PRIMARY SUBSTATION

EARTHING TROLLEY FOR AIR INSULATED "COMPACT" SWITCHGEAR FAMILY

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Revision	Data	List of modifications
00	22/12/2020	First emission

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Figure and Table indexes

1 EXECUTIVE SUMMARY

This document contains technical specification for Earthing Trolley (ET) including service conditions, technical and constructive features, testing and supply requirement for ET are included.

2 SCOPE

Document applies to the vertical translation ET for indoor application with nominal voltage Ur = 24kV, used in the Air Insulated "compact" Switchgear (AIS) family described in the Volume XIX "Family of AIS "compact" ***enel*** type technical specifications collection" to be installed in primary substation.

3 LIST OF COMPONENTS

***enel* type**	**Description**
GSCM735	Earthing Trolley

Table 1 – List of components

4 APPLICABLE LAWS, REFENCE STANDARDS AND LIST OF REPLACED STANDARDS

4.1 International standard

IEC 62271-1
IEC 62271-102
IEC 62271-200
IEC/TS 62271-210
IEC 60529
IEC 62271-304
ISO 12944

Table 2 – International standard

Last edition of previous standards shall be utilized.

4.2 *enel* standards

- GSCG002 rev.2 "Technical conformity assessment";
- Volume XIX rev.8 "Family of AIS "compact" ***enel*** type technical specifications collection";
- GSCM1676 "Mock-up template utilization procedure";
- Contractual Requirements for Components and Materials Quality management.
- GSCM505 "Extractable vertical translation, three pole, vacuum circuit breaker Ur=24 kV for AIR insulated "compact" switchgear family";
- GSCM731 "Voltage bus bar measurement functional unit switchgear";
- GSCM734 "Voltage transformer trolley for AIR insulated "compact" switchgear family";
- Contractual Requirements for Components and Materials Quality management.

4.3 Local Law and Standard

4.3.1 Italy

- D. Lgs n. 81 e s.m.i.;
- PVR001 "Gestione delle Garanzie dei Materiali di Enel Distribuzione";
- PVR006 "Codici a barre - Garanzia e Rintracciabilità dei Materiali di Enel Distribuzione";
- GUI 101 "Caratteristiche generali e prescrizioni di impiego del pallet in legno da utilizzare per imballo di trasporto".

4.3.2 Spain

- RAT, Seguridad, Declaracion de conformidad;
- R.D. 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. 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;

- 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.

4.3.3 Rumania

- Prescriptia Energetica PE 101/85 – Normativ pentru construcţia instalaţiilor electrice de conexiuni şi transformare cu tensiuni peste 1 Kv;
- GUI 101 RO.

4.3.4 Chile

- Norma técnica de calidad de servicios para sistema de distribución, Comisión Nacional de Energía, Diciembre 2017;
- Norma Técnica de Seguridad y Calidad de Servicio, Comisión Nacional de Energía, Enero 2016.

4.3.5 Brazil

- NR-10 - segurança em instalações e serviços em eletricidade

4.3.6 Peru

4.3.7 Colombia

- RETIE – Reglamento Técnico de Instalaciones Eléctricas

4.3.8 Argentine

5 NORMAL SERVICE CONDICTIONS

ET shall be compliant with normal service conditions for indoor installation, defined in IEC 62271-1, considering as minimum value of ambient temperature - 5°C.

Maximum altitude shall be as defined in normal service condition (1000 m).

Constructor shall define the Ur referred to 2700 m of altitude for Colombia.

Seismic level of apparatuses, functional unit switchgear and ET shall be:

- seismic severity 2;

- acceptance class 1;

as defined in IEC/TS 62271-210.

ET shall be compliant for installation in three-phases MV effectively and non-effectively earthed neutral system (impedance earthed neutral system, resonant earthed neutral system, arc-suppression-coil-earth neutral system).

ET shall be compliant with design class 2 (CH; PH) of IEC 62271-304.

6 TECNICHAL CHARACTERISTIC

In the following table, electrical ratings for ET GSMC735 are defined.

