

Electricity Specification 400I4

Issue 5 December 2021

Overhead Line Insulators



Amendment Summary

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Issue 5	New template applied.
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1 Introduction

This Specification comprises general requirements for the Approval and testing of insulators used on 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 in alphanumeric order, followed by associated drawings (in drawing number order). The load appended to the title of each insulator is the minimum failing load (MFL) of that insulator. [Appendix B](#) shows a photographic categorisation of hydrophobicity class.

2 Scope

This Specification covers all insulators required by for the construction of overhead lines on wood poles (from LV to 132kV) as identified in the appropriate overhead line Specification (e.g. ES40002, ES40003).

3 Definitions

Approval	Sanction by the Electricity North West Overhead Line Policy Manager that specified criteria have been satisfied
Contract	The agreement between Electricity North West and the Contractor for the execution of the Works including therein all documents to which reference may properly be made in order to ascertain the rights and obligations of the parties under the said agreement.
Contractor	The person or person's firm or company, including personal representatives, successors and permitted assigns, who's Tender has been accepted by Electricity North West.
MFL	Minimum Failing Load.
Specification	The Specifications and schedules (if any) agreed by the parties for the purpose of the Contract.
Sub-Contractor	Any person (other than the Contractor) named in the Contract for any part of the Works or any person to whom any part of the Contract has been sub-let with the consent in writing of the Electricity North West Overhead Line Policy Manager, and the legal representatives, successors and assigns of such person.

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

No change in the product, packaging or labelling shall be made after Approval has been granted without prior notice to the Electricity North West Overhead Line Policy Manager, and receipt of a written agreement to the proposed change from the Electricity North West Overhead Line Policy Manager.

4.2 Electricity North West Technical Approval

The Tenderer shall submit, with this Tender, proposals for testing which will demonstrate, to the satisfaction of the Electricity North West Overhead Line Policy Manager, compliance with this Specification. Such tests shall be carried out without expense to Electricity North West.

Alternatively, technical reports and other data may be submitted that the Tenderer considers will demonstrate, to the satisfaction of the Electricity North West Overhead Line Policy Manager, compliance with this Specification. Acceptance of this evidence shall be at the discretion of the Electricity North West Overhead Line Policy Manager but will not be unreasonably withheld.

Approval shall be 'factory specific' and is not transferable to another factory without the written Approval of the Electricity North West Overhead Line Policy Manager.

The Supplier and product shall comply with all the relevant requirements of Electricity North West document CP311.

4.3 Quality Assurance

The Tenderer shall confirm whether or not Approval is held in accordance with a quality assurance scheme accredited under ISO 9000. If not, the Tenderer shall submit a statement of the quality assurance procedures employed to control the quality of the product, including the performance of Suppliers and Sub-Contractors.

The right is reserved for the repeat of such tests, from time to time, that the Electricity North West Overhead Line Policy Manager may deem to be reasonably necessary to demonstrate continued compliance with the Specification.

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 Overhead Line Policy Manager, fitness for installation and service.

The Tenderer shall provide free of charge to Electricity North West such samples as may, in the opinion of the Electricity North West Overhead Line Policy Manager, be reasonably required for inspection and/or retention as quality control samples. The Electricity North West Overhead Line Policy Manager will confirm the requirement for samples at the time of Tendering.

The right is reserved for inspections to be made of Tenderer's facilities, from time to time, as deemed reasonably necessary by the Electricity North West Overhead Line Policy Manager to ensure compliance with this Specification and any Contract of which it forms a part.

The Tenderer shall submit, with the Tender, such details of product packaging disposal, as will enable Electricity North West to comply with the requirements of BS EN ISO 14001 - Environmental Management Systems.

4.4 Formulation

The Tenderer shall submit, with the Tender, such details of the formulation and use of the product and associated substances as will enable Electricity North West to comply with the obligations of the Health and Safety at Work Act 1974 and the Control of Substances Hazardous to Health Regulations 2002, in the use, storage and disposal of the product. The Tenderer may stipulate, prior to submission of such information, that it is to remain confidential, and the Electricity North West Overhead Line Policy Manager will, if requested, confirm agreement to this prior to receipt of the information.

4.5 Identification Markings

The Tenderer shall submit, with the Tender, details of markings which it is proposed to apply to the product or packaging to identify manufacturing batches or items. The forms and content of such markings shall be subject to the Approval of the Electricity North West Overhead Line Policy Manager and shall in all cases include the Electricity North West approved description and commodity code number.

The Tenderer shall submit, with the Tender, such details of marking gross weight on components, assemblies and packages, as will enable Electricity North West to comply with the Health and Safety Manual Handling Operation Regulations 1992, for components, assemblies and packages supplied with a gross weight over 1kg. The forms and content of such markings shall be subject to the Approval of the Electricity North West Overhead Line Policy Manager.

4.6 Minimum Life Expectancy

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

4.7 Product Conformity

Preference will be given to those Suppliers who can provide suitable product conformity certification to a recognised or specified standard, or an equivalent certification.

4.8 Confirmation of Conformance

The Tenderer shall complete the conformance declaration sheets in [Appendix C](#). Failure to complete these declaration sheets may result in an unacceptable bid.

5 Requirements for Type and Routine Testing

The Electricity North West Overhead Line Policy Manager shall set out the requirement of the following tests to be carried out by the Supplier at the Supplier's cost.

5.1 Requirement for Type Tests at Suppliers Premises

These are a series of one-off type tests, which are carried out to ensure the satisfactory performance of the product design, under extremes of operating stresses, and of endurance, as may be appropriate, to be determined by the Electricity North West Overhead Line Policy Manager.

These may or may not be destructive tests.

5.2 Requirement for Routine Tests at the Supplier's Premises

These tests may be required to be carried out on every individual unit or component, as specified, or at some regular frequency to be determined by the Electricity North West Overhead Line Policy Manager.

The results of these tests may be required to be supplied to Electricity North West with each unit purchased or retained for inspection, at a period to be determined by the Electricity North West Overhead Line Policy Manager.

6 Constructional Requirements

6.1 General

Insulators shall conform to all requirements of this Specification and ENA TS 43-91 (Stay Strands and Stay Fittings for Overhead Lines), CP420 Part 1 Chapter 07 (Stay Arrangements for Wood Pole Overhead Lines) and ENA TS 43-93 (Line insulators). Insulators manufactured to drawings I-40014-INS-008 to I-40014-INS-010 and I-40014-INS-017 shall be manufactured from silicone rubber. The dimensions shown on the attached drawings are given for information purposes only. However, the dimension of length of each individual insulator is critical for replacement of existing insulators. Drawings of suitable alternatives shall be supplied with the Tender for evaluation if being offered.

The colour of ceramic insulators shall be brown.

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 ± 2 mm.

33kV insulator shall have a neck diameter of 120 ± 4 mm.

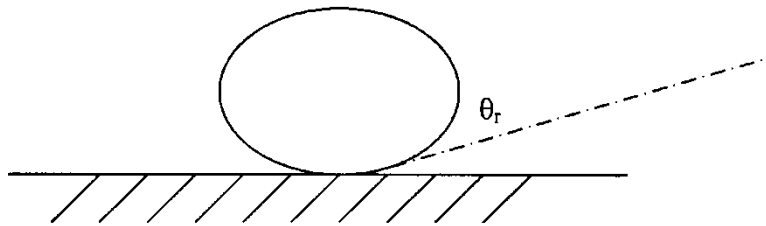
Drawings of insulators shall be supplied with the Tender for evaluation.

7 Test Requirements for the Ageing of Polymeric Insulators

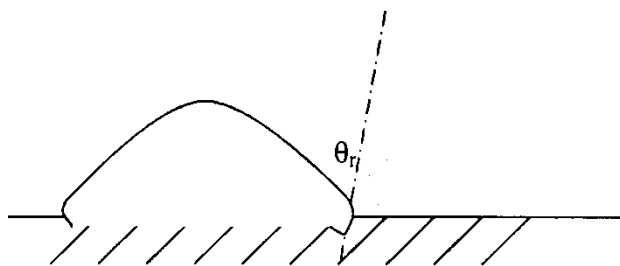
The insulators shall be subjected to the IEC 61109 saline fog 5000 hour test.

A measurement of the insulators hydrophobicity shall be taken by measurement of the static contact angle as shown in the [Figure 1](#) below.

Figure 1



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



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

Alternatively the hydrophobicity of the insulator surface may be defined by using the classification guide in [Appendix 'B'](#).

8 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: 2004	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 Policy Process.
CP420 Part 1	Policy and Practice for Wood Pole Overhead Lines.
ES40002	Overhead-Lines of Compact-Covered-Construction for 11/6.6 kV: Design and Construction.

ES40003

Bare-Wire Overhead-Lines on Wood Poles for 11/6.6 and 33 kV:
Design and Construction.

ES40004

LV ABC Overhead Lines and Services: Design and Construction.

9 Keywords

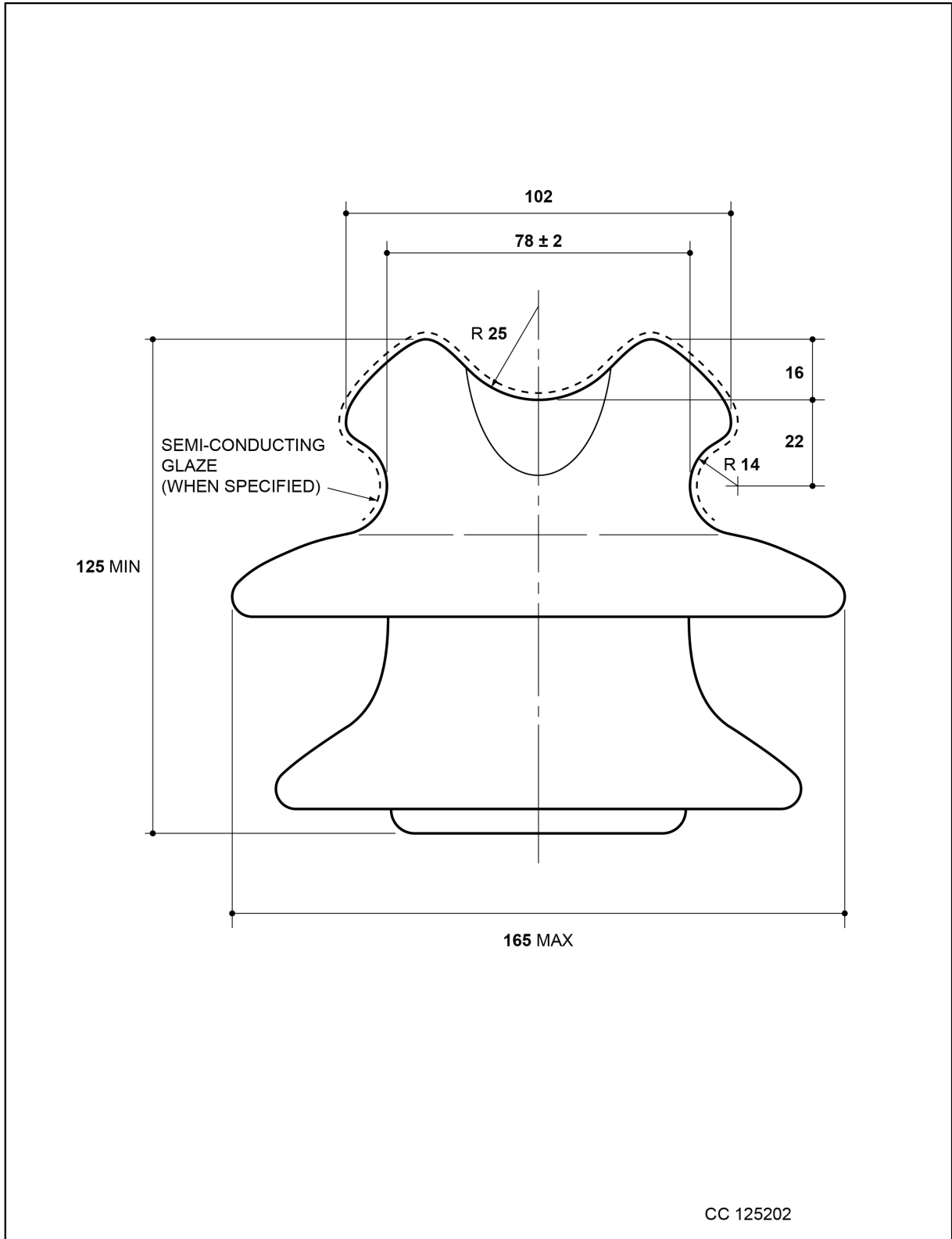
Insulator

Appendix A – Schedule of All OHL Insulators

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)	Dwg I-400I4-INS-005 (ENA TS 43-93 Dwg 439305)	ENA TS 43-30 ES400O4	125205
1a	Insulator, coach screw, service type, polymeric (Dwg I-400I4-INS-005)	Dwg I-400I4-INS-005	ENA TS 43-30 ES400O4	125230
2	Insulator, disc, 70kN MFL (Dwg I-400I4-INS-016)	Dwg I-400I4-INS-016	ENA TS 43-7 ENA TS 43-9	125214
3	Insulator, disc, 125kN MFL (Dwg I-400I4-INS-014)	Dwg I-400I4-INS-014	ENA TS 43-7 ENA TS 43-9	125212
4	Insulator, disc, 190kN MFL (Dwg I-400I4-INS-011)	Dwg I-400I4-INS-011	ENA TS 43-7 ENA TS 43-9	125208
5	Insulator, disc, anti-fog, 70kN MFL (Dwg I-400I4-INS-013)	Dwg I-400I4-INS-013	ENA TS 43-7 ENA TS 43-9	125211
6	Insulator, disc, anti-fog, 125kN MFL (Dwg I-400I4-INS-015)	Dwg I-400I4-INS-015	ENA TS 43-7 ENA TS 43-9	125213
7	Insulator, disc, anti-fog, 190kN MFL (Dwg I-400I4-INS-012)	Dwg I-400I4-INS-012	ENA TS 43-7 ENA TS 43-9	125209
8	Insulator, pilot, 132kV wood pole line 24kN MFL (Dwg I-400I4-INS-019)	Dwg I-400I4-INS-019	ENA TS 43-50	125226
9	Insulator, pin-mounted, 11kV, 10kN MFL (Dwg I-400I4-INS-001)	Dwg I-400I4-INS-001 (ENA TS 43-93 Dwg 439301)	ES400O2 ES400O3	125202
10	Insulator, pin-mounted, 33kV, 10kN MFL (Dwg I-400I4-INS-002)	Dwg I-400I4-INS-002 (ENA TS 43-93 Dwg 439302)	ES400O2 ES400O3	125199

11	Insulator, pin-mounted, polymeric, compacted covered conductor lines, 11kV	Not illustrated – see Section Error! Reference source not found..	ES40002	175270
12	Insulator, pin-mounted, polymeric, compacted covered conductor lines, 33kV	Not illustrated – see Section Error! Reference source not found..	ES40002	175271
13	Insulator, post type, 33kV, 10kN MFL (Dwg I-40014-INS-003)	Dwg I-40014-INS-003 (ENA TS 43-93 Dwg 439303)	ES40003	125203
14	Insulator, post type, 132kV wood pole line, 24kN MFL (Dwg I-40014-INS-020)	Dwg I-40014-INS-020	ENA TS 43-50	125227
15	Insulator, reel type, LV, 15kN MFL (Dwg I-40014-INS-004)	Dwg I-40014-INS-004 (ENA TS 43-93 Dwg 439304)	ENA TS 43-30	125204
16	Insulator, stay, 132kV wood pole line, 125kN MFL (Dwg I-40014-INS-017)	Dwg I-40014-INS-017 (ENA TS 43-91)	ENA TS 43-50	125215
17	Insulator, stay, LV and 11kV, type 1, 110kN MFL (Dwg I-40014-INS-007)	Dwg I-40014-INS-007 (ENA TS 43-91 Dwg 439107, type 1)	ENA TS 43-30 ES40002 ES40003 ES40004	126470
18	Insulator, stay, 33kV, type 2, 110kN MFL (Dwg I-40014-INS-007)	Dwg I-40014-INS-007 (ENA TS 43-91 Dwg 439107, type 2)	ES40002 ES40003	126489
19	Insulator, string insulator unit, 70kN MFL (Dwg I-40014-INS-006)	Dwg I-40014-INS-006 (ENA TS 43-93 Dwg 439306)	ES40003	125206
20	Insulator, tension, 132kV wood pole line, 125kN MFL (Dwg I-40014-INS-018)	Dwg I-40014-INS-018	ENA TS 43-50	125228
21	Insulator, tension, silicone, heavy duty, ball/ball, 70kN MFL (Dwg I-40014-INS-010)	Dwg I-40014-INS-010	ES40002 ES40003	125240

22	Insulator, tension, silicone, heavy duty, ball/hook, 70kN MFL (Dwg I-40014-INS-008)	Dwg I-40014-INS-008	ES40002 ES40003	125232
23	Insulator, tension, silicone, light duty, ball/pigtail hook, 20kN MFL (Dwg I-40014-INS-009)	Dwg I-40014-INS-009	ES40003	125237

