# UL 60079-31

Explosive Atmospheres – Part 31: Equipment Dust Ignition Protection by Enclosure “t”

UL Standard for Safety for Explosive Atmospheres – Part 31: Equipment Dust Ignition Protection by Enclosure “t”, UL 60079-31

Second Edition, Dated June 12, 2015

***Summary of Topics***

***This revision of ANSI/UL 60079-31 dated August 13, 2020 is being issued to update the title page to reflect the reaffirmation of its ANSI approval. No changes in requirements have been made.***

***This is an Adoption of IEC 60079-31, Explosive Atmospheres – Part 31: Equipment Dust Ignition Protection by Enclosure “t” (second edition issued November 2013) as an IEC-based UL standard, UL 60079-31 (IEC 60079-31:2013), with US National Differences.***

Although this is the first-time publication of this Standard by UL and ISA, it is being published as the Second edition in order to align UL’s and ISA’s edition numbers with that of the IEC Standard. As a result, one or more UL edition numbers have been skipped to match that of the IEC edition number.

The requirements are substantially in accordance with Proposal(s) on this subject dated May 29, 2020.

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**ISA – The International Society of Automation**
**ANSI/ISA 60079-31-2015 (R2020)**
**Second Edition**

**Underwriters Laboratories Inc.**
**UL 60079-31**
**Second Edition**

# Explosive Atmospheres – Part 31: Equipment Dust Ignition Protection by Enclosure "t"

June 12, 2015

(Title Page Reprinted: August 13, 2020)



**ANSI/UL 60079-31-2015 (R2020)**

**Commitment for Amendments**

This standard is issued jointly by the International Society of Automation (ISA) and Underwriters Laboratories Incorporated (UL). Comments or proposals for revisions on any part of the standard may be submitted to UL at any time. Revisions to this standard will be made only after processing according to the standards development procedures of UL. ISA and UL will issue revisions to this standard by means of a new edition or revised or additional pages bearing their date of issue.



The most recent designation of ANSI/ISA 60079-31 as an American National Standard (ANSI) occurred on August 13, 2020.



This ANSI/UL Standard for Safety consists of the Second Edition including revisions through August 13, 2020. The most recent designation of ANSI/UL 60079-31 as a Reaffirmed American National Standard (ANS) occurred on August 13, 2020. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, Title Page (front and back), or the Preface. The National Difference Page and IEC Foreword are also excluded from the ANSI approval of IEC-based standards. Any other portions of this ANSI/UL standard that were not processed in accordance with ANSI/UL requirements are noted at the beginning of the impacted sections.

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## CONTENTS

No Text on This Page

# General Notes

This UL Standard is based on IEC Publication 60079-31: second edition Explosive Atmospheres – Part 31: Equipment Dust Ignition Protection by Enclosure “t”. IEC publication 60079-31 is copyrighted by the IEC.

Efforts have been made to synchronize the UL edition number with that of the corresponding IEC standard with which this standard is harmonized. As a result, one or more UL edition numbers have been skipped to match that of the IEC edition number.

This is the common ISA and UL standard for Explosive Atmospheres – Part 31: Equipment Dust Ignition Protection by Enclosure “t”. It is the Second edition of ANSI/ISA-60079-31 and the Second edition of ANSI/UL 60079-31. The document is a modification of the IEC document and includes U. S. national differences encompassing both additions and deletions of information.

As the publication of this standard by UL is being done as a result of a simple reaffirmation of ISA’s currently published standard, National Differences are shown using ISA’s format. All future publications of this standard will show National Differences using UL’s format.

This common standard was prepared by the (ISA) – The International Society of Automation on June 12, 2015 but is now being maintained by Underwriters Laboratories Inc. (UL).

Note – Although the intended primary application of this Standard is stated in its Scope, it is important to note that it remains the responsibility of the users of the Standard to judge its suitability for their particular purpose.

**Level of harmonization**

This standard adopts the IEC text with national differences.

The requirements in this Standard are not presented in different formats by UL and ISA as this is a simple reaffirmation of an existing ISA standard. Therefore, the UL version of the standard is being published as the ISA version of the standard which illustrates the national differences from the IEC text through the use of legislative text (strike-out and underline).

