

10th edition, June 2005

Translation

OR

Electrical power supply for trains - Standard technical characteristics of the train line

*Alimentation des trains en énergie électrique - Caractéristiques techniques unifiées de la ligne de train
Versorgung der Züge mit elektrischer Energie - Technische Einheitsmerkmale der Zugsammelschiene (ZS)*



UNION INTERNATIONALE DES CHEMINS DE FER
INTERNATIONALER EISENBAHNVERBAND
INTERNATIONAL UNION OF RAILWAYS

Leaflet to be classified in Volumes:

V - Rolling Stock

VI- Traction

Application:

With effect from 1 June 2005

All members of the International Union of Railways

Record of updates

1st edition, January 1930

First issue under the title: "Electric heating - Coaches" and with the code No. 44. New code in 1952.

9th edition, January 1997

10th edition, June 2005

Editorial revision (point 3.4 is new)
Addition of standards in the bibliography:
- EN 60529:2000
- ISO 3864:1984

Important: the points in this leaflet have been renumbered in the new edition. The first digit of each point has been increased by one (i.e. 0 \Rightarrow 1, 1 \Rightarrow 2, etc.). Please take account of this when using cross-references from other leaflets!

The person responsible for this leaflet is named in the UIC Code

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Summary

This leaflet applies to all rolling stock and tractive units used in international traffic which are equipped with a train line and contains general provisions which are to be observed by the train line for supplying the train with electrical power, including the components such as coupling fittings and conductors.

o 1 - General

1.1 - This leaflet shall apply to all rolling stock used in international traffic and which is equipped with a train line.

It shall also apply to the train lines of tractive units.

1.2 - This leaflet contains general provisions which are to be observed by the train line for supplying the train with electrical power.

2 - Characteristics of the train line

- 2.1 - The train line shall be capable of operation under the voltages specified in *UIC Leaflet 550, Appendix B* (see [Bibliography - page 17](#)) (including the voltage tolerances).
- 2.2 - The train line should be dimensioned only for those rated voltages which it will encounter in operation.
- 2.3 - The single-pole train line comprises the coupling gear mounted on the vehicle headstocks and one or more continuous conductors. The diagram in [Appendix B - page 10](#) shows a train line in a vehicle.
- 2.4 - The train line shall be capable of providing the current flow corresponding to the values of the diagram in [Appendix A - page 9](#).
- 2.5 - All metal parts encompassing the train line shall be of non-magnetic material to avoid heating due to eddy-current losses. This covers principally the handles of coupler plugs, coupler sockets, cable-holder junction boxes and the metallic covering of the cable.
- 2.6 - The train line shall be so installed that it is protected against physical damage and electrical interference.

o 3 - Coupling gear for the train line

3.1 - The train line coupling gear at the vehicle end shall comprise:

- a coupler socket;
- a cable-holder junction box;
- a coupler plug with cable. The earthing conductor for the coupler plug handle shall be integrated in the plug cable;
- a dummy socket.

3.2 - The layout of the coupling gear at vehicle ends and the length of the plug cable shall conform to Appendix E - page 14. The plug cable in the coupler socket of the adjacent vehicle or in the dummy socket of its own vehicle shall not foul the vehicle gauge as defined in *UIC Leaflet 505-1* (see Bibliography - page 17).

3.3 - Coupler plugs, coupler sockets and dummy sockets shall conform to the specifications and limit dimensions of Appendix C - page 11. With the cover closed, and also with the coupler plug inserted, the coupler socket shall provide protection to IP 54 of *EN 60529* (see Bibliography - page 17) by means of the spring pressure.

3.4 - The coupler plug inserted completely into the coupler socket shall be secured against disengaging and falling out in all operating conditions. For this purpose, there shall be a securing catch located on the inside of the coupler socket cover and which engages into the corresponding groove of the coupler plug by means of the spring pressure of the cover (see point D.1 - page 12).

4 - Characteristics of conductors for the train line

4.1 - Train line conductors shall be capable of carrying the following rated voltages:

Rated supply voltage U_n after point 2.1	Rated voltage of conductor U_o/U
up to 1 500 V	1,8 / 3 kV
up to 3 000 V	3,3 / 6 kV

U_o : phase voltage
 U : phase-to-phase voltage

4.2 - Train line conductors shall fall within category II and Group B as defined under *UIC Leaflet 895, point 1.3* (see Bibliography - page 17). For diesel tractive units and generator vans, conductors for the train line shall conform to category III.

