UL 1059

STANDARD FOR SAFETY

Terminal Blocks

UL Standard for Safety for Terminal Blocks, UL 1059

Sixth Edition, Dated December 11, 2024

Summary of Topics

This new Sixth Edition of ANSI/UL 1059 dated December 11, 2024 includes the following changes:

– Expanded Provisions for Evaluating Current-Limiting Breakers for Short-Circuit Ratings: A2.1.3;

– Addition of Referenced Standards: Section 4;

– Style updates; 5.1

The requirements are substantially in accordance with Proposal(s) on this subject dated July 26, 2024 and October 18, 2024.

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UL 1059

Standard for Terminal Blocks

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The most recent designation of ANSI/UL 1059 as an American National Standard (ANSI) occurred on December 11, 2024. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, and Title Page.

Comments or proposals for revisions on any part of the Standard may be submitted to ULSE at any time. Proposals should be submitted via a Proposal Request in the On-Line Collaborative Standards Development System (CSDS) at https://csds.ul.com.

No Text on This Page

CONTENTS

INTRODUCTION

PART I – TERMINAL BLOCKS RATED 600 VOLTS AND LESS

CONSTRUCTION

PERFORMANCE

RATING

MARKING

PART II – TERMINAL BLOCKS RATED 601 – 1500 VOLTS

INTRODUCTION

CONSTRUCTION

PERFORMANCE

RATING

MARKING

PART III – SPRING FORCE CONNECTIONS

CONSTRUCTION

PERFORMANCE

RATING

MARKING

PART IV – INSULATION PIERCING OR DISPLACEMENT CONNECTIONS

CONSTRUCTION

PERFORMANCE

RATING

MARKING

PART V – PROTECTIVE CONDUCTOR TERMINAL BLOCKS (PCTB)

CONSTRUCTION

PERFORMANCE

RATING

MARKING

Annex A (normative) – Short Circuit Current Ratings for Terminal Blocks Greater Than 10 kA

No Text on This Page

INTRODUCTION

1 Scope

1.1 These requirements cover assemblies of wiring terminals and supporting blocks intended to provide for the connection of wiring. Compliance with these requirements does not assure that the terminal block is suitable for use as a component of an end product.

1.2 These requirements cover terminal blocks rated 1500 volts or less.

1.3 These requirements also cover protective conductor terminal blocks (PCTB) used to make the electrical and mechanical connection between conductors or between conductors and a fixing support such as a mounting rail. A PCTB is not required to be insulated.

1.4 These terminal blocks are intended to permanently support and insulate wire terminations and joints from each other, and from the surface on which the terminal block is mounted, where the absence of such support or insulation presents a risk of fire, electric shock, or injury to persons.

1.5 The acceptability of a terminal block in any particular application depends upon its suitability for continued use under the conditions that prevail in actual service. Accordingly, for a particular application a terminal block may be affected by the requirements for the equipment in which it is used, and it may be necessary to additionally evaluate that terminal block for features or performance characteristics that are not specified in this Standard.

1.6 Terminal blocks employing types of connecting means not covered by this standard such as those in which conductors are secured to the terminals by means of a special tool can be evaluated under this standard but may require separate investigation.

1.7 These requirements do not cover field installed power distribution blocks intended to distribute power in a building to separate units such as apartments, separate heaters, and air conditioning units. Power distribution blocks are investigated to Subject 1953, Outline of Investigation for Power Distribution Blocks.

2 Glossary

2.1 For the purpose of this Standard the following definitions apply.

2.2 FACTORY WIRING – The connection of a wire in the end application under controlled conditions, usually at a manufacturer's location.

2.3 FIELD WIRING – The connection of a wire, which is made in the field and that is subjected to the requirements for a terminal for field wiring as specified in this Standard and NFPA 70.

2.4 INSULATION PIERCING OR DISPLACEMENT CONNECTOR – A connector for the connection and possible disconnection of one conductor or the interconnection of two or more conductors, the connection being made by piercing, boring through, cutting through, removing, displacing, or making ineffective in some other manner the insulation of the conductor or conductors without previous stripping.

2.5 POST CONNECTOR – A connector utilizing a post (solderless wire wrap and similar for example) onto which one or more conductors are secured by means of a tool.

2.6 PREPARED CONDUCTOR – A conductor, the strands of which are soldered or tinned; or the end of which is fitted with a cable lug, eyelet, quick-connect, ring terminal, spade terminal, or similar component, prior to insertion into the terminal.

2.7 PROTECTIVE CONDUCTOR TERMINAL BLOCK (PCTB) – A device with one or more clamping units for connecting or joining protective conductors (Protective Earthing (PE) conductors) or connecting such conductors to the support for the clamping units. The clamping units can be secured with screw- or screwless-type fixing means. Examples of supports are mounting rails, sheet metal cut-outs, or mounting plates. A PCTB is either uninsulated, non-isolated, or isolated [See (a) and (b)]. Operating insulation is not necessary as a PCTB is intended to be at ground potential.

a) ISOLATED PROTECTIVE CONDUCTOR TERMINAL BLOCK – A protective conductor terminal block that provides insulation from live parts of other terminal blocks, adjacent poles of the same terminal block, or other devices and isolation from the support. It does not have provisions for path 2-2 of Figure 50.1. It uses path 1-1 only.

b) NON-ISOLATED PROTECTIVE CONDUCTOR TERMINAL BLOCK – A protective conductor terminal block that provides insulation from live parts of other terminal blocks, adjacent poles of the same terminal block, or other devices, but does not provide isolation from the support itself. It is mechanically and electrically attached to its support, path 2-2 in Figure 50.1. It may or may not have path 1-1.

2.8 TERMINAL CONNECTOR – A device that establishes the connection between two or more conductors or between one or more conductors and a terminal by means of mechanical pressure.

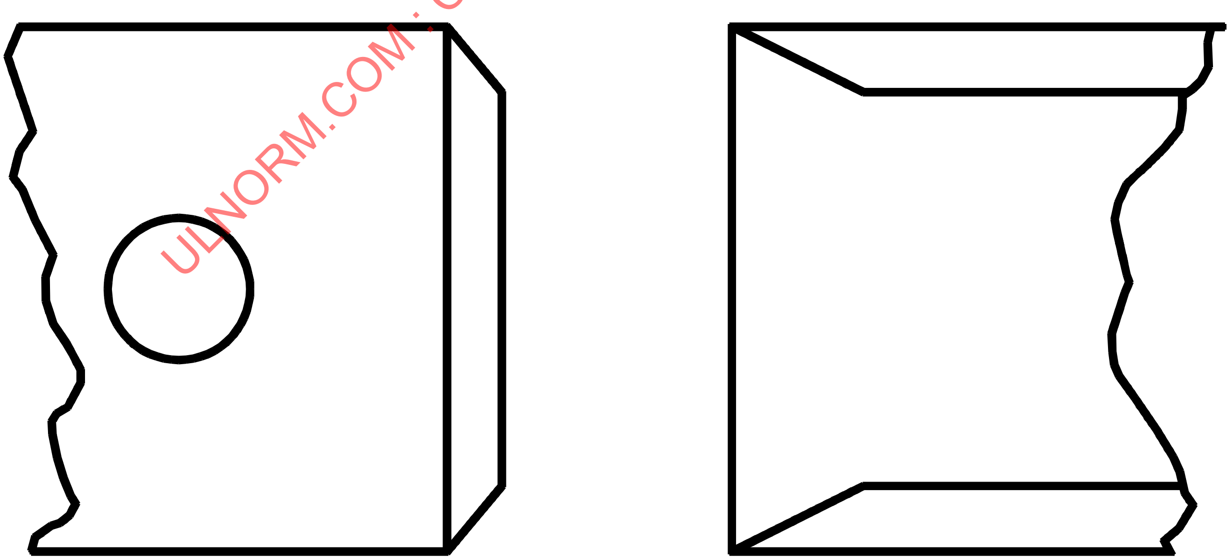
2.9 SEPARABLE TYPE CONNECTORS – Connectors consisting of separable, mating members that can be readily engaged or disengaged without the use of tools.

a) Quick Connect Type – Typical mating components as shown in Figure 2.1.

b) Other Types – Other than quick connect type. Acceptability to be determined by separate investigation.

Figure 2.1

Quick-Connect-Type Connector



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2.10 SOLDER CONNECTORS – A connector in which the conductor is connected to the current-carrying member by soldering.

2.11 SPRING-FORCE CONNECTOR – A connector utilizing a spring action for retaining a conductor.

2.12 STUD AND NUT TYPE CONNECTOR – A connector in which:

a) An unprepared conductor is looped around a stud and retained by a nut; or

b) A prepared conductor is assembled to a stud and retained by a nut.

2.13 TERMINAL BLOCK – A terminal block is a rigidly mounted device that is composed of an insulated base with barriers having one or more electrically conductive members. Each electrically conductive member serves as a junction to electrically connect two or more conductors and also provides means to individually connect or disconnect conductors. The device can be a sectional or one-piece design.

2.14 UNPREPARED CONDUCTOR – A conductor which has been cut and the insulation of which has been removed for insertion into a terminal. The conductor end is bare. The conductor in an insulation piercing or displacement connector is considered to be unprepared.