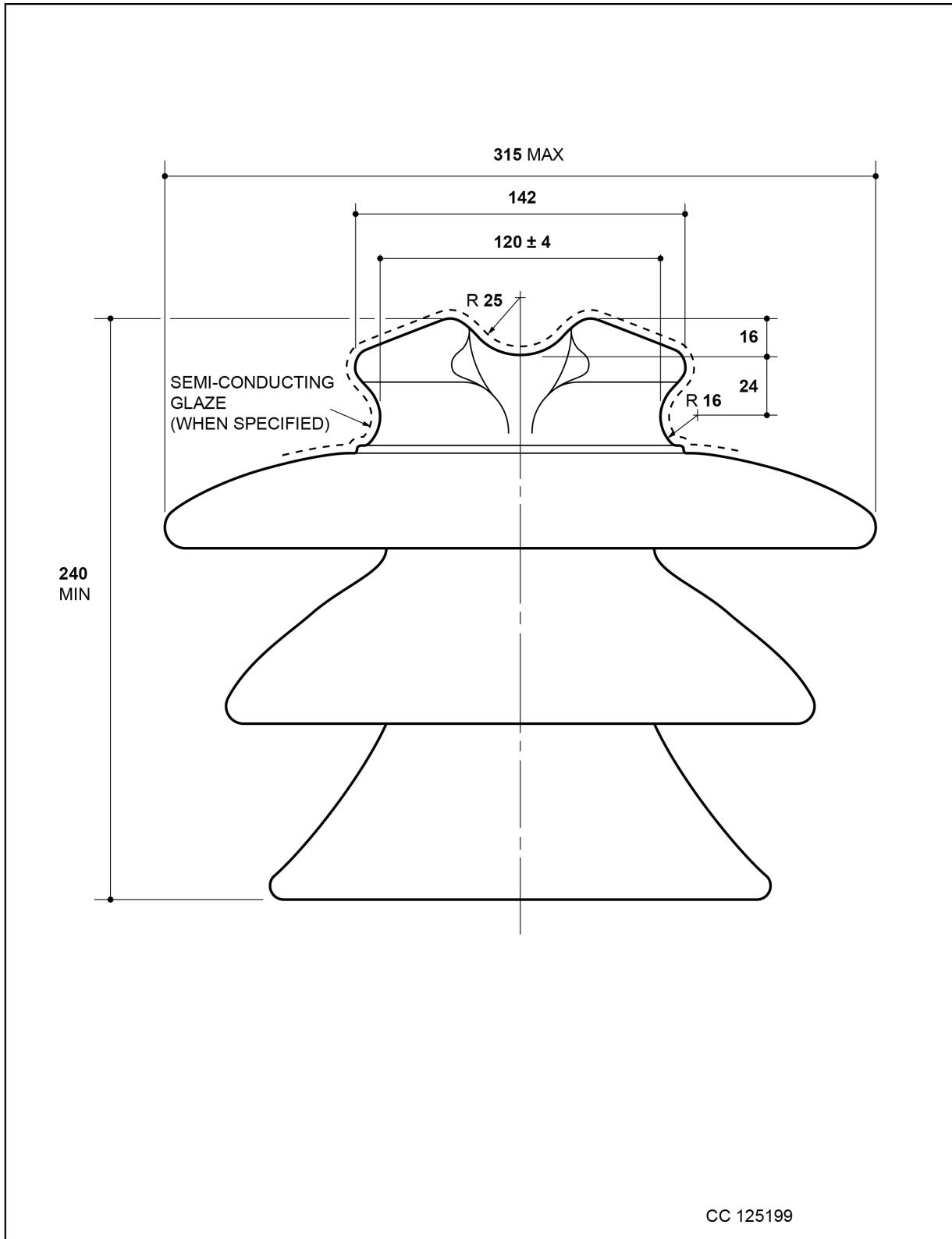


CC 125202

INSULATOR
PIN MOUNTED
11KV, 10KN MFL

Change information for this issue
N/A

Appears in
ES40014

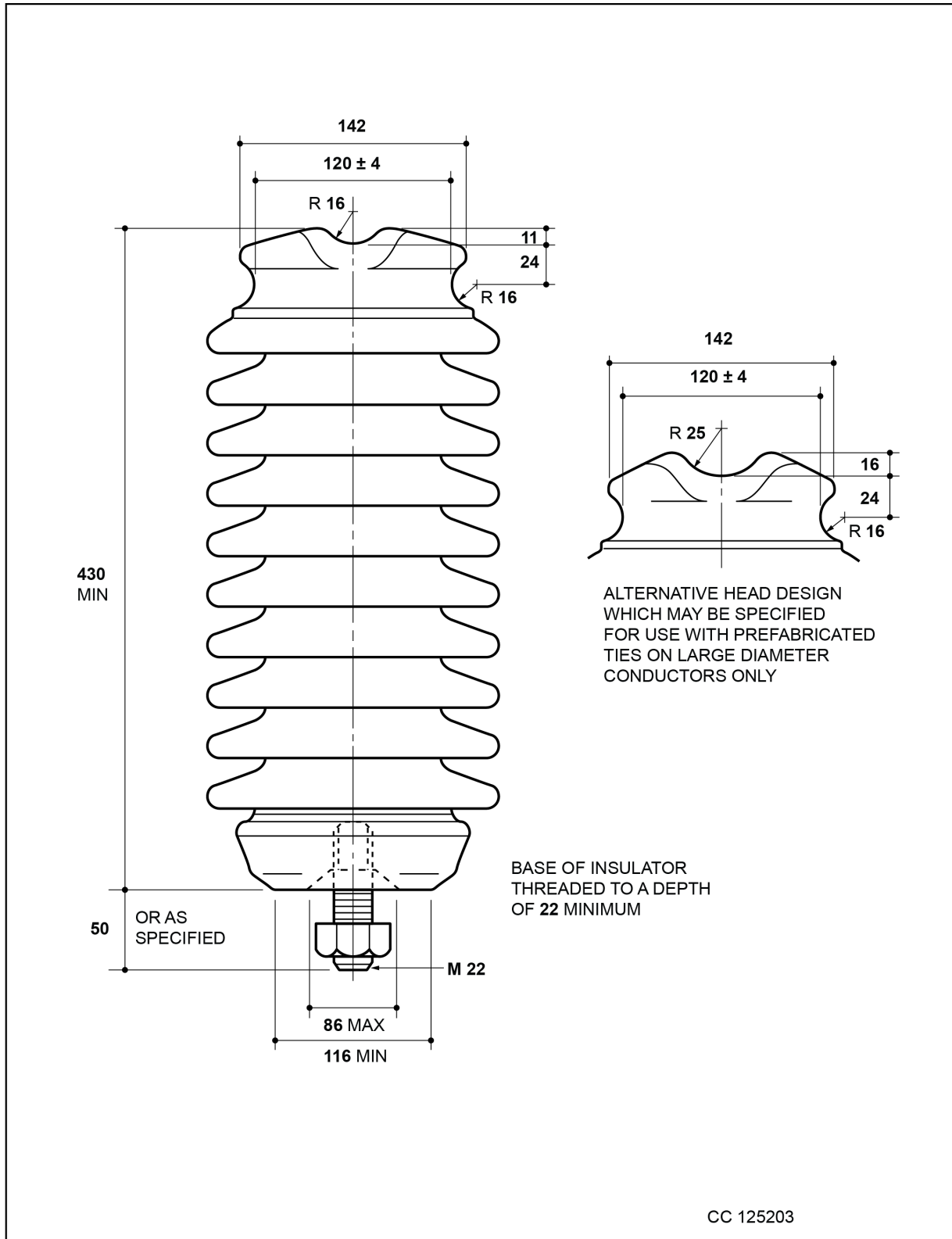


CC 125199

INSULATOR
PIN MOUNTED
33kV, 10kN MFL

Change information for this issue
N/A

Appears in
ES40014

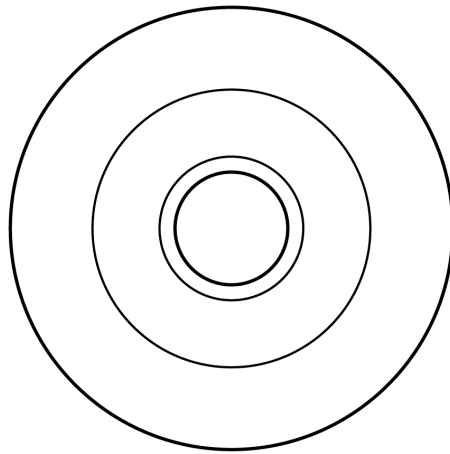
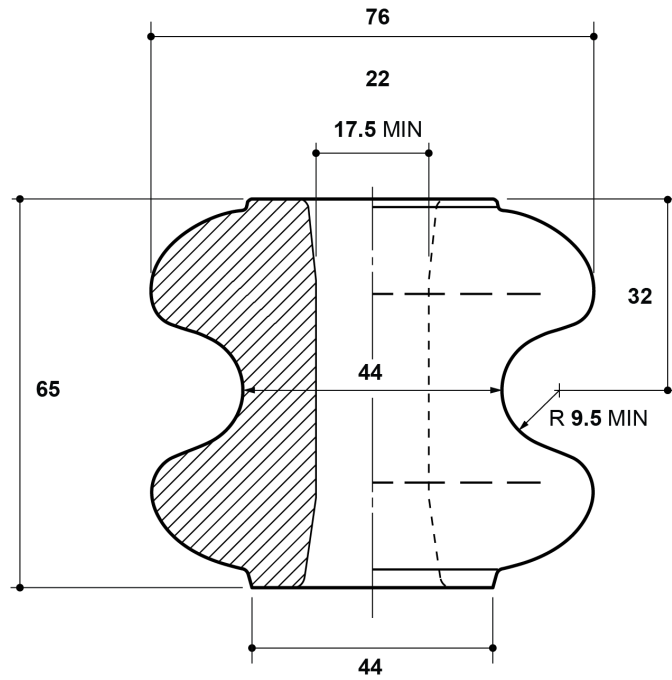


CC 125203

INSULATOR
POST TYPE
33kV, 10kN MFL

Change information for this issue
N/A

Appears in
ES40014

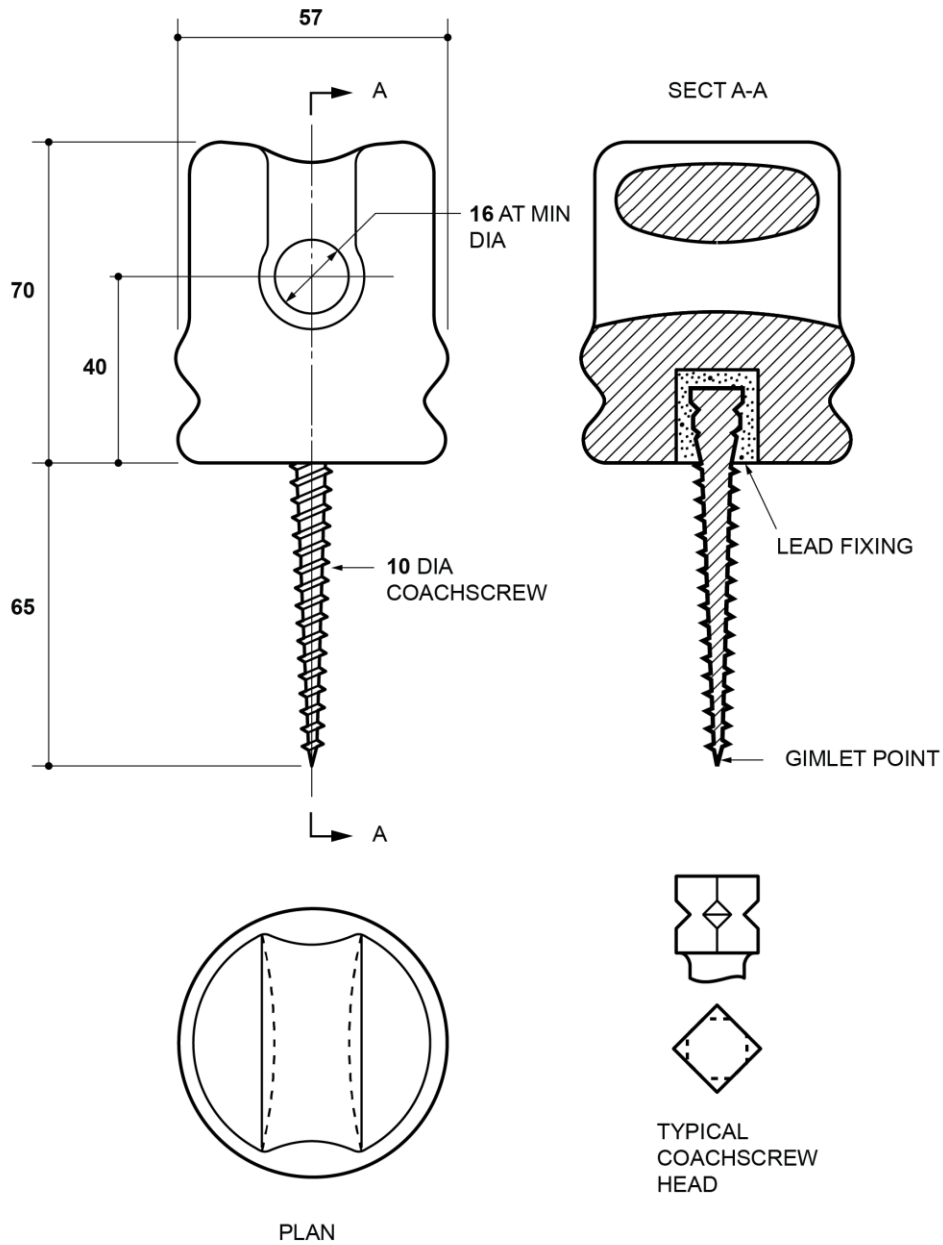


CC 125204

INSULATOR
REEL TYPE
LV, 15kN MFL

Change information for this issue
N/A

Appears in
ES40014



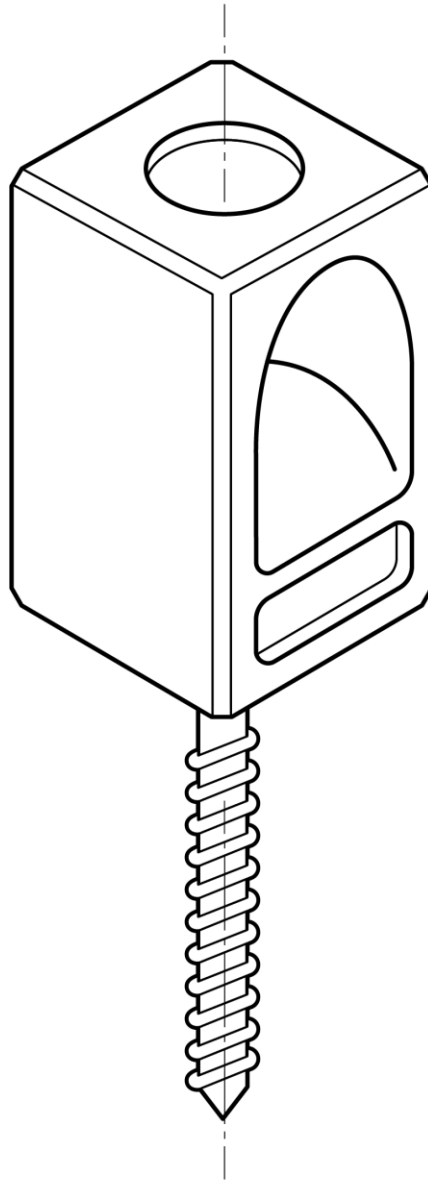
Ceramic insulator

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
ES40014



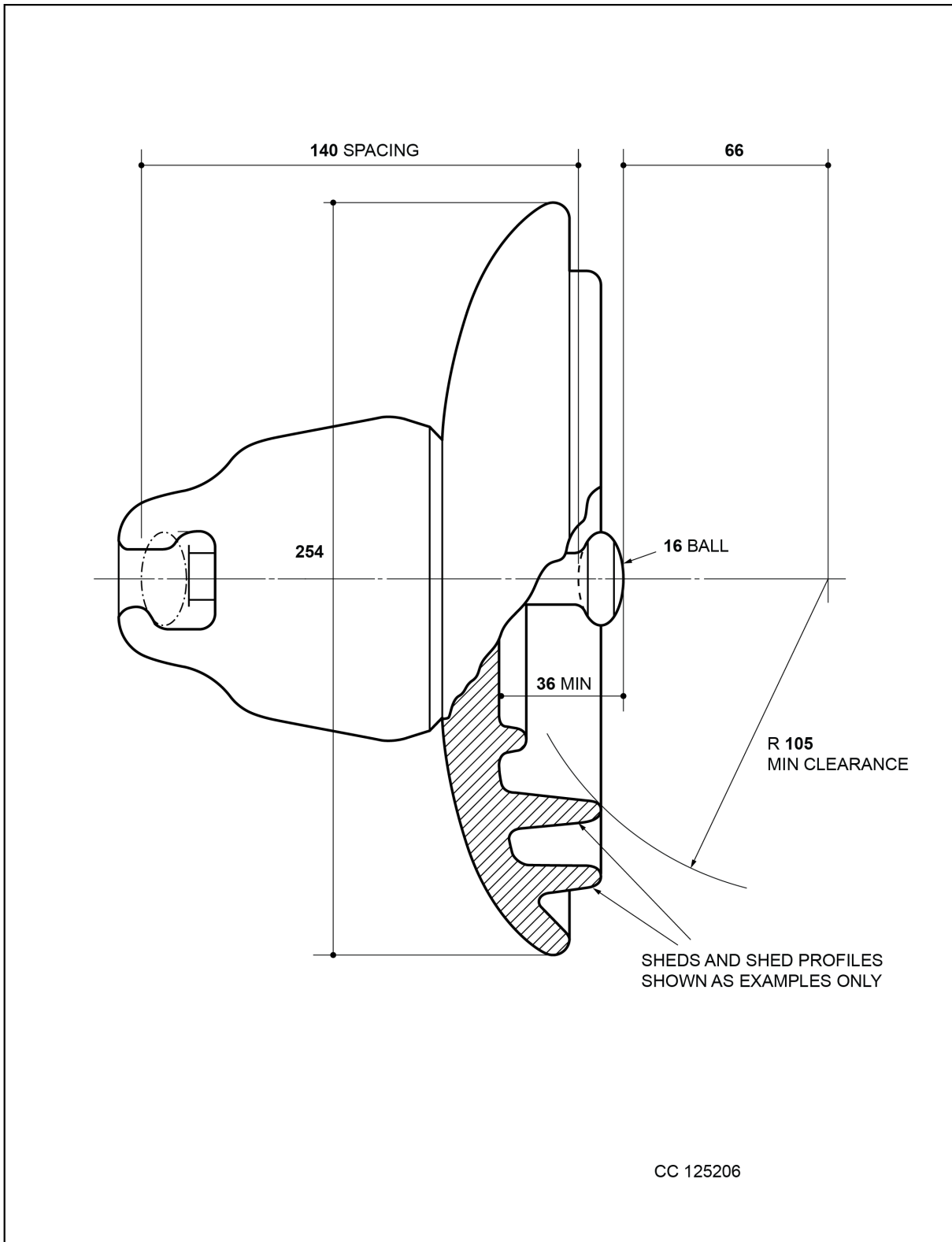
Example polymeric insulator

CC 125230

INSULATOR
COACH SCREW
SERVICE TYPE

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Sheet 2 created for new polymeric
insulator.
Sheet 1 identified as ceramic insulator.

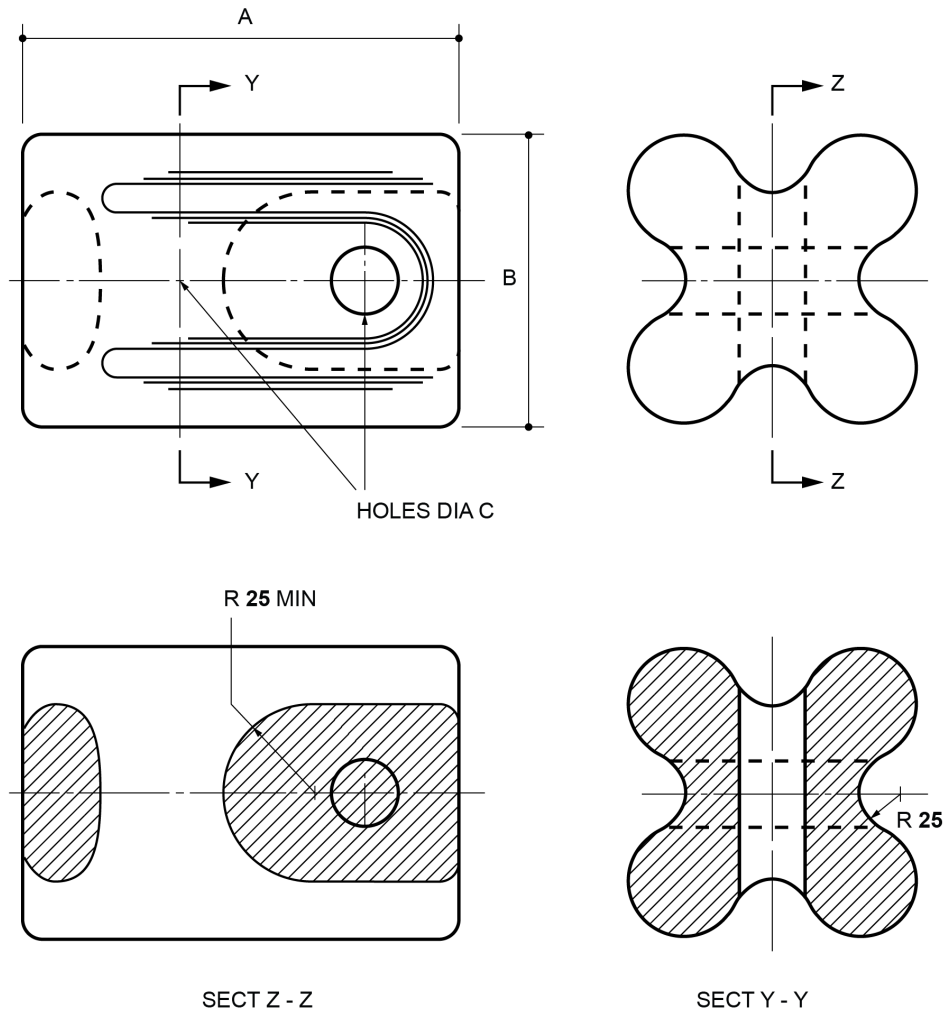
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INSULATOR
STRING INSULATOR UNIT
70kN MFL

