4	Both discrete droplets and wetted traces from the water runnels are observed (ie $\theta_r = 0°$). Completely wetted areas < $2cm^2$. Together they cover < 90% of the tested area.
5	Some completely wetted areas > $2cm^2$ which cover < 90% of the tested area.
6	Wetted areas cover > 90% ie small unwetted areas (spots/traces) are still observed.
7	Continuous water film over the whole tested area.

Appendix D – Conformance Declaration

SECTION-BY-SECTION CONFORMANCE WITH SPECIFICATION

The Tenderer shall declare conformance or otherwise for each product/service or range of products/services, section-by-section, using the following Conformance Declaration Codes.

Conformance Declaration Codes:

N/A =	Clause is not applicable/appropriate to the product/service.
C1 =	The product/service conforms fully with the requirements of this clause.
C2 =	The product/service conforms partially with the requirements of this clause.
C3 =	The product/service does not conform to the requirements of this clause.
C4 =	The product/service does not currently conform to the requirements of this clause, but the manufacturer proposes to modify and test the product in order to conform.

Manufacturer:

Product/Service Description:

Product/Service Reference:

Name:

Company:

Signature:

SECTION-BY-SECTION CONFORMANCE			
Section	**Section Topic**	**Conformance Declaration Code**	**Remarks * (must be completed if code is not C1)**
4.1	**Product not to be Changed**		
4.2	**Electricity North West Technical Approval**		
4.3	**Quality Assurance**		
4.4	**Formulation**		
4.5	**Identification Markings**		
4.6	**Minimum Life Expectancy**		
4.7	**Product Conformity**		
4.8	**Confirmation of Conformance**		
5.1	**Requirement for Type Tests at the Supplier's Premises**		
5.2	**Requirement for Routine Tests at the Supplier's Premises**		
6	**Constructional Requirements**		
6.1	**General**		
6.2	**Polymeric Pin-Mounted Insulators for Covered Conductors**		

*** Applicable Specifications shall be stated in the Remarks column where alternatives are quoted within a section. The Remarks column shall also be used to indicate cases where the products or services exceed the quoted Specifications.**

Additional Notes: