

3rd edition, April 2004

*Translation*

# OR

## **Production of electrical power on diesel tractive units for supplying the train cable**

*Production d'énergie électrique à bord des engins moteurs diesel destinée à l'alimentation de la ligne de train*

*Elektrische Energieversorgung auf Dieseltriebfahrzeugen für die Versorgung von Wagen über die Zugsammelschiene*



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## Leaflet to be classified in Volumes :

V - Rolling Stock

VI - Traction

## Application :

With effect from 1 January 1995 for all diesel tractive units to be designed and for power generating equipment being rebuilt.

It is recommended that existing tractive units be adapted.

All members of the International Union of Railways

## Record of updates

**2nd edition, January 1995**

First issue

**3rd edition, April 2004**

Retyped in FrameMaker.

Important: the articles (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 becomes 1, 1 becomes 2, and so on). Please take account of this when using cross-references from other leaflets.

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

# Contents

Summary .....	1
1 - General - Field of application.....	2
2 - Power rating of the generating equipment .....	3
3 - Voltage and frequency of the power generating equipment.....	4
4 - Inductive loads .....	5
5 - Behaviour in the event of an outside short circuit .....	6
6 - Protection against power backfeed from the train cable .....	7
7 - Voltages surges on the train cable.....	8
Appendix A - Characteristic load line of the power generating equipment .....	9
Appendix B - Permissible voltage and frequency fluctuations in the power generating equipment of diesel tractive units .....	10
Appendix C - Power factor .....	11
Bibliography .....	12

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## Summary

This leaflet applies to diesel tractive units that haul passenger stock, the electrical power for which is supplied from the train cable, and that is freely used in international traffic. The purpose of this leaflet is to ensure compatibility, as far as the electrical power supply is concerned, between diesel tractive units and coaches. It also applies by analogy to generator vans.

It contains the general requirements with which generating equipment serving the train cable of diesel tractive units shall comply. Railways, however, remain free to determine the design of the technical equipment.

## 1 - General - Field of application

**1.1** - This leaflet applies to diesel tractive units that haul passenger stock, the electrical power for which is supplied from the train cable, and that is freely used in international traffic. The purpose of this leaflet is to ensure compatibility, as far as the electrical power supply is concerned, between diesel tractive units and coaches. It also applies by analogy to generator vans.

**1.2** - It contains the general requirements with which generating equipment serving the train cable of diesel tractive units shall comply. Railways, however, remain free to determine the design of the technical equipment.

- **1.3** - As regards the effect the return current may have on signalling installations, the use in international traffic of diesel tractive units supplying the train cable shall be governed by bilateral agreements between the railways concerned.

## 2 - Power rating of the generating equipment

- **2.1** - The nominal power of the power generating equipment should be adjusted to the power rating of the diesel tractive unit, taking account of the permissible consumption by coaches of power from the train cable (*UIC Leaflet 550* (see [Bibliography - page 12](#))). The overload capacity of the power generating equipment may be deduced from the lower voltage tolerances at  $0,8 U_{nom}$ . The overload

factor  $\ddot{U} = \frac{U_{I_{nom}} \times I_{rupt}}{U_{I_{nom}} \times U_{I_{nom}}}$  (parameters defined in [Appendix A - page 9](#)) should be greater than 1,2.

- **2.2** - When the train cable is energised, the power generating equipment should be capable of providing power to a trainset with resistive loads only up to the nominal value stipulated with no turn-on delay in the coaches.

**2.3** - When outside temperatures are  $> 15^{\circ}\text{C}$ , the power drawn by a rake of coaches falls as shown in *UIC Leaflet 552, Appendix A*. The power generating equipment of diesel tractive units may take account of this.

### 3 - Voltage and frequency of the power generating equipment

**3.1** - The power generating equipment should supply one of the nominal voltages indicated in *UIC Leaflet 550, Plate 1*.