The structure of the conductors shall, as a minimum, be designed to flexibility class 5 as defined in *IEC 60228* (see Bibliography - page 17).

4.3 - Train line conductors shall be of copper, with a minimum cross-section of 185 mm².

4.4 - In addition to the requirements of points 4.1 to 4.3, the plug cable shall contain an earthing conductor of copper with a minimum cross-section of 25 mm² (e.g. as screen) for the coupler plug handle.

o 5 - Locking of coupling gear

5.1 - The coupler and dummy sockets of coaches do not have locking systems.

5.2 - If railways wish to have locking systems for couplings on tractive units, they should use a system for the coupler socket which is comprised of the following parts:

5.2.1 - A latch on the coupler socket as shown in point [D.1 - page 12](#), which, when in the locked position, secures the cover of the coupler socket both without coupler plug and with coupler plug as shown in point [3.4 - page 4](#), and when in the unlocked position, frees the movement of the coupler socket cover.

5.2.2 - A key for locking and unlocking, with the additional dimensions and tolerances specified in point [D.2 - page 13](#). This key can only be inserted in and removed from the lock in the locking position.

o 6 - Test voltages

6.1 - The value of the test voltage used during dielectric tests preceding introduction into service shall be left to the discretion of individual railways. However the train line must be able to withstand a minimum effective a.c. voltage of $2U_n + 1\,000$ V, where U_n is the rated voltage as defined under point [2.1 - page 3](#).

6.2 - The duration of tests shall be:

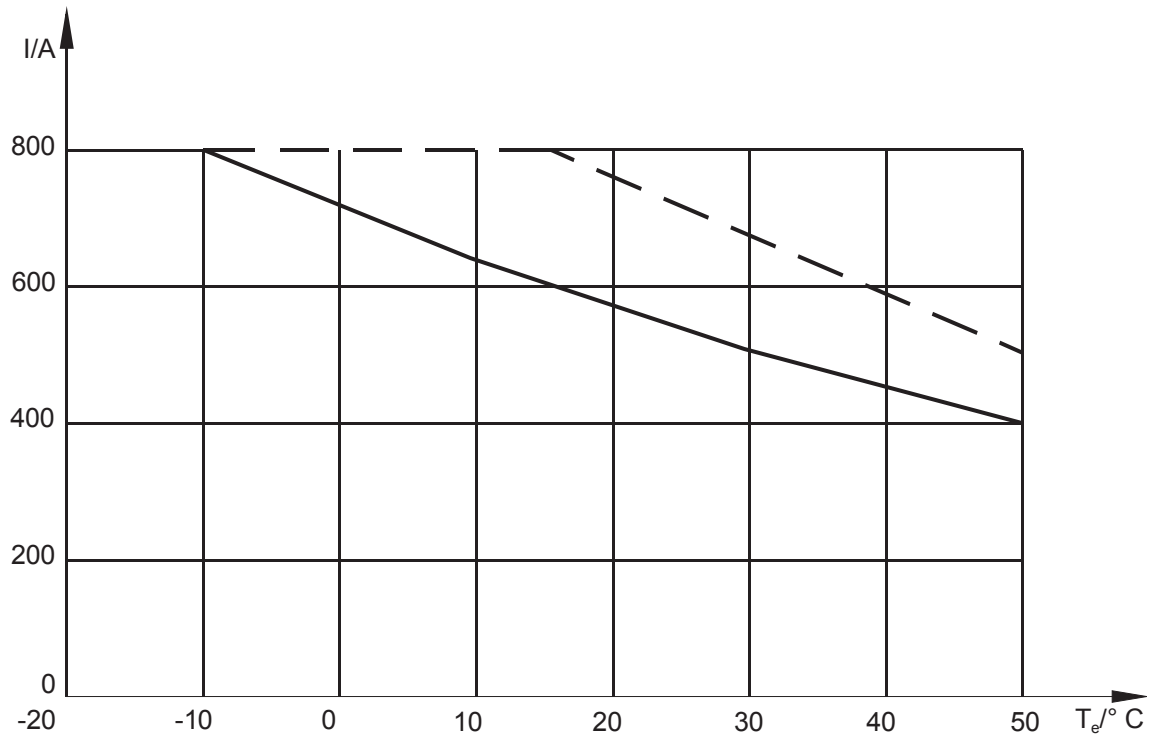
- 120 seconds for 1 000 V a.c. voltage,
- 60 seconds for 1 500 V a.c. and d.c. voltage,
- 30 seconds for 3 000 V d.c. voltage.

o 7 - Inscriptions

7.1 - Vehicles equipped for electrical power supply from the train line or equipped only with a train line shall be marked as shown in point [F.1 - page 15](#) for passenger rolling stock and point [F.2 - page 16](#) for freight rolling stock.