**Interpretations**

The interpretation by the SDO of an identical or equivalent standard shall be based on the literal text to determine compliance with the standard in accordance with the procedural rules of the SDO. If more than one interpretation of the literal text has been identified, a revision shall be proposed as soon as possible to each of the SDOs to more accurately reflect the intent.

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## Preface (ISA)

The preface, as well as all footnotes and annexes, is included for information purposes and is not part of ANSI/ISA-60079-31-2015 (R2020).

This document has been prepared as part of the service of ISA toward a goal of uniformity in the field of instrumentation. To be of real value, this document should not be static but should be subject to periodic review.

The ISA Standards and Practices Department is aware of the growing need for attention to the metric system of units in general, and the International System of Units (SI) in particular, in the preparation of instrumentation standards. The Department is further aware of the benefits to USA users of ISA standards of incorporating suitable references to the SI (and the metric system) in their business and professional dealings with other countries. Toward this end, this Department will endeavour to introduce SI-acceptable metric units in all new and revised standards, recommended practices, and technical reports to the greatest extent possible. Standard for Use of the International System of Units (SI): The Modern Metric System, published by the American Society for Testing & Materials as IEEE/ASTM SI 10-97, and future revisions, will be the reference guide for definitions, symbols, abbreviations, and conversion factors.

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## National Differences

National Differences from the text of International Electrotechnical Commission (IEC) Publication 60079-31, Explosive atmospheres – Part 31: Equipment dust ignition protection by enclosure “t”, copyright 2013, are indicated by notations (differences) and are presented in bold text.

In the ISA publication of this standard, National Differences are presented using legislative text (strike-out and underline). The national difference type is identified in an informative annex.

There are five types of National Differences as noted below. The difference type is noted on the first line of the National Difference in the standard. The standard may not include all types of these National Differences.

The UL printed standard includes the national difference types within the body of the text. The ISA printed standard includes the national difference types in an annex at the back of the standard.

**D1 –** These are National Differences which are based on **basic safety principles and requirements**, elimination of which would compromise safety for consumers and users of products.

**D2 –** These are National Differences from IEC requirements based on existing **safety practices**. These requirements reflect national safety practices, where empirical substantiation (for the IEC or national requirement) is not available or the text has not been included in the IEC standard.

**DC –** These are National Differences based on the **component standards** and will not be deleted until a particular component standard is harmonized with the IEC component standard.

**DE –** These are National Differences based on **editorial comments or corrections**.

**DR –** These are National Differences based on the **national regulatory requirements**.

Each national difference contains a description of what the national difference entails. Typically one of the following words is used to explain how the text of the national difference is to be applied to the base IEC text:

***Addition / Add*** - An addition entails adding a complete new numbered clause, subclause, table, figure, or annex. Addition is not meant to include adding select words to the base IEC text.

***Deletion / Delete*** - A deletion entails complete deletion of an entire numbered clause, subclause, table, figure, or annex without any replacement text.

***Modification / Modify*** - A modification is an altering of the existing base IEC text such as the addition, replacement or deletion of certain words or the replacement of an entire clause, subclause, table, figure, or annex of the base IEC text.

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# FOREWORD

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

## EXPLOSIVE ATMOSPHERES – Part 31: Equipment dust ignition protection by enclosure “t”

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as “IEC Publication(s)”). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.

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8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.

9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 60079-31 has been prepared by IEC technical committee 31: Equipment for explosive atmospheres.

This second edition cancels and replaces the first edition published in 2008. This edition constitutes a technical revision.

The significance of changes between IEC 60079-31, Edition 2.0 (2012) and IEC 60079-31, Edition 1.0 (2008) (including Corrigendum) is as listed below:

| | | Type | | |
|---|---|---|---|---|
| **Changes** | **Clause** | **Minor and editorial changes** | **Extension** | **Major technical changes** |
| Document has been restructured from the first edition | Numerous | X | | |
| The marked maximum surface temperature shall be measured on the external surfaces of the enclosure and the surfaces of the internal components for equipment with types of protection “ta” | 4.3.2 | | | C1 |
| Additional protection for arcing and sparking parts for “ta” | 4.3.6 | | | C2 |
| Limiting the internal pressure test to enclosures where the seal is not physically constrained from moving. | 4.4.2 | | X | |
| Requirements for tapered threaded joints without an additional seal or gasket added. | 5.1.2 | | X | |
| Requirements for cable gland aligned for all levels and Groups the only difference is now the required IP protection | 5.2 | X | | |
| Requirements for plain entries added | 5.3.1 | | X | |
| 5 threads for parallel threads only required when no seal is used | 5.3.2 | | X | |
| Test for internal enclosure for level “ta” added. | 6.1.1.2 | | | C3 |
| Eliminating of the “fault” table and reduction of the dust layer depth for the thermal test for type of protection “ta”. | 6.1.2 | | X | |

NOTE The technical changes referred to include the significance of technical changes in the revised IEC Standard, but they do not form an exhaustive list of all modifications from the previous version. More guidance may be found by referring to the Redline Version of the standard.

**Explanations:**

**A) Definitions**

**Minor and editorial changes**

clarification

decrease of technical requirements

minor technical change

editorial corrections

These are changes which modify requirements in an editorial or a minor technical way. They include changes of the wording to clarify technical requirements without any technical change, or a reduction in level of existing requirement.

**Extension** addition of technical options

These are changes which add new or modify existing technical requirements, in a way that new options are given, but without increasing requirements for equipment that was fully compliant with the previous standard. Therefore, these will not have to be considered for products in conformity with the preceding edition.

**Major technical changes**

addition of technical requirements

increase of technical requirements

These are changes to technical requirements (addition, increase of the level or removal) made in a way that a product in conformity with the preceding edition will not always be able to fulfil the requirements given in the later edition. These changes have to be considered for products in conformity with the preceding edition. For these changes additional information is provided in clause B) below.

NOTE These changes represent current technological knowledge. However, these changes should not normally have an influence on equipment already placed on the market.

**B) Information about the background of 'Major Technical Changes'**

C1 – A requirement was added for "ta" to require the temperature marking to be based on the highest of either the temperature produced by the internal components or the external surface temperature.

C2 – Requirements were added for "ta" equipment that contains a normally arcing part to require a supplementary internal enclosure around the arcing part.

C3 – Requires an impact test on the supplementary enclosure for "ta" equipment.

The text of this standard is based on the following documents:

| FDIS | Report on voting |
|---|---|
| 31/1079/FDIS | 31/1094/RVD |

Full information on the voting for the approval of this standard 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.

This International Standard is to be used in conjunction with IEC 60079-0.

A list of all parts of the IEC 60079 series, under the general title Explosive atmospheres, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site 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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# EXPLOSIVE ATMOSPHERES – Part 31: Equipment dust ignition protection by enclosure “t”

## 1 Scope

**1DV.1 DR *Modification of Clause 1, first and second paragraphs to replace with the following:***

**1DV.1.1 This ~~part of IEC 60079~~ standard is applicable to electrical equipment protected by enclosure and surface temperature limitation for use in explosive dust atmospheres. It specifies requirements for design, construction and testing of electrical equipment and Ex Components.**

**This standard supplements and modifies the general requirements of UL ~~IEC~~ 60079-0. Where a requirement of this standard conflicts with a requirement of UL ~~IEC~~ 60079-0, the requirement of this standard takes precedence.**

This standard does not apply to dusts of explosives, which do not require atmospheric oxygen for combustion, or to pyrophoric substances.

This standard does not apply to electrical equipment or Ex Components intended for use in underground parts of mines as well as those parts of surface installations of such mines endangered by firedamp and/or combustible dust.

This standard does not take account of any risk due to an emission of flammable or toxic gas from the dust.

Consideration of additional protective measures is required where the application of electrical equipment is in atmospheres, which can contain combustible dust as well as explosive gas, whether simultaneously or separately.

Where the electrical equipment has to meet other environmental conditions, for example, protection against ingress of water and resistance to corrosion, additional measures can be necessary. The measures used should not adversely affect the integrity of the enclosure.