2.15 WIRE BINDING SCREW CONNECTOR – A connector that uses a binding head screw, with or without a flat ring or lock washers, where:

a) An unprepared conductor is looped around the shank of the screw and secured under the head of the screw; or

b) A prepared conductor is assembled about the screw shank and retained by the head of the screw.

3 Units of Measurement

3.1 Values stated without parentheses are the requirement. Values in parentheses are explanatory or approximate information.

4 Referenced Publications

4.1 Any undated reference to a code or standard appearing in the requirements of this Standard shall be interpreted as referring to the latest edition of that code or standard.

4.2 The following publications are referenced in this Standard:

ASTM E230/E230M, *Standard Specification and Temperature-Electromotive Force (emf) Tables for Standardized Thermocouples*

IEEE C37.09, *Standard Test Procedure for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis*

NFPA 70, *National Electrical Code*

UL 94, *Tests for Flammability of Plastic Materials for Parts in Devices and Appliances*

UL 310, *Electrical Quick-Connect Terminals*

UL 486A-486B, *Wire Connectors*

UL 486E, *Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors*

UL 508, *Industrial Control Equipment*

UL 746A, *Polymeric Materials – Short Term Property Evaluations*

UL 746C, *Polymeric Materials – Use in Electrical Equipment Evaluations*

UL 746D, *Polymeric Materials – Fabricated Parts*

UL 840, *Insulation Coordination Including Clearances and Creepage Distances for Electrical Equipment*

UL 61800-5-1, *Adjustable Speed Electrical Power Drive Systems – Part 5-1: Safety Requirements – Electrical, Thermal and Energy*

5 Components

5.1 A component of a product covered by this Standard shall:

a) Comply with the requirements for that component as specified in this Standard;

b) Be used in accordance with its rating(s) established for the intended conditions of use; and

c) Be used within its established use limitations or conditions of acceptability.

5.2 A component of a product covered by this Standard is not required to comply with a specific component requirement that:

a) Involves a feature or characteristic not required in the application of the component in the product;

b) Is superseded by a requirement in this Standard; or

c) Is separately evaluated when forming part of another component, provided the component is used within its established ratings and limitation.

5.3 Specific components are incomplete in construction features or restricted in performance capabilities. Such components are intended for use only under limited conditions, such as certain temperatures not exceeding specified limits, and shall be used only under those specific conditions.

5.4 A component that is also intended to perform other functions such as overcurrent protection, ground-fault circuit-interruption, surge suppression, any other similar functions, or any combination thereof, shall comply additionally with the requirements of the applicable standard(s) that cover devices that provide those functions.

PART I – TERMINAL BLOCKS RATED 600 VOLTS AND LESS

CONSTRUCTION

6 Materials

6.1 Current-carrying parts

6.1.1 A current-carrying part intended for use with copper wire shall be of copper, a copper alloy, or other material suitable for the purpose.

6.1.2 A current-carrying part intended for use with aluminum wire shall be of aluminum, an aluminum alloy, copper or a copper alloy, or other material suitable for the purpose. A current-carrying part intended for use with aluminum wire shall be coated with a suitable electrically conductive coating to inhibit oxidation and corrosion.

6.1.3 Tin, applied in a suitable manner, is acceptable for the coating mentioned in 6.1.2, and other coatings may be accepted if suitable for the purpose.

6.2 Insulation

6.2.1 Insulation material shall not have less than the minimum values specified in Table 6.1 and shall be subjected to the Mold Stress Relief Test, Section 16. The relative thermal index used shall be the lesser published value from Electrical or Mechanical without Impact. For the purpose of this Standard, an insulation material is defined as a material which is in contact with or within 1/32 inch (0.8 mm) to either uninsulated live parts of opposite polarity, or uninsulated live parts and either metal parts that are capable of being grounded in service, or any surface exposed to contact.

Exception No. 1: The relative thermal index of the base material can be as tabulated for the following generic materials:

Unfilled polycarbonate : 105 °C

Unfilled nylon : 105 °C

Phenolic : 150 °C

Molded Melamine : 130 °C

Melamine phenolic : 130 °C

Urea formaldehyde : 100 °C

Exception No. 2: An insulation material having values less than any of those contained in Table 6.1 is capable of being used, when based on end-product performance tests. See UL 746C and footnotes c, d, and e of Table 6.1.

Exception No. 3: The Mold Stress Relief Test is not required for rigid thermosetting materials, such as phenolic.

Exception No. 4: The Mold Stress Relief Test is not required for materials identified in Exception No. 1, or that have a published relative thermal index (Electrical and Mechanical without Impact) greater than 70 °C.

Table 6.1
Maximum Performance Level Category (PLC) Values for Insulation Materials

Test specified[a]	Flammability rating of material[b]			
	V-0	V-1	V-2	HB
Hot Wire Ignition (HWI)[c]	4	3	2	2
High Current Arc Ignition (HAI)[d]	3	2	2	1
Comparative Tracking Index (CTI)[e]	3	3	3	3

[a] See UL 746A for these specified tests.

[b] These flammability classifications are derived from UL 94. A terminal block shall be permitted to be marked with the flammability classification, see 18.5.

[c] A material with weaknesses in these values is capable of being used provided an Abnormal Overload or Glow-Wire End product tests are performed. See UL 746C.

[d] A material with weaknesses in these values is capable of being used provided an end product Arcing test is performed at 50 % power factor and the amperage and voltage that the terminal block is rated for, to a maximum of 30A, 250V. For terminal blocks rated at greater than 30A, 250V, a minimum V-1 flammability rating and minimum CTI of 175 (PLC max of 3), is also required. See UL 746C.

[e] A Proof Tracking Index (PTI) test may be performed on the terminal block for those materials where no CTI rating exists.

6.2.2 Insulation material bases that have been molded or fabricated from regrind materials, blending of materials, use of pigment, colorants, flame retardants, or similar means, shall comply with UL 746D.

6.2.3 The insulating material for other than a non-isolated or isolated protective conductor terminal block shall be any color other than green-and-yellow.

7 Wiring Terminals

7.1 A wiring terminal employing a screw or nut for securing the conductors shall be so located that:

a) It is accessible for examination; and

b) Connectors can be tightened or wires removed without loosening or removing connectors, conductors, screws, or nuts in any other connector that is not secured by the screws or nuts being loosened or tightened.

7.2 A wiring terminal intended for use with stranded wire shall be such that all strands of the conductor are confined. The clamping movement alone shall adapt the terminal for use with a stated range of wire sizes without permanent removal or addition of parts, if such use is intended.

7.3 There shall be no sharp edges or corners that can damage conductor insulation with which it may come in contact.

7.4 A terminal that is intended to secure a copper wire and an aluminum wire simultaneously shall be such that there will be no direct physical contact between the wires of different metals, unless the terminal is suitable for the purpose.

7.5 A terminal connector provided with or specified for use with a terminal block shall comply with the requirements in UL 486A-486B or UL 486E, as appropriate, and with this Standard.

7.6 A nominal 0.110-, 0.125-, 0.187-, 0.205-, or 0.250-inch wide quick-connect terminal shall comply with the applicable requirements in UL 310. Other sizes of quick-connect terminals shall be investigated with respect to crimp pull-out, engagement-disengagement forces of the connector and tab, and temperature rise; all tests are to be conducted in accordance with UL 310. The terminal shall also comply with the performance requirements in this Standard.

Exception: The crimp pull-out test need not be conducted on a male tab or female connector that does not have provision for inserting and crimping conductors.

7.7 A wire-binding screw or stud-and-nut type terminal (see 2.12 and 2.15) may be employed for conductors 10 AWG (5.3 mm^2) and smaller, provided that the application of normal clamping action as intended will not impair the integrity of the joint. See Section 13, Solid-Wire Tightening Test.

7.8 A wire-binding screw or stud-and-nut terminal shall be capable of accommodating a three-quarter loop.

7.9 To determine compliance with 7.7, the conditions in (a) and (b) shall be met or, for a solid conductor, the test described in 13.2 shall be conducted. A stranded conductor shall meet conditions described in (a).

a) The threaded screw or stud shall not have more than 32 threads per inch (12.6 threads per centimeter) and shall not be smaller than No. 8 (4.2 mm diameter) for 10 AWG (5.3 mm^2) and smaller wire and not smaller than No. 6 (3.5 mm diameter) for 14 AWG (2.1 mm^2) and smaller wire. A wire-binding screw or stud-and-nut type terminal shall be provided with upturned lugs, a cupped washer, barriers or other equivalent means, to hold the wires in position even though the screw or nut becomes slightly loose.

b) The tapped terminal plate shall not have less than two full threads, and shall be of metal not less than 0.050 inch (1.3 mm) thick for a wire larger than 14 AWG (2.1 mm^2) and not less than 0.030 inch (0.76 mm) thick for 14 AWG (2.1 mm^2) or smaller wire. Threads provided by extruding a hole before tapping are to be counted if the thickness of the unextruded metal is not less than the pitch of the thread.

7.10 A terminal block intended for use with other wire connecting means not referenced in 7.5 – 7.7 may be used when it meets the appropriate performance requirements in this Standard.

7.11 A terminal block may use a combination of different types of connectors.

8 Spacings

8.1 The spacings on a terminal block shall be as specified in Table 8.1. Spacings shall be measured through cracks or between sections of a sectional type terminal block. In applying Table 8.1, it is to be assumed that:

a) Adjacent poles are at opposite polarity; and

b) Any mounting surface is at ground potential.

Note – Spacings are measured at all live parts of a terminal block including factory terminations, i.e. printed circuit board solder pins. When soldered or wired in the actual end use application, these spacings must be additionally evaluated in the end product.

Table 8.1
Minimum Acceptable Spacings

Application		Potential involved in volts	Minimum spacings in inches (mm) between uninsulated live parts of opposite polarity; and between an uninsulated live part and a grounded part including any mounting surface or exposed metal part			
			Through air		Over surface	
A.	Service – including dead-front switchboards, panelboards, service equipment, and the like	51 – 150	1/2	(12.7)	3/4	(19.1)
		151 – 300	3/4	(19.1)	1-1/4	(31.8)
		301 – 600	1	(25.4)	2	(50.8)
B.	Commercial appliances, including business equipment, electronic data processing equipment, and the like	51 – 150	1/16[a]	(1.6)[a]	1/16[a]	(1.6)[a]
		151 – 300	3/32[a]	(2.4)[a]	3/32[a]	(2.4)[a]
		301 – 600	3/8	(9.5)	1/2	(12.7)
C.	Industrial, general	51 – 150	1/8[a]	(3.2)[a]	1/4	(6.4)
		151 – 300	1/4	(6.4)	3/8	(9.5)
		301 – 600	3/8	(9.5)	1/2	(12.7)
D.	Industrial, devices having limited ratings[b]	51 – 300	1/16[a]	(1.6)[a]	1/8[a]	(3.2)[a]
		301 – 600	3/16[a]	(4.8)[a]	3/8	(9.5)
E.	Terminal blocks rated 601 – 1500 V[c]	601 – 1000	0.55	(14.0)	0.85	(21.6)
		1001 – 1500	0.70	(17.8)	1.20	(30.5)
F.	Industrial, devices using the alternative approach to spacings[d]	51 – 1500	As Determined By Evaluation[d]			
G.	LED lighting equipment[b]	51 – 300	1/16[a]	(1.6)[a]	1/8[a]	(3.2)[a]
		301 – 600	1/16 – 3/16[a,e]	(1.6 – 4.8)[a,e]	1/8 – 3/8[a,e]	(3.2 – 9.5)[a,e]

NOTES –

1) A slot, groove, or similar spacing, 0.013 inch (0.33 mm) wide or less in the contour of insulating material is to be disregarded.

2) An air space of 0.013 inch (0.33 mm) or less between a live part and an insulating surface is to be disregarded for the purpose of measuring over surface spacings.

[a] The spacing between field wiring terminals of opposite polarity and the spacing between a field wiring terminal and a grounded dead metal part shall not be less than 1/4 inch (6.4 mm) if short-circuiting or grounding of such terminals may result from projecting strands of wire. Examples of means that prevent stray wire strand contact include rating the terminal block for solid wire only, and design features such as recessed terminal pockets.

[b] See 8.5.

[c] Applies only to terminal blocks investigated to Part II of this Standard. See 22.1.

[d] See 8.6.

[e] See 8.11.

8.2 In a circuit not involving a potential of more than 50 volts, spacings at field-wiring terminals shall be a minimum of 1/8 inch (3.2 mm) through air and 1/4 inch (6.4 mm) over surface, and spacings at other than field-wiring terminals shall be a minimum of 1/16 inch (1.6 mm) through air or over surface; provided that the insulation and clearances between that circuit and a higher potential circuit are in accordance with the requirements that are applicable to the higher potential circuit.

8.3 Spacings shall be measured with terminals connected to the rated conductor that results in the most onerous condition.

Note – In most situations the maximum size conductor would yield the most onerous condition. In some situations, the minimum size conductor may result in less spacings, i.e. underside of a open bottom terminal block with exposed screw would have less spacings to the mounting surface when wired with the minimum size conductor.

8.4 A live screw head or nut on the underside of an insulating base shall be reliably prevented from loosening and shall be adequately insulated or spaced from the mounting surface. This may be accomplished by:

a) Countersinking such parts not less than 1/8 inch (3.2 mm) in the clear and then covering them with a waterproof, insulating sealing compound that does not melt at a temperature of 15 °C (27 °F) higher than the normal operating temperature in the device, and not less than 100 °C (212 °F) in any case, or

b) Reliably securing such parts and insulating them from the mounting surface by means of a barrier or the equivalent, or by means of through-air or over-surface spacings as specified in Table 8.1.

8.5 The spacings specified in items D and G of Table 8.1 are applicable to terminal blocks for use only in or with noted equipment types where the load on any single circuit of the terminal block does not exceed 15 amperes at 51 – 150 volts, 10 amperes at 151 – 300 volts, 5 amperes at 301 – 600 volts, or the maximum ampere rating, whichever is less.

8.6 The spacing provisions in item F of Table 8.1 are applicable to a terminal block for use only in or with industrial control equipment where an alternative spacing evaluation is conducted in accordance with Section 39 of UL 508 and UL 61800-5-1. Through-air and over-surface spacings are determined using the requirements in these Sections of UL 508 and UL 61800-5-1, and are specified for each terminal block. See 8.7.

Note: This alternative spacing allowance permits evaluation in accordance with the requirements in UL 840.

8.7 In conducting evaluations as specified in item F, the following guidelines shall be used when applying the requirements in UL 840:

a) For evaluating through-air (clearance) spacings:

1) If using UL 840 Section 7 "Clearance A (Equivalency)", an impulse test potential having a value as determined in UL 840 is to be applied.

2) If using UL 840 Section 8 "Clearance B (Controlled Overvoltage)":

i) Terminal blocks intended to operate in the direct line of the source of power to the load equipment shall be evaluated for Overvoltage Category III. Other terminal blocks shall be evaluated for Overvoltage Category II;

ii) The voltage used in the determination of Clearances shall be the terminal block rated voltage rounded to the next higher value (in the table for determining clearances for equipment).

iii) Terminal blocks shall be evaluated for pollution degree 3.

b) For evaluating over-surface (creepage) spacings, terminal blocks shall be evaluated for pollution degree 3.

c) The spacings at field wiring terminals shall be in accordance with items A, C or D (including footnote "a"), in Table 8.1, as applicable, unless the design of the field wiring terminals is such that it will prevent the possibility of reduced spacing due to stray strands or improper wiring installations. Examples of means that prevent stray wire strand contact include rating the terminal block for solid wire only, and design features such as recessed terminal pockets.

8.8 An insulating barrier or liner used as the sole separation between an uninsulated live part and a noncurrent-carrying metal part (including grounded metal part) or between uninsulated live parts of opposite polarity shall be of material that complies with 6.2.1 and not less than 0.028 inch (0.71 mm) thick.

8.9 An insulating barrier or liner that is used in addition to an air space in place of the required spacing through air shall not be less than 1/32 inch (0.8 mm) thick. If the barrier or liner is of fiber, the air space shall not be less than 1/32 inch, and if that barrier or liner is of material of a type that is not suitable for contact with an uninsulated live metal part in accordance with 6.2.1, the air space provided shall be such that, upon investigation, it is found to be adequate for the particular application.

Exception: A barrier or liner that is used in addition to at least one-half of the required spacing through air may be less than 1/32 inch, but not less than 0.013 inch (0.33 mm) thick, provided that the barrier or liner is of a material that complies with 6.2.1, of adequate mechanical strength if exposed or otherwise subjected to mechanical damage, and reliably held in place.

8.10 Insulating material having a thickness less than that indicated in 8.8 and 8.9 can be used if, upon investigation, it is found to be suitable and adequate for the particular application.

8.11 For terminal blocks used in LED lighting equipment (item G), where the rated potential voltage (V) is above 300 V, linear interpolation is permitted using the following equations to calculate minimum spacings:

a) Through Air Minimum Spacing: in = 0.00042(V) – 0.0625, (mm) = 0.0107(V) – 1.6

b) Over Surface Minimum Spacing: in = 0.00083(V) – 0.125, (mm) = 0.0210(V) – 3.1

The calculated minimum spacings using this method shall be rounded up to the next higher 0.001 in (0.1 mm) increment.

PERFORMANCE

9 General

9.1 A terminal connector as mentioned in 7.5 shall be subjected to the performance tests described in UL 486A-486B or UL 486E. The tests shall not result in severed strands of wires, stripping of threads, broken parts, or other damage to the terminal.

Exception No. 1: A terminal block rated for factory wiring only need not be subjected to these tests.

Exception No. 2: A terminal connector need not be subjected to the Stress corrosion/moist ammonia or Stress corrosion/mercurous nitrate.

9.2 The insulating base of the terminal block is not required to withstand the pull-out test force in 9.1 without breakage, but it is to secure the terminal to the insulating base in a reliable manner, maintain position, and withstand the required tightening torque.