Change information for this issue
N/A

Appears in
ES40014

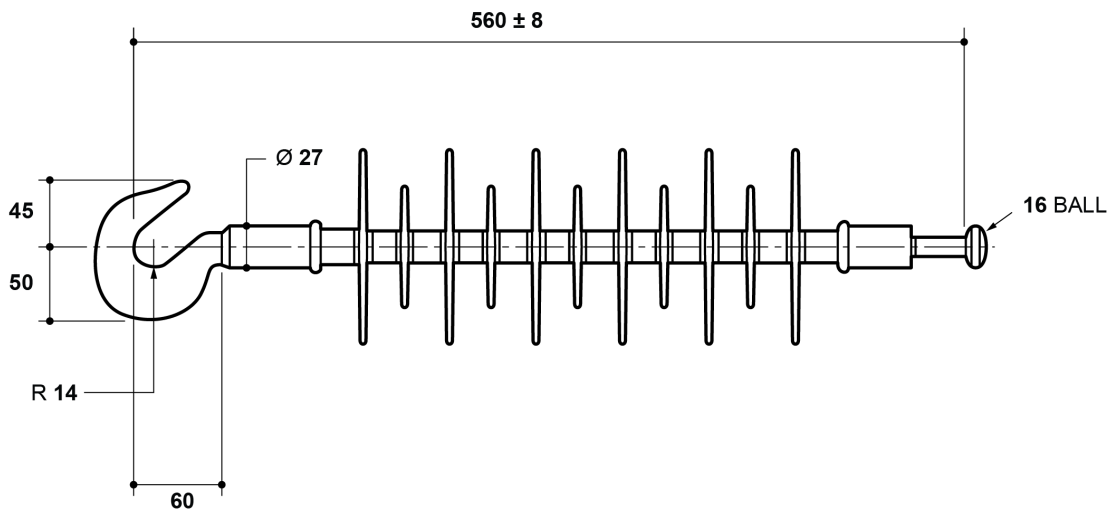


TYPE	VOLTAGE	MINIMUM DIMENSIONS			CC No
		A	B	C	
1	LV & 11kV	115	75	20	126470
2	33kV	220	120	20	126489

INSULATOR
STAY
LINES UP TO 33kV

Change information for this issue
N/A

Appears in
ES40014

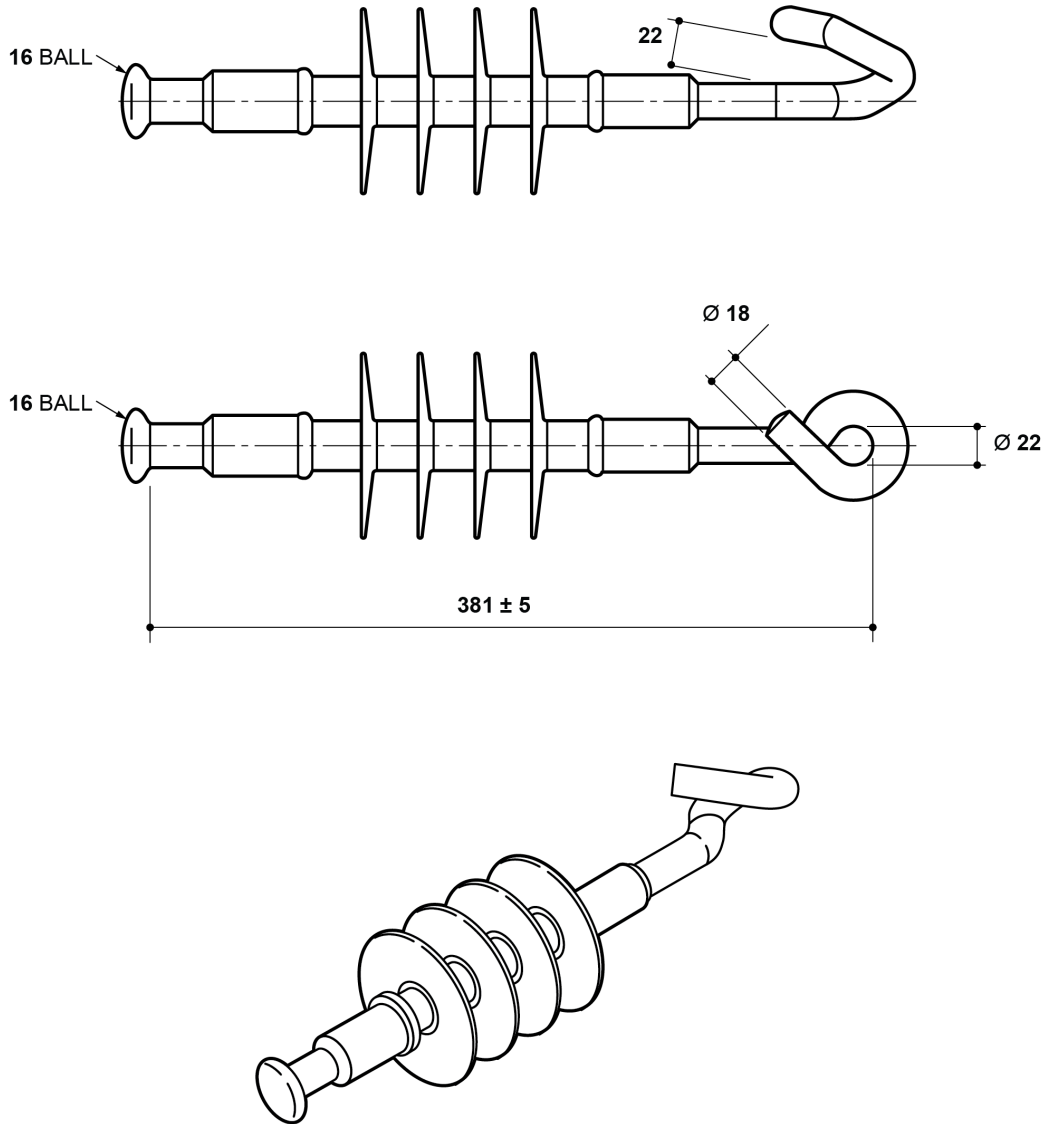


CC 125232

INSULATOR
TENSION, SILICONE, HEAVY DUTY,
BALL / HOOK, 70kN MFL

Change information for this issue
N/A

Appears in
ES40014

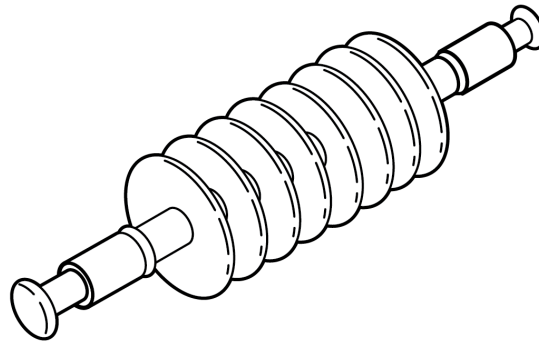
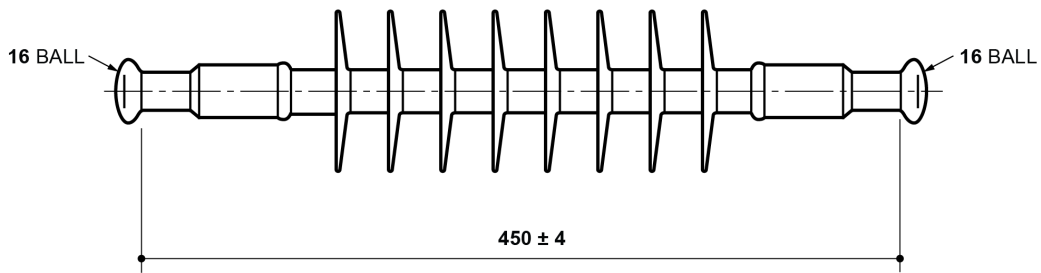