***enel* Type**	**GSCM735**
Rated Voltage Ur (kV)	24
Rated frequency fr (Hz)	50 and 60
Rated short-time withstand current Ik (kA)	16
Rated duration of short circuit tk (s)	1
Rated peak withstand current Ip (kA)	41,6 (d.c. time = 45 ms)

Table 3 – Technical features

7 CONSTRUCTION CHARACTERISTICS

7.1 Generality

Earthing trolley shall be extractable type, with clamp contacts and shall be suitable for installing inside a voltage bus bar measurement functional unit switchgear GSCM731.

Dimensions of ET and interfaces with GSCM731 functional unit switchgear reference shall be made to GSCM505.

7.2 Construction details

7.2.1 Protection panel

ET shall be equipped, in front and sides, with a protection metallic (other materials shall be taken into account) panel of adequate resistance to mechanical stress and internal fault. Panel shall be without sharp corners at the edges. Design of lowest part of the panel shall also take in consideration the maneuverability of the handles for extraction of the ET (see paragraph 7.2.4).

7.2.2 Wheels

ET shall be equipped of 4 sliding stainless wheels suited to the guides installed inside the functional unit switchgear; the wheels shall permit the easy handling of ET.

Wheels fixing system shall be contained in the maximum width of trolley.

7.2.3 Earthing circuit

Earthing circuit shall be built with copper bar of proper dimension compliant with electrical ratings of ET and to be coupled with the functional unit switchgear earthing system.

Earthing circuit shall connect the contact clamps of each phase of the functional unit switchgear with the earth contacts of the trolley, see figure 1 annex A.

Clamp contacts shall be designed in order to be coupled with the functional unit switchgear fixed contacts (reference GSCM505).

Penetration of clamp in the fixed contacts shall be 30 mm as minimum values; at any case the penetration shall be adequate in order to ensure the electrical ratings of functional unit switchgear.

Clamp contacts shall have a degree of mobility in order to permit a correct coupling with the fixed contacts even in case of offset with respect to the bus bar.

Every group of contacts shall be equipped by independent re-entry springs in order to permit, after a disconnection of ET from bus bar, that the clamp return to pre-connection position.

7.2.4 Drag handles for trolley

ET shall be equipped with two handles positioned in the front panel, retractable by means of return springs; handles shall allow to release the two rectangular blocking pivots of the ET.

Mechanism shall be designed in order to operate correctly with functional unit switchgear interlocks.

Design of handles shall be ergonomic, safe and effortlessly for operators.

7.2.5 Lifting devices

Removable lifting devices shall be installed on ET (for example eyebolts or similar), for the lifting of the complete ET.

7.3 Blocking pivot

ET shall be equipped with a blocking pivot with a diameter of 20 mm, rounded edges and stroke at least 20 mm (see GSCM505).

When the trolley is "totally relieved" and "totally lowered" (ET connected and disconnected), the pivot will be in its more external position.

Such position of pivot shall be maintained by a horizontal pressure towards external direction with respect to trolley.

The pressure shall have proper accordance with specific mechanism present on the front of functional unit switchgear (see GSCM505).

Activation of blocking pivot shall occur when it is pushed towards internal direction starting from 5 mm and to 10 mm from beginning of horizontal stroke.

7.4 Manuals

Constructor shall provide the ET manual compliant with IEC 62271-102.

Minimum time of maintenance shall be 60 months.

The language shall be compliant with the country of supply, e.g. in Italian/Spanish/ Romanian/Portuguese.

7.5 Nameplates and signs

7.5.1 Nameplates

ET shall be equipped, on front part and in visible position, with a nameplate where, as far as applicable, dates indicated (included the mass) by IEC 62271-102 shall be listed.

Also on the nameplate following indications shall be included:

- ***enel*** type;
- ***enel*** material code;
- Barcode compliant with ***enel*** relevant specification (in case there is not enough space on the nameplate, barcode could be inserted out of the nameplate).