7.2 - A warning sign marked "Warning of dangerous electrical voltage" conforming to *ISO 3864* (see [Bibliography - page 17](#)), with a minimum edge length of 80 mm, shall be affixed to coupler sockets, cable-holder junction boxes and dummy sockets for the coupler plugs.

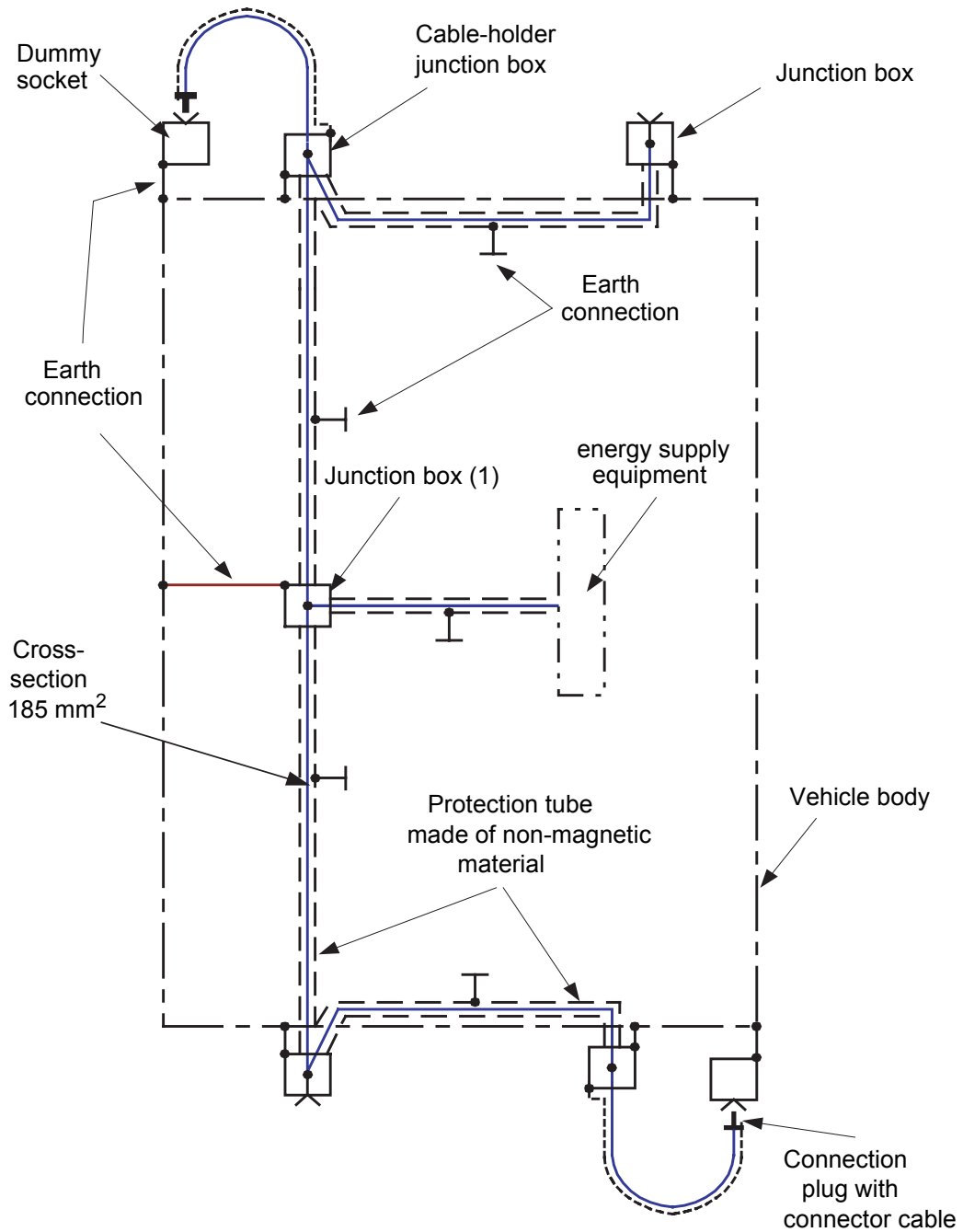
Appendix A - Permissible train line load ($I = f(T_e)$)



