Technical Specification

for

Insulators

Part 1

Insulators for High and Extra-High Voltage Overhead Lines

1.2 Cap-and-pin insulators made of pre-stressed glass

This technical specification is valid for the business units of the market units E.ON Energie and E.ON Ruhrgas and E.ON Nordic.

With this specification, technical determinations were made beyond existing publications.

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Table of contents

1. Area of Application

This technical specification applies for the manufacturing, the delivery and the testing of cap-and-pin insulators made of pre-stressed glass according to EN 60305 for high voltage and extra-high voltage overhead lines of the associated companies mentioned in the title.

This technical specification only regards insulators of class B according to EN 60383-1 (cap-and pin insulators), preferably used in suspension insulator and tension insulator sets.

2. General requirements

2.1 Standards, regulations and ordinances

For the manufacturing, delivery and testing of cap-and-pin insulators of pre-stressed glass, the standards listed in Appendix A of this technical specification are valid, as far as no divergent requirements are made in this technical specification.

The respectively most current version or replacement edition of standards and regulations at the moment of delivery must be used, as well as the standards further mentioned in these,

Generally all standards, rules, regulations, provisions and laws applying in the country of the client have to be followed, even if they are not specifically listed in this specification

The business and communication language is the language of the client.

2.2 Manufacturing facilities

A possibly scheduled relocation to manufacturing facilities not designated in the last pre-qualification procedure of the respective contractor is noticeable and, for a running order, only admissible in case of mutual consent.

The contractor is responsible for the product, including semi-finished products.

3. Further Requirements

3.1 Manufacturing regulations and requirements

The cap-and-pin insulators of pre-stressed glass described in this technical specification are specified in Appendix B.

3.1.1 Design of the insulating body

The sheds must be designed with the standard shed shape according to image 3a of the standard IEC 60815-2.

3.1.2 Design of the insulator socket caps/insulator pins and their cementing

The insulator caps must be manufactured as pin-socket-connection according to EN 60305. The connection dimensions must correspond to IEC 60120. The insulator manufacturer must deliver proof of the quality of the cap and the pin by means of acceptance inspection protocols. These must be forwarded to the client on request with the insulator inspection protocols.

Only one cap and one pin of the same manufacturer may be installed to one individual insulator.

A cementing of aluminium oxide and aluminous cement must be used for the fixing of cap and pin. The cast surface must be even.

The locking devices must be designed according to IEC 60372, split-pin or V-shaped clip. The possibility of unintended detachment of the cap/pin connection caused by un-tensioned chains must be excluded by the use of the mentioned locking devices.

For areas with increased pollution it is necessary to protect the pins of the cap-and-pin insulators against accelerated corrosion by additional sacrificial zinc electrodes. The sacrificial zinc electrode, in the shape of a zinc ring (anti-corrosion ring), must be designed in a way that the endangered border region between the cementing and the air at the zinc-plated pin is covered. Protection must be ensured according to the service life of the insulator. This design type is designated “DC” in this specification.

3.1.3 Tolerances

The dimensions of the insulator and its individual parts generally must correspond to the tolerances according to EN 60305. Deviating from this, the nominal creeping path according to the types listed in Appendix B, must not be fallen short of.

3.1.4 Identification

As a restriction to EN 60305, the insulator must carry its identification on the socket cap. The identification of all insulators must have a legibility life of more than 20 years and bear the following indications:

- Manufacturer/Company logo
- Manufacturing date
- Determined electromechanical or mechanical failing load.

Furthermore, the caps must be permanently identified with the sign of the cap manufacturer.

3.1.5 Determined electromechanical or mechanical failing load and unit test force

The following mechanic routine test loads and determined electromechanical and mechanical failing loads must be complied with for all cap-and-pin insulators:

Insulator designation acc. to EN 60305	Old insulator designation	Determined (electro)-mechanical failing load: [kN]	Unit test force for insulator [kN]
U 70 BL DC	F 70 / 146 DC	70	42
U 70 BS DC	F 70 / 127 DC	70	42
U 100 BLP DC	F 100 P / 146 DC	100	60
U 120 B DC	F 12 / 146 DC	120	72
U 120 BS DC	F 12 / 127 DC	120	72
U 160 B 160 DC *	F160 / 160 DC	160	96
U 210 B DC	F 21 / 170 DC	210	126
U 300 B DC	F 300 / 195 DC	300	180

Comment:
„DC“ zinc anti-corrosion ring at the pin
* Insulator type cannot be classified according to EN 60305

3.2 Materials

3.2.1 Glass

The insulating body must be made of pre-stressed alcali-lime silicate glass according to EN 60672-1 in G 120.

3.2.2 Caps

The caps must be made of malleable cast iron according to EN 1562. The hot-dip galvanising of the caps must conform EN ISO 1461. A stainless steel locking device (split pin) is integrate part of the caps.

3.2.3 Pin

The pins must be made of tempering steel according to EN 10083. The hot-dip galvanising of the pins must conform EN ISO 1461. All pins must be equipped with an anti-corrosion ring made of a zinc alloy.

4. Approval and testing

4.1 Quality control

The contractor has to provide proof of an integrated quality control system according to ISO 9001, which guarantees a continuous assurance of the unchanging product properties as requested by the client and agreed upon by the manufacturer.

4.2 Testing

Routine and sample tests must be performed in order to ensure continuous quality monitoring. As far as not required differently in the following, these inspections must be performed according to EN 60383.

4.2.1 Type test

For an initial order at a new contractor, the client requires a type test according to section 6.1 and table 3 of EN 60383, part 1, in order to test the main characteristics of the insulator. The extent to which this type test is performed must be agreed beforehand between contractor and client. If a new insulator type is used, the type test must be performed in any case. The tests must be performed in a certified testing station, either owned by the manufacturer or external, acknowledged by certification.

Deviating from EN 60383-1, the subsequently listed requirements must be proven by tests in addition to the type test; these tests must be documented.

4.2.1.1 Axial and radial deviation

Deviating from EN 60383-1, the axial and radial deviations must be proven also in the type test. The detected deviations must comply with the requirements according to section 21 of EN 60383-1.

4.2.1.2 Residual strength of the glass caps after mechanical damage

Deviating from EN 60383-1, the residual strength of the glass cap-and-pin insulators after mechanical damage must be proven according to the test in IEC 797. The acceptance criteria is the constant k=0.8.

4.2.2 Routinet test

Routine tests must be performed according to section 6.3 and table 3 of EN 60383-1 for all cap-and-pin insulators of pre-stressed glass of the contractor's delivery lot.

4.2.2.1 Visual inspection

The cap-and-pin insulators must be inspected for visible defects. As a restriction to the standard mentioned above, bubbles with a size of more than 1 mm are not admissible.

4.2.2.2 Mechanical routine test

All insulators must be tested according to item 28.2 of EN 60383-1.

4.2.3 Sample test

Sample test must be performed according to the requirements given in section 6.2 and table 3 of EN 60383-1, as well as according to Appendix B of this technical specification. For this, a random sample must be taken from the delivery lot. The amount of samples E1 and E2 depends on section 8.2 of EN 60383-1.

Sample tests must be performed by the contractor independently from the presence of a representative of the client. Generally, for every order the client reserves the right to participate in the sample tests in factory. The sample test date must be agreed between the client and the contractor 3 weeks before delivery.

Independent from an inspection performed by the client in the factory of the contractor, two copies of the complete inspection protocols about the factory inspections performed by the contractor, must always be handed to the client, generally together with the delivery of an order. These protocols must clearly state the results of the required inspections as well as the comparison to the target values.

During the acceptance of the fabricated insulators, all protocols on the incoming inspections of the used raw materials, as well as the production reports, must be provided on request. All batches of the used raw materials must be submitted to an incoming inspection prior to processing. Furthermore, the following criteria must be complied with during the sample test.

4.2.3.1 Test of the locking device

The test of the locking device must be performed for all samples E1 and E2.

4.2.3.2 Mechanical failure load test

The testing of the insulators with respect to the achievement of the specified mechanical failure load, as well as the evaluation of the tests, must be performed according to section 19 of EN 60383, part 1, for which all insulators to be tested must comply with the required minimum failure load.

4.2.3.3 Galvanising test

The galvanising test must be performed for all samples E1 and E2.

4.2.4 Acceptance/rejection

If only one insulator fails as a complete component during the sample test, a repeated test according to item 8.3 of EN 60383, part 1, must be performed. If two or more insulators fail the sample test as complete components, the entire delivery lot must be withdrawn by the manufacturer.

5. Documentation

The complete subject (order number, text, site) must be repeated in all written documents of the contractor. Generally, the correspondence of the contractor (order acceptance, delivery schedule, quantity changes) is directed to the corresponding orderer stated in the call for supply. Correspondence must generally be in the language of the client.

The correspondence between contractor and client with respect to acceptance tests/quality control must be carried out between the responsible technical departments.

On demand of the client, the following must be presented by the contractor:

- a valid QM certificate for the production place according to EN ISO 9001, for which the entity of certification must be accredited at the DAR or at another member entity of the EAC
- if necessary, proof of the validity of the QM certificate and the regular inspection by the certifying body
- all required product-specific documentation, proof certificates and test protocols, in two copies (see also section 4.2.3 of this technical specification)

- all records, documents and descriptions as well as indication, type and warning signs shall be executed in the language of the client. Translations have to be notarised and handed over together with original text.

6. Packaging, delivery and transport

6.1. Packaging

The packing of the individual glass cap-and-pin insulators must be such that damage can generally be excluded. The packed glass caps must be bound to Euro pallets. Packing must be performed separately according to individual projects of the client. The packaging must allow at least two more transport processes after delivery (e. g. on the construction or in the storage site). All pallets must be equipped with a data sheet, clearly visible from the outside, including following indications:

- Order number of the client for the call for supply
- Complete insulator designation, e. g.: U 120 BS DC
- Quantity of insulators on the corresponding pallet
- Manufacturer

6.2 Delivery and transport

The transport of the insulators must be performed in a way that damage is avoided. Shipping is performed according to orders of the client or of the calling contractor (installation company). The shipping address is included in the order or will be disclosed by the calling contractor (installation company). The addressees must be informed in time (at least 3 working days before delivery) about the scheduled delivery in order to enable exact timely matching.

Unloading of the insulators is performed by the contractor (installation company) in co-ordination with the client.

7. Disposal

With the delivery of the insulators, the manufacturer/supplier undertakes to indicate the possibilities for disposal/recycling based upon the corresponding laws, regulations and ordinances of the country of the client.

Appendix A – List of Applicable Standards

EN ISO 1461	Hot dip galvanized coatings on fabricated iron and steel articles – Specification and test methods
EN 1562	Malleable cast irons
ISO 9001	Quality assurance systems; model for the proof of quality assurance in design/development, production, installation and service
EN 10083-2	Steels for quenching and tempering – Part 2: Technical delivery for non alloy steels
EN 50341-1	Overhead lines of more than 45 kV AC
EN 50341-3-4	Overhead lines of more than 45 kV AC –National Normative Appendix
IEC 60120	Dimensions of ball and socket couplings of string insulator units
EN 60305	Ceramic or glass insulators for AC systems - Parameters of cap-and-pin insulators
EN 60372	Locking devices for ball and socket couplings of string insulator units – Dimensions and tests
EN 60383-1	Insulators: Testing and acceptance
EN 60672	Ceramic and glass insulating materials
IEC 60797	Residual strength of string insulator units of glass or ceramic material for overhead lines after mechanical damage of the dielectric
IEC 60815-1-2	Selection and dimensioning of high-voltage insulators for polluted conditions

Appendix B – Specification of cap-and-pin insulators

B-1	U 70 BL DC	(old designation F 70/146 DC)
B-2	U 70 BS DC	(old designation F 70/127 DC)
B-3	U 100 BLP DC	(old designation F 100P/146 DC)
B-4	U 120 B DC	(old designation F 12/146 DC)
B-5	U 120 BS DC	(old designation F 12/127 DC)
B-6	U 160 B 160 DC	(old designation F 160/160 DC) (The insulator cannot be classified according to EN 60305 because of the reduced length)
B-7	U 210 B DC	(old designation F 21/170 DC)
B-8	U 300 B DC	(old designation F 300/195 DC)

B-1 Type: U 70 BL DC according to EN 60305
(old designation F 70/146 DC)

Sample tests as per DIN EN 60383-1

Date:	_____	Manufacturer:	_____
Order:	_____	Project:	_____
Quantity ordered:	_____	Quantity inspected:	E1=___ E2=___

1. Mechanic key data (samples E1+E2)

Construction height:	146 mm (141,32 - 150,68 mm)	
Shed diameter:	255 mm (243.3 – 266.7 mm)	
Failure load:	70 kN	
Nominal creepage distance:	320 mm	
ball-/socket coupling	16 A	IEC 60120
Socket opening:	19.2 mm (+1.6 mm / –0 mm)	IEC 60120
Locking device	Split-pin (V-shaped clip) 16 A	IEC 60372

The checking of the ball-/socket coupling has to be done with adequate calibres.

