



**Technical Specification code:** GRI-GRI-MAT-E&C-0014

Version no. 1 dated 07/11/2022

**Subject:** GSCM008 - Medium Voltage Back-Up Fuses

**Application Areas**

Perimeter: Global

Staff Function: -

Service Function: -

Business Line: Enel Grids

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**THE HEAD OF GLOBAL NETWORK COMPONENTS**

**Fabrizio Gasbarri**



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## 1 DOCUMENT AIMS AND APPLICATION AREA

The scope of this document is to provide the technical requirements for the supply of HIGH VOLTAGE INDOOR FUSE-LINKS used by the Enel Group Distribution Companies, listed below:

Country	Distribution Company
Argentina	Edesur
Brazil	Enel Distribuição Rio Enel Distribuição Ceará Enel Distribuição Goiás Enel Distribuição São Paulo
Chile	Enel Distribución Chile
Colombia	Enel Distribución Colombia
Italy	e-distribuzione
Peru	Enel Distribución Perú
Romania	E-Distributie Banat E-Distributie Dobrogea E-Distributie Muntenia
Spain	e-distribución

**Table 1 – Distribution Companies**

This standard applies to all types of high-voltage current-limiting fuses designed for use in indoors on alternating current systems of 50 Hz and 60 Hz and of rated voltages exceeding 1000 V.

*This document shall be implemented and applied to the extent possible within the Enel Grids Business Line and in compliance with any applicable laws, regulations and governance rules, including any stock exchange and unbundling-relevant provisions, which in any case prevail over the provisions contained in this document.*



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## 1.1 RELATED DOCUMENTS TO BE IMPLEMENTED AT COUNTRY LEVEL

This document does not require implementation of further documents.

Anyway, each Enel Grids Company can issue, under the supervision of Enel Grids Global Network Components detailed documents, according to the provisions of the present document and in case of specific needs.

## 2 DOCUMENT VERSION MANAGEMENT

Version	Date	Main changes description
1	07/11/2022	Issuing of "Medium Voltage Back-Up Fuses "Technical Specification



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### 3 UNITS IN CHARGE OF THE DOCUMENT

Responsible for drawing up the document:

- Enel Grids: Engineering and Construction/Components and Devices Design /Network Components unit.

Responsible for authorizing the document:

- Enel Grids: Head of Network Components unit;
- Enel Grids: Head of Quality unit.



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## 4 REFERENCES

- Code of Ethics of Enel Group;
- Enel Human Right Policy;
- The Enel Group Zero Tolerance of Corruption (ZTC) Plan;
- Organization and management model as per Legislative Decree No. 231/2001;
- Enel Global Compliance Program (EGCP);
- Integrated Policy of Quality, Health and Safety, Environment, anti-Bribery and information security;
- ISO 9001:2015 - Quality Management System – Requirements;
- ISO 14001:2015 - Environmental Management System - Requirements with guidance for use;
- ISO 45001:2018 - Occupational Health and Safety Management System - Requirements with guidance for use;
- ISO 37001:2016 - Anti-bribery Management System - Requirements with guidance for use;
- ISO 27001:2017 - Information Security Management System – Requirements.
- CNS-O&M-S&L-2021-0032-EGIN Global Infrastructure and Networks Barcode specification.
  
- ISO/IEC 17000 Conformity assessment – Vocabulary and general principles
- ISO/IEC 17020 General criteria for the operation of various types of bodies performing inspection
- ISO/IEC 17025 General requirements for the competence of testing and calibration laboratories
- ISO/IEC 17050-1 Conformity assessment - Supplier's declaration of conformity - Part 1: General requirements
- ISO/IEC 17050-2 Conformity assessment - Supplier's declaration of conformity - Part 2: Supporting documentation
- ISO/IEC 17065 Conformity assessment – Requirements for bodies certifying products, processes and services

### 4.1 APPLICABLE LAWS AND REFERENCE STANDARDS

Reference documents listed below (amendments included) shall be the edition in-force at the contract date.



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#### **4.1.1 Reference Laws**

##### **Brazil**

NR-10 – Segurança em instalações e serviços em eletricidade;

##### **Colombia**

RETIE – Reglamento Técnico de Instalaciones Eléctricas;

##### **Peru**

CNE – Suministro - Código Nazional de Electricidad - Suministro 2011;

##### **Italy**

D.Lgs n. 81 of the 9th of April 2008 and subsequent modifications;

D.P.R. n. 43 of the 27th of January 2012;

##### **Spain**

Real Decreto 337/2014, de 9 de mayo, por el que se aprueban el Reglamento sobre condiciones técnicas y garantías de seguridad en instalaciones eléctricas de alta tensión y sus Instrucciones Técnicas Complementarias ITC-RAT 01 a 23.

Real Decreto 614/2001, de 8 de junio, sobre disposiciones mínimas para la protección de la salud y seguridad de los trabajadores frente al riesgo eléctrico.

R. D. 223/2008, de 15 de febrero, por el que se aprueban el Reglamento sobre condiciones técnicas y garantías de seguridad en líneas eléctricas de alta tensión y sus instrucciones técnicas complementarias ITC-LAT 01 a 09.

##### **Romania**

Legea nr.319 din 14 iulie 2006 securității și sănătății în muncă and subsequent modifications.

#### **4.1.2 International Standards**

The below listed reference documents shall be intended in the in-force edition at the contract date (amendments included). Unless otherwise specified, these documents are valid until the new editions replace them.

For Latin America destinations, the reference standards are the IEC/ISO, whilst for Europe destinations the reference standards are the correspondent European ones (EN).

IEC 60282-1                      High-voltage fuses. Part 1: Current-limiting fuses.



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IEC 62271-105	High-voltage switchgear and controlgear - Part 105 Alternating current switch-fuse combinations for rated voltages above 1 kV up to and including 52 kV
ISO 2859	Sampling procedures for inspection by attributes
IEC/TR 62655	Tutorial and application guide for high voltage fuses





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## 5 ORGANIZATIONAL PROCESS POSITION IN THE PROCESS TAXONOMY

Value Chain/Process Area: Engineering and Costruction

Macro Process: Devices and Components Development

Process: Standard Catalog Management



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## 6 DEFINITIONS AND ACRONYMS

Acronym and Key words	Description
<b>Technical Conformity Assessment (TCA)</b>	A “conformity assessment” <sup>1</sup> with respect to “specified requirements” <sup>2</sup> consists in functional, dimensional, constructional and test characteristics required for a product (or a series of products) and quoted in technical specifications and quality requirements issued by Enel Group distribution companies. This also includes the verification of conformity with respect to local applicable regulation and laws and possession of relevant requested certifications
<b>TCA dossier</b>	Set of final documents delivered by the Supplier for the TCA

<sup>1</sup> Definition 2.1 of ISO/IEC 17000

<sup>2</sup> Definition 3.1 of ISO/IEC 17000



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## 7 DESCRIPTION

### 7.1 LIST OF COMPONENTS

Type code	Country code	Country	Local technical specification	Rated voltage [kV]	Rated current I <sub>r</sub> [A]	Rated maximum breaking current [kA]	Rated minimum breaking current I <sub>3</sub> [kA]	Maximum value of temperature [°C] (for silver and nickel coated components)	Maximum value of temperature rise [K] (for silver and nickel coated components)	Limits of switching voltage [kV]	Class of fuse	DESCRIPTION
GSCM008/1	170108	BR	PM-Br 139.01	24	2	≥ 31,5	≤ 10	105	65	75	Back-up	FUSE-LINK 24KV - 2A - Back-Up fuse
GSCM008/2	170101	BR	PM-Br 139.01	24	4	≥ 31,5	≤ 20	105	65	75	Back-up	FUSE-LINK 24KV - 4A - Back-Up fuse
GSCM008/3	170111	BR	PM-Br 139.01	24	5	≥ 31,5	≤ 25	105	65	75	Back-up	FUSE-LINK 24KV - 5A - Back-Up fuse
GSCM008/4	170112	BR	PM-Br 139.01	24	6,3	≥ 31,5	≤ 31,5	105	65	75	Back-up	FUSE-LINK 24KV - 6,3A - Back-Up fuse
GSCM008/4	160837	CL	ESP-0238	24	6,3	≥ 31,5	≤ 31,5	105	65	75	Back-up	FUSE-LINK 24KV – 6,3A - Back-Up fuse
GSCM008/5	170113	BR	PM-Br 139.01	24	10	≥ 31,5	≤ 50	105	65	75	Back-up	FUSE-LINK 24KV - 10A - Back-Up fuse
GSCM008/5	170894	CO	ET517	24	10	≥ 31,5	≤ 50	105	65	75	Back-up	FUSE-LINK 24KV - 10A - Back-Up fuse
GSCM008/6	170883	CO	ET517	24	16	≥ 31,5	≤ 80	105	65	75	Back-up	FUSE-LINK 24KV - 16A - Back-Up fuse
GSCM008/6	0110-0240	AR	DFEC02	24	16	≥ 31,5	≤ 80	105	65	75	Back-up	FUSE-LINK 24KV - 16A - Back-Up fuse
GSCM008/6	170114	BR	PM-Br 139.01	24	16	≥ 31,5	≤ 80	105	65	75	Back-up	FUSE-LINK 24KV - 16A - Back-Up fuse
GSCM008/6	170123	PE	MAT-OYM-NDS-18-416-ESP_1	24	16	≥ 31,5	≤ 80	105	65	75	Back-up	FUSE-LINK 24KV - 16A - Back-Up fuse
GSCM008/7	170884	CO	ET517	24	20	≥ 31,5	≤ 100	105	65	75	Back-up	FUSE-LINK 24KV - 20A - Back-Up fuse
GSCM008/7	170107	BR	PM-Br 139.01	24	20	≥ 31,5	≤ 100	105	65	75	Back-up	FUSE-LINK 24KV - 20A - Back-Up fuse