**1DV.2 DR *Addition of 1DV.2.1***

**1DV.2.1 Where references are made to other IEC 60079 standards, the referenced requirements found in these standards apply as modified by any applicable U.S. National Differences.**

## 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.

**2DV D1** ***Modification of Clause 2 references to replace with the following:***

~~**IEC 60079-0, Explosive atmospheres – Part 0: Equipment – General requirements**~~

**IEC 60127 (all parts), Miniature fuses**

**IEC 60529, Degrees of Protection Provided by Enclosures (IP code)**

**IEC 60691, Thermal-links – Requirements and application guide**

**ISA 60079-0, Explosive atmospheres – Part 0: Equipment – General requirements**

**ISO 965-1, ISO general-purpose metric screw threads – Tolerances – Part 1: Principles and basic data**

**UL 60079-0, Explosive atmospheres – Part 0: Equipment – General requirements**

**UL 248 Series Low-Voltage Fuses**

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60079-0, as well as the following definitions, apply.

NOTE Additional definitions applicable to explosive atmospheres can be found in IEC 60050-426.

3.1 **dust ignition protection by enclosure "t"** type of protection for explosive dust atmospheres where electrical equipment is provided with an enclosure providing dust ingress protection and a means to limit surface temperatures

3.2 **joint** place where the corresponding surfaces of two parts of an enclosure, or the conjunction of enclosures, come together

3.3 **gasket** compressible element provided in a joint to provide a degree of protection against the ingress of solid foreign objects and /or against ingress water/dust

## 4 General

### 4.1 Levels of protection

Type of protection "t" is divided into three Levels of Protection based on the risk of the electrical equipment becoming an ignition source in an explosive dust atmosphere. Electrical equipment with dust ignition protection by enclosure "t" shall be either:

- Level of Protection "ta" (EPL "Da"), or
- Level of Protection "tb" (EPL "Db"), or
- Level of Protection "tc" (EPL "Dc").

The construction and marking requirements apply to all electrical equipment, and in addition, the requirements for "ta" as given in 4.3 and the requirements for "tb" and "tc" as given in 4.4.

Failure modes as defined in the industrial standard for particular components shall be taken into account when considering applicable fault conditions.

### 4.2 Equipment groups and ingress protection

The relationship between the level of protection, the group, and ingress protection required is shown in Table 1.

**Table 1**
**Level of Protection, equipment group and ingress protection (IP) relationship**

| Level of Protection | Group IIIC | Group IIIB | Group IIIA |
|---|---|---|---|
| "ta" | IP6X | IP6X | IP6X |
| "tb" | IP6X | IP6X | IP5X |
| "tc" | IP6X | IP5X | IP5X |
| Ingress protection shall be determined in accordance with degree of protection (IP) of enclosures as specified in IEC 60079-0 for level of protection "tb" and "tc". For Level of Protection "ta" the level of depression shall be increased to at least 4 KPa for a period of least 8 h. Any grease in the joints shall be removed before the IP test is performed.<br>When IP5X is required, all enclosures including rotating machines, shall satisfy the test and acceptance requirements of IP5X, as specified in IEC 60529. | | | |

### 4.3 Requirements for electrical equipment with level of protection "ta"

#### 4.3.1 Fault current

For Level of Protection "ta", the electrical equipment shall be rated for connection to a circuit having a prospective short circuit current of not greater than 10 kA. Where the prospective short circuit current withstand is less than 10 kA, it shall be marked according to Clause 7.

#### 4.3.2 Maximum surface temperature

The requirements for maximum surface temperature for "ta" electrical equipment modify and supplement the requirements of IEC 60079-0.

The marked maximum surface temperature shall be measured on the external surfaces of the enclosure and the surfaces of the internal components for electrical equipment with types of protection "ta" in accordance with 6.1.2. The highest of the measured temperatures shall be the basis for the maximum surface temperature marking.

#### 4.3.3 Overpressure

A positive internal pressure of 4 kPa shall be applied to the enclosure in accordance with 6.1.1.3 prior to the dust exclusion test.

#### 4.3.4 Dust exclusion

Dust exclusion by enclosure shall be carried out in accordance with 6.1.1.

### 4.3.5 Protective devices

#### 4.3.5.1 General

If the electrical equipment is capable of exceeding the maximum surface temperature as a result of the temperature test of 6.1.2, a protective device is required. The protective device may be directly integrated into the electrical equipment or be external to the electrical equipment.