**3.2** - The voltages and frequencies may vary in accordance with the values given in Appendix B - page 10.

**3.3** - When load fluctuations occur within the nominal power, the power generating equipment should remain within the voltage and frequency limits shown in Appendix B and should not cut out.

**3.4** - Where alternating current is concerned, sinusoidal, or even rectangular, wave forms is acceptable. For non-sinusoidal wave patterns, voltage peaks  $> 1,5 \times U_{max}$  over a period equal to 3 % of the duration of the nominal period shall not be allowed on the up and down shoulders of the wave. Voltage drops of a maximum of 5 % of the nominal voltage shall be allowed within each half-wave for a period of 2 % of the nominal period.

**3.5** - To guarantee incident-free operation of the circuitry in coaches, the gap between two semi-oscillations should be at least 1 ms for a nominal voltage of 1 000 V, in the case of rectangular wave forms. For a nominal voltage of 1 500 V, the gap should be at least 2 ms.

**3.6** - With alternating current, the percentage of the direct current voltage component for a load of  $\geq 5$  % of the nominal voltage (S max. in accordance with the figure in Appendix C - page 11) must not exceed the value of 0,2 %. The direct current voltage component calculated over two consecutive periods must not exceed 1 % (not applicable in the event of changes in dynamic load in accordance with point 2.3 - page 3).

**NB** : The percentage of the direct current voltage component  $U_{Gf}$  is defined by:

$$U_{Gf} = \frac{\frac{1}{T} \int u(x) dx}{U_{eff}} \times 100 \%$$

Where the integration time T corresponds to 10 periods.

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## ○ 4 - Inductive loads

4.1 - It must be possible to supply inductive loads in accordance with *UIC Leaflet 550*.

4.2 - The power generating equipment must be able to supply power at any point in the cross-hatched area of the power factor-load diagram (see [Appendix C - page 11](#)).



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## 5 - Behaviour in the event of an outside short circuit

In order to be certain that the 100 A high voltage fuse will trigger in the event of a short circuit in the equipment of coaches connected to the train cable, the power generating equipment must be capable of providing a 500 A current for a period of 500 ms without the internal safety equipment triggering first. This requirement shall only apply in the case of power generating equipment with a nominal voltage of 1 000 V.

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## **6 - Protection against power backfeed from the train cable**

It must not be possible for the power supply equipment to be connected up to an energised train cable, for example in cases where the vehicle fleet is supplied with power from a power generating station when stabled in readiness for service.

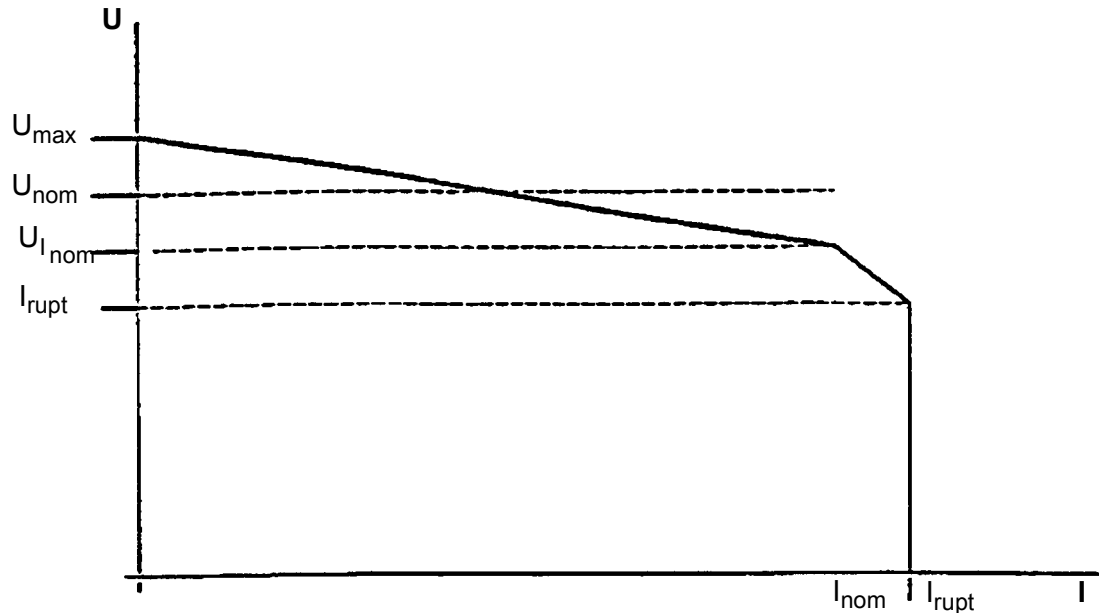
## 7 - Voltages surges on the train cable

