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TECHNICAL REPORT

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Mechanical structures for electrical and electronic equipment – Dimensions of mechanical structures of the 482,6 mm (19 in) series
Part 3-1: Technological schemes and applications

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Part 3-1: Technological schemes and applications

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

MECHANICAL STRUCTURES FOR ELECTRICAL AND ELECTRONIC EQUIPMENT – DIMENSIONS OF MECHANICAL STRUCTURES OF THE 482,6 mm (19 in) SERIES

Part 3-1: Technological schemes and applications

FOREWORD

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IEC TR 60297-3-1 has been prepared by subcommittee 48D: Mechanical structures for electrical and electronic equipment, of IEC technical committee 48: Electrical connectors and mechanical structures for electrical and electronic equipment. It is a Technical Report.

The text of this Technical Report is based on the following documents:

Draft	Report on voting
48D/756/DTR	48D/757/RVDTR

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

The language used for the development of this Technical Report is English.

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This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

A list of all parts in the IEC 60297 series, published under the general title *Mechanical structures for electrical and electronic equipment – Dimensions of mechanical structures of the 482,6 mm (19 in) series*, can be found on the IEC website.

Future documents in this series will carry the new general title as cited above. Titles of existing documents in this series will be updated at the time of the next edition.

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INTRODUCTION

The IEC 60297 series contains dimensional definitions of the entire mechanical structure layers from level 1 to level 4 for electrical and electronic equipment practices. Nowadays, the IEC 60917-1 generic standard defines all the elements and components in the mechanical structure layers from level 1 to level 4, and they are adopted for the IEC 60917-2 (metric) series. The original concept of the mechanical structure layers was established in DIN 41494 and introduced into the former IEC 297 series, later republished as the IEC 60297 series. Therefore, the second edition of IEC 60917-1:2019 (generic) categorizes the existing IEC 60297 series as a "conventional standard (legacy system)", which contains the detail dimensions of the structure levels from level 1 to level 4 as well as the structure levels of the IEC 60917-2 series (metric).

Applications of the IEC 60297 series are divided into two different perceptions by the users:

a) the traditional 19-inch racks and chassis configurations, and

b) the 19-inch subrack system.

The latter has been providing effective and rational solutions for the critical issues on interconnection and packaging for electronic equipment, which have been in a close relationship with the IEC connector standards of IEC SC 48B, in the microelectronics era since the 1960s.

In the 1980s, the 19-inch subrack system was adopted as the mechanical specifications for open computer bus standards in the IEEE and other manufacturers' associations or industrial consortia. In such fields, not only newly developed high-performance connectors have been applied, but also advanced mechanical features have been developed, based on the 19-inch subrack system. These new technologies have been standardized, and their efforts considered as development for extended specifications for the 19-inch subrack system in IEC SC 48D.

From these points of view, this Technical Report has been prepared to provide the following information, not only for users of the IEC 60297 series standards, but also for the engineers who will develop new architectures or hardware for advanced ICT equipment or systems for the current IoT or Industry 4.0 era:

– information on technological schemes of the IEC 60297 series standards, which have been in development for over 40 years in IEC TC 48/SC 48D. (In the market for industrial electronics and information and communication technology (ICT), there are active users who take the two different approaches regarding the application or adoption of the technologies from the IEC 60297 series standards);

– the technological background of the standards, and the principles or concepts, which had been adopted to cope with the technological evolutions through the development process of the IEC 60297 series standards in IEC SC 48D;

– in standardization for mechanical structures for electrical and electronic equipment in IEC SC 48D, IEC 60917-1 has been published as the generic standard for modular order for the development of mechanical structures for electrical and electronic equipment practices. The IEC 60297 series also considered that the dimensions of the mechanical structure are partly in accordance with IEC 60917-1. This document clarifies the relationship between the IEC 60917 series and the IEC 60297 series;

– to introduce the domain of each part of the IEC 60297 series for structures for electrical and electronic equipment.

Annex A introduces applicable connectors for the 19-inch subrack system, including newly developed high-performance connectors which are not (yet) published as IEC SC 48B standards.

