

# TECHNICAL REPORT



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## Environmental conditions – Vibration and shock of electrotechnical equipment – Part 5: Equipment during storage and handling



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## Environmental conditions – Vibration and shock of electrotechnical equipment – Part 5: Equipment during storage and handling

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

ICS 19.040

ISBN 978-2-8322-2815-9

**Warning! Make sure that you obtained this publication from an authorized distributor.**

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**ENVIRONMENTAL CONDITIONS – VIBRATION  
AND SHOCK OF ELECTROTECHNICAL EQUIPMENT –****Part 5: Equipment during storage and handling**

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IEC TR 62131-5, which is a technical report, has been prepared by IEC technical committee 104: Environmental conditions, classification and methods of test.

The text of this technical report is based on the following documents:

Enquiry draft	Report on voting
104/620A/DTR	104/639/RVC

Full information on the voting for the approval of this technical report can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all the parts in the IEC 62131 series, under the general title *Environmental conditions – Vibration and shock of electrotechnical equipment*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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# ENVIRONMENTAL CONDITIONS – VIBRATION AND SHOCK OF ELECTROTECHNICAL EQUIPMENT –

## Part 5: Equipment during storage and handling

### 1 Scope

IEC TR 62131-5, which is a technical report, reviews the available dynamic data relating to the handling of electrotechnical equipment. The intention is that from all the available data an environmental description will be generated and compared to that set out in the IEC 60721 series.

For each of the sources identified, the quality of the data is reviewed and checked for self consistency. The process used to undertake this check of data quality and that used to intrinsically categorize the various data sources is set out in IEC TR 62131-1.

This technical report primarily addresses data extracted from a number of different sources for which reasonable confidence exist in its quality and validity. The report also reviews some data for which the quality and validity cannot realistically be verified. These data are included to facilitate validation of information from other sources. The report clearly indicates when utilising information in this latter category.

This technical report addresses data from a number of data gathering exercises. The quantity and quality of data in these exercises varies considerably as does the range of conditions encompassed.

Not all of the data reviewed were made available in electronic form. To permit comparison to be made, in this assessment, a quantity of the original (non-electronic) data has been manually digitized.

### 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60068 (all parts), *Environmental testing*

IEC 60068-2-27, *Environmental testing – Part 2-27: Tests – Test Ea and guidance: Shock*

IEC 60068-2-29<sup>1</sup>, *Environmental testing – Part 2-29: Tests – Test Eb Bump*

IEC 60068-2-64, *Environmental testing – Part 2-64: Tests – Test Fh: Vibration, broadband random and guidance*

IEC 60721 (all parts), *Classification of environmental conditions*

IEC 60721-3-2:1997, *Classification of environmental conditions – Part 3: Classification of groups of environmental parameters and their severities – Section 2: Transportation*

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<sup>1</sup> Withdrawn and now incorporated into IEC 60068-2-27.

IEC TR 60721-4-2, *Classification of environmental conditions – Part 4-2: Guidance for the correlation and transformation of environmental condition classes of IEC 60721-3 to the environmental tests of IEC 60068 – Transportation*

IEC TR 62131-1, *Environmental conditions – Vibration and shock of electrotechnical equipment – Part 1: Process for validation of dynamic data*

IEC TR 62131-2, *Environmental conditions – Vibration and shock of electrotechnical equipment – Part 2: Equipment transported in fixed wing jet aircraft*

IEC TR 62131-3, *Environmental conditions – Vibration and shock of electrotechnical equipment – Part 3: Equipment transported in rail vehicles*

IEC TR 62131-4, *Environmental conditions – Vibration and shock of electrotechnical equipment – Part 4: Equipment transported in road vehicles*

### **3 Data source and quality**

#### **3.1 Container handling measurements by Hoppe and Gerock**

Work by Hoppe and Gerock was undertaken in the early 1970s and the resultant data are reproduced in a number of publications (see [1])<sup>2</sup>.

Those data appear to have formed the basis for the road transportation severities in a number of national standards. Moreover, as far as can be identified, they are probably the original basis for the severities in IEC 600721-3-2. As the measured data also include a number of handling conditions, it is likely they were also considered in setting such severities. Although the measured data presented are limited, the scope of the measurements is sufficient to justify their inclusion here.

The Hoppe and Gerock work relating to handling, involved vibration and shock measurements on ISO containers at the container terminal, Hamburg/Burchardkai, during both in-yard transport and handling. The measurements included both 6 m (20 foot) and 12 m (40 foot) units when empty and loaded. Loaded 6 m and 12 m containers were also transferred onto a container train by means of a gantry crane. Dock side to ship measurements were made on loaded 6 m containers only.

Acceleration measurements were made at six locations within the containers; door end centre (in three orthogonal axes), door end right hand side (vertical only), centre of container (vertical only) and at the forward wall centre (vertical only). All six measurements were recorded simultaneously and continuously on an analogue FM recorder. The frequency range covered was 1 Hz to 1 250 Hz. All PSD analysis was undertaken using a 3 Hz frequency resolution and a record duration of 32 s.

The ISO containers used comprised steel framed structures with plywood walls with roofs reinforced with laminated fibreglass. The 6 m container was manufactured in 1969/70, it had an empty mass of 1 950 Kg and a loaded mass of 20 320 Kg. The 12 m containers were manufactured in 1970/71, had an empty mass of 3 490 Kg and a loaded mass of 30 480 Kg.

The container vibration measurements made during movement around the container terminal are summarised in Table 1. The measurements were found to contain predominant resonances associated with the suspension of the straddle or van carrier used to undertake the movements (typically at between 2 Hz to 3 Hz), the spreader used to support the container (6 Hz to 7 Hz)

<sup>2</sup> Numbers in square brackets refer to the Bibliography.