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Type code	Country code	Country	Local technical specification	Rated voltage [kV]	Rated current I <sub>r</sub> [A]	Rated maximum breaking current [kA]	Rated minimum breaking current I <sub>B</sub> [kA]	Maximum value of temperature [°C] (for silver and nickel coated components)	Maximum value of temperature rise [K] (for silver and nickel coated components)	Limits of switching voltage [kV]	Class of fuse	DESCRIPTION
GSCM008/8	170373	CL	ESP-0238	24	25	≥ 31,5	≤ 125	105	65	75	Back-up	FUSE-LINK 24KV - 25A - Back-Up fuse
GSCM008/8	170885	CO	ET517	24	25	≥ 31,5	≤ 125	105	65	75	Back-up	FUSE-LINK 24KV - 25A - Back-Up fuse
GSCM008/8	170007	IT	DY561	24	25	≥ 31,5	≤ 125	105	65	75	Back-up	FUSE-LINK 24KV - 25A - Back-Up fuse
GSCM008/8	172541	RO	FT-050_MAT	24	25	≥ 31,5	≤ 125	105	65	75	Back-up	FUSE-LINK 24KV - 25A - Back-Up fuse
GSCM008/8	0110-0241	AR	DFEC02	24	25	≥ 31,5	≤ 125	105	65	75	Back-up	FUSE-LINK 24KV - 25A - Back-Up fuse
GSCM008/8	170106	BR	PM-Br 139.01	24	25	≥ 31,5	≤ 125	105	65	75	Back-up	FUSE-LINK 24KV - 25A - Back-Up fuse
GSCM008/8	170122	PE	MAT-OYM-NDS-18-416-ESP_1	24	25	≥ 31,5	≤ 125	105	65	75	Back-up	FUSE-LINK 24KV - 25A - Back-Up fuse
GSCM008/9	170897	CO	ET517	24	31,5	≥ 31,5	≤ 157,5	105	65	75	Back-up	FUSE-LINK 24KV - 31,5A - Back-Up fuse
GSCM008/9	170105	BR	PM-Br 139.01	24	31,5	≥ 31,5	≤ 157,5	105	65	75	Back-up	FUSE-LINK 24KV - 31,5A - Back-Up fuse
GSCM008/10	170375	CL	ESP-0238	24	40	≥ 31,5	≤ 200	105	65	75	Back-up	FUSE-LINK 24KV - 40A - Back-Up fuse
GSCM008/10	170886	CO	ET517	24	40	≥ 31,5	≤ 200	105	65	75	Back-up	FUSE-LINK 24KV - 40A - Back-Up fuse
GSCM008/10	170008	IT	DY561	24	40	≥ 31,5	≤ 200	105	65	75	Back-up	FUSE-LINK 24KV - 40A - Back-Up fuse
GSCM008/10	172542	RO	FT-050_MAT	24	40	≥ 31,5	≤ 200	105	65	75	Back-up	FUSE-LINK 24KV - 40A - Back-Up fuse
GSCM008/10	0110-0242	AR	DFEC02	24	40	≥ 31,5	≤ 200	105	65	75	Back-up	FUSE-LINK 24KV - 40A - Back-Up fuse
GSCM008/10	170104	BR	PM-Br 139.01	24	40	≥ 31,5	≤ 200	105	65	75	Back-up	FUSE-LINK 24KV - 40A - Back-Up fuse
GSCM008/10	170121	PE	MAT-OYM-NDS-18-416-ESP_1	24	40	≥ 31,5	≤ 200	105	65	75	Back-up	FUSE-LINK 24KV - 40A - Back-Up fuse
GSCM008/11	170371	CL	ESP-0238	24	50	≥ 31,5	≤ 250	105	65	75	Back-up	FUSE-LINK 24KV - 50A - Back-Up fuse
GSCM008/11	170898	CO	ET517	24	50	≥ 31,5	≤ 250	105	65	75	Back-up	FUSE-LINK 24KV - 50A - Back-Up fuse