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Annex B introduces relationships and compatibilities between the 19-inch subrack system standards in IEC SC 48D, the IEEE standards for the 19-inch subrack and plug-in units, and other industrial standards for the mechanical specifications. It also shows outlines of the extended mechanical features adopted for the 19-inch subrack system. These features include the implementations of the mezzanine cards and the conduction cooled system, and they are not yet defined in IEC SC 48D standards.

Through the study of the additional information given in Annex A and Annex B, further prospects on applications of the 19-inch subrack system will be seen, and the directions of the next standards development in IEC TC 48/SC 48D will be provided.

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MECHANICAL STRUCTURES FOR ELECTRICAL AND ELECTRONIC EQUIPMENT – DIMENSIONS OF MECHANICAL STRUCTURES OF THE 482,6 mm (19 in) SERIES

Part 3-1: Technological schemes and applications

1 Scope

This part of IEC 60297 provides information on the technological schemes of the IEC 60297 series, and shows how to apply the 19-inch series standards for the mechanical structure practices for electrical and electronic equipment.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60297-3-100:2008, *Mechanical structures for electronic equipment – Dimensions of mechanical structures of the 482,6 mm (19 in) series – Part 3-100: Basic dimensions of front panels, subracks, chassis, racks and cabinets*

IEC 60297-3-101:2004, *Mechanical structures for electronic equipment – Dimensions of mechanical structures of the 482,6 mm (19 in) series – Part 3-101: Subracks and associated plug-in units*

IEC 60297-3-102:2004, *Mechanical structures for electronic equipment – Dimensions of mechanical structures of the 482,6 mm (19 in) series – Part 3-102: Injector/extractor handle*

IEC 60297-3-103:2004, *Mechanical structures for electronic equipment – Dimensions of mechanical structures of the 482,6 mm (19 in) series – Part 3-103: Keying and alignment pin*

IEC 60297-3-104:2006, *Mechanical structures for electronic equipment – Dimensions of mechanical structures of the 482,6 mm (19 in) series – Part 3-104: Connector dependent interface dimensions of subracks and plug-in units*

IEC 60297-3-105:2008, *Mechanical structures for electronic equipment – Dimensions of mechanical structures of the 482,6 mm (19 in) series – Part 3-105: Dimensions and design aspects for 1U high chassis*

IEC 60297-3-106:2010, *Mechanical structures for electronic equipment – Dimensions of mechanical structures of the 482,6 mm (19 in) series – Part 3-106: Adaptation dimensions for subracks and chassis applicable with metric cabinets or racks in accordance with IEC 60917-2-1*

IEC 60297-3-107:2012, *Mechanical structures for electronic equipment – Dimensions of mechanical structures of the 482,6 mm (19 in) series – Part 3-107: Dimensions of subracks and plug-in units, small form factor*

IEC 60297-3-108:2014, *Mechanical structures for electronic equipment – Dimensions of mechanical structures of the 482,6 mm (19 in) series – Part 3-108: Dimensions of R-type subracks and plug-in units*

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IEC 60297-3-109:2015, *Mechanical structures for electrical and electronic equipment – Dimensions of mechanical structures of the 482,6 mm (19 in) series – Part 3-109: Dimensions of chassis for embedded computing devices*

IEC 60297-3-110:2018, *Mechanical structures for electrical and electronic equipment – Dimensions of mechanical structures of the 482,6 mm (19 in) series – Part 3-110: Residential racks and cabinets for smart houses*

IEC 60603-2, *Connectors for frequencies below 3 MHz for use with printed boards – Part 2: Detail specification for two-part connectors with assessed quality, for printed boards, for basic grid of 2,54 mm (0,1 in) with common mounting features*

IEC 60917-1, *Modular order for the development of mechanical structures for electrical and electronic equipment practices – Part 1: Generic standard*

IEC 60917-2:1992, *Modular order for the development of mechanical structures for electronic equipment practices – Part 2: Sectional specification – Interface co-ordination dimensions for the 25 mm equipment practice*

IEC 60917-2-1:1993, *Modular order for the development of mechanical structures for electronic equipment practices – Part 2: Sectional specification – Interface co-ordination dimensions for the 25 mm equipment practice – Section 1: Detail specification – Dimensions for cabinets and racks*