**4.3.5.1DV.1 DR** ***Modification of Clause 4.3.5.1, second paragraph to replace with the following:***

**4.3.5.1DV.1.1 Where the external protective device is not provided by the manufacturer as part of the electrical equipment, the marking to indicate the Specific Conditions of Use shall be in accordance with ~~include the symbol "X" in accordance with IEC 60079-0~~ UL 60079-0, and the specific Conditions of Use shall detail the required ratings and characteristics of the protective device. The protective device shall be capable of interrupting the maximum current of the circuit in which it is installed. If the electrical equipment contains a cell or battery and a control device is provided to prevent overheating of the cell or battery, the control device can also be considered as a protective device, provided it also protects the complete electrical equipment from exceeding the maximum surface temperature.**

#### 4.3.5.2 Thermal protective devices

**4.3.5.2DV D1** ***Modification of Clause 4.3.5.2 to replace with the following:***

**The electrical equipment shall be protected by one or more integral thermal protective devices. Thermal protective devices shall not be of a self-resettable type and shall be duplicated unless conforming to IEC 60127 series, UL 248 series, or IEC 60691, in which case only one device is necessary.**

**Alternatively, if it can be demonstrated that an overcurrent protective device can be used to provide thermal protection, such a device may be used. The overcurrent protective device used in this way shall conform to IEC 60127 series or UL 248 series and shall be rated at not more than 170 % of the maximum rated current of the electrical equipment. When an overcurrent protective device is not also used as a thermal protective device, it is permissible for the overcurrent protective device to be located outside the enclosure of the electrical equipment. In this case, the marking ~~shall include~~ to indicate the Specific Conditions of Use ~~symbol "X"~~ shall be in accordance with ~~IEC 60079-0~~ UL 60079-0 and the Specific Conditions of Use shall detail the required overcurrent protective device. The response time of the thermal protective devices should be taken into account and be adequate for the necessary overtemperature protection.**

**NOTE When no such information exists, a common practice is to use 1.7 × rated current.**

### 4.3.6 Protection for arcing and sparking parts

Where normally arcing and sparking parts are incorporated, these parts shall have a supplementary enclosure inside the main enclosure. This supplementary enclosure shall meet the requirements for a "tc" enclosure with the following exceptions and modifications:

- The tests for thermal endurance to heat and cold and resistance to light, specified in 6.1.1.1 are not applicable,

- A COT of at least equal to the lower specified ambient temperature and at least 20 K greater than the maximum service temperature applies for non-metallic materials,

- The internal enclosure is not considered to have external surfaces and the resistance to ultraviolet light and electrostatic requirements are not applicable,

- The requirements for threaded entries, hinges, and requirements for threaded fasteners are not applicable,

- Resistance to impact test is performed in accordance with 6.1.1.2 with no hot and cold impact testing required,

- Pressure test is not applied,

- IP6X is required.

### 4.4 Requirements for electrical equipment with Level of Protection "tb" and "tc"

#### 4.4.1 Maximum surface temperature

**4.4.1DV DR *Modification of Clause 4.4.1 to replace with the following:***

**The marked maximum surface temperature shall be measured on the external surfaces of the enclosure for electrical equipment with types of protection "tb" and "tc" in accordance with 6.1.2DV ~~with no dust layer on the external surfaces under normal operating conditions~~.**

#### 4.4.2 Over pressure

A positive internal pressure of 2 kPa shall be applied to the enclosure in accordance with 6.1.1.3 prior to the dust exclusion test, except where the design of the electrical equipment is such that gaskets or seals are physically constrained from moving e.g. an "O" ring in a groove.

#### 4.4.3 Dust exclusion

Dust exclusion by enclosure shall be carried out in accordance with 6.1.1.

## 5 Construction

### 5.1 Joints

#### 5.1.1 General

All joints in the structure of the enclosure, whether permanently closed or designed to be opened from time to time, shall fit closely together within the tolerances specified in the documentation. They shall be effectively sealed against the ingress of dust and shall comply with the following particular requirements and be subjected to the test of 6.1.1.