Parameter:		T_e	External temperature
Plug handle:	max. 60°C	---	Hourly load
Conductors:	max. 100°C	—	Continuous load

NB : Applies to both direct current and currents with a frequency of 16 2/3 Hz and 50 Hz.

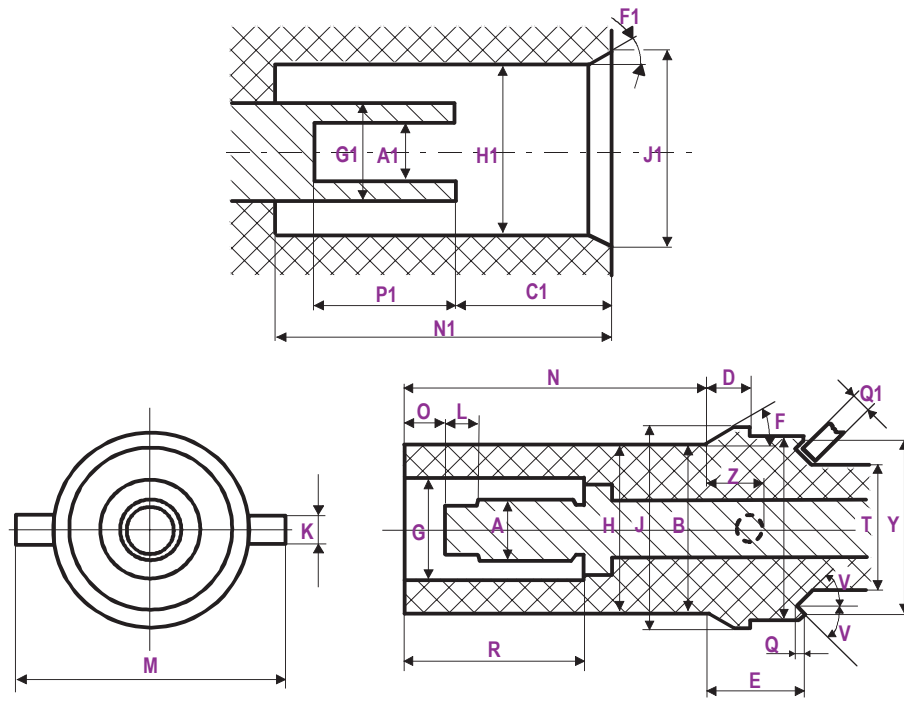
Appendix B - Schematic diagram of the train line on a vehicle



(1) The position of a junction box for the connection of the energy supply equipment to the train line shall be left to the discretion of the railways.

Appendix C - Train line - Coupling

Maximum and minimum dimensions for coupling sockets and connection plugs, which must always be adhered to when in use – Drawings and measures table.



Coupling socket

	nominal dimension	limit value
A1	∅25	a
C1	66	+2 -1
F1	30°	±1
G1	∅40	max.
H1	71	min.
J1	∅82	±0,7
N1	144	min.
Q1	7,5	±1
P1	60	min.