9.3 A terminal block shall perform acceptably when subjected to the tests described in Sections 11 – 16.

10 Selection and Preparation of Samples for Temperature and Dielectric Voltage-Withstand Tests

10.1 Representative samples of the terminal block are to be assembled to lengths of wire of the proper size and in the manner that is followed in service.

10.2 Wires are to be carefully stripped and wiped clean for a distance that is proper for insertion into the terminal, and are to be assembled to the terminal in the intended manner. Care is to be taken:

a) When stripping the wires to avoid cutting, nicking, scraping, or other damaging of the conductors; and

b) When removing foreign materials, such as insulation, separators, or related parts, from the stripped ends.

10.3 If special instructions for assembling a terminal block to the wire are furnished with the terminal block by the manufacturer, these are to be followed in the preparation of the samples.

10.4 Stranded conductors in accordance with Table 10.1 shall be used for 30 – 16 AWG (0.05 – 1.3 mm^2) and 8 AWG (8.4 mm^2) and larger conductor sizes. Solid conductors shall be used for 14 – 10 AWG (2.1 – 5.3 mm^2) conductor sizes, unless the terminal block is rated for stranded wire only, in which case stranded wire shall be used. Also see 17.8.

Note – Performance testing with 14 – 10 solid conductors is representative of testing with stranded conductors of the same size for the Heating and Dielectric Voltage Withstand tests.

Table 10.1
Stranded Wire for Test

Size of conductor to which terminal is to be assembled		Number of strands, if stranded conductors		
		Copper		Aluminum
AWG or kcmil	(mm^2)	Class B	Class C	Class B
30 – 24	(0.05 – 0.21)	a	–	–
22	(0.32)	7	–	–
20	(0.52)	10	–	–
18	(0.82)	16	–	–
16	(1.3)	26	–	–
14 – 2	(2.1 – 33.6)	7	19	7[b]
1 – 4/0	(42.4 – 107)	19	37	19
225 – 500	(125 – 253)	37	61	37
550 – 1000	(279 – 507)	61	91	61
1100 – 1500	(557 – 760)	91	127	91
1600 – 2000	(811 – 1010)	127	271	127

[a] Number of strands may vary.

[b] Aluminum 14 AWG (2.1 mm^2) is not available.

10.5 The torque specified in UL 486A-486B, or UL 486E, shall be applied to the conductor.

Exception No. 1: The torque for a wire-binding-screw connector or a stud-and-nut type connector shall be in accordance with Table 10.2, unless it has a different assigned torque, in which case the assigned torque shall be used. See also 17.4.

Exception No. 2: For factory wire only rated terminals, the torque shall be in accordance with the manufacturer's specifications.

Exception No. 3: A terminal connector having assigned torque ratings as specified in the Exception to 17.3 shall use those assigned values.

Table 10.2
Tightening Torque for Wire-Binding Screws and Stud-and-Nut Type Connectors

Size of terminal screw		Tightening torque	
Number	(mm Diameter)	Pound-inches	(Newton-meters)
6	(3.5)	12	(1.4)
8	(4.2)	16	(1.8)
10	(4.8)	20	(2.3)

10.6 For a line of terminal blocks employing connectors of similar design but of different sizes, tests need not be performed on all intermediate sizes providing that the largest size connector and smallest size connector and two intermediate size connectors are found to be acceptable.

11 Temperature Test

11.1 The temperature rises on a terminal block shall not exceed the applicable values specified in Table 11.1. The test is to be conducted in a nominal 25 °C (77 °F) ambient and while the terminal block is continuously carrying its maximum rated current. Temperatures are to be taken on each pole of terminal blocks assembled as indicated in 11.3. See 17.1.

Table 11.1
Maximum Acceptable Temperature Rises

Materials and components	°C	(°F)
1. Wire insulation or insulated tubing	35	(63)
2. Electrical tape	55	(99)
3. Varnished cloth insulation	60	(108)
4. Fiber employed as electrical insulation	65	(117)
5. Sealing compound	50	(90)
6. Phenolic composition employed as electrical insulation or as a part the deterioration of which would result in a risk of fire, electric shock, or injury to persons	125	(225)
7. Insulation base	a	a
8. Wiring terminal of a terminal block	30	(54)
9. Any bus, strap, or clip that mates with another similar bus, strap, or clip to facilitate a disconnection arrangement of a 2 piece terminal block	50	(90)
For a fuse type terminal block:		
10. Any bus, strap or fuse clip when tested with a dummy fuse	30	(54)
11. Any bus, strap or fuse clip when tested with a fuse	85	(185)
12. Pressure terminal connectors for field installed conductors	50[b]	(90)[b]

NOTE – These limits do not apply to an insulated conductor or other material that has been investigated and found acceptable for a higher temperature.

[a] Rated temperature limit of material minus test ambient temperature.

[b] For a fuse type terminal block tested with dummy fuses, the recorded temperature rise is increased 20 °C to represent the heating of fuses.

11.2 The terminal block shall be mounted on a horizontal nonmetallic surface and connected to an acceptable current source. Three adjacent terminal block poles shall be connected in series using the conductor size corresponding to the ampere rating in accordance with the assigned ampere rating columns of Table 7 of UL 486A-486B or Table 10.1 of UL 486E, as appropriate. If the ampere rating of a terminal block falls between two consecutive values in the table, the wire size selected shall be the higher value.

11.3 In a three or more circuit terminal block, or a sectional terminal block, any adjacent three circuits may be used. Terminal blocks constructed as one-circuit or two-circuit units shall be mounted side by side as close as practicable, with the three closest circuits wired.

11.4 Wire lengths shall be 18 inches (0.46 m) for 16 AWG (1.3 mm^2) and smaller, and 48 inches (1.22 m) per terminal for 14 AWG (2.1 mm^2) and larger.

11.5 Temperatures are to be measured by thermocouples having conductors not larger than 24 AWG (0.21 mm^2) and not smaller than 30 AWG (0.05 mm^2).

11.6 When thermocouples are used in determining temperatures in electrical equipment, it is common practice to employ thermocouples consisting of 30 AWG (0.05 mm^2) iron and constantan conductor and a potentiometer-type instrument; and such equipment is to be used whenever referee temperature measurements by thermocouples are necessary.

11.7 The thermocouples and related instruments are to be accurate and calibrated according to good laboratory practice. The thermocouple conductor is to conform with the requirements for Special Tolerances thermocouples as listed in the Tolerances on Initial Values of EMF versus Temperature tables in ASTM E230/E230M.

11.8 Ambient temperature is to be measured by means of a thermocouple or a thermometer, located in the vicinity of the terminal block being tested. Temperatures are to be considered constant when three successive readings at 15 minute intervals indicate that stable conditions have been reached.

12 Dielectric Voltage-Withstand Test

12.1 Immediately following the temperature test and while still in a heated condition, a terminal block shall be capable of withstanding without breakdown for 1 minute the application of an essentially sinusoidal potential with a frequency between 45 Hz and 65 Hz at 1000 volts plus twice the rated voltage of the terminal block between:

a) Live parts that are not conductively interconnected; and

b) Live parts and the surface to which the terminal block is mounted.

12.2 To determine that a terminal block complies with 12.1, the terminal block is to be tested by means of a suitable 500-volt-ampere or larger capacity transformer whose output voltage is essentially sinusoidal and can be varied. The applied potential is to be increased from zero until the required test level is reached, and is to be held at that level for 1 minute. The increase in the applied potential is to be at a substantially uniform rate and as rapid as is consistent with its value being correctly indicated by a voltmeter.

13 Solid-Wire Tightening Test

13.1 Application of the normal clamping action of a wire-binding screw and stud-and-nut type terminal as specified in 7.7 shall not impair the integrity of the joint.

13.2 To determine that normal clamping action as intended does not impair the integrity of a joint as specified in 13.1, the binding member is to be tightened on a solid wire to the torque specified in 10.5, without causing:

a) The wire to be forced out of the joint; or

b) Damage to any part of the terminal block.

13.3 The wire is to be of the maximum and minimum sizes intended to be connected to the terminal block and is to be formed into a three-quarter loop of a size that can just be accommodated by the assembly. See also 7.7.

14 Tab Pull Test

14.1 Following the test described in 14.2, no damage shall have occurred to the terminal assembly, the terminal block, or the mounting means.

14.2 Six samples of a male tab of a terminal block employing quick-connect terminals are to be subjected to a direct, in-line pull along the axis of the tab for 1 minute. The force of the pull is to be as specified in Table 14.1. The terminal block is to be mounted as in service.

Table 14.1
Forces for Tab Pull Test

Tab size inches (mm)	Force pounds (N)
0.250 (6.35)	18 (80)
0.205 and 0.187 (5.21 and 4.75)	20 (89)
0.125 and 0.110 (3.18 and 2.79)	14 (62)

15 Verification of the Performance of Terminal Assemblies

15.1 Following the test described in 15.2, the conductor ends shall not be cut off or damaged in any way that prevents their further use, and no damage shall have occurred to the terminal assemblies, the terminal block, or the mounting means.