2. Radial and axial deviation test (samples E1+E2)
Inspection as per Section 21; Axial deviation (A) 4% x 255 mm = 10.2 mm;
Radial deviation (B) 3% x 255 mm = 7.7 mm

3. Locking device test (samples E2)
Inspection as per Section 22; conformity of the safety device with requirements as per EN 60372; safety inspection on the basis of a fitted pin-socket connection; performing the functional inspection with F_{min} = 50 N and F_{max} = 500 N

4. Temperature shock test (E2)
Inspection as per Section 24; the heated insulators must be immerse into cold water; temperature difference between insulator and water must be at least 100 K; duration of immersion at least 2 min

5. Proof of mechanical failure load (E1)
Testing as per section 19; Constant increase of load until 75% of the mechanical failure load:
0.75 x 70 kN = 52.5 kN; subsequently increase of load until failure (failure description/cause/acceptance criteria according to item 4.2.4 of the technical specification)

6. Puncture voltage withstand test (E2)
Testing as per section 15.1; the testing must be done with power frequency withstand voltage; Minimum puncture voltage 130 kV

7. Galvanising test (E1 + E2)
Testing as per Section 26; Test of the evenness of the zinc layer by layer thickness measurement (10 measurements); Average value ≥ 85 µm, minimum value = 70 µm

B-2 Type: U 70 BS DC according to EN 60305
(old designation F 70/127 DC)

Sample tests as per DIN EN 60383-1

Date:	_____	Manufacturer:	_____
Order:	_____	Project:	_____
Quantity ordered:	_____	Quantity inspected:	E1=___ E2=___

1. Mechanic key data (samples E1+E2)

Construction height:	127 mm (122.89-131.11 mm)	
Failure load:	70 kN	
Nominal creepage distance:	320 mm	
ball-/socket coupling	16 A	IEC 60120
Socket opening:	19.2 mm (+1.6 mm / –0 mm)	IEC 60120
Locking device	Split-pin (V-shaped clip) 16 A	IEC 60372
Shed diameter:	255 mm (243.3 – 266.7 mm)	

The checking of the ball-/socket coupling has to be done with adequate calibres.

2. Radial and axial deviation test (samples E1+E2)
Inspection as per Section 21; Axial deviation (A) 4% x 255 mm = 10.2 mm;
Radial deviation (B) 3% x 255 mm = 7.7 mm

3. Locking device test (samples E2)
Inspection as per Section 22; conformity of the safety device with requirements as per EN 60372; safety inspection on the basis of a fitted pin-socket connection; performing the functional inspection with F_{min} = 50 N and F_{max} = 500 N

4. Temperature shock test (E2)
Inspection as per Section 24; the heated insulators must be immerse into cold water; temperature difference between insulator and water must be at least 100 K; duration of immersion at least 2 min

5. Proof of mechanical failure load (E1)
Testing as per section 19; Constant increase of load until 75% of the mechanical failure load:
0.75 x 70 kN = 52.5 kN; subsequently increase of load until failure (failure description/cause/acceptance criteria according to item 4.2.4 of the technical specification)

6. Puncture voltage withstand test (E2)
Testing as per section 15.1; the testing must be done with power frequency withstand voltage; Minimum puncture voltage 130 kV

7. Galvanising test (E1 + E2)
Testing as per Section 26; Test of the evenness of the zinc layer by layer thickness measurement (10 measurements); Average value ≥ 85 µm, minimum value = 70 µm

B-3 Type: U 100 BLP DC according to EN 60305
(old designation F 100P/146 DC)

Sample tests as per DIN EN 60383-1

Date:	_____	Manufacturer:	_____
Order:	_____	Project:	_____
Quantity ordered:	_____	Quantity inspected:	E1=___ E2=___

1. Mechanic key data (samples E1+E2)

Construction height:	146 mm (141.32-150.68 mm)	
Failure load:	100 kN	
Nominal creepage distance:	445 mm	
ball-/socket coupling	16 A	IEC 60120
Socket opening:	19.2 mm (+1.6 mm / –0 mm)	IEC 60120
Locking device	Split-pin (V-shaped clip) 16 A	IEC 60372
Shed diameter:	280 mm (267.3-292.7 mm)	

The checking of the ball-/socket coupling has to be done with adequate calibres.