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Type code	Country code	Country	Local technical specification	Rated voltage [kV]	Rated current I <sub>r</sub> [A]	Rated maximum breaking current [kA]	Rated minimum breaking current I <sub>B</sub> [kA]	Maximum value of temperature [°C] (for silver and nickel coated components)	Maximum value of temperature rise [K] (for silver and nickel coated components)	Limits of switching voltage [kV]	Class of fuse	DESCRIPTION
GSCM008/11	170103	BR	PM-Br 139.01	24	50	≥ 31,5	≤ 250	105	65	75	Back-up	FUSE-LINK 24KV - 50A - Back-Up fuse
GSCM008/12	170899	CO	ET517	24	63	≥ 31,5	≤ 315	105	65	75	Back-up	FUSE-LINK 24KV - 63A - Back-Up fuse
GSCM008/12	170009	IT	DY561	24	63	≥ 31,5	≤ 315	105	65	75	Back-up	FUSE-LINK 24KV - 63A - Back-Up fuse
GSCM008/12	172544	RO	FT-050_MAT	24	63	≥ 31,5	≤ 315	105	65	75	Back-up	FUSE-LINK 24KV - 63A - Back-Up fuse
GSCM008/12	0110-0243	AR	DFEC02	24	63	≥ 31,5	≤ 315	105	65	75	Back-up	FUSE-LINK 24KV - 63A - Back-Up fuse
GSCM008/12	170102	BR	PM-Br 139.01	24	63	≥ 31,5	≤ 315	105	65	75	Back-up	FUSE-LINK 24KV - 63A - Back-Up fuse
GSCM008/12	170119	PE	MAT-OYM-NDS-18-416-ESP_1	24	63	≥ 31,5	≤ 315	105	65	75	Back-up	FUSE-LINK 24KV - 63A - Back-Up fuse
GSCM008/13	170372	CL	ESP-0238	24	80	≥ 31,5	≤ 400	105	65	75	Back-up	FUSE-LINK 24KV - 80A - Back-Up fuse
GSCM008/13	170895	CO	ET517	24	80	≥ 31,5	≤ 400	105	65	75	Back-up	FUSE-LINK 24KV - 80A - Back-Up fuse
GSCM008/13	170124	BR	PM-Br 139.01	24	80	≥ 31,5	≤ 400	105	65	75	Back-up	FUSE-LINK 24KV - 80A - Back-Up fuse
GSCM008/13	170120	PE	MAT-OYM-NDS-18-416-ESP_1	24	80	≥ 31,5	≤ 400	105	65	75	Back-up	FUSE-LINK 24KV - 80A - Back-Up fuse
GSCM008/14	170896	CO	ET517	24	100	≥ 31,5	≤ 500	105	65	75	Back-up	FUSE-LINK 24KV - 100A - Back-Up fuse
GSCM008/14	170010	IT	DY561	24	100	≥ 31,5	≤ 500	105	65	75	Back-up	FUSE-LINK 24KV - 100A - Back-Up fuse
GSCM008/14	172546	RO	FT-050_MAT	24	100	≥ 31,5	≤ 500	105	65	75	Back-up	FUSE-LINK 24KV - 100A - Back-Up fuse
GSCM008/14	0110-0244	AR	DFEC02	24	100	≥ 31,5	≤ 500	105	65	75	Back-up	FUSE-LINK 24KV - 100A - Back-Up fuse
GSCM008/14	170118	PE	MAT-OYM-NDS-18-416-ESP_1	24	100	≥ 31,5	≤ 500	105	65	75	Back-up	FUSE-LINK 24KV - 100A - Back-Up fuse