Power generating equipment should be protected against voltage surges which may originate from the train cable as a result, for instance, of switching operations, load changes or the tripping of fuses in coaches. These surges may attain the values shown in *UIC Leaflet 550, Plates 4.1 to 4.4*.

When designing power generating equipment protection against overvoltages from the train cable, account should be taken of the following overvoltage values as a minimum:

- for alternating current voltages, up to 2,5 times the peak value of the nominal voltage;
- for direct current voltages, 4 times the nominal voltage (the values for the power content of voltage surges will be set later).

## Appendix A - Characteristic load line of the power generating equipment



$I_{nom}$  Nominal current of the power generating equipment

$I_{rupt}$  Cut-off current of the power generating equipment under overload

$U_{nom}$  Nominal voltage of the power generating equipment

$U_{max}$  Maximum voltage of the power generating equipment off-load  
 $U_{max} < U_{max_2}$  from Appendix B - page 10

$U_{I_{nom}}$  Voltage of the power generating equipment for nominal current flow

$U_{I_{rupt}}$  Voltage of the power generating equipment for which, in the event of overload, the cut-off current  $I_{rupt}$  is reached

$$U_{I_{rupt}} \geq 0,8 U_{nom}$$

## Appendix B - Permissible voltage and frequency fluctuations in the power generating equipment of diesel tractive units