2. Radial and axial deviation test (samples E1+E2)
Inspection as per Section 21; Axial deviation (A) 4% x 280 mm = 11.2 mm;
Radial deviation (B) 3% x 280 mm = 8.4 mm

3. Locking device test (samples E2)
Inspection as per Section 22; conformity of the safety device with requirements as per EN 60372; safety inspection on the basis of a fitted pin-socket connection; performing the functional inspection with F_{min} = 50 N and F_{max} = 500 N

4. Temperature shock test (E2)
Inspection as per Section 24; the heated insulators must be immerse into cold water; temperature difference between insulator and water must be at least 100 K; duration of immersion at least 2 min

5. Proof of mechanical failure load (E1)
Testing as per section 19; Constant increase of load until 75% of the mechanical failure load:
0.75 x 100 kN = 75 kN; subsequently increase of load until failure (failure description/cause/acceptance criteria according to item 4.2.4 of the technical specification)

6. Puncture voltage withstand test (E2)
Testing as per section 15.1; the testing must be done with power frequency withstand voltage; Minimum puncture voltage 130 kV

7. Galvanising test (E1 + E2)
Testing as per Section 26; Test of the evenness of the zinc layer by layer thickness measurement (10 measurements); Average value ≥ 85 µm, minimum value = 70 µm

B-4 Type: U 120 B DC according to EN 60305
(old designation F 12/146 DC)

Sample tests as per DIN EN 60383-1

Date:	_____	Manufacturer:	_____
Order:	_____	Project:	_____
Quantity ordered:	_____	Quantity inspected:	E1=___ E2=___

1. Mechanic key data (samples E1+E2)

Construction height:	146 mm (141.32-150.68 mm)	
Failure load:	120 kN	
Nominal creepage distance:	320 mm	
ball-/socket coupling	16 A	IEC 60120
Socket opening:	19.2 mm (+1.6 mm / –0 mm)	IEC 60120
Locking device	Split-pin (V-shaped clip) 16 A	IEC 60372
Shed diameter:	255 mm (243.3 – 266.7 mm)	

The checking of the ball-/socket coupling has to be done with adequate calibres.

2. Radial and axial deviation test (samples E1+E2)
Inspection as per Section 21; Axial deviation (A) 4% x 255 mm = 10.2 mm;
Radial deviation (B) 3% x 255 mm = 7.7 mm

3. Locking device test (samples E2)
Inspection as per Section 22; conformity of the safety device with requirements as per EN 60372; safety inspection on the basis of a fitted pin-socket connection; performing the functional inspection with F_{min} = 50 N and F_{max} = 500 N

4. Temperature shock test (E2)
Inspection as per Section 24; the heated insulators must be immerse into cold water; temperature difference between insulator and water must be at least 100 K; duration of immersion at least 2 min

5. Proof of mechanical failure load (E1)
Testing as per section 19; Constant increase of load until 75% of the mechanical failure load:
0.75 x 120 kN = 90 kN; subsequently increase of load until failure (failure description/cause/acceptance criteria according to item 4.2.4 of the technical specification)

6. Puncture voltage withstand test (E2)
Testing as per section 15.1; the testing must be done with power frequency withstand voltage; Minimum puncture voltage 130 kV

7. Galvanising test (E1 + E2)
Testing as per Section 26; Test of the evenness of the zinc layer by layer thickness measurement (10 measurements); Average value ≥ 85 µm, minimum value = 70 µm

B-5 Type: U 120 BS DC according to EN 60305
(old designation F 12/127 DC)

Sample tests as per DIN EN 60383-1

Date:	_____	Manufacturer:	_____
Order:	_____	Project:	_____
Quantity ordered:	_____	Quantity inspected:	E1=___ E2=___

1. Mechanic key data (samples E1+E2)

Construction height:	127 mm (122.89-131.11 mm)	
Failure load:	120 kN	
Nominal creepage distance:	320 mm	
ball-/socket coupling	16 A	IEC 60120
Socket opening:	19.2 mm (+1.6 mm / –0 mm)	IEC 60120
Locking device	Split-pin (V-shaped clip) 16 A	IEC 60372
Shed diameter:	255 mm (243.3 – 266.7 mm)	

The checking of the ball-/socket coupling has to be done with adequate calibres.