15.2 A terminal assembly is to be supplied for both the maximum rated and the minimum cross section conductors. The terminal block is to be mounted using its normal mounting means. An unprepared conductor of the maximum rated cross section is to be inserted in the terminal assembly and an unprepared conductor of the smallest cross section of the connector capacity (if specified) in another terminal assembly, and the clamping screws tightened to 110 % of the torque specified in 10.5 and its exceptions. The clamping screws are then to be unscrewed and new conductors inserted, and the screws tightened as previously specified. The test is to be repeated five times using the same clamping units and five new conductors for each terminal.

Exception: A terminal block that is rated for prepared conductors only is not required to be subjected to this test.

15.3 The test specified in 15.2 is to be repeated on all alternate base materials for a terminal block of one design that uses two or more alternate materials.

16 Mold Stress Relief Test

16.1 Except for rigid thermosetting materials, conditioning of the terminal block as described in 16.2 shall not result in softening of the material as determined by handling immediately after the conditioning. There shall also be no shrinkage, warpage, or other distortion as judged after cooling to room temperature that results in reduction of spacings between uninsulated live parts of opposite polarity, uninsulated live parts and accessible grounded metal, or uninsulated live parts and any enclosure below the minimum acceptable values.

16.2 One complete terminal block is to be placed in a full draft circulating air oven maintained at a uniform temperature not less than 10 °C (18 °F) higher than the maximum temperature of the material measured during the Temperature Test, Section 11, but not less than 70 °C (158 °F) in any case. The sample is to remain in the oven for 7 hours. After its removal from the oven and return to room temperature, the sample is to be investigated for compliance with 16.1.

RATING

17 Details

17.1 The maximum value of current shall be specified.

17.2 The wire size range shall be specified.

17.3 The tightening torque for a terminal connector shall be specified. The torque specifications shall be related to wire size and shall be at least 90 % but not greater than 100 % of the value specified for the static heating test in UL 486A-486B or in UL 486E.

Exception: The torque value may be less than 90 % if the terminal connector is investigated with the smaller torque value in accordance with UL 486A-486B or UL 486E, as applicable.

17.4 The tightening torque for a wire binding screw or stud and nut type termination shall be specified in accordance with Exception No. 1 of 10.5. A torque rated termination may have a value of tightening torque that differs from Table 10.2.

17.5 The voltage rating of a terminal block shall be specified.

17.6 A terminal block with wiring terminals intended and found acceptable for use with copper and aluminum conductors shall be rated "AL-CU." Terminals for aluminum wire only shall be rated "AL."

17.7 A terminal block having terminal connectors shall be rated for:

a) Field wiring and factory wiring (see 9.1); or

b) Factory wiring only (see Exception to 9.1).

17.8 A terminal block tested with stranded wire only, see 10.4, shall be rated “Stranded” or “STR” or equivalent wording.

MARKING

18 General

18.1 The marking of a terminal block shall include:

a) The manufacturer's name, trademark, or other descriptive marking by which the organization responsible for the product can be identified; and

b) The catalog number or equivalent (can be provided on the shipping container).

18.2 Suitable markings or other instructions shall be provided to clearly indicate any rearrangement or adjustment that is necessary to adapt to various sizes of wire if the rearrangement or adjustment is not obvious.

18.3 Instructions for proper installation of the wire shall be provided for constructions where the wiring method is not obvious.

18.4 If a manufacturer produces a terminal block at more than one factory, each finished terminal block shall have a distinctive marking – which may be in code – by means of which it may be identified as the product of a particular factory.

18.5 In addition to the required markings, the manufacturer is not prohibited from marking the flammability classification of the insulating material on the terminal block, smallest unit container, or on an information sheet placed in the unit container.

18.6 As an alternative, all markings (with the exception of those referenced in 18.1, 18.4, and 53.1) may be made by cross-media documentation (e.g. QR-codes with reference to internet, electronic catalogs, web-link on the package unit or delivery papers, etc.).

PART II – TERMINAL BLOCKS RATED 601 – 1500 VOLTS

INTRODUCTION

19 Details

19.1 The requirements in Sections 20 – 24 cover terminal blocks rated 601 – 1500 volts.

CONSTRUCTION

20 General

20.1 A terminal block rated 601 – 1500 volts shall comply with the applicable construction requirements in Sections 6 – 8 in addition to the requirements for Insulating Materials, Section 21, and for Spacings, Section 22.

21 Insulating Material

21.1 An insulating material used as direct or indirect support of an uninsulated live part shall comply with 6.2.1 and the Inclined Plane Tracking Test specified in UL 746A. The insulating material shall not track beyond one inch in less than 60 minutes using the time to track method. The voltage for the Inclined Plane Tracking Test shall be not less than the rated voltage of the equipment.

22 Spacings

22.1 The minimum spacings on a terminal block rated 601 – 1500 volts shall not be less than the values specified in Table 8.1, application E.

PERFORMANCE

23 General

23.1 A terminal block rated 601 – 1500 volts shall comply with the applicable performance requirements in Sections 9 – 16 and the requirements for the Dielectric Voltage-Withstand Test, Section 24.

24 Dielectric Voltage-Withstand Test

24.1 A terminal block rated 601 – 1500 volts shall comply with the requirements in Section 12, Dielectric Voltage-Withstand Test, except that an alternating-current test potential shall be 2000 volts plus 2.25 times maximum rated voltage, and a direct-current test potential shall be 1.414 times the alternating-current test potential specified in this paragraph.

RATING

25 Details

25.1 A terminal block rated for 601 – 1500 volts shall be rated as specified in Section 17, Details.

MARKING

26 General

26.1 A terminal block rated for 601 – 1500 volts shall be marked as specified in Section 18, General.

PART III – SPRING FORCE CONNECTIONS

CONSTRUCTION

27 General

27.1 A terminal block having spring force connections shall comply with the requirements in Sections 6 – 8 except as indicated in Part III of this Standard.

27.2 The main current carrying part of a terminal block having spring force connections shall be copper or a copper alloy, or other material suitable for the purpose.

27.3 The spring force connector of a terminal block shall comply with the construction requirements in UL 486A-486B or UL 486E, as appropriate, and with this Standard.

PERFORMANCE

28 General

28.1 A terminal block having spring force connections shall be subjected to the tests specified in this section and Section 16, Mold Stress Relief Test, if applicable. Tests that are to be conducted in sequence are specified in Table 28.1.

Table 28.1
Sequence of Tests for Terminal Blocks Having Spring Force Connections

Test	Sample sets[a]			
	A[b]	B[c]	C[d]	D[e]
Secureness	1			
Pullout	2			

Table 28.1 Continued on Next Page

Table 28.1 Continued

Test	Sample sets[a]			
	A[b]	B[c]	C[d]	D[e]
Conditioning		1		
Temperature		2		
Dielectric Withstand		3		
Heat Cycling			1	
Mold Stress Relief				1

[a] Additional sample sets may be required for connections having a range of conductor sizes. One sequence need not be completed as a prerequisite to the starting of another sequence or another set of samples within the same sequence.

[b] See 29.1 and 29.2.

[c] See Sections 30 – 32.

[d] See Section 33.

[e] See Section 16.

28.2 A terminal block using spring force connectors is to be tested using both solid and stranded wire for 30 – 10 AWG (0.05 – 5.3 mm^2) wire sizes and using stranded wire for 8 AWG (8.4 mm^2) and larger wire sizes unless the terminal is marked according to 34.1 in which case the wire used is to be of the type the terminal block is rated.

28.3 When tested with stranded conductors, all strands of the conductor must enter the terminal gripping area as intended without exposure of stray strands or reduction of required spacings.

28.4 Instructions for preparation of conductors such as tinning of stranded wire, strip length, and related preparation processes, are to be followed in the assembly of the conductor to the terminal block. See 35.2 and 35.3.

29 Secureness and Pullout Tests

29.1 A terminal block having spring force connections shall comply with the Mechanical Sequence (Secureness and Pullout Tests) in UL 486A-486B or UL 486E, as appropriate.

Exception: A terminal block rated for factory wiring only need not be subjected to these tests. See 29.2.

29.2 A terminal block having spring force connections rated for factory wiring only shall be subjected to this test in lieu of the Secureness and Pullout Test in UL 486A-486B or UL 486E. Previously unused samples of the spring force connection are to be subjected to a gradual tensile pull force. Four samples each of the minimum and maximum rated wire size and type are to be assembled in accordance with 28.2 – 28.4. The force to cause displacement shall be recorded.

30 Conditioning

30.1 Six previously unused connections are to be subjected to a conditioning of nine insertions and withdrawals of a conductor of the maximum size and type. A tenth insertion of a newly-stripped, previously unused length of wire corresponding to the ampere rating, see 11.2, is to be made and left in place for the remaining tests. Types with release mechanisms or simultaneous twist and turn instructions are to be conditioned.

Exception: A terminal block that does not allow for reusability or requires the conductor to be cut for removal is not to be conditioned.

31 Temperature Test

31.1 The temperature rises on a terminal block having spring force connections shall not exceed the applicable values specified in Table 11.1 while carrying its rated current. The test is to be conducted in a nominal 25 °C (77 °F) ambient. Temperatures are to be taken on each of the six terminations assembled as indicated in 31.2. The current shall be passed through the termination continuously for a period of 30 days. Temperatures are to be measured and recorded approximately every 24 hours.