CC 125237

INSULATOR
TENSION, SILICONE, LIGHT DUTY
BALL / PIGTAIL HOOK, 20kN MFL

Change information for this issue
N/A

Appears in
ES40014

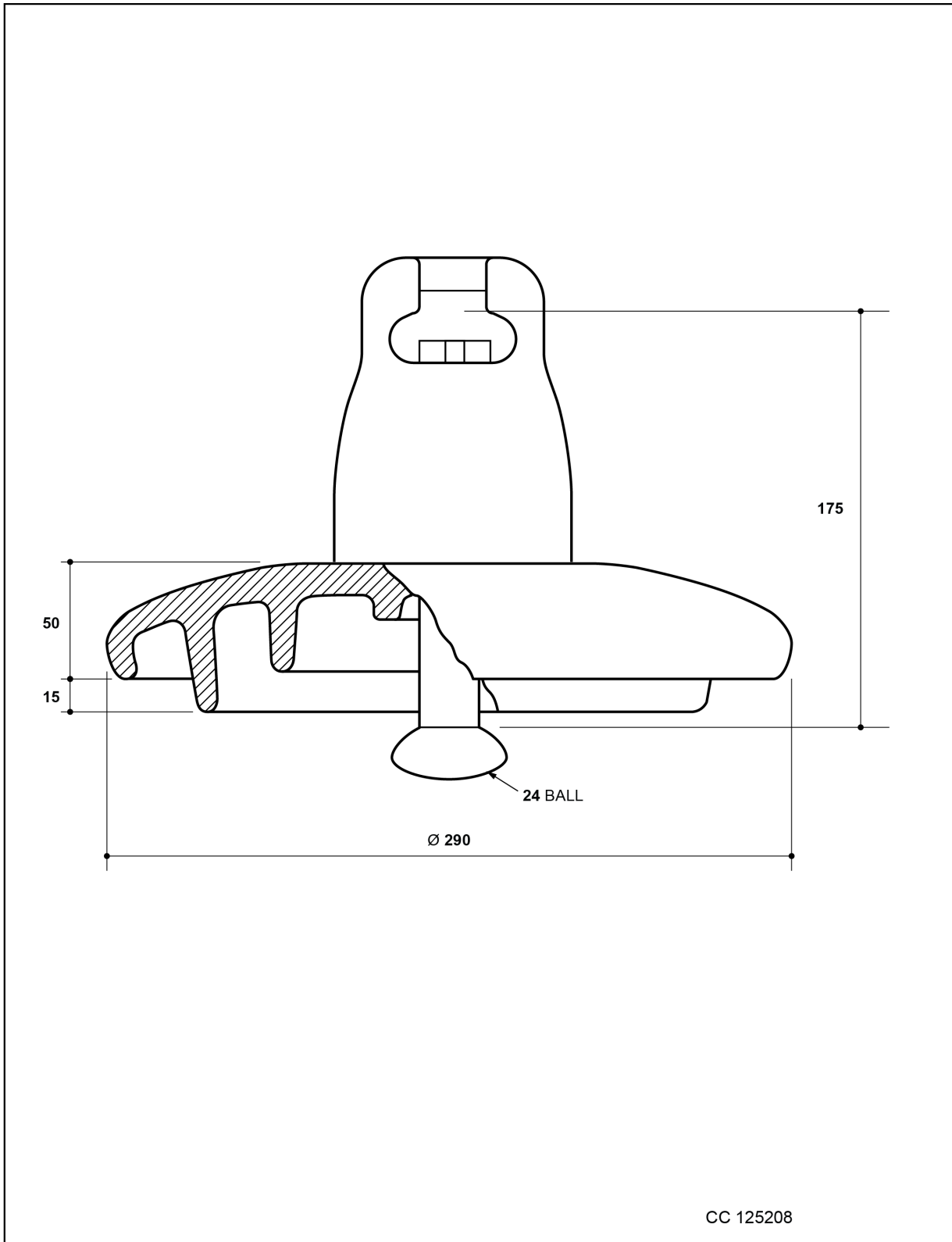


CC 125240

INSULATOR
TENSION
SILICONE, HEAVY DUTY
BALL / BALL, 70kN MFL

Change information for this issue
N/A

Appears in
ES40014

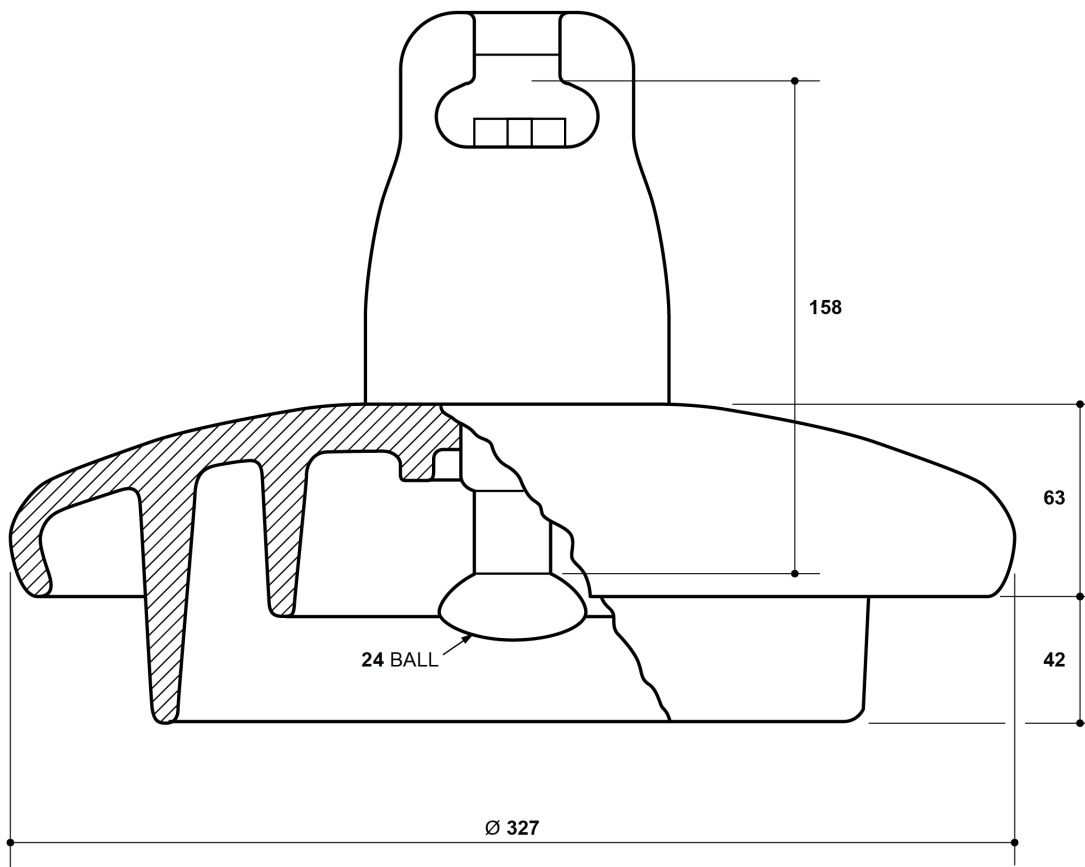


CC 125208

INSULATOR
DISC
190kN MFL

Change information for this issue
N/A

Appears in
ES40014

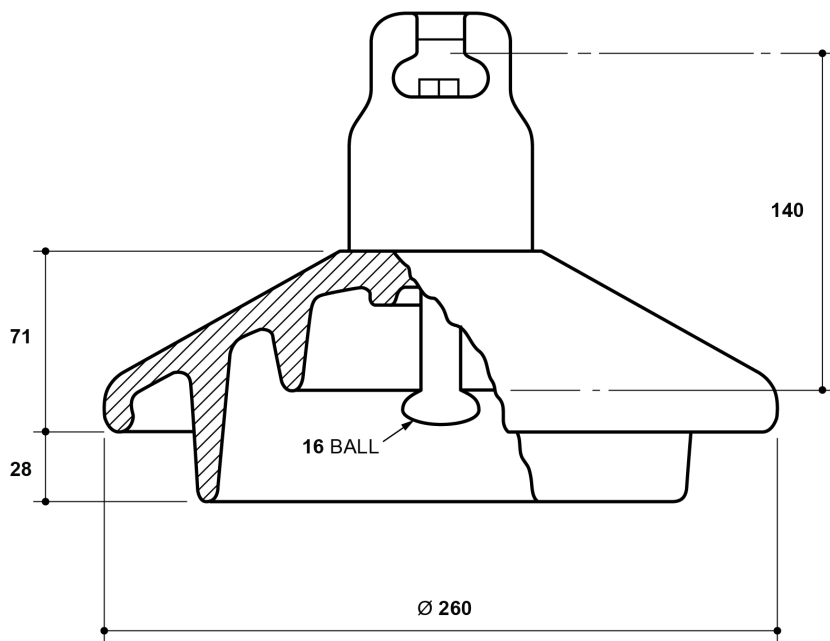


CC 125209

INSULATOR
DISC
ANTI-FOG
190kN MFL

Change information for this issue
N/A

Appears in
ES40014

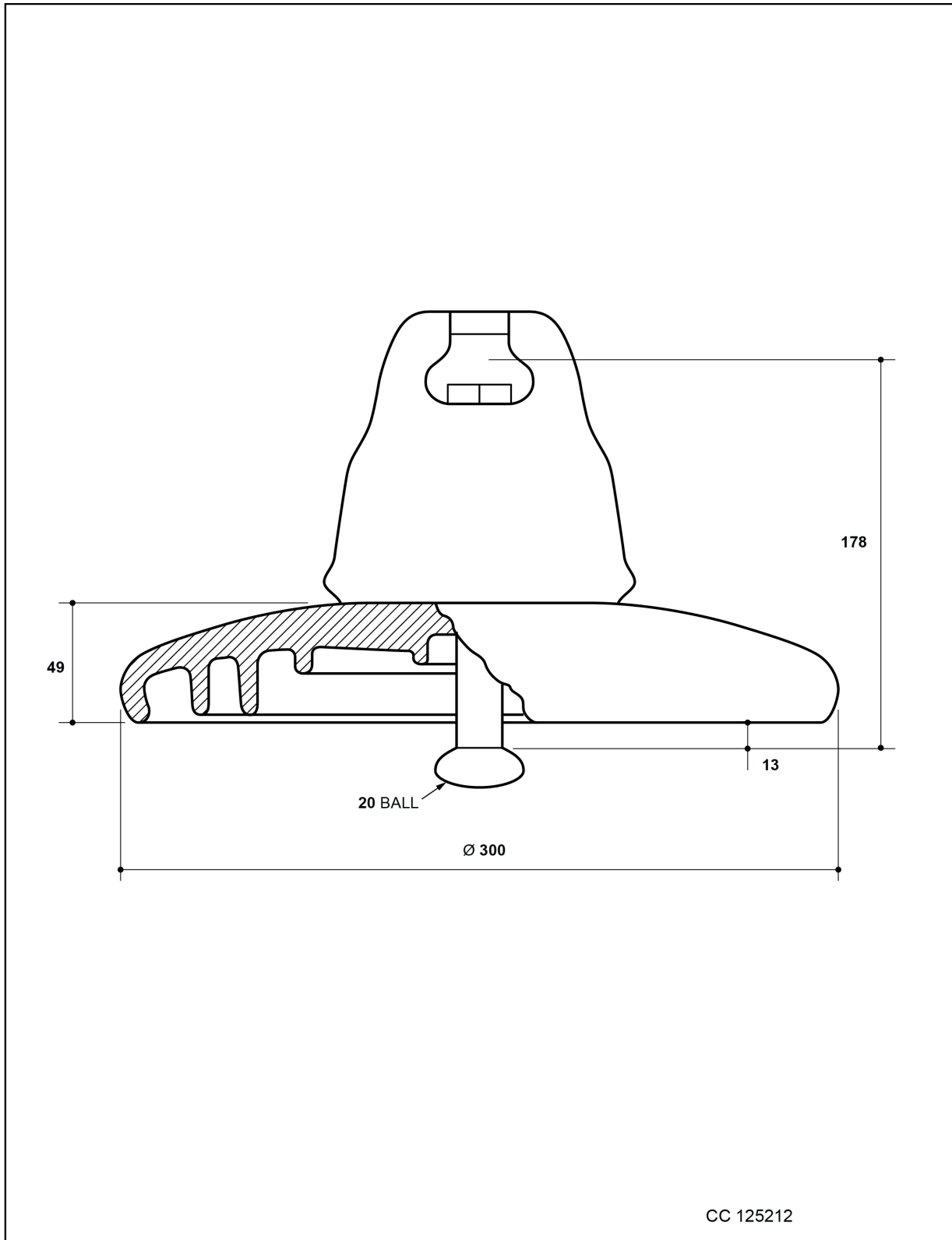


CC 125211

INSULATOR
DISC
ANTI-FOG
70KN MFL

Change information for this issue
N/A

Appears in
ES40014