2. Radial and axial deviation test (samples E1+E2)
Inspection as per Section 21; Axial deviation (A) 4% x 255 mm = 10.2 mm;
Radial deviation (B) 3% x 255 mm = 7.7 mm

3. Locking device test (samples E2)
Inspection as per Section 22; conformity of the safety device with requirements as per EN 60372; safety inspection on the basis of a fitted pin-socket connection; performing the functional inspection with F_{min} = 50 N and F_{max} = 500 N

4. Temperature shock test (E2)
Inspection as per Section 24; the heated insulators must be immerse into cold water; temperature difference between insulator and water must be at least 100 K; duration of immersion at least 2 min

5. Proof of mechanical failure load (E1)
Testing as per section 19; Constant increase of load until 75% of the mechanical failure load:
0.75 x 120 kN = 90 kN; subsequently increase of load until failure (failure description/cause/acceptance criteria according to item 4.2.4 of the technical specification)

6. Puncture voltage withstand test (E2)
Testing as per section 15.1; the testing must be done with power frequency withstand voltage; Minimum puncture voltage 130 kV

7. Galvanising test (E1 + E2)
Testing as per Section 26; Test of the evenness of the zinc layer by layer thickness measurement (10 measurements); Average value ≥ 85 µm, minimum value = 70 µm

B-6 Type: U 160 B 160 DC
Insulator cannot be classified according to EN 60305 because of the reduced length (old designation F 160/160 DC)

Sample tests as per DIN EN 60383-1

Date:	_____	Manufacturer:	_____
Order:	_____	Project:	_____
Quantity ordered:	_____	Quantity inspected:	E1=___ E2=___

1. Mechanic key data (samples E1+E2)

Construction height:	160 mm (154.9-165.1 mm)	
Failure load:	160 kN	
Nominal creepage distance:	380 mm	
ball-/socket coupling	20	IEC 60120
Socket opening:	23.0 mm (+2.1 mm / –0 mm)	IEC 60120
Locking device	Split-pin (V-shaped clip) 20	IEC 60372
Shed diameter:	280 mm (267.3-292.7 mm)	

The checking of the ball-/socket coupling has to be done with adequate calibres.

2. Radial and axial deviation test (samples E1+E2)
Inspection as per Section 21; Axial deviation (A) 4% x 280 mm = 11.2 mm;
Radial deviation (B) 3% x 280 mm = 8.4 mm

3. Locking device test (samples E2)
Inspection as per Section 22; conformity of the safety device with requirements as per EN 60372; safety inspection on the basis of a fitted pin-socket connection; performing the functional inspection with F_{min} = 50 N and F_{max} = 500 N

4. Temperature shock test (E2)
Inspection as per Section 24; the heated insulators must be immerse into cold water; temperature difference between insulator and water must be at least 100 K; duration of immersion at least 2 min

5. Proof of mechanical failure load (E1)
Testing as per section 19; Constant increase of load until 75% of the mechanical failure load:
0.75 x 160 kN = 120 kN; subsequently increase of load until failure (failure description/cause/acceptance criteria according to item 4.2.4 of the technical specification)

6. Puncture voltage withstand test (E2)
Testing as per section 15.1; the testing must be done with power frequency withstand voltage; Minimum puncture voltage 130 kV

7. Galvanising test (E1 + E2)

Testing as per Section 26; Test of the evenness of the zinc layer by layer thickness measurement (10 measurements); Average value ≥ 85 µm, minimum value = 70 µm

B-7 Type: U 210 B DC according to EN 60305
(old designation F21/170 DC)

Sample tests as per DIN EN 60383-1

Date:	_____	Manufacturer:	_____
Order:	_____	Project:	_____
Quantity ordered:	_____	Quantity inspected:	E1=___ E2=___

1. Mechanic key data (samples E1+E2)

Construction height:	170 mm (164.6-175.4 mm)	
Failure load:	210 kN	
Nominal creepage distance:	380 mm	
ball-/socket coupling	20	IEC 60120
Socket opening:	23.0 mm (+2.1 mm / –0 mm)	IEC 60120
Locking device	Split-pin (V-shaped clip) 20	IEC 60372
Shed diameter:	280 mm (267.3-292.7 mm)	

The checking of the ball-/socket coupling has to be done with adequate calibres.