Connection plug

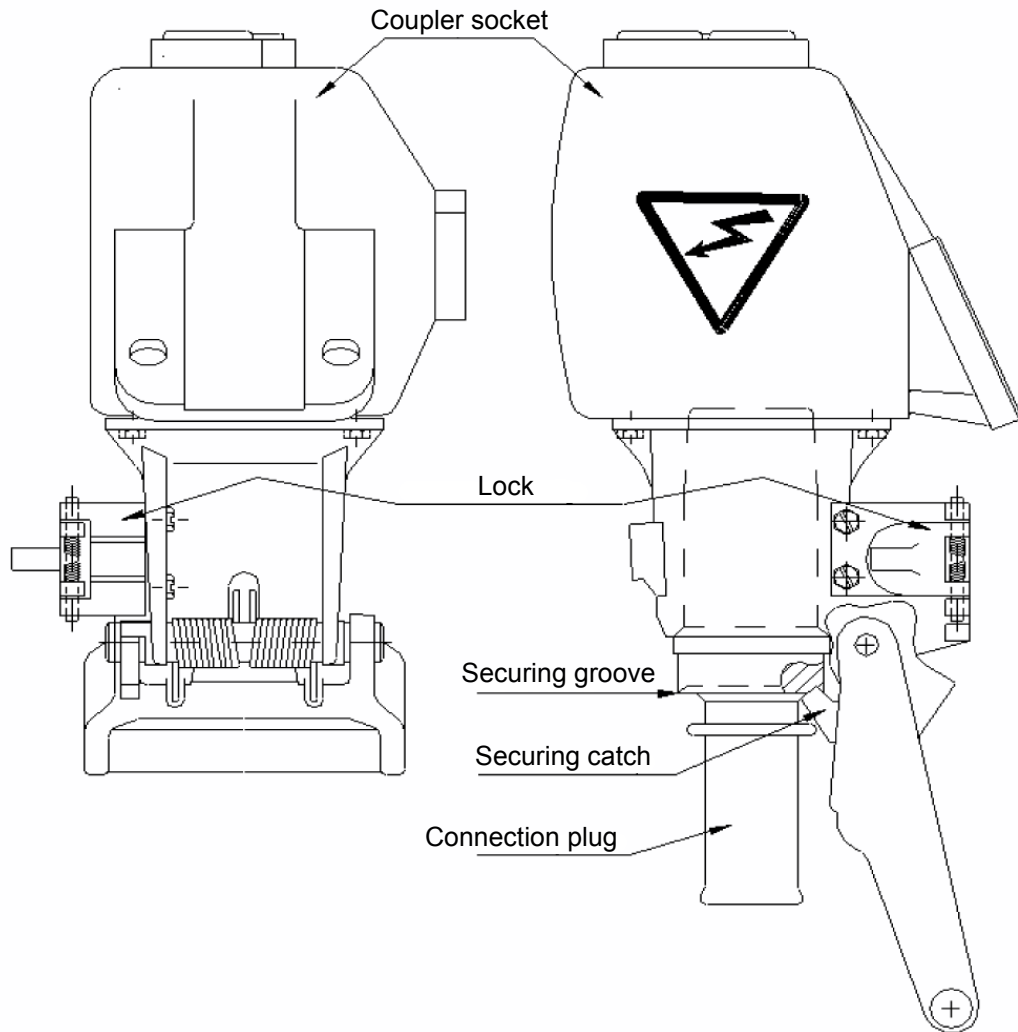
	nominal dimension	limit value		nominal dimension	limit value
A	∅25	+0,045 -0,040	L	14	+1 -0,5
B	∅72	±0,2	M	114	±2,5
C	∅80	+2 -1	N	130	±2
D	18	max.	O	18	±1
E	41	±0,1	Q	3,5	min.
F	30°	±1°	R	77	min.
G	∅42,5	min.	T	∅55	max.
H	∅70,3	max. ^b	V	45°	±1°
J	∅87	±2	Y	∅76	min.
K	∅12	+1 -0,5	Z	24	±1

a. In order that, when coupled, the resistance to current flow be as weak as possible, contact between socket and plug must be made by means of an elastic gripping device and obligatorily through the spring of the box; to this effect, it must be possible to open the socket clamps to a diameter of at least 25^{+0,05} mm and close them to at least 25^{-0,05} mm.