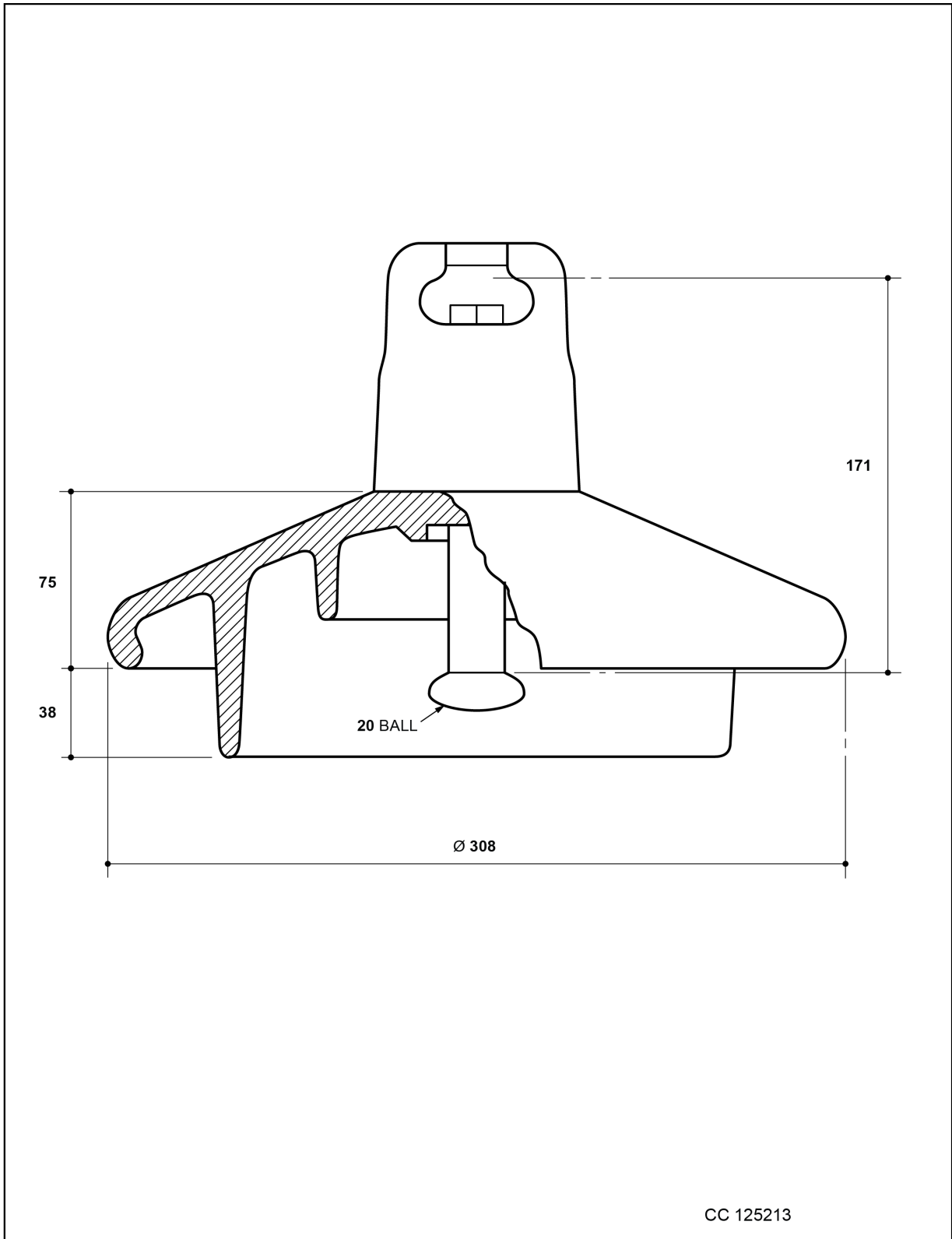


CC 125212

INSULATOR
DISC
125kN MFL

Change information for this issue
N/A

Appears in
ES40014

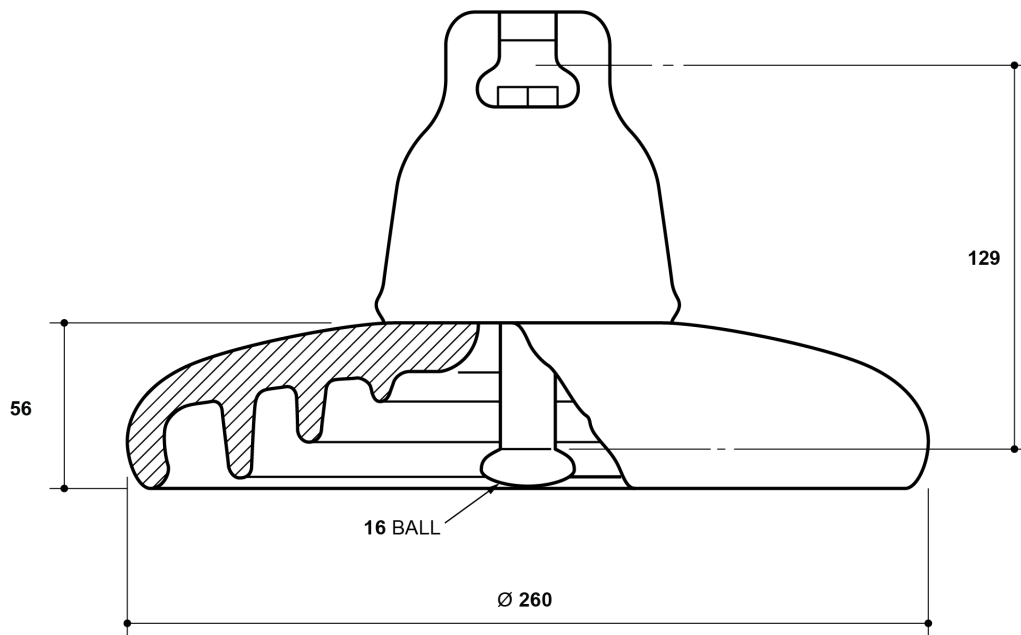


CC 125213

INSULATOR
DISC
ANTI-FOG
125kN MFL

Change information for this issue
N/A

Appears in
ES40014

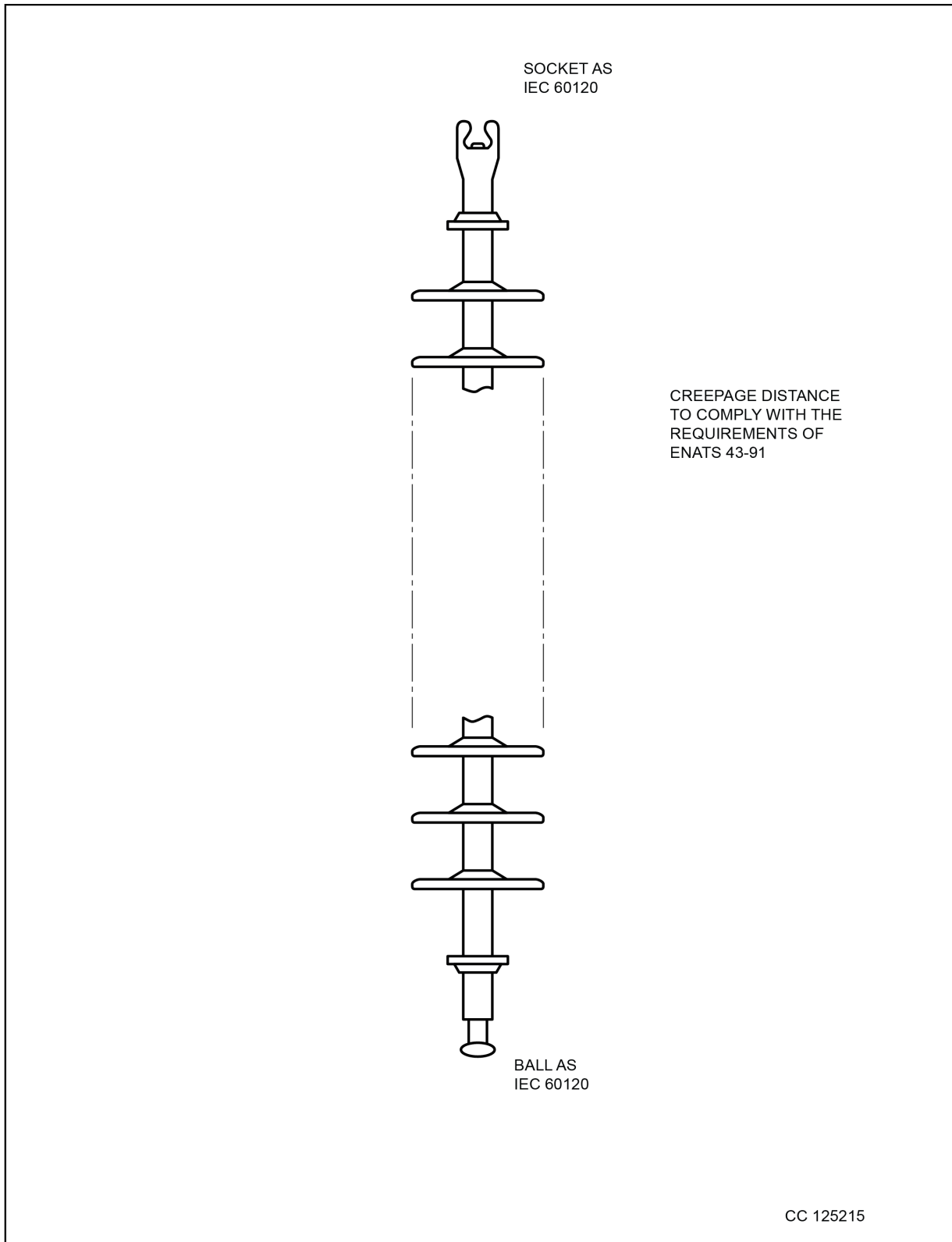


CC 125214

INSULATOR
DISC
70KN MFL

Change information for this issue
N/A

Appears in
ES40014

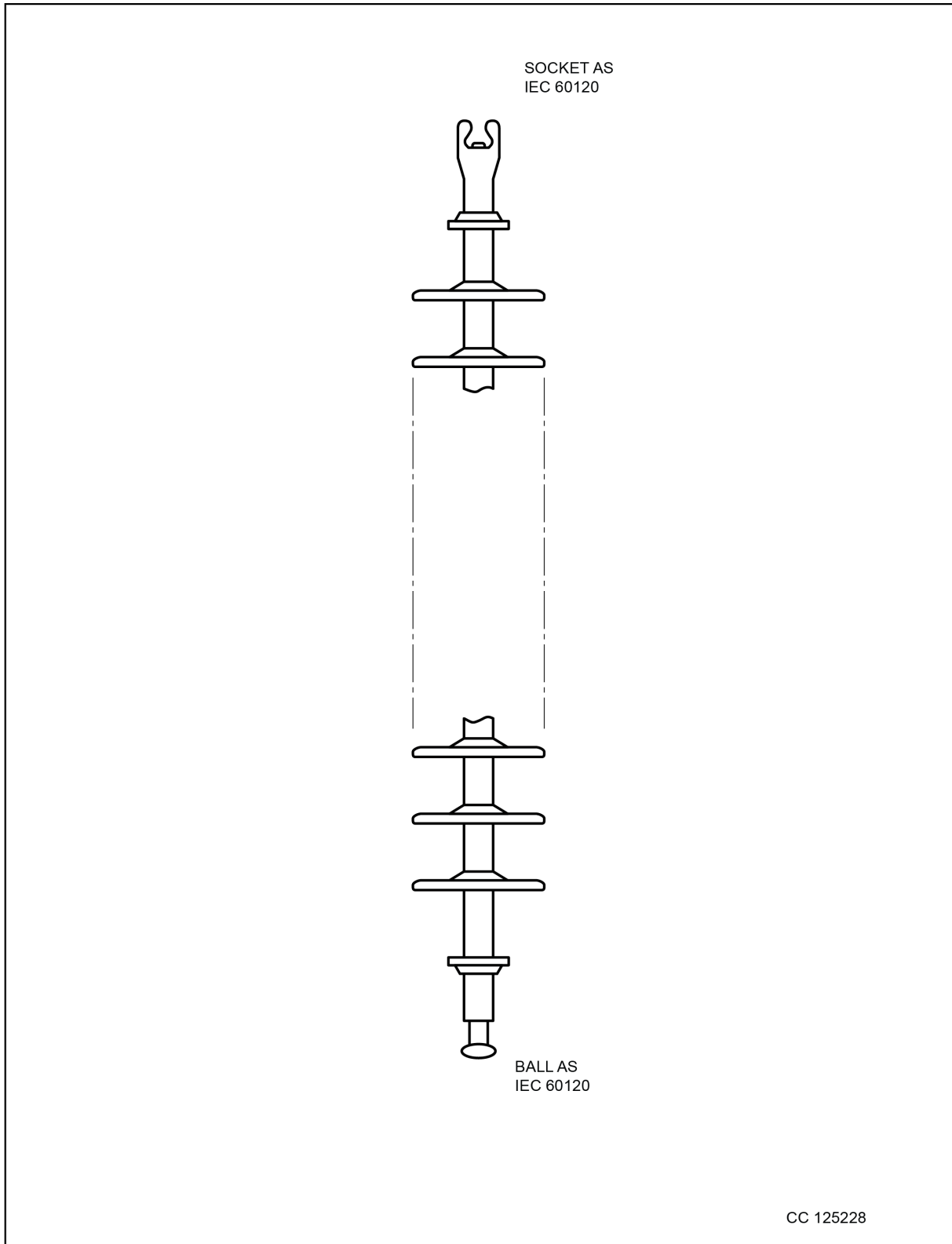


INSULATOR STAY 132kV WOOD POLE LINE 125kN MFL
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Change information for this issue N/A
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Appears in ES40014

electricity north west
I-40014-INS-017 Iss 1 sht 1 of 1
Scale: nts Auth: DMT Date: 15/5/2012