7.5.2 Sequence of maneuvers plate

Sequence of maneuvers plate and single line scheme shall be present in front of ET (see figure 2 annex A).

The language shall be compliant with the country of supply, e.g. in Italian/Spanish/ Romanian/Portuguese.

Here below an example of maneuvers sequence in English language and of the single line scheme of ET.

Warning: The previous sequence is to be applied after the assembly of MV switchgear is put "out of service".

MV Bus bar Earthing and Short Circuiting

1- Disconnect and extract VT trolley GSCM734 from functional unit switchgear GSCM731;

2- Insert the ET inside the functional unit switchgear GSCM731 until the "disconnect" position is reached;

3- If required attach warning sing on the external front of functional unit switchgear GSCM731 as example see figure 4;

4- Close the door;

5- Open the shutter;

6- Insert and actuate the block key;

7- Insert and actuate the command maneuver of blocking pivot;

8- Insert the vertical translation maneuver and actuate for vertical translation of ET from "disconnected" conditions to "service" conditions;

9- Extract the vertical translation maneuver;

10- De-actuate and extract the command maneuver of blocking pivot;

11- If required insert the padlock or take the interlock key.

MV Bus bar Earthing short circuiting removal

1- If present remove the padlock or insert the interlock key;

2- Insert and actuate the command maneuver of blocking pivot;

3- Insert the vertical translation maneuver and actuate for vertical translation of ET from "service" conditions to "disconnected" conditions;

4- Extract the vertical translation maneuver;

5- De-actuate and extract the command maneuver of blocking pivot;

6- De-actuate and extract the block key;

7- Close the shutter;

8- Open the door;

9- Extract the ET from functional unit switchgear GSCM731

10- Remove warning sign if attached previously.

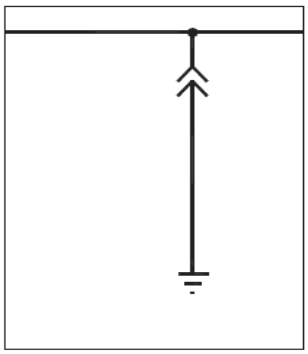


Figure 1 – Single line scheme of ET

7.6 Protective coatings

The carpentry shall have a protective coating compliant with ISO 12944 with the following features:

- Durability:
  - Very High (VH) more than 25 years;
- Atmospheric - corrosivity categorie:
  - C5;

Alternative values of atmospheric corrosion category are permitted but class 2 of IEC62271-304 shall be guaranteed.

Use of painting cycles or alternatively, electrolytic galvanizing on items that are not part of the load-bearing structure of the trolley is allowed.

8 TESTING

Type and routine test shall be performed in compliance with IEC 62271-1, IEC 62271-102, IEC 62271-200 and the clarifications indicated in the following paragraphs.

Technical conformity assessment (TCA) process shall be compliant with GSCG002.

Electronic type A documentations shall be "BIM compliant" ISO 16739.

Functional unit switchgear GSCM731 with TCA in force necessary for all type tests shall provided by Constructor.

8.1 List of test

8.1.1 List of type test

Type test	Reference
Constructive features and interlock functionality verifications	Par. 8.2.1
Mechanical operation tests	Par. 8.2.2; Par. 6.102 of IEC 62271-200 ed.2
Measurement of the resistance of the main circuit	Par.8.2.3 Par. 7.4 of IEC 62271-102 ed.2 Par. 6.4 of IEC 62271-200 ed.2
Short-time withstand current and peak withstand current tests	Par. 8.2.4 Par. 7.6 of IEC 62271-102 ed.2 Par. 6.6 of IEC 62271-200 ed.2
Ageing and humidity test	Par. 8.2.5 IEC 62271-304
Seismic test	Par. 8.2.6 IEC TS 62271-210
Protective coating verifications	ISO 12944

Table 4 – Type test list

8.1.2 List of routine test

Routine test	Reference
Type correspondence verifications	Par. 8.3.1 Par. 8.6 of IEC 62271-102 ed.2
Mechanical operation tests and interlock functionality	Par. 8.3.2 Par. 8.101 of IEC 62271-102 ed.2 Par. 7.102 of IEC 62271-200 ed.2
Verification of earthing functioning and measurement of the resistance of the main circuit	Par. 8.3.3 Par. 8.102 of IEC 62271-102 ed.2 Par. 8.4 of IEC 62271-102 ed.2 Par. 7.3 of IEC 62271-200 ed.2
Protective coating verifications	ISO 12944

Table 5 – Routine test list

8.2 Type tests

Type tests shall be performed on ET fully equipped as for ordinary use.

8.2.1 Constructive features and interlock functionality verifications

For this verification, a mechanical simulation of functional unit switchgear is necessary.

Mechanical simulation of functional unit switchgear and ET (mock-up template) shall be manufactured by constructor in compliance with ***enel*** drawings and specifications; verification of the template accuracy is in charge of constructor.

Annual check of mock-up template with portable 3D automatic measurement shall be performed by constructor.

The right interlock functionality, listed in this document and its annexes, shall be also checked with the mock-up template, procedure described in GSCM1676 shall be followed. Furthermore, nameplates shall be verified in compliance with paragraph 7.5.1.

8.2.2 Mechanical operation tests

Test shall be performed on ET installed inside functional unit switchgear GSCM731, in compliance with the paragraph 6.102 of IEC 62271-200 ed.2.

Correct insertion and vertical translation of ET inside functional unit switchgear shall be checked.

8.2.3 Measurement of the resistance of the main circuit

Test shall be performed on ET installed inside functional unit switchgear GSCM731, in compliance with paragraphs 7.4 of IEC 62271-102 ed.2 and 6.4 of IEC 62271-200 ed.2.

For each phase the following measurement shall be performed:

a) R1: between MV busbar and earth circuit of GSCM731 switchgear;

average value, for each phase, of measurement carried out during the check a), shall be adopted as referring value for the routine tests.

8.2.4 Short-time withstand current and peak withstand current tests

Test shall be performed on ET installed inside functional unit switchgear GSCM731, in compliance with paragraphs 7.6 of IEC 62271-102 ed.2 and 6.6 of IEC 62271-200 ed.2.

8.2.5 Ageing and humidity test

Test shall be performed on ET in compliance with IEC 62271-304 with design class 2.

8.2.6 Seismic test

Compliance with IEC TS 62271-210 shall be proven of the ET installed inside functional unit switchgear GSCM731.

8.3 Routine tests

The routine tests are indicated in the table 6, these tests shall be carried out by the constructor on all the specimen prepared for the commissioning.

For each piece belonging to the prepared batch, the supplier shall fill in a test report with the results of the tests performed.

The routine tests shall be repeated under ***enel*** surveillance according to conditions stated in the "Contractual Requirements for Components and Materials Quality management" document.

For routine tests reference values and acceptability ranges defined in the TCA Report (GSCG002) shall be considered.

Routine tests shall be performed on ET fully equipped as for ordinary use

8.3.1 Type correspondence verifications

Test shall be performed on ET in compliance with the paragraph 8.6 of IEC 62271-102, following verifications shall be performed:

a) Visual examination in order to check the absence of external imperfections and constructive defects;

b) Dimensional and constructive verification, with mock-up template of panel switchgear conformity to ***enel*** drawings and specifications, according procedure described in the GSCM1676 shall be ensured.

c) Constructive features check with drawings schemes and pictures of the approved type A documentations.

8.3.2 Mechanical operation tests and interlock functionality

Test compliant with paragraphs 7.102 of IEC 62271-200 ed.2 and 8.101 of IEC 62271-102 ed.2 shall be performed on ET installed inside functional unit switchgear GSCM731.

Correct functionality of interlocks listed in this document shall be checked.

The right interlock functionality, listed in this document and its annexes, shall be also checked with the mock-up template, procedure described in GSCM1676 shall be followed.

8.3.3 Verification of earthing functioning

Test compliant with paragraph 7.102 of IEC 62271-200 shall be performed.

Measurement of main circuit resistance shall be performed on ET installed inside functional unit switchgear GSCM731, in compliance with paragraph 8.4 of IEC 62271-102 ed.2 with paragraph 7.3 IEC 62271-200 ed.2, measures shall be executed with methods indicated in par. 8.2.3 at letter a), checking that measured values do not exceed 1,2 time the values of reference measuring obtained during type test.

9 Supply requirements

ET shall be supplied in single package, in order to ensure a proper protection during the transportation and storage.

Inside the package followings elements shall be supplied:

- ET completely equipped;
- All accessories necessary for the complete installation and commissioning of ET;
- Installation, operation and maintenance manuals;
- Any other device eventually needed for the operation ET.

Out of the package followings indications shall be present:

- ***enel*** DSO;

- Name of supplier;
- Description of product;
- ***enel*** material and type code;
- Constructor type code and serial number;
- Gross weight.

Package shall be assembled for delivering as prescribed in the GUI101.

Annex A - OVERALL VIEW

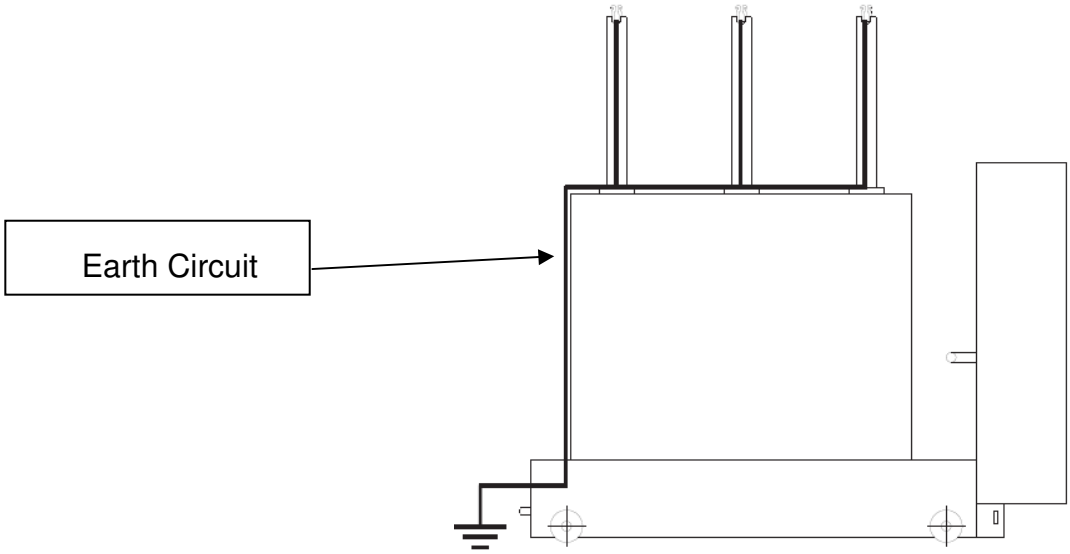
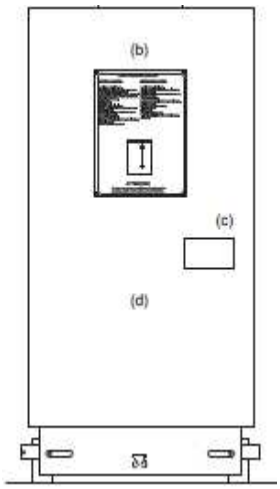


Figure 2 – Lateral view



b) Maneuverers sequence
c) Features plate
d) Front panel

Figure 3 – Frontal view

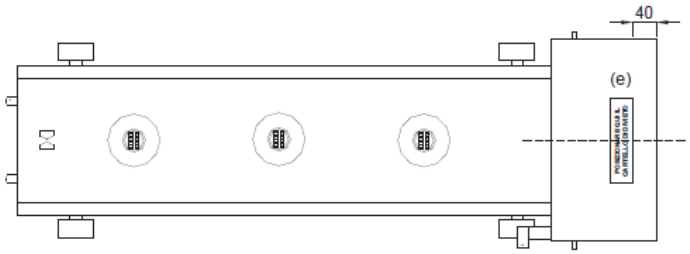


Figure 4 – Plan view

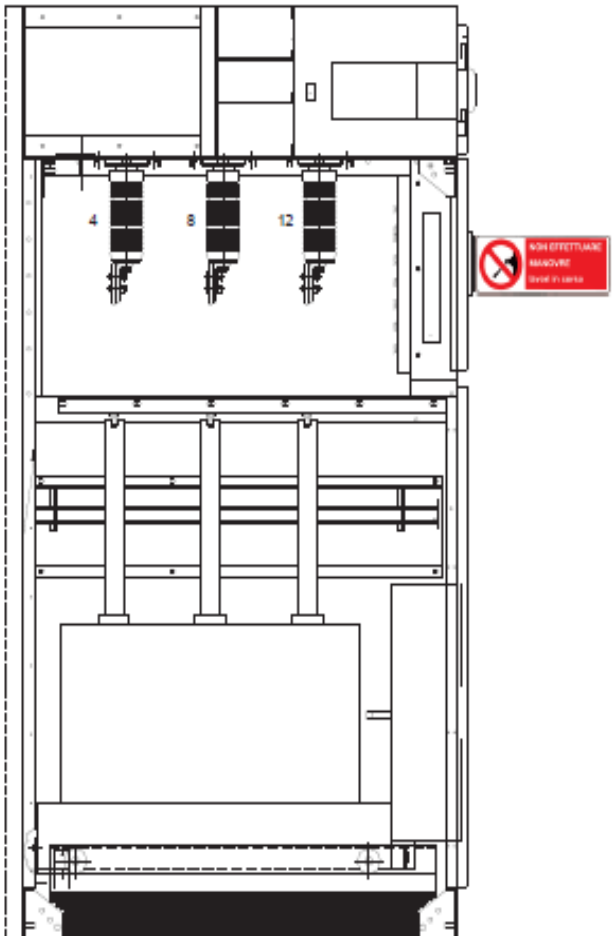


Figure 5 – Earthing trolley inside the VT functional unit switchgear GSCM731

Annex B - "Documentations to be provided in technical offer"

Documentations:

- Check list;
- Drawings with overall dimensions;
- Supplier declaration of compliance of offered products with present TS and main standards and laws;
- Deviations letter (if any).

Technical specification:	**Offer number:**
Constructor:	**Site of production:**
***enel* type code:**	**Constructor type code or designation:**
***enel* material code:**	

	Technical ratings	**Request**	**Constructor offer**
1	**Service conditions**	Capt. 5	
2	**Maximum altitude only for Colombia(m)**	2700	
3	**Minimum ambient air temperature (°C)**	-5	
4	**Severity degree of pollution (IEC 62271-304)**	design class 2	
5	**Seismic level; acceptance class**	2 ;1	
6	**Rated frequency fr (Hz)**	50 and 60	
7	**Rated voltage Ur (kV)**	24	
8	**Rated Voltage Ur (kV) to 2700 m**	Constructor information	
9	**Rated short-time withstand current Ik (kA)**	16	
10	**Rated duration of short circuit tk (s)**	1	
11	**Rated peak withstand current Ip (kA)**	41,6	
12	**Overall dimension**	Annex A and GSCM505	

Table 6 – Check list

Annex C - “Local Material Codes”

Company	GSCM735
e-distribuzione (Italy)	
e-distribución (Spain)	140716
e-distributie (Rumanian)	140052
enel Distribución Chile (Chile);	
enel Distribuição Rio (Brazil);	
enel Distribuição Ceará (Brazil);	
enel Distribuição Goiás (Brazil);	
enel Distribución Perú (Perù);	
Edesur (Argentine)	
Codensa (Colombia)	

Table 7 – Local material codes