31.2 The test is to be performed in accordance with 11.2 – 11.8 except all six connections are to be connected in series.

32 Dielectric Voltage-Withstand Test

32.1 Immediately following the Temperature Test and while still in a heated condition, each connection shall comply with 12.1 when subjected to the Dielectric Voltage-Withstand Test, Section 12.

33 Heat Cycling Test

33.1 Two previously unused samples of the spring force connection are to be connected to the size and type conductor corresponding to the ampere rating. The connections are to be connected in series as in 31.1 and 31.2. A current of 150 % of rated current is to be passed through the connections for 84 on periods of 3-1/2 hours, each followed by a 1/2 hour off period. The temperature rise for each connection is to be determined at the end of the first on period and again at the end of the final on period. The temperature rise for the last on period shall not be more than 5 °C (9 °F) higher than the first on period.

RATING

34 Details

34.1 A terminal block having spring force connections and tested with solid or stranded wire other than as noted in 28.2 shall be rated "Solid " or "Stranded " or both as appropriate. Any special wire types such as prebonded, pretinned, or double tinned wire shall also be specified.

MARKING

35 General

35.1 In addition to Section 18, General, a terminal block having spring force connections shall be marked as specified in 35.2 and 35.3.

35.2 A nominal strip length shall be provided on the terminal block, the unit container, or an information sheet packed within the unit container.

35.3 A procedure that must be followed for preparation of the conductors such as pretwisting or tinning shall appear on the unit container or on an information sheet packed within the unit container.

35.4 As an alternative to the requirements mentioned in 35.2 and 35.3 the marking can also be made accessible to all customers by cross-media documentation e.g. QR-codes with reference to internet, electronic catalogs, web-link on the package unit or delivery papers, etc.

PART IV – INSULATION PIERCING OR DISPLACEMENT CONNECTIONS

CONSTRUCTION

36 General

36.1 A terminal block having insulation piercing or displacement connections shall comply with the requirements in Sections 6 – 8.

PERFORMANCE

37 General

37.1 A terminal block having insulation piercing or displacement connections shall be subjected to the tests specified in this section and Section 16, Mold Stress Relief Test, if applicable. Tests that are to be conducted in sequence are specified in Table 37.1.

Table 37.1
Sequence of Tests for Terminal Blocks Having Piercing or Displacement Connections

Test	Sample sets[a]			
	A[b]	B[c]	C[d]	D[e]
Secureness	1			
Pullout	2			
Conditioning		1		
Temperature		2		
Dielectric Withstand		3		
Heat Cycling			1	
Mold Stress Relief				1

[a] Additional sample sets may be required for connections having a range of conductor sizes. One sequence need not be completed as a prerequisite to the starting of another sequence or another set of samples within the same sequence.

[b] See 38.1 and its exception.

[c] See Sections 39 – 41.

[d] See Section 42.

[e] See Section 16.

37.2 A terminal block using insulation piercing or displacement connectors is to be tested using both solid and stranded wire for 30 – 10 AWG (0.05 – 5.3 mm^2) wire sizes and using stranded wire for 8 AWG (8.4 mm^2) and larger wire sizes unless the terminal is marked according to 43.1 and 43.2 in which case the wire used is to be of the type or types the terminal block is rated.

38 Secureness and Pullout Tests

38.1 A terminal block having insulation piercing or displacement connections shall comply with the Mechanical Sequence (Secureness and Pullout Tests) in UL 486A-486B or UL 486E, as appropriate.

Exception: A terminal block rated for factory wiring only need not be subjected to these tests.

39 Conditioning

39.1 Six previously unused connections are to be subjected to a conditioning whereby the insulation piercing or displacement mechanism (jaws) are flexed by nine insertions and withdrawals of a conductor of the maximum size and type. A tenth insertion of a new, previously unused length of wire corresponding to the ampere rating, see 11.2, is to be made and left in place for the remaining tests.

Exception: A terminal block that does not allow for reusability is not to be conditioned. A nonreusable connection is one where the conductor must be cut.

40 Temperature Test

40.1 The temperature rises on a terminal block having insulation piercing or displacement connections shall not exceed the applicable values specified in Table 11.1 while carrying its rated current. The test is to be conducted in a nominal 25 °C (77 °F) ambient. Temperatures are to be taken on each of the six connections assembled as indicated in 40.2. The current shall be passed through the connection continuously for a period of 30 days. Temperatures are to be measured and recorded approximately every 24 hours.

40.2 The test is to be performed in accordance with 11.2 – 11.8 except all six connections are to be connected in series.

41 Dielectric Voltage-Withstand Test

41.1 Immediately following the Temperature Test and while still in a heated condition, each connection shall comply with 12.1 when subjected to the Dielectric Voltage-Withstand Test, Section 12.

42 Heat Cycling Test

42.1 A terminal block having insulation piercing or displacement connections shall comply with the Heat Cycling Tests in UL 486A-486B or UL 486E, as appropriate. Heat Cycling Tests are required for copper only as well as copper and aluminum rated connections.

RATING

43 Details

43.1 A terminal block having insulation piercing or displacement connections and tested with solid or stranded wire other than as noted in 28.2 shall be rated "Solid " or "Stranded " or both as appropriate.

43.2 A terminal block having insulation piercing or displacement connections shall be rated for specific conductor types, such as TW or THW.

MARKING

44 General

44.1 In addition to Section 18, General, a terminal block having insulation piercing or displacement connections shall be marked as specified in 44.2 and 44.3.

44.2 The procedure that must be followed for proper assembly of a conductor into the terminal block such as use of a specific tool, multiple crimping operations, and related processes shall be clearly provided on the unit container or on an information sheet packed within the unit container.

44.3 The specific conductor insulation types, see 43.2, for which the terminal block is rated shall be clearly marked on the unit container or information sheet packed within the unit container.

PART V – PROTECTIVE CONDUCTOR TERMINAL BLOCKS (PCTB)

CONSTRUCTION

45 General

45.1 A protective conductor terminal block shall comply with the applicable requirements in Sections 1 – 18 and Sections 46 – 53.

46 Connection of Support

46.1 A protective conductor terminal block shall be provided with means that securely attaches it to the corresponding support without a risk of galvanic corrosion.

46.2 A protective conductor terminal block (PCTB) shall be constructed so that the grounding path connection is established independently or simultaneously with the termination of the grounding conductor when the PCTB is installed on its support.

46.3 A clamping-type fixing means used to secure or mount an uninsulated or non-isolated protective conductor terminal block (PCTB) to the support shall be such that it can only be released by means of a tool.

47 Spacings

47.1 The spacings in a protective conductor terminal block, between live parts and uninsulated live parts of opposite polarity – including live parts and uninsulated live parts of adjacent poles of the same terminal block or another terminal block – shall comply with Spacings, Section 8.

48 Identification

48.1 The insulation of a non-isolated or isolated protective conductor terminal block shall be colored green or green-and-yellow. A green colored screw head alone does not meet the intent of this requirement.

49 Protective Conductor Mounting Rails

49.1 The mounting rails of a protective conductor terminal block intended to be connected to a busbar designated as the protective conductor shall be of steel, copper alloy, or aluminum alloy.

PERFORMANCE

50 Short Time Current Sequence (Commercial and Industrial Applications)

50.1 General

50.1.1 A protective conductor terminal block (PCTB) or pole of a PCTB intended for use in commercial and industrial applications, as specified in items B and C of Table 8.1, shall be subjected to the tests described in 50.2 – 50.4.

50.1.2 The tests are to be conducted on a protective conductor terminal block installed on its support according to the manufacturer's instructions. The tests are to be repeated for each alternate support construction, support material, or both.

50.1.3 A conductor of the largest size for which the terminal block is rated, not less than 2 feet (0.609 m) long, is to be installed. A terminal block rated for use with copper shall be tested with a copper conductor, a terminal block rated for use with aluminum shall be tested with an aluminum conductor, and a terminal block rated for use with both copper and aluminum conductors shall be tested with copper.The conductor connection and the connection to the support are to be made using the torque specified in 10.5.