2. Radial and axial deviation test (samples E1+E2)
Inspection as per Section 21; Axial deviation (A) 4% x 280 mm = 11.2 mm;
Radial deviation (B) 3% x 280 mm = 8.4 mm

3. Locking device test (samples E2)
Inspection as per Section 22; conformity of the safety device with requirements as per EN 60372; safety inspection on the basis of a fitted pin-socket connection; performing the functional inspection with F_{min} = 50 N and F_{max} = 500 N

4. Temperature shock test (E2)
Inspection as per Section 24; the heated insulators must be immerse into cold water; temperature difference between insulator and water must be at least 100 K; duration of immersion at least 2 min

5. Proof of mechanical failure load (E1)
Testing as per section 19; Constant increase of load until 75% of the mechanical failure load:
0.75 x 210 kN = 157.5 kN; subsequently increase of load until failure (failure description/cause/acceptance criteria according to item 4.2.4 of the technical specification)

6. Puncture voltage withstand test (E2)
Testing as per section 15.1; the testing must be done with power frequency withstand voltage; Minimum puncture voltage 130 kV

7. Galvanising test (E1 + E2)
Testing as per Section 26; Test of the evenness of the zinc layer by layer thickness measurement (10 measurements); Average value ≥ 85 µm, minimum value = 70 µm

B-8 Type: U 300 B DC according to EN 60305
(old designation F300/195 DC)

Sample tests as per DIN EN 60383-1

Date:	_____	Manufacturer:	_____
Order:	_____	Project:	_____
Quantity ordered:	_____	Quantity inspected:	E1=___ E2=___

1. Mechanic key data (samples E1+E2)

Construction height:	195 mm (188.85-201.15 mm)	
Failure load:	300 kN	
Nominal creepage distance:	485 mm	
ball-/socket coupling	24	IEC 60120
Socket opening:	27.5 mm (+2.5 mm / –0 mm)	IEC 60120
Locking device	Split-pin (V-shaped clip) 24	IEC 60372
Shed diameter:	320 mm ((306 – 334 mm)	

The checking of the ball-/socket coupling has to be done with adequate calibres.

2. Radial and axial deviation test (samples E1+E2)
Inspection as per Section 21; Axial deviation (A) 4% x 320 mm = 12.8 mm;
Radial deviation (B) 3% x 320 mm = 9.6 mm

3. Locking device test (samples E2)
Inspection as per Section 22; conformity of the safety device with requirements as per EN 60372; safety inspection on the basis of a fitted pin-socket connection; performing the functional inspection with F_{min} = 50 N and F_{max} = 500 N

4. Temperature shock test (E2)
Inspection as per Section 24; the heated insulators must be immerse into cold water; temperature difference between insulator and water must be at least 100 K; duration of immersion at least 2 min

5. Proof of mechanical failure load (E1)
Testing as per section 19; Constant increase of load until 75% of the mechanical failure load:
0.75 x 300 kN = 225 kN; subsequently increase of load until failure (failure description/cause/acceptance criteria according to item 4.2.4 of the technical specification)

6. Puncture voltage withstand test (E2)
Testing as per section 15.1; the testing must be done with power frequency withstand voltage; Minimum puncture voltage 130 kV

7. Galvanising test (E1 + E2)
Testing as per Section 26; Test of the evenness of the zinc layer by layer thickness measurement (10 measurements); Average value ≥ 85 µm, minimum value = 70 µm

Appendix C – Definitions

Business Unit
Single company within the E.ON group. It is member of a super ordinate market unit.

Charge
Quantity of products with the same characteristics which are either manufactured in a cohesive production process or purchased by a collective order.

Client
Affiliated company of the E.ON group that places orders to the contractor for the delivery of certain products.

Contractor
Company that contracts with the E.ON group for the delivery of distinctive products.

Malleable cast iron
Malleable cast iron is a heat-treated iron-carbon alloy, which solidifies in the as-cast condition with a graphite-free structure, i.e. the total carbon content is present in the cementite form (Fe3C). Two groups of malleable cast iron are specified, differentiated by chemical composition, temperature and time cycles of the annealing process, the annealing atmosphere and the properties and microstructure resulting there from. These are:
- Whiteheart malleable cast iron and
- Blackheart malleable cast iron.

Market Unit
Super ordinate unit that is responsible for a special market within the E.ON group.

Prequalification system
System for the release of new suppliers. It consists of the following procedure steps:
1. Pre-inspection of the interested supplier using questionnaires and documents required in these.
2. Auditing of companies, products and procedures.
3. Assignment and verification of a test order.