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Rolling stock — DC surge arresters

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Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of Economy, Trade and Industry, through deliberations at the Japanese Industrial Standards Committee as the result of proposal for revision of Japanese Industrial Standard submitted by Japan Association of Rolling Stock Industries (JARI)/ Japanese Standards Association (JSA) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law applicable to the case of revision by the provision of Article 14.

Consequently **JIS E 5003:1989** is replaced with this Standard.

Attention is drawn to the possibility that some parts of this Standard may conflict with a patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have technical properties. The relevant Minister and the Japanese Industrial Standards Committee are not responsible for identifying the patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have the said technical properties.

Rolling stock — DC surge arresters*

1 Scope

This Japanese Industrial Standard specifies the d.c. surge arresters (hereafter referred to as “arresters”) mounted on d.c. electric rolling stock and a.c./d.c. dual system electric rolling stock for the nominal line voltages 600 V, 750 V and 1 500 V. It is applicable to metal-oxide type (gapless) arresters which use the zinc oxide elements as characteristic elements.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. The most recent editions of the standards (including amendments) indicated below shall be applied.

JIS E 4031 *Railway rolling stock parts — Test methods for vibration*

JIS Z 8703 *Standard atmospheric conditions for testing*

3 Terms and definitions

For the purpose of this Standard, the following terms and definitions apply.

a) **surge arrester**

device intended to limit transient overvoltage caused by lightning, switching, etc. to a specified level by electric discharge

It is for the purpose of protecting insulation of electrical facilities, interrupting the follow current and recovering to the original service condition without disturbing normal system conditions.

b) **zinc oxide element**

sintering block element, which consists mainly of zinc oxide

Characterized by the non-linear voltage and current characteristics and excelling in the electrical discharge resistance capacity, this element is used for an arrester without series spark gaps.

c) **cooling**

the process in which a heated arrester element is left until it cools down to the normal temperature (5 °C to 35 °C)

d) **thermal runaway**

phenomenon in which the sustained power loss of an arrester exceeds the thermal dis

*Editor's note: The original title "DC surge arresters for rolling stock" has been modified to "Rolling stock — DC surge arresters" in this document by Japan Association of Rolling Stock Industries (JARI).

sipation capability, leading to a cumulative increase of the leakage current under the specified ambient temperature and voltage

e) **overvoltage**

voltage to appear between line to ground, which exceeds the upper limit value of the d.c. voltage under the normal service conditions

f) **follow current**

current which is supplied from the d.c. system to the arrester even after the discharge phenomenon is substantially over

g) **ratings**

performance guarantee limits of the arrester

h) **rated voltage**

the maximum guaranteed limit of the voltages normally generated between the arrester terminals, up to which the arrester is capable of executing its operating duty

i) **continuous operating voltage**

designated permissible d.c. voltage value that can be applied continuously between the arrester terminals for a long period of time

j) **discharge**

function of passing a current through the arrester when an overvoltage is applied between the arrester terminals

k) **discharge current**

impulse current which flows through the arrester at the time the arrester discharges

l) **nominal discharge current**

specified lightning impulse discharge current, which is used to define the protective performance and restitution capability of the arrester

m) **impulse voltage**

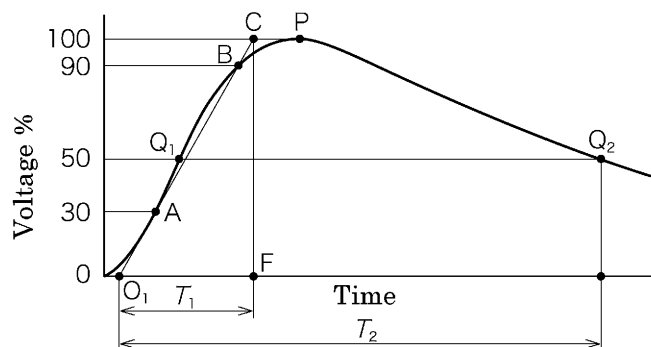
voltage appearing transiently for a short period of time (usually μs to ms), which rises rapidly to a peak value and falls gradually to zero

It is indicated with a curve as shown in figure 1. In this Standard, an impulse voltage with the virtual front time of several microseconds is especially called a “lightning impulse voltage”.

n) **impulse current**

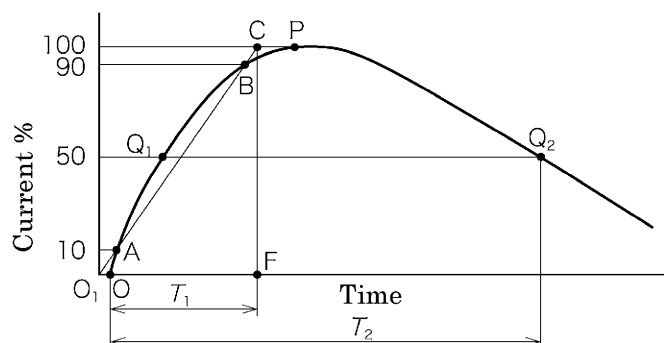
current appearing transiently for a short period of time (normally μs to ms)

It is indicated with a curve as shown in figure 2. In this Standard, an impulse current with the virtual front time of several microseconds is especially called a “lightning impulse current”.



- T_1 : Virtual front time
 T_2 : Virtual tail time
 O_1 : Virtual origin (The intersection of the straight line connecting the 30 % wave peak A and the 90 % wave peak B with the time axis)
 Q_1, Q_2 : Half peak value point
 P : Peak value point
 CF : Peak value
 CF/T_1 : Virtual wave front steepness

Figure 1 Indication of the virtual impulse voltages



- O : Origin
 T_1 : Virtual front time
 T_2 : Virtual tail time
 O_1 : Virtual origin (The intersection of the straight line connecting the 10 % wave peak A and the 90 % wave peak B with the time axis)
 Q_1, Q_2 : Half peak value point
 P : Peak value point
 CF : Peak value
 CF/T_1 : Virtual wave front steepness

Figure 2 Indication of the virtual impulse currents