50.2 Voltage drop test

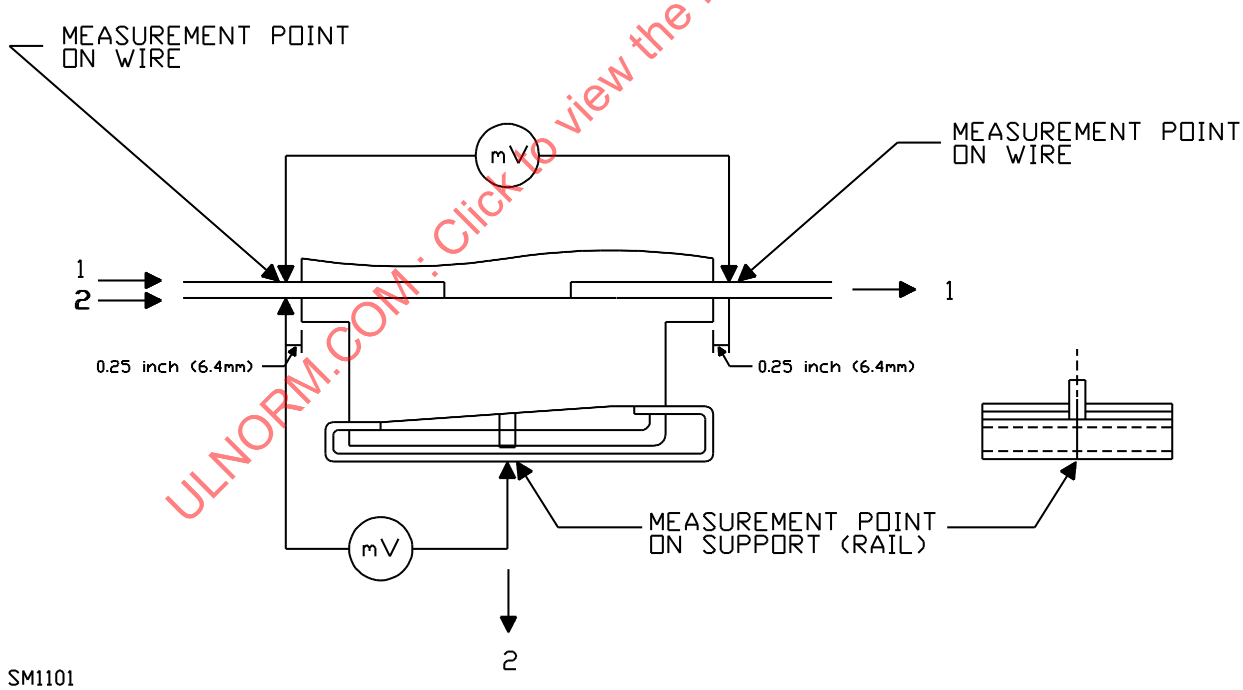
50.2.1 The voltage drop is to be measured on each terminal block as shown in Figure 50.1, with a d-c current of 0.1 times the maximum rated current of the terminal block passing through the measurement points.

a) The voltage drop shall not exceed 3.2 mV, when measured across the clamping units; and

b) The voltage drop shall not exceed 6.4 mV, when measured from the clamping units to the support.

Figure 50.1

Voltage Drop Measurement Points



50.3 Current test

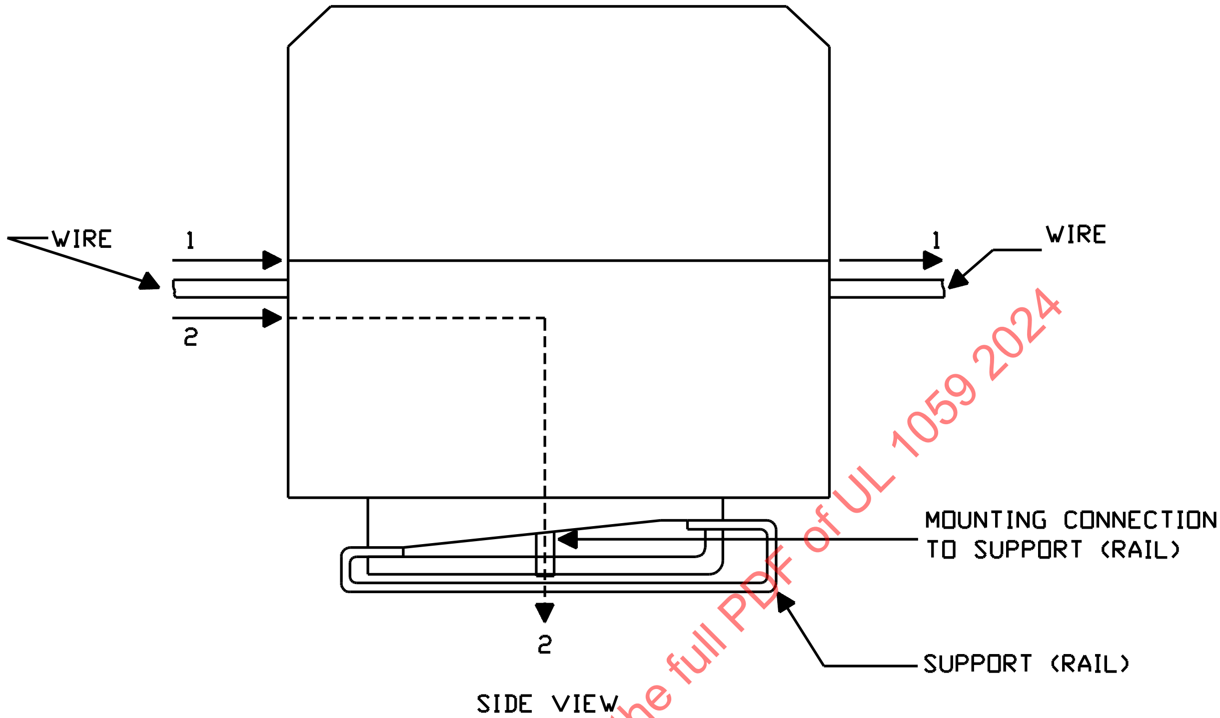
50.3.1 Following the measurement of voltage drop, three separate applications of the test current specified in Table 50.1 are to be applied, one after another, through the current paths 1-1 and 2-2, as appropriate, as shown in Figure 50.2. The test current is to be applied for 1 second during each application with an interval of 6 minutes or more between applications of the current. There shall be no damage to the terminal block or its support.

Table 50.1
Short-Time Test Currents

Conductor size, AWG/kcmil (mm^2)		Test current, amperes	
		Copper	Aluminum
14 AWG	(2.1)	252	170
12	(3.3)	396	270
10	(5.3)	636	430
8	(8.4)	1008	680
6	(13.3)	1596	880
4	(21.2)	2544	1400
3	(26.7)	3204	1770
2	(33.6)	4032	2230
1	(42.4)	5088	2800
1/0	(53.5)	6420	2900
2/0	(67.4)	8088	3600
3/0	(85.0)	10,200	4600
4/0	(107)	12,840	5800
250 kcmil	(127)	15,240	6900
300	(152)	18,240	8200
350	(177)	21,240	9600
400	(203)	24,360	11000
500	(253)	30,360	13700
600	(304)	36,480	16500
700	(355)	42,600	19250
750	(380)	45,600	20600
800	(405)	48,600	22000
900	(456)	54,720	24700
1000	(507)	60,840	27500

Figure 50.2

Current Path for Short Time Current Test



50.4 Voltage drop test repeated

50.4.1 Following the test described in 50.3.1 and after cooling to room temperature and without any change to the arrangement, the voltage drop test described in 50.2.1 is to be repeated.

a) The voltage drop shall not exceed 3.2 mV, when measured across the clamping units;

b) The voltage drop shall not exceed 6.4 mV, when measured from the clamping units to the support; and

c) The voltage drop shall not exceed 150 % of the voltage drop measured in 50.2.1 (a) and (b).

51 Short Time Current Sequence (Service Applications)

51.1 General

51.1.1 A protective conductor terminal block intended for use in service applications, see item A of Table 8.1, shall carry the current specified in Table 50.1 for the time specified in Table 51.1 without damage to the terminal block or its support. At the conclusion of the test, continuity shall exist when tested as described in 51.3.1 and 51.3.2.

Table 51.1
Short-Time Current Test Duration

Conductor size		Time,
AWG/kcmil	(mm^2)	seconds
14	(2.1)	4
12	(3.3)	4
10	(5.3)	4
8	(8.4)	4
6	(13.3)	6
4	(21.2)	6
3	(26.7)	6
2	(33.6)	6
1	(42.4)	6
1/0 and larger	(53.5)	9

51.2 Current test

51.2.1 A conductor of the maximum intended size, not less than 2 feet (0.609 m) long, shall be installed. A terminal block rated for use with copper shall be tested with a copper conductor, a terminal block rated for use with aluminum shall be tested with an aluminum conductor, and a terminal block rated for use with both copper and aluminum conductors shall be tested with copper. A terminal connector shall be tightened using the torque specified in 10.5. The test current shall pass through the mounting support and the conductor.

51.3 Continuity test

51.3.1 After the current test described in 51.2.1, continuity shall exist on the test sample assembly when measured between a point on the mounting support 1/4 inch (6.4 mm) from the connection and a similar point on the wire.

51.3.2 An indicating device such as an ohmmeter, battery-and-buzzer combination, or similar device shall be used to determine if continuity exists.

RATING

52 Details

52.1 A protective conductor terminal block shall be rated for use in a protected circuit [see Short Time Current Test (Commercial and Industrial Applications), Section 50] or an unprotected circuit [see Short Time Current Test (Service Applications), Section 51].

MARKING

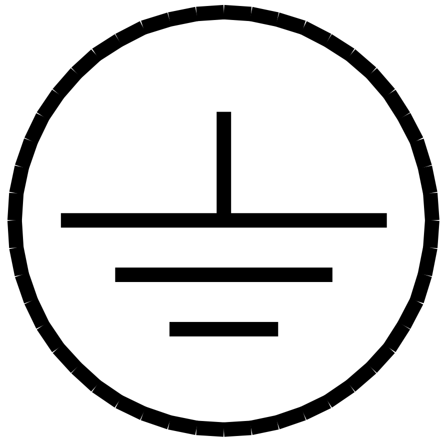
53 General

53.1 A protective conductor terminal block shall be marked with the symbol in Figure 53.1 or with "G," "GR," "GND," "Ground," "Grounding," or related marking.