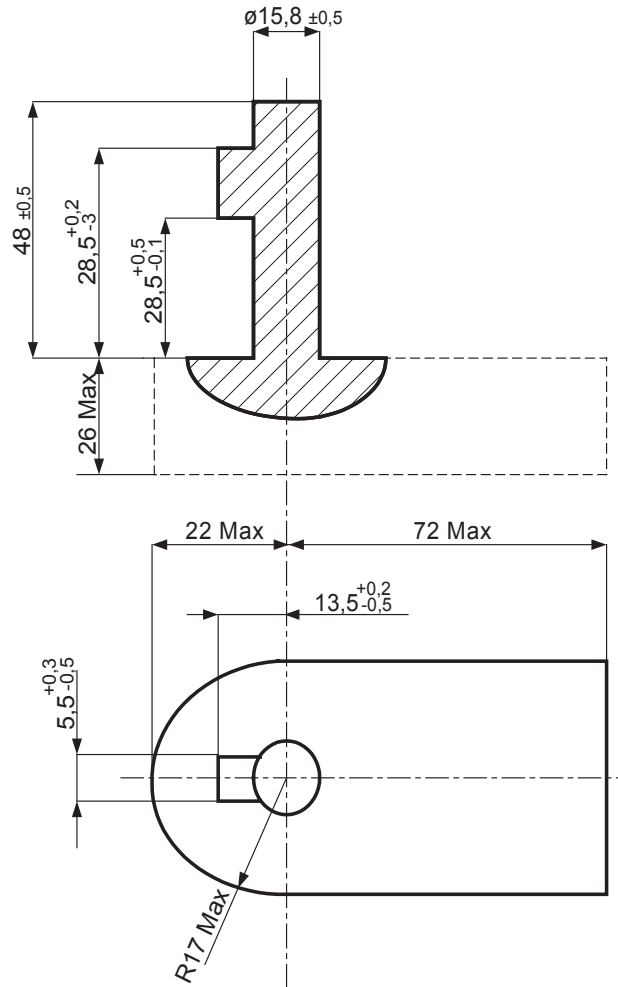
b. Outside diameter, including paint.

Appendix D - Coupling parts for the train line

D.1 - Securing the coupler plug in the coupler socket and example of a coupler socket with lock

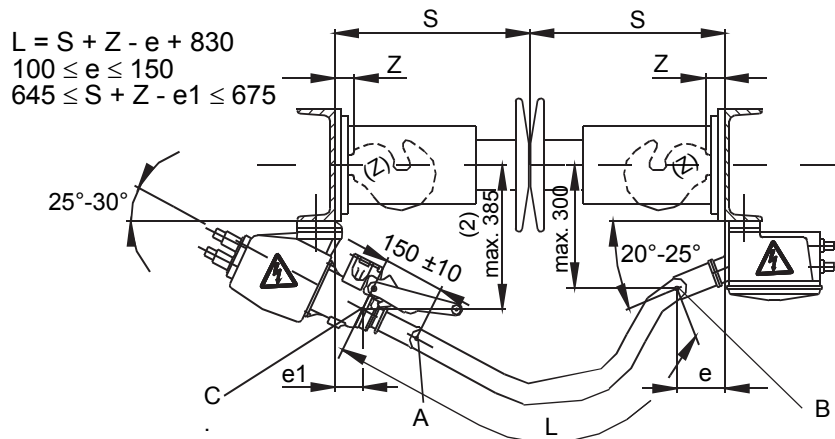


D.2 - Locking key: maximum size



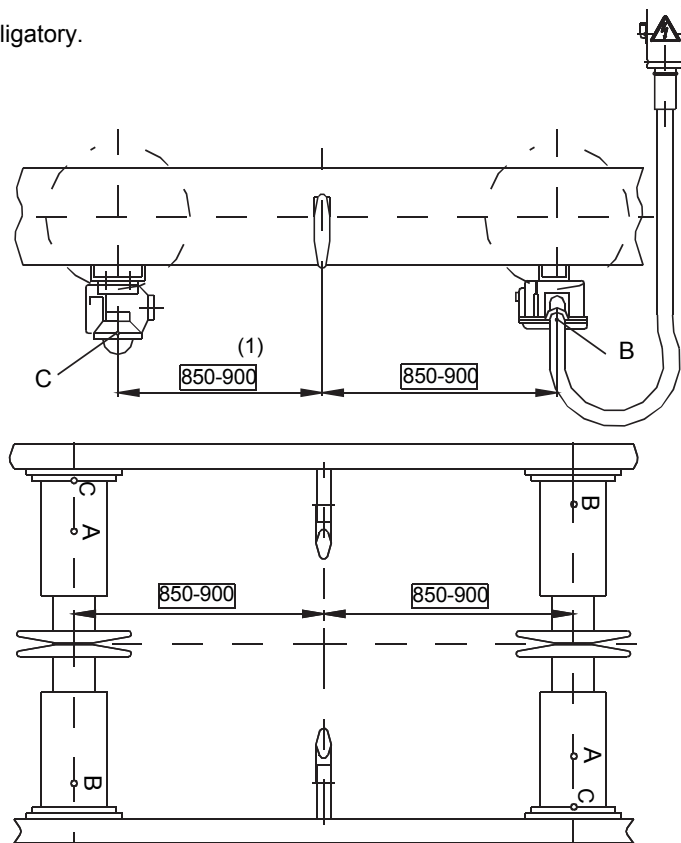
NB : The bit of the key which puts the locking system out of action must be fully retractable and, in all its positions, be fully determined by the internal dimensions of the key hole which itself is determined by the maximum permissible dimensions.

Appendix E - Coupling parts for the train line - Position of the couplings for the train line



- L : Length of the cable between points C and B
 - S : Distance of the buffer projection from buffer beam
 - Z : Draw-hook travel
 - e : Point B overhang: distance between the cable exit aperture on the cable-holder junction box and the headstock
 - e1 : Point C overhang: distance between the centre of the socket mouth and the head stock
- (1) : Tolerance of 850 to 1 100 on tractive stock
 - (2) : Tolerance of up to 410 on tractive stock

Dimensions are obligatory.



Appendix F - Train line / Power supply - Inscriptions

F.1 - Marking and inscriptions for passenger coaches

Particulars of the voltages for which the vehicle's electrical equipment has been designed shall be entered in the designated area of the right-hand section of the frame.

Particulars concerning each of the nominal voltages that cannot be used shall be replaced by a horizontal bar.

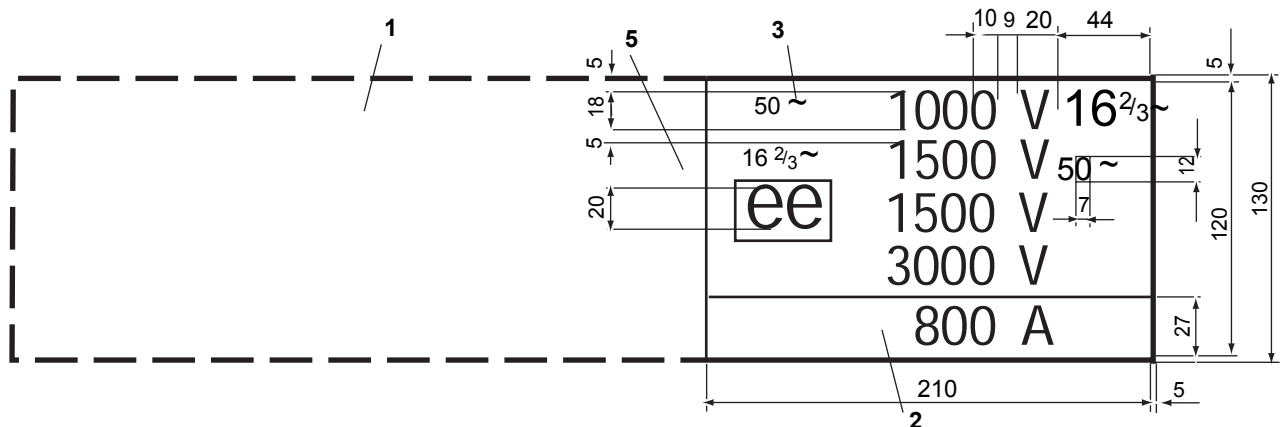


Fig. 1 - Vehicles with central electric energy supply through the train line to power-using installations, and more particularly to battery-charging equipment

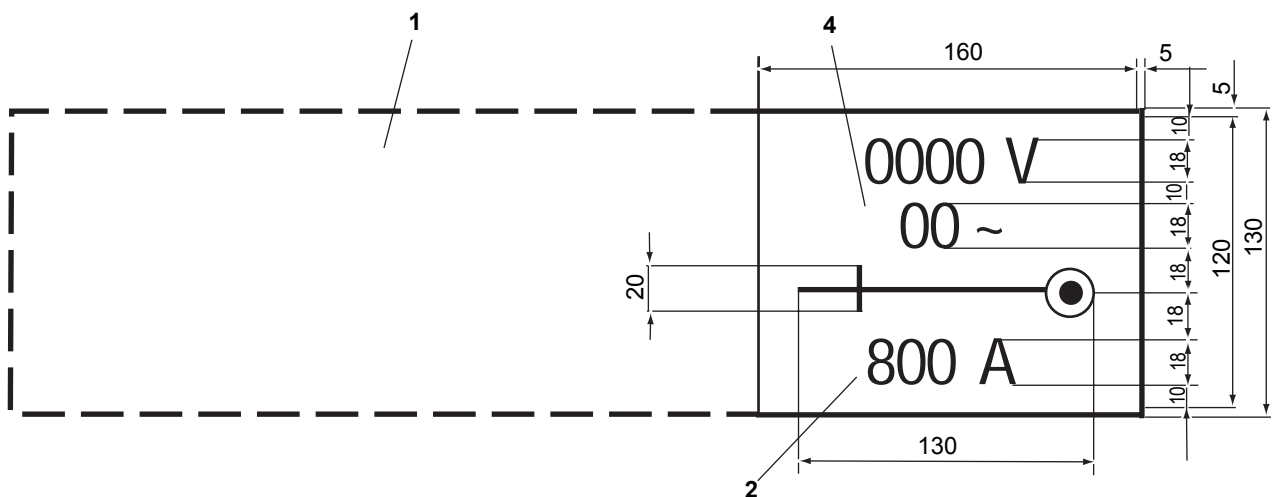


Fig. 2 - Vehicles fitted only with a continuous train line

Legende:

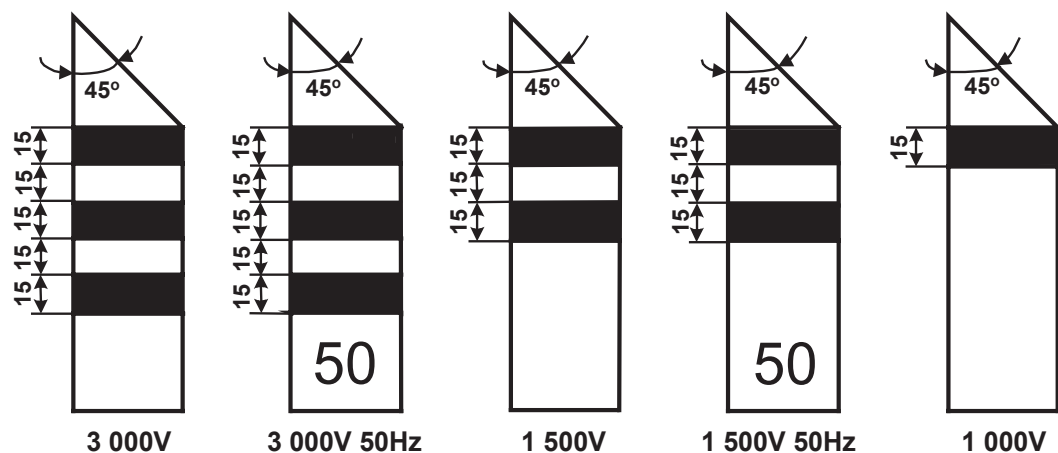
- 1 RIC inscription and maximum speed
- 2 For a train line for a current of 800 A, the indication shall be "800 A"
- 3 Only for vehicles capable of also being supplied under 1 000 V, 50 Hz
- 4 The indication ...V concerns the maximum nominal voltage for which the train line is designed. If the vehicle is not designed for 50 Hz a. c., the indication 50 Hz shall be replaced by a horizontal bar
- 5 Only for vehicles capable of also being supplied under 1 500 V, 16 2/3 Hz

F.2 - Marking and inscriptions for freight wagons

On the lower part of the corner posts and on each side of these posts, a light yellow rectangle about 200 mm long and of the same width as the corner post, shall be affixed; the upper part of the rectangle shall be cut off across the entire width, at an angle of about 45°, sloping towards the centre of the vehicle.

The yellow rectangle shall have one, two or three horizontal black stripes, 15 mm in width with the same distance of 15 mm between them, indicating that the train line is fitted for nominal voltage of 1 000, 1 500 or 3 000 volts.

On wagons fitted to run on electrified systems with an alternating current of 50 Hz, the number 50 shall be painted in black under the stripes, with figures about 35 mm high.



NB : On wagons which are not fitted with corner posts, it is recommended that the mandatory markings be affixed on a plate.

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3. International standards

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