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Type code	Country code	Country	Local technical specification	Rated voltage [kV]	Rated current I <sub>r</sub> [A]	Rated maximum breaking current [kA]	Rated minimum breaking current I <sub>3</sub> [kA]	Maximum value of temperature [°C] (for silver and nickel coated components)	Maximum value of temperature rise [K] (for silver and nickel coated components)	Limits of switching voltage [kV]	Class of fuse	DESCRIPTION
GSCM008/15				24	125	≥ 31,5	≤ 625	105	65	75	Back-up	FUSE-LINK 24KV - 125A - Back-Up fuse
GSCM008/16				24	140	≥ 31,5	≤ 700	105	65	75	Back-up	FUSE-LINK 24KV - 140A - Back-Up fuse
GSCM008/17				24	160	≥ 31,5	≤ 800	105	65	75	Back-up	FUSE-LINK 24KV - 160A - Back-Up fuse
GSCM008/18				24	200	≥ 31,5	≤ 1000	105	65	75	Back-up	FUSE-LINK 24KV - 200A - Back-Up fuse
GSCM008/19	170125	BR	PM-Br 139.01	36	2	≥ 20	≤ 10	105	65	112	Back-up	FUSE-LINK 36KV - 2A - Back-Up fuse
GSCM008/20	170100	BR	PM-Br 139.01	36	4	≥ 20	≤ 20	105	65	112	Back-up	FUSE-LINK 36KV - 4A - Back-Up fuse
GSCM008/21	170126	BR	PM-Br 139.01	36	5	≥ 20	≤ 25	105	65	112	Back-up	FUSE-LINK 36KV - 5A - Back-Up fuse
GSCM008/22	170099	BR	PM-Br 139.01	36	6,3	≥ 20	≤ 31,5	105	65	112	Back-up	FUSE-LINK 36KV - 6,3A - Back-Up fuse
GSCM008/23	170098	BR	PM-Br 139.01	36	10	≥ 20	≤ 50	105	65	112	Back-up	FUSE-LINK 36KV - 10A - Back-Up fuse
GSCM008/24	170116	BR	PM-Br 139.01	36	16	≥ 20	≤ 80	105	65	112	Back-up	FUSE-LINK 36KV - 16A - Back-Up fuse
GSCM008/25	170117	BR	PM-Br 139.01	36	20	≥ 20	≤ 100	105	65	112	Back-up	FUSE-LINK 36KV - 20A - Back-Up fuse
GSCM008/26	170115	BR	PM-Br 139.01	36	25	≥ 20	≤ 125	105	65	112	Back-up	FUSE-LINK 36KV - 25A - Back-Up fuse
GSCM008/27	170110	BR	PM-Br 139.01	36	31,5	≥ 20	≤ 157,5	105	65	112	Back-up	FUSE-LINK 36KV - 31,5A - Back-Up fuse
GSCM008/28	170109	BR	PM-Br 139.01	36	40	≥ 20	≤ 200	105	65	112	Back-up	FUSE-LINK 36KV - 40A - Back-Up fuse
GSCM008/29				36	50	≥ 20	≤ 250	105	65	112	Back-up	FUSE-LINK 36KV - 50A - Back-Up fuse
GSCM008/30				36	63	≥ 20	≤ 315	105	65	112	Back-up	FUSE-LINK 36KV - 63A - Back-Up fuse
GSCM008/31				36	80	≥ 20	≤ 400	105	65	112	Back-up	FUSE-LINK 36KV - 80A - Back-Up fuse
GSCM008/32				36	100	≥ 20	≤ 500	105	65	112	Back-up	FUSE-LINK 36KV - 100A - Back-Up fuse

Table 2 – List of components



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Staff Function: -

Service Function: -

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## 7.2 SERVICE CONDITIONS

Fuses complying with this standard are designed to be used under the following conditions:

- The maximum ambient air temperature is 40 °C and its mean measured over a period of 24 h does not exceed 35 °C.
- The minimum ambient air temperature is –25 °C.
- The altitude up to 1000 m.

When fuses incorporating external insulation are required for use at altitudes above 1.500 m, the procedure given in section 4.2 of IEC 60282-1: 2020-04 should be adopted.



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## 7.3 TECHNICAL CHARACTERISTICS

### 7.3.1 Definitions

- Fuse: Device that by the fusing of one or more of its specially designed and proportioned components opens the circuit in which it is inserted by breaking the current when this exceeds a given value for a sufficient time. The fuse comprises all the parts that form the complete device.
- Fuse-base: Fixed part of a fuse provided with contacts and terminals. (When applicable, the covers are considered as part of the fuse-base).
- Fuse-link: Part of a fuse including the fuse-element(s) and striker or indicating device, intended to be replaced after the fuse has operated.
- Fuse-link-contact: Two or more conductive parts designed to ensure circuit continuity between a fuse-link and the corresponding fuse-holder.
- Fuse-element: Part of the fuse-link designed to melt under the action of current exceeding some definite value for a definite period of time (the fuse-link may comprise several fuse-elements in parallel). The basic material of the fuse- element must be pure silver (Ag) or copper silver.

Application field of fuse-link designed for high-voltage current-limiting shall be according to IEC 60282-1, limited to indoor installation on alternating current systems of 50 Hz and 60 Hz and rated voltages exceeding 1000 V.

Fuses must be fitted with thermal protection, which is intended to trip the fuse when a dangerous temperature is reached.

The purpose is to extend the protection curve of the fuse towards relatively low current values  $<I_3$ .



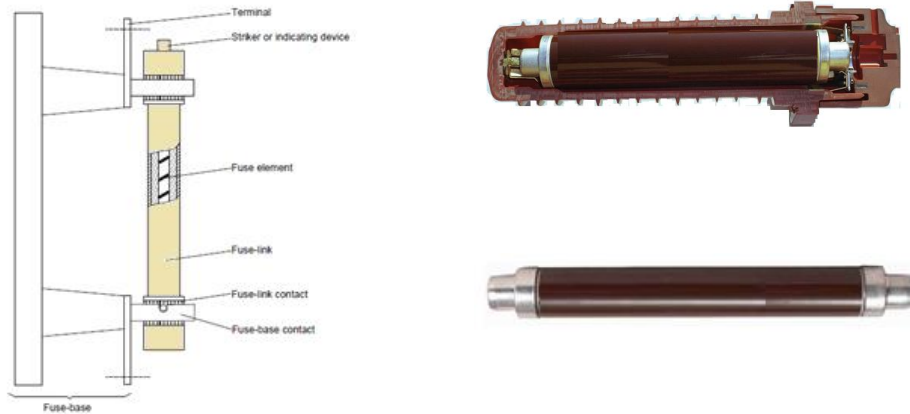
**Application Areas**

Perimeter: Global

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**Figure 1 - Example of a complete MT fuse-link**
**7.3.2 Rated Voltage ( $U_r$ )**

The rated voltage used to designate the fuse-link and from which the test conditions are determined:

- 24kV
- 36kV

24 kV fuses will be used for voltage levels from 10 to 24 kV.

36 kV fuses will be used for voltage levels above 24kV up to 36kV.

**7.3.3 Rated current of fuse-link ( $I_r$ )**

The rated currents " $I_r$ " of a fuse-link are:

Rated current [A]																	
2	4	5	6,3	10	16	20	25	31,5	40	50	63	80	100	125	140	160	200

**Table 3 – Rated current**
**7.3.4 Rated frequency**

Standard values of rated frequency are:



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Country	Rated frequency [Hz]
Argentina	50
Brazil	60
Chile	50
Colombia	60
Italy	50
Perù	60
Spain	50

**Table 4 – Country frequencies**

**7.3.5 Rated maximum breaking maximum current**

Rated voltage [kV]	Rated maximum breaking current [kA]
24	≥ 31,5
36	≥ 20

**Table 5 - Maximum breaking current**

**7.3.6 Rated minimum breaking current  $I_3$**

The minimum breaking current must be  $\leq 5$  times the rated current.

**7.3.7 Temperature limits**

The fuse must be able to carry his rated current continuously without exceeding the temperature rise limits without deteriorating:

Component or material	Maximum value of	
	Temperature °C	Temperature rise °K
Silver or nickel coated	105	65

**Table 6 - Limits of temperature and temperature rise for components and materials**



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### 7.3.8 Limits of switching voltage

The value of the switching voltage during operation in all tests must not exceed those indicated in the Table 7:

Rated voltage [kV]	Maximum switching voltage [kV]
24	75
36	112

**Table 7 - Maximum permissible switching voltages**

### 7.3.9 Time-current characteristics

The manufacturer shall make available average melting-curves from the data determined by the time-current characteristics type tests.

The time-current curves shall be performed according to the standard tests given in IEC 60282-1.

The curves show:

- The relationship between the virtual pre-arc time and the prospective current.
- The minimum breaking current must be low enough to ensure proper coordination with the breaking currents of the distribution network.
- The type and range of the fuse for which the curve applies.

The curves should be provided in digital format and entered into TCA (excel sheet).

### 7.3.10 Cut-off characteristics

The manufacturer shall indicate the upper limit of the cut-off current corresponding to each value of prospective breaking current up to the rated maximum breaking current of the fuse.

### 7.3.11 I<sup>2</sup>t characteristics

The manufacturer shall make available values of operating I<sup>2</sup>t and pre-arcing I<sup>2</sup>t for those prospective currents for which the fuse exhibits cut-off characteristics.



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### 7.3.12 Power dissipation

For the measurement of the power dissipation two values must be measured, one at 50% and the second at 100% of the rated current of the fuse link.

### 7.3.13 Class

Back-Up.

### 7.3.14 Rated transient recovery voltage (rated TRV)

The tests are made with the standardized values of TRV specified in Table 8:

Rated voltage	Basic parameters		Derived values			
	Peak voltage	Time coordinate	Time delay	Voltage coordinate	Time coordinate	Rate of rise
$U_t$	$u_c$	$t_3$	$t_d$	$u^l$	$t^l$	$u_c / t_3$
kV	kV	$\mu s$	$\mu s$	kV	$\mu s$	kV/ $\mu s$
24	41	88	13,2	13,8	42,5	0,47
36	62	108	16,2	20,6	52	0,57

**Table 8 – TRV table**

For definitions of  $u_c$ ,  $t_d$ ,  $u^l$ ,  $t^l$  refers to table 12 of IEC 60282-1

### 7.3.15 Mechanical characteristics of strikers

The mechanical characteristics of the strikers are given in Table 9:

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Type	Energy	Mechanical characteristics						
		Values of			Actual travel		Minimum withstand force	Maximum duration of travel
		Free travel	Further travel during which energy shall be delivered	Min.	Max.			
		(OA)	(AB)	(OB)	(OC)			
[J]	[mm]	[mm]	[mm]	[mm]	[N]	[ms]		
Medium	1± 0,5	4	16	20	40	20	50	

Table 9 – Strikes Mechanical characteristics

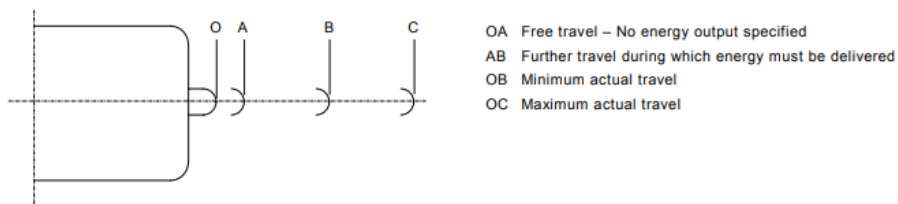


Figure 2 – Various stages of the striker travel

The energy measurement shall be tested as prescribed in paragraph 8.3.2.5.2 of the standard IEC 60282-1.

## 7.4 CONSTRUCTION CHARACTERISTICS

### 7.4.1 Dimensions

The dimension of fuse-link shall be as indicated in table.

kV	ØA	B	ØC <sub>2</sub>	ØC <sub>1</sub> and C <sub>2</sub>	D <sub>-1</sub> <sup>0</sup>
24	45 ± 1	33 <sub>0</sub> <sup>2</sup>	50	88	442
36					537

Table 10 – Dimensions of fuse-link in mm

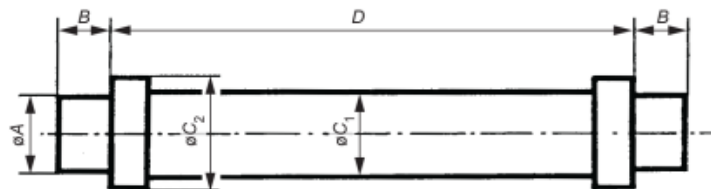
**Application Areas**

Perimeter: Global

Staff Function: -

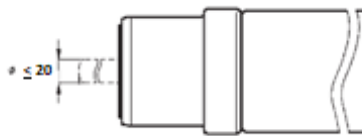
Service Function: -

Business Line: Enel Grids


**Figure 3 - Dimensions of fuse-link**

The fuse must have a striker signal or an indicator.

The striker shall be on the centerline of the fuse-link with diameter  $\leq 20$  mm.


**Figure 4 - Diameter striker**

Particular care must be taken in the construction of the two conductive ends of the fuse-link which must be completely smooth, without any grooves, as shown in Figure 5; no grooves are allowed on the contact surface.


**Figure 5 - Conductive ends of fuse-link**
**7.4.2 Identifying markings of fuse-links**

Identifying marking must be indelible and easily legible with the following information:

- Manufacturer's name or trademark
- Manufacturer's type designation
- Type Code ENEL (only for fuses compared directly by Enel)
- Country code



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- 
- Rated voltage [V]
  - Rated current [A]
  - Rated maximum breaking current
  - Rated minimum breaking current
  - Maximum application temperature 40°C
  - Class: Back-Up
  - Type of striker: medium
  - Location of the striker: on the top
  - Manufacturing number
  - Manufacturing date
  - Reference to the IEC 60282-1 standard

## 7.5 TESTING

The tests shall be carried out according to following paragraphs. Unless otherwise stated, tests are referred to IEC 60282-1 standard.

The tests specified in this section must be carried out under manufacturer responsibility.

Tests are divided in:

- Type tests
- Acceptance Tests.

### 7.5.1 Type tests

To obtain type-approval (TCA), the fuse-links must pass successfully the tests listed in Table 11. Data, curves and results of all type tests shall be reported and documented in the TCA Dossier. It must be ensured that fuses can be used on modules with voltage levels below 24kV and 36kV.



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<b>TYPE TESTS</b>	<b>STANDARD 60282-1</b>
<b>Applying the common practices for all tests given in IEC 60282-1, paragraph 7.3.</b>	
Dielectric tests	7.4
Temperature-rise tests and power-dissipation measurement	7.5
Breaking tests	7.6
Tests for time-current characteristics	7.7
Test of strikers	8.3.2
Resistance at 20 °C	-
Tests for back-Up fuses for use in switch-fuse combination of IEC 62271-105	8.3.3

**Table 11 – Type tests for fuse-links**

**7.5.2 Acceptance tests**

The list of acceptance tests is indicated in Table 12

<b>N°</b>	<b>ACCEPTANCE TEST</b>	<b>DESTRUCTIVE TEST</b>	<b>NOTE</b>	<b>STANDARD 60282-1</b>
1	Visual check	NO	Verification of correspondence to the approved prototype (completeness of the accessory kit, presence and correctness of identification labels and marking, packaging and barcodes).	-
2	Dimensions Test	NO		-
3	Resistance at 20	NO	The resistance measurement must be within $\pm 10\%$ of the manufacturer's specifications	-
4	Striker test	YES	Verification of the Striker's mechanical characteristics	8.3.2
5	Test of energy	YES	Verification of the Striker's force-travel	8.3.2.5





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N°	ACCEPTANCE TEST	DESTRUCTIVE TEST	NOTE	STANDARD 60282-1
1	Visual check	NO	Verification of correspondence to the approved prototype (completeness of the accessory kit, presence and correctness of identification labels and marking, packaging and barcodes).	-
2	Dimensions Test	NO		-
3	Resistance at 20	NO	The resistance measurement must be within $\pm 10\%$ of the manufacturer's specifications	-
4	Striker test	YES	Verification of the Striker's mechanical characteristics	8.3.2
5	Test of energy	YES	Verification of the Striker's force-travel	8.3.2.5

**Table 12 – Acceptance tests**

Sampling plan:

- During the acceptance tests performed autonomously by the supplier the samples to be tested shall be chosen randomly from the batch already for shipping applying the UNI ISO 2859-1 Ed. 5-2007 standard according to the following criteria: Single sampling plans for normal inspection, General inspection LEVEL I, Acceptance Quality Limit – AQL 2,5% as show in the Table 13.

Lot size	Sample	Ac	Re
1-150	5	0	1
151-500	20	1	2
501-1200	32	2	3
1201-3200	50	3	4
3201-10000	80	5	6
10001-35000	125	7	8

**Table 13 - Application of the sampling criteria for acceptance test execution**

- During the repetition of the routine tests at the presence of the Enel or designated inspector, the test shall be carried out on a sample chosen randomly from the batch already successfully tested by the supplier, applying the following reduction criteria to the sampling for each test



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- Non-destructive tests: 50% of the required sampling
- Destructive tests: 25% of the required sampling.

Lot size	Destructive test?		Ac	Re
	NO	YES		
1-150	2	1	0	1
151-500	10	5	1	2
501-1200	16	8	2	3
1201-3200	25	12	3	4
3201-10000	40	20	5	6
10001-35000	62	31	7	8

**Table 14 – Application of the sampling criteria for acceptance test repetitions**

## 7.6 PACKAGING

The fuses will be provided in packs of three in a packing box. Every single fuse must have a packing box; on each box must be clearly indicated:

- Name of the power distribution company (only for fuses supplied directly by Enel)
- Name of the supplier
- Product description (same information as for fuse mark)
- Code assigned by the supplier
- Type code and country code (if fuses are bought from Enel)
- Date of construction (month/year)
- Gross weight
- Purchase order number (if fuses are bought from Enel).

In each box must be present the Instruction Manual for the installation and removal of the fuse-link with the relevant prescriptions/indications (in the language of the country of supply). The instructions will include the need to change the three fuses in each fusion of one of them.

The markings on the fuse must be in the target language of the material.



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## **7.7 DISPOSAL**

The manufacturer shall provide information concerning the disposal of fuses with due regard to environmental considerations.

## **7.8 MANUAL**

Each fuse must be accompanied by a fuse manual in the language in which the material will be supplied.



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## 8 CHECK LIST

ITEM	DENOMINATION	UNIT	REQUESTED
1	Supplier	-	
2	Manufacturer	-	
3	Country of manufacturer	-	
4	Ordering number	-	
5	Manufacturing and testing standard	-	IEC 60282-1
6	Designation	-	
7	Rated voltage	kV	
8	Operating voltage	kV	
9	Rated Current	A	
10	Breaking test – Test duty I <sub>1</sub>	kA	
11	Breaking test – Test duty I <sub>2</sub>	kA	
12	Breaking test – Test duty I <sub>3</sub>	A	
13	Power dissipation	W	
14	Resistance m-ohm at 20 °C	m-ohm	
15	Time current required curve	required	
16	Current limiting curve kA required	required	
17	Back-up class	-	Back-up
18	Frequency	Hz	50-60
19	Material porcelain enamelled	-	
20	Colour brown	-	
21	Percutor	mm	
22	Type	-	
23	Energy	J	
24	Clearance	-	
25	Total distance	mm	

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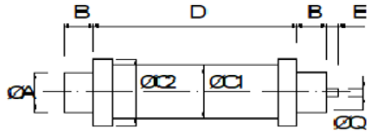
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Perimeter: Global

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26	Travel time	ms		
27	Dimensions	mm		
				
28	Drums diameter ( $\varnothing A$ , $\varnothing C1$ , $\varnothing C2$ )	mm		
29	B: Drum length	mm		
30	C: Cylinder diameter	mm		
31	D: Cylinder length	mm		
32	E: Firing pin length	mm		
33	Q: Cylinder diameter	mm		
34	Class: total range or backup total range			
TECHNICAL EVALUATION RESULT				

**Table 15 – Check list**