IEC 60917-2-2:1994, *Modular order for the development of mechanical structures for electronic equipment practices – Part 2: Sectional specification – Interface co-ordination dimensions for the 25 mm equipment practice – Section 2: Detail specification – Dimensions for subracks, chassis, backplanes, front panels and plug-in units*

IEC 61076-4-100, *Connectors for electronic equipment – Part 4-100: Printed board connectors with assessed quality – Detail specification for two-part connector modules having a grid of 2,5 mm for printed boards and backplanes*

IEC 61076-4-101, *Connectors for electronic equipment – Part 4-101: Printed board connectors with assessed quality – Detail specification for two-part connector modules, having a basic grid of 2,0 mm for printed boards and backplanes in accordance with IEC 60917*

IEC 61076-4-113, *Connectors for electronic equipment – Printed board connectors – Part 4-113: Detail specification for two-part connectors having 5 rows with a grid of 2,54 mm for printed boards and backplanes in bus applications*

IEC 61076-4-116, *Connectors for electronic equipment – Product requirements – Part 4-116: Printed board connectors – Detail specification for a high-speed two-part connector with integrated shielding function*

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at https://www.electropedia.org/
- ISO Online browsing platform: available at https://www.iso.org/obp

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4 Technological scheme of the IEC 60297 series

4.1 Development history and technological background

4.1.1 General

This Subclause 4.1 introduces the history of the development and the applications of the IEC 60297-X series in IEC SC 48D.

The initial standards of the IEC 60297-X series[1] were published at the beginning of the 1980s. Before the publication of IEC standards, there was the EIA 19-inch rack standard (ANSI/EIA RS310-C 1971 *Rack, Panels and Associated Equipment*[2]), and the combination of 19-inch racks or cabinets and 19-inch chassis (modular chassis) in accordance with the EIA standard had been used broadly for telecommunication, instrumentation, and other electronic equipment in many countries. This model is still being applied to current IT equipment, servers, etc., which are mounted within the 19-inch racks/cabinets in datacentres. It is the traditional 19-inch rack and chassis configuration of the 482,6 mm (19 in) standard series.

IEC 60297-3[3] was published in 1984. This standard was developed by DIN and IEC SC 48D under the following circumstances.

4.1.2 Development of the 482,6 mm (19 in) subracks and associated plug-in units (19-inch subrack system)

In the middle of the 1960s, to cope with the expanding adoption of printed boards (PBs) in the fields of industrial electronics and telecommunication equipment, the development of a mechanical structure for housing PBs in a rack started in Germany. The dimensions of the rack and chassis were adopted from the 19-inch EIA standard, and the following development concept was established to mount the PBs into the 19-inch modular chassis as the structure of 482,6 mm (19 in) subracks and associated plug-in units.

Electronic equipment for telecommunication or industrial uses is required to obtain reliability, compatibility and interchangeability for easy maintenance. In such electronic equipment, in the case where one electronic system consists of multiple PCBs (functional units/sub-systems, they are interconnected in one chassis), its hardware should adopt the mechanical structure described above. And, the mechanical structure, 482,6 mm (19 in) subracks and associated plug-in units, shall be designed based on the following principles.

- The sizes of PBs of plug-in units are unified and based on the height and depth of the accommodated subracks.
- The adopted connectors on the PBs of plug-in units are unified and standardized to establish the interconnection between plug-in units (via a backplane or wire-wrap[4], which is a cable-connecting technology between tail pins of fixed connectors on the backside of a subrack).
- The plug-in units are placed vertically in the subracks to promote convective air flow for heat dissipation.

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1 The main parts of the IEC 60297-X series were published in the 1980s. IEC 60297-1:1986 and IEC 60297-2:1982 were merged into IEC 60297-3-100:2008.

2 The standard defines a flange width of 19 in (482,6 mm) and a height pitch of 1U = 1,75 in (44,45 mm) for mounting the chassis to the rack.

3 IEC 60297-3:1984 was replaced by IEC 60297-3-101:2004.

4 Wrapped connections are described in IEC 60352-1.

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