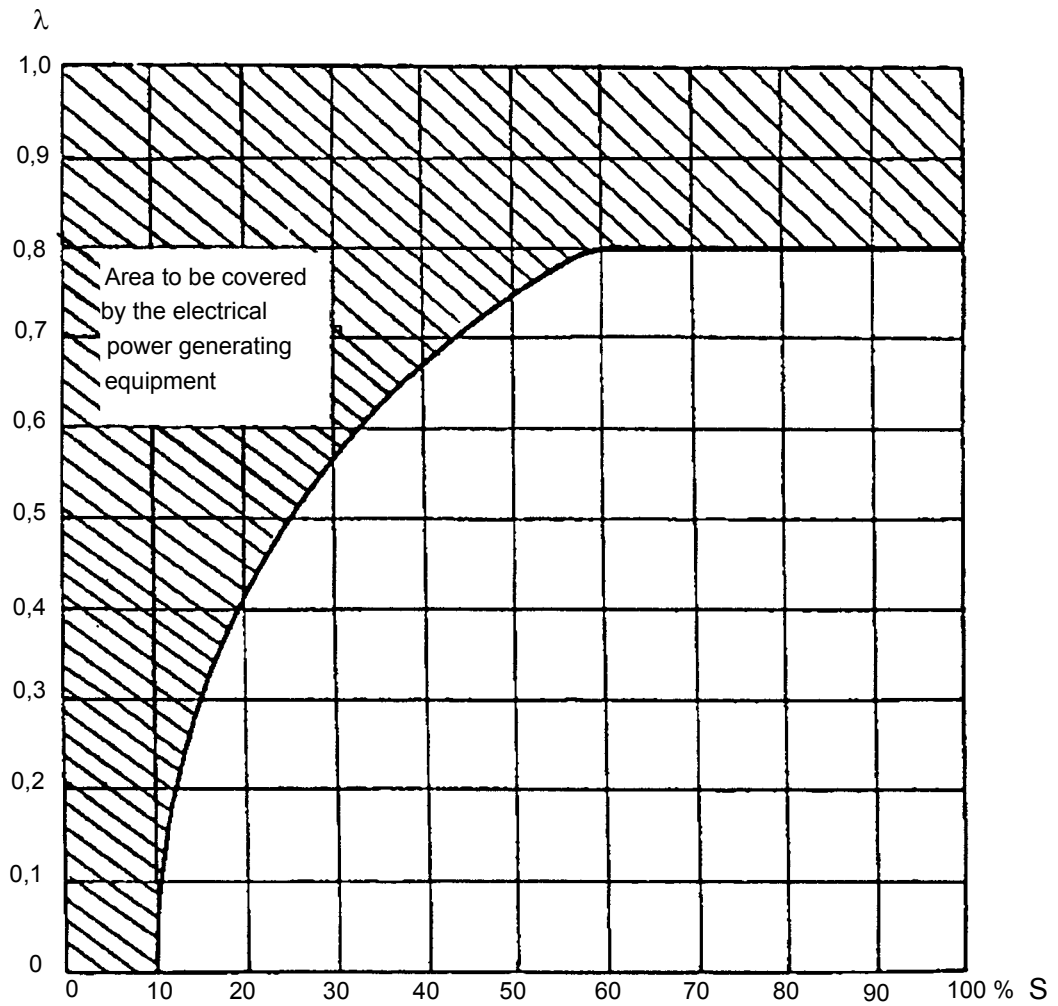
Minimum voltage in the train cable		Nominal voltage $U_{nom}$ (V)  Nominal frequency $f_{nom}$ (Hz)	Maximum voltage in the train cable	
up to max. 30 s  $U_{min_2}$ (V)	possible permanently  $U_{min_1}$ (V)		possible permanently  $U_{max_1}$ (V)	up to max. 5 min  $U_{max_2}$ (V) <sup>a</sup>
700	800	1 000	1 150	1 200
		16 2/3		
1 050	1 140	1 500	1 650	1 740
		50		
900	1 100	1 500	1 800	1 950
1 800	2 000	3 000	3 600	3 900

a. The voltages shown are in accordance with UIC Leaflet 550, Plate 1. They are, however, not to be used for working out the power rating of generating equipment.

Nominal frequency $f_{nom}$ (Hz)	Frequency fluctuations (Hz)
16 2/3	16 - 17,5
50	48 - 52

## Appendix C - Power factor

Power factor  $\lambda = f(S)$



# Bibliography

## 1. UIC leaflets

### **International Union of Railways (UIC)**

*UIC Leaflet 550: Power supply installations for passenger stock*, 10th edition of 1.1.97

*UIC Leaflet 552: Electric power supply for trains - Standard technical characteristics of the train bus*, 9th edition of 1.1.97

*UIC Leaflet 600: Electric traction with aerial contact line*, 4th edition, November 2003

*UIC Leaflet 622: Definition of the nominal power of locomotives and railcars fitted with internal combustion engines*, 4th edition of 1.7.80

*UIC Leaflet 623-1: Approval procedures for the diesel engines of motive power units*, 2nd edition of 1.7.97

*UIC Leaflet 623-2: Approval tests for diesel engines of motive power units*, 2nd edition of 1.7.97 and Erratum of 1.1.99

*UIC Leaflet 623-3: Series test and acceptance conditions for diesel engines of motive power units*, 3rd edition, December 2003

## 2. Minutes of meetings

### **International Union of Railways (UIC)**

*Traction and Rolling Stock Committee (Question 5/R/FIC - Item 7.1 - Revision of leaflets)*, May 1994

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