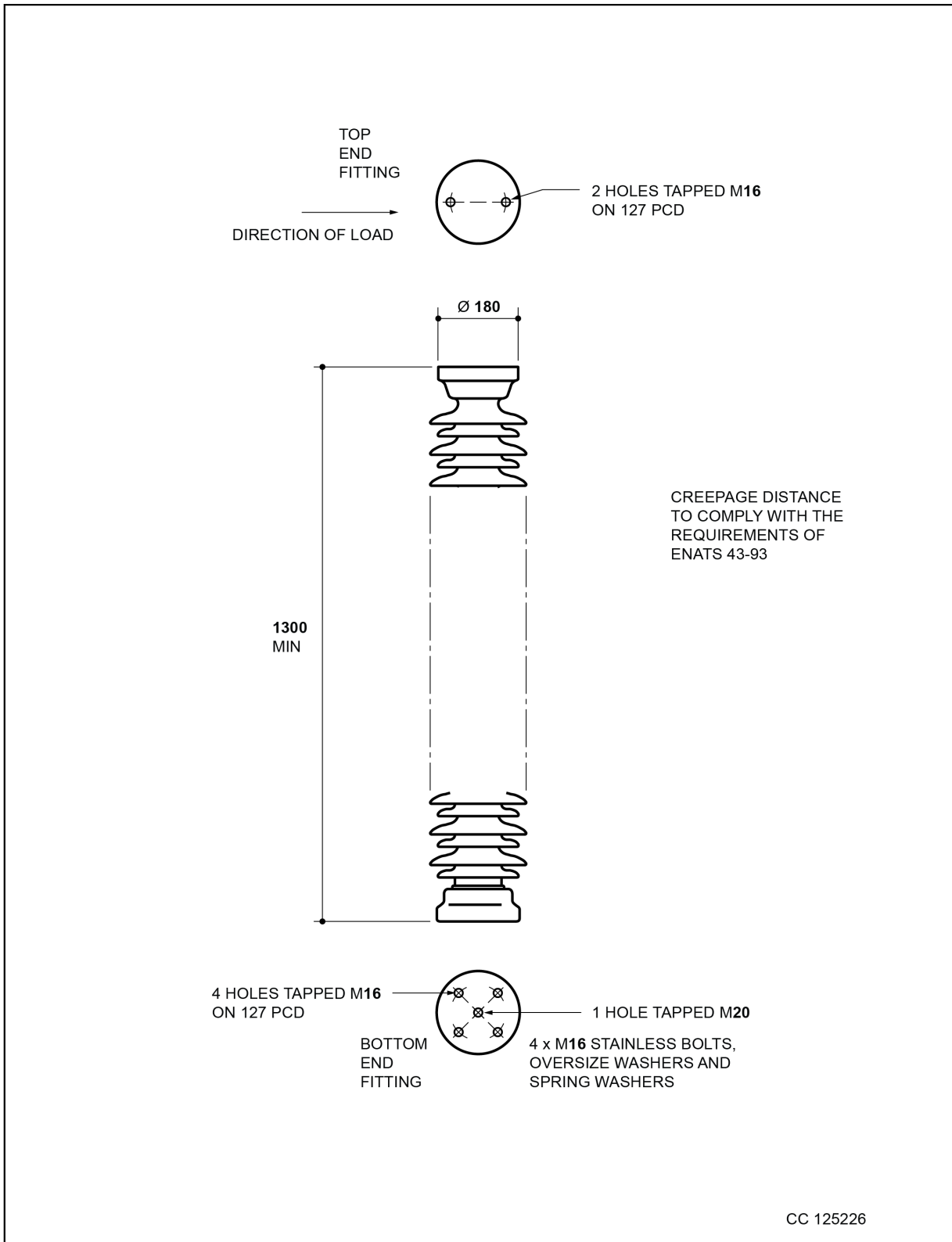


INSULATOR TENSION 132kV WOOD POLE LINE 125kN MFL

Change information for this issue N/A
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Appears in ES40014

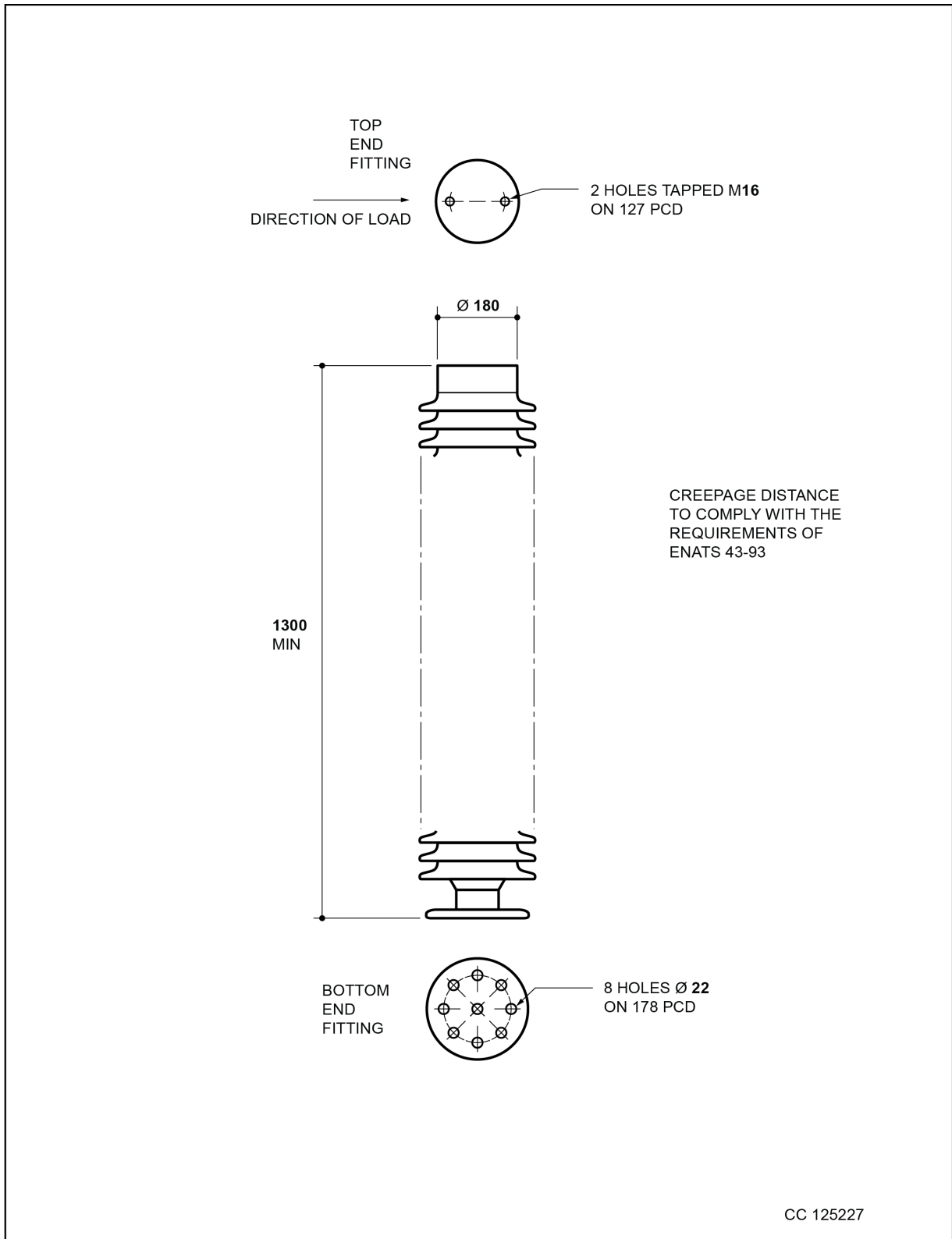
electricity north west
I-40014-INS-018 Iss 1 sht 1 of 1
Scale: nts Auth: DMT Date: 15/5/2012



INSULATOR
PILOT
132KV WOOD POLE LINE
24kN MFL

Change information for this issue
N/A

Appears in
ES40014

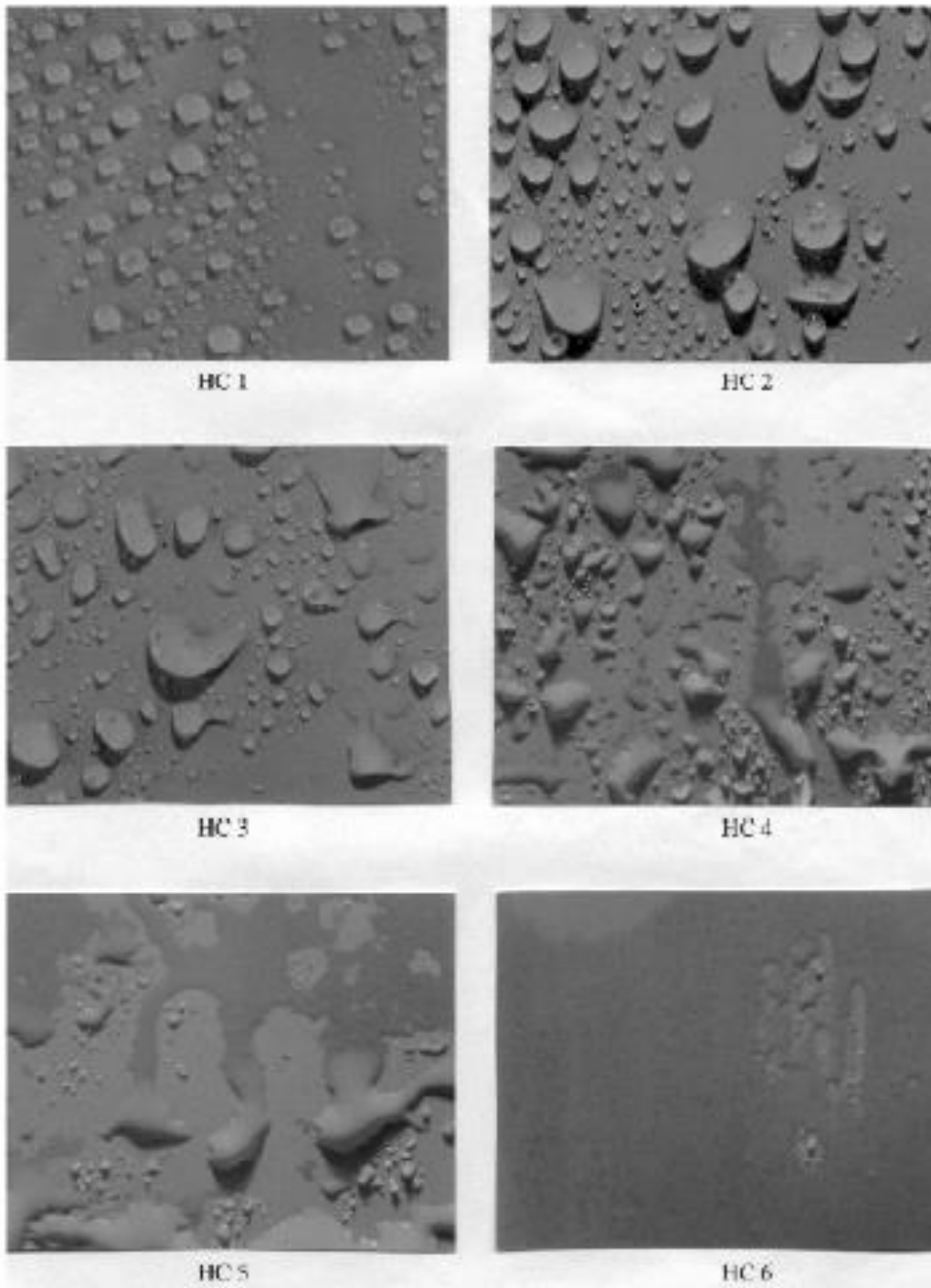


INSULATOR
POST TYPE
132kV WOOD POLE LINE
24kN MFL

Change information for this issue
N/A

Appears in
ES40014

Appendix B – Photographic Categorisation of Hydrophobicity Class



Description of Hydrophobicity Class

HC	DESCRIPTION
1	Only discrete droplets are formed. $\theta_r = 80^\circ$ or larger for the majority of droplets.
2	Only discrete droplets are formed. $50^\circ < \theta_r < 80^\circ$ for the majority of droplets.
3	Only discrete droplets are formed. $20^\circ < \theta_r < 50^\circ$ 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 $\theta_r = 0^\circ$). Completely wetted areas $< 2\text{cm}^2$. Together they cover $< 90\%$ of the tested area.
5	Some completely wetted areas $> 2\text{cm}^2$ 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 C – 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		

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**Test Requirements for
the Ageing of Polymeric
Insulators**

*** 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: