



**EMPRESA DE TRANSPORTE DE PASAJEROS
METRO S.A.
GERENCIA CORPORATIVA DE INGENIERÍA**

NORMAS DEL SISTEMA ELÉCTRICO

0	12/06/19	Para uso	A. R. N / F. E. J.	F. E. J	S. F. T.
B	29/04/19	Revisión	A. R. N / F. E. J.	F. E. J	S. F. T.
A	15/04/19	Revisión	A.R. N.		
REV N°	FECHA	EMITIDO PARA	ELABORADO POR	REVISADO POR	APROBADO POR
 METRO DE SANTIAGO		L2-150200-IB-0-5EN-ETG-0007			Página 1 de 9
					Revisión 0

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Consulte la revisión actual en Departamento de Procesos y Calidad

APROBACIONES

GERENCIA COORPORATIVA DE INGENIERÍA		FIRMAS	FECHA
PREPARADO POR	A. R. N.		15.04.2019
REVISADO POR			12.06.2019
APROBADO POR			12.06.2019

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CONTROL DE CAMBIOS

Rev.	Punto	Título	Modificación Realizada

1. OBJETIVO

El presente documento tiene como objetivo presentar las normas asociadas al sistema de energía que forman parte del presente proyecto.

El diseño, los materiales, la construcción, los ensayos y los repuestos del sistema de Energía eléctrica deben ser conformes con las normas internacionales para ferrocarriles. Salvo indicación contraria, el Contratista debe cumplir con las normas internacionales especificadas a continuación.

Se permitirán normas alternativas si el Contratista da la prueba que la norma propuesta está al mínimo equivalente a la especificada en este documento, es decir si éstas incluyen requisitos iguales o más exigentes. Para demostrar la equivalencia de las normas alternativas propuestas, el Contratista tendrá que entregar un cuadro comparativo en español a la aprobación del Metro.

El sistema de energía eléctrica suministrado deberá ser conforme a las normas aplicables al inicio de la fase de diseño del proyecto en su última versión. El Contratista tendrá que cumplir igualmente con las normas referenciadas en dichas normas.

Las normas relativas a los estudios de la ingeniería de detalle, los materiales, la construcción, los ensayos, los repuestos y la capacitación del personal serán entregadas por el Contratista a la aprobación del Metro.

2. LISTADO DE NORMAS CHILENAS

NSEG 20/78	Subestaciones Interiores
NCH Elec. 4/2003	Norma Chilena de Electricidad – Instalaciones de Consumo en Baja Tensión
NCH Elec. 2/84	Elaboración y Presentación de Proyectos
NSEG 5/71	Instalaciones de Corrientes Fuertes
NSEG 8/71	Tensiones Normales
ETG 1.020	Especificaciones técnicas generales de Diseño Sísmico - ENDESA

3. LISTADO DE NORMAS INTERNACIONALES

EN 50163:2004	Railway applications - supply voltages of traction systems
IEC 60529:2013	Degree of protection provided by enclosures (IP codes)
IEEE 693:2005	Recommended Practice for Seismic Design of Substations
IEC 61000-5-2	EMC part 5: Installation and mitigation guidelines. Section 2: Earthing and cabling
IEC 60076-1:2011	Power transformers - Part 1: General
IEC 60076-2:2011	Power transformers - Part 2: Temperature rise
IEC 60076-3:2013	Power transformers - Part 3: Insulation levels – dielectric Tests and external clearances in air
IEC 60076 -5:2006	Power transformers - Part 5: Ability to withstand short-circuit
IEC 60076 -11:2004	Power Transformers - Part11: Dry type Transformers
EN 60146-1-1:2009	Semiconductor converters: general requirements and line commutated convertors: Specifications of Basic requirements
IEC 60146-1-2:2011	semiconductor converters: general requirements and line commutated convertors: Application Guide
IEC 60146-1-3:1991	Semiconductor converters: general requirements and line commutated convertors: Transformers and Reactors
EN 50388:2012	Railway Applications - Power supply and rolling stock - Technical criteria for the coordination between power supply (substation) and rolling stock to achieve interoperability.
EN 50328:2004	Railway Applications - Fixed installations – Electronic power converters for substations
EN 50329:2003	Railway Applications-Fixed installations- Traction transformers
EN 50121-1:2015	Railway applications – electromagnetic compatibility – part 1: general

EN 50121-2:2015	Railway applications – electromagnetic compatibility – part 2: emission of the whole railway system to the outside world
EN 50121-5:2015	Railway applications – Electromagnetic compatibility – part 5: Emission and immunity of fixed power supply installations and apparatus
EN 50122-1:2011	Railway applications - fixed installation – part 1: protective provisions relating to electrical safety and earthing
EN 50122-2:2010	Railway applications - fixed installations – part 2: protective provisions against the effects of stray currents caused by d.c. traction systems
EN 50123-1:2004	General
EN 50123-2:2004	railway applications – fixed installations d.c. switchgear
EN 50123-3:2013	DC switchgear ; Switch-disconnectors, Switch-disconnectors and earthing switch
EN 50124-1:2001	Railway Applications - Insulation coordination Part1: Basic requirements
EN 50124-1-A1:2003	Railway Applications - Insulation coordination Part1: Basic requirements A1: Amendment 1
EN 50124-1-A2:2005	Railway Applications - Insulation coordination Part1: Basic requirements A2: Amendment 2
EN 50124-2:2001	Railway Applications - Insulation coordination Part2: overvoltages and related protection
EN 50125-2:2002	Railway Applications - Environmental Conditions for Equipment Part2: Fixed Electrical Installations
IEC 61869-1:2007	Instrument transformers – Part 1: General requirements
IEC 61869-2:2012	Instrument transformers – Part 2: Additional requirements for current transformers
IEC 61869-3:2011	Instrument transformers – Part 3: Additional requirements for inductive voltage transformers
EN 60896-2:1995	Stationary Lead-Acide batteries. General requirements and method of test. Part2 : Valve regulated types
IEC 62271-100:2008	Part 100: High-Voltage switchgear and controlgear
IEC 62271-102:2001	Part 102 : Alternating current disconnectors and earthing switches

IEC 62271-103:2011	Part 103 : Switches for rated voltages above 1 kV up to and including 52 kV
IEC 62271-105:2002	Part 105 : Alternating current switch-fuse combinations
IEC 62271-106:2011	Part 106: Alternating Current contactors
IEC 62271-200:2011	A.C. metal-enclosed switchgear and controlgear for rated voltages above 1 kV and up to 52 kV
IEC 62271-206:2011	High-Voltage switchgear and controlgear: Part 206: Voltage presence indicating systems for rated voltages above 1 kV and up to and including 52 kV
IEC 60694:2002	Common Specifications for High-Voltage Switchgear and Controlgears Standards
IEC 60228:2004	Conductors of insulated cables
IEC 61034-1:2005	Common test methods for cables under Fire Condition- Measurement of smoke density of cables burning under defined conditions - Part1: Test apparatus
IEC 61034-2:2005	Common test methods for cables under Fire Condition - Measurement of smoke density of cables burning under defined conditions - Part2: Test procedure and requirements
IEC 60754 -1:2011	Test on gases evolved during combustion of materials from cables Part 2.1: procedures – Determination of the amount of halogen acid gas
IEC 60754-2:2011	Test on gases evolved during combustion of materials from cables Part 2.2: procedures – determination of degree acidity of gases for materials by measuring Ph and conductivity
IEC 60331:2009	Tests for electric cables under fire conditions – Circuit integrity
IEC 60332-3-22 2004	Common Test methods for cables under fire conditions. Test for vertical flame spread of vertically-mounted bunched wires or cables. Part 2-2: Procedures- Category A
IEC 60502-1:2004	Power cables with extruded insulation and their accessories for rated voltages from 1kV to 30 kV <u>Part1</u> : Cables for 1 kV and 3 kV

IEC 60502-2:2014	Power cables with extruded insulation and their accessories for rated voltages from 1kV to 30 kV <u>Part2</u> : Cables from 6 kV to 30 kV
IEC 60502-4:2010	Power cables with extruded insulation and their accessories for rated voltages from 1kV to 30 kV <u>Part4</u> : Tests requirements on accessories for cables with rated voltage from 6 kV to 30 kV
IEC 61439-1:2011	Low Voltage Switchgear and Controlgear assemblies - Part1: General Rules
EN 61558-1:2005	Isolating transformer and Safety isolating transformer
EN 61558-2-4:2009	Isolating transformer and Safety isolating transformer
EN 61558-2-5:2010	Isolating transformer and Safety isolating transformer
EN 61558-2-6::2009	Isolating transformer and Safety isolating transformer
EN 61558-2-7:2007	Isolating transformer and Safety isolating transformer
EN 61558-2-8:2010	Isolating transformer and Safety isolating transformer
EN 61558-2-9:2010	Isolating transformer and Safety isolating transformer
IEEE Std 519:2014	IEEE Recommended Practices Requirements for Harmonic Control in Power Systems
IEC 60332-3-22	Tests on electric cables under fire conditions Part 3-22: Test for vertical flame spread of vertically-mounted bunched wires or cables - Category A
IEC 60754-1	Test on gases evolved during combustion of materials from cables - Part 1: Determination of the halogen acid gas content
IEC 61034-2	Measurement of smoke density of cables burning under defined conditions - Part 2: Test procedure and requirements
IEC 60332-33-21	Tests for electric cables under fire conditions Part 3-21: Test for vertical flame spread of vertically-mounted bunched wires or cables – Category A F/R