Exception: This requirement does not apply to a protective conductor terminal block identified by color in accordance with 48.1.

Figure 53.1

Grounding Symbol



IEC Publication 417, Symbol 5019

Annex A (normative) – Short Circuit Current Ratings for Terminal Blocks Greater Than 10 kA

A1 Scope

A1.1 These requirements cover terminal blocks and Protective Conductor Terminal Blocks (PCTB) provided with an optional short-circuit current rating (SCCR) greater than 10 kA. These requirements supplement the requirements contained elsewhere in this Standard. These requirements apply to terminal blocks intended for installation in end-products where the final assembly is intended for installation in accordance with NFPA 70, or for installation directly in the field in accordance with requirements in the National Electrical Code (NEC).

a) Protection provided for the short-circuit current rating may not be suitable for overload protection, additional overload protection may be necessary to protect the terminal block and the electrical circuit from overload conditions.

b) Terminal blocks with provisions for tap conductors are intended to be installed in accordance with requirements in the National Electrical Code that allow for protection of the circuit at the load end of the circuit (see NEC Section 240.21).

A1.2 For PCTB's provided with an optional SCCR, the SCCR applies to the path 1-1 of Figure 50.1. SCCR's do not apply to path 2-2 of Figure 50.1. Only Isolated PCTB's and Non-Isolated PCTB's with a path 1-1 shall be provided with an optional SCCR. PCTBs are rated for use with either "protected circuits" or "unprotected circuits", see Section 52, Details, for both path 1-1 and 2-2.

A2 Short-Circuit Current Evaluation

A2.1 Selection of protective device

A2.1.1 A short circuit current rating for a terminal block shall be determined in combination with the use of a specified protective device.

Exception: Testing without a protective device for a duration of 3 electrical cycles qualifies the terminal block for a short circuit current rating without the need of a specific protective device.

A2.1.2 For terminal blocks intended to be used with fuses, the protective devices used for the test are to be selected as follows:

a) Fuses specified for terminal blocks rated over 10,000 amperes shall be limited to high-interrupting capacity, current-limiting types – for example, Class CC, G, J, L, R, and T.

b) A terminal block rated for use with RK1 or RK5 fuses is to be tested with fuses having I^2t and I_p characteristics for Class RK5 fuses. All references to Class R fuses are intended to mean fuses with energy let-through (I^2t), characteristics of Class RK5 fuses.

Exception: A terminal block marked to restrict its use to RK1 fuses is able to be tested with fuses having energy let-through characteristics of a Class RK1 fuse.

c) A Class CC, G, J, L, R, or T fuse is to be selected such that, when tested on a single-phase circuit, the peak let-through current and clearing I^2t are not less than the maximum value established for the fuse. For a fuse with I_p and I^2t limits established for several different short-circuit current levels, the test fuse is to be selected to have at least the maximum values of the current corresponding to the marked short circuit current rating of the terminal block. See Table A2.1 for peak let-through currents and I^2t values for common classes of fuses. Refer to the applicable fuse Standards for peak let-through currents and I^2t values that are not provided in Table A2.1.

Exception: A test limiter is able to be used in place of the fuses.

Table A2.1
Fuse Peak Let Through Currents, I_p , and Clearing, I^2t, Based on Available Short Circuit Current Levels

Fuse types	Fuse rating amperes	Between threshold and 50 kA		100 kA		200 kA	
		$I^2t \times 10^3$	$I_p \times 10^3$	$I^2t \times 10^3$	$I_p \times 10^3$	$I^2t \times 10^3$	$I_p \times 10^3$
Class CC	15	2	3	2	3	3	4
	20	2	3	3	4	3	5
	30	7	6	7	7.5	7	12
Class G	15	–	–	3.8	4	–	–
	20	–	–	5	5	–	–
	30	–	–	7	7	–	–
	60	–	–	25	10.5	–	–
300 volt Class T[b]	1	–	–	0.4	0.8	–	–
	3	–	–	0.6	1.3	–	–
	6	–	–	1	2	–	–
	10	–	–	1.5	3	–	–
	15	–	–	2	4	–	–
	20	–	–	2.5	4.5	–	–
	25	–	–	2.7	5.5	–	–
	30	3.5	5	3.5	7	3.5	9
	35	–	–	6	7	–	–
	40	–	–	8.5	7.2	–	–
	45	–	–	9	7.6	–	–
	50	–	–	11	8	–	–
	60	15	7	15	9	15	12
	70	–	–	25	10	–	–
	80	–	–	30	10.7	–	–
	90	–	–	38	11.6	–	–
	100	40	9	40	12	40	12
	110	–	–	50	12	–	–
	125	–	–	75	13	–	–
	150	–	–	88	14	–	–
	175	–	–	115	15	–	–
	200	150	13	150	16	150	20
	225	–	–	175	21	–	–
	250	–	–	225	22	–	–
	300	–	–	300	24	–	–
	350	–	–	400	27	–	–
	400	500	22	550	28	550	35
	450	–	–	600	32	–	–
	500	–	–	800	37	–	–
	600	1000	29	1000	37	1000	46
	700	–	–	1250	45	–	–

Table A2.1 Continued on Next Page

Table A2.1 Continued

Fuse types	Fuse rating amperes	Between threshold and 50 kA		100 kA		200 kA	
		$I^2t \times 10^3$	$I_p \times 10^3$	$I^2t \times 10^3$	$I_p \times 10^3$	$I^2t \times 10^3$	$I_p \times 10^3$
	800	1500	37	1500	50	1500	65
	1000	–	–	3500	65	–	–
	1200	3500	50	3500	65	4000	80
Class CF (up to 100 A), Class J and 600 volt Class T[b]	1	–	–	0.8	1	–	–
	3	–	–	1.2	1.5	–	–
	6	–	–	2	2.3	–	–
	10	–	–	3	3.3	–	–
	15	–	–	4	4	–	–
	20	–	–	5	5	–	–
	25	–	–	5.5	6	–	–
	30	7	6	7	7.5	7	12
	35	–	–	12	7.5	–	–
	40	–	–	17	8	–	–
	45	–	–	18	8.5	–	–
	50	–	–	22	9	–	–
	60	30	8	30	10	30	16
	70	–	–	50	11.5	–	–
	80	–	–	60	12.5	–	–
	90	–	–	75	13.5	–	–
	100	60	12	80	14	80	20
	110	–	–	100	14.5	–	–
	125	–	–	150	15.5	–	–
	150	–	–	175	17	–	–
	175	–	–	225	18.5	–	–
	200	200	16	300	20	300	30
	225	–	–	350	22.5	–	–
	250	–	–	450	24	–	–
	300	–	–	600	26	–	–
	350	–	–	800	29	–	–
	400	1000	25	1100	30	1100	45
	450	–	–	1500	36	–	–
	500	–	–	2000	42	–	–
	600	2500	35	2500	45	2500	70
	700	–	–	1200	45	–	–
	800[a]	4000	50	4000	55	4000	75
Class L	800	10000	80	10000	80	10000	80
	1200	12000	80	12000	80	15000	120
	1600	22000	100	22000	100	30000	150
	2000	35000	110	35000	120	40000	165

Table A2.1 Continued on Next Page

Table A2.1 Continued

Fuse types	Fuse rating amperes	Between threshold and 50 kA				100 kA				200 kA			
		$I^2t \times 10^3$		$I_p \times 10^3$		$I^2t \times 10^3$		$I_p \times 10^3$		$I^2t \times 10^3$		$I_p \times 10^3$	
	2500	–		–		75000		165		75000		180	
	3000	–		–		100000		175		100000		200	
	4000	–		–		150000		220		150000		250	
	5000	–		–		350000		–		350000		300	
	6000	–		–		350000		–		500000		350	
Class R		**RK1**	**RK5**	**RK1**	**RK5**	**RK1**	**RK5**	**RK1**	**RK5**	**RK1**	**RK5**	**RK1**	**RK5**
	30	10	50	6	11	10	50	10	11	11	50	12	14
	60	200	200	10	20	40	200	12	21	50	200	16	26
	100	500	500	14	22	100	500	16	25	100	500	20	32
	200	1600	1600	18	32	400	1600	22	40	400	2000	30	50
	400	5000	5000	33	50	1200	5000	35	60	1600	6000	50	75
	600	10000	10000	43	65	3000	10000	50	80	4000	12000	70	100

[a] Value applies to Class T fuses.

[b] When values at 50 kA and 200 kA are needed, the standard case size shall be used.

A2.1.3 Circuit breakers may be added to the short-circuit current marking based on an evaluation of data from previously conducted short-circuit tests. The evaluation shall be conducted as follows:

a) The circuit breakers to be added shall be current limiting,

b) The short-circuit current and voltage rating of the circuit breakers to be added shall be the same or lower than the short-circuit current and voltage rating for which the test was conducted, and

c) The peak let-through current (I_p) and I^2t of the circuit breakers to be added shall not be greater than values for peak let-through current (I_p) and I^2t measured during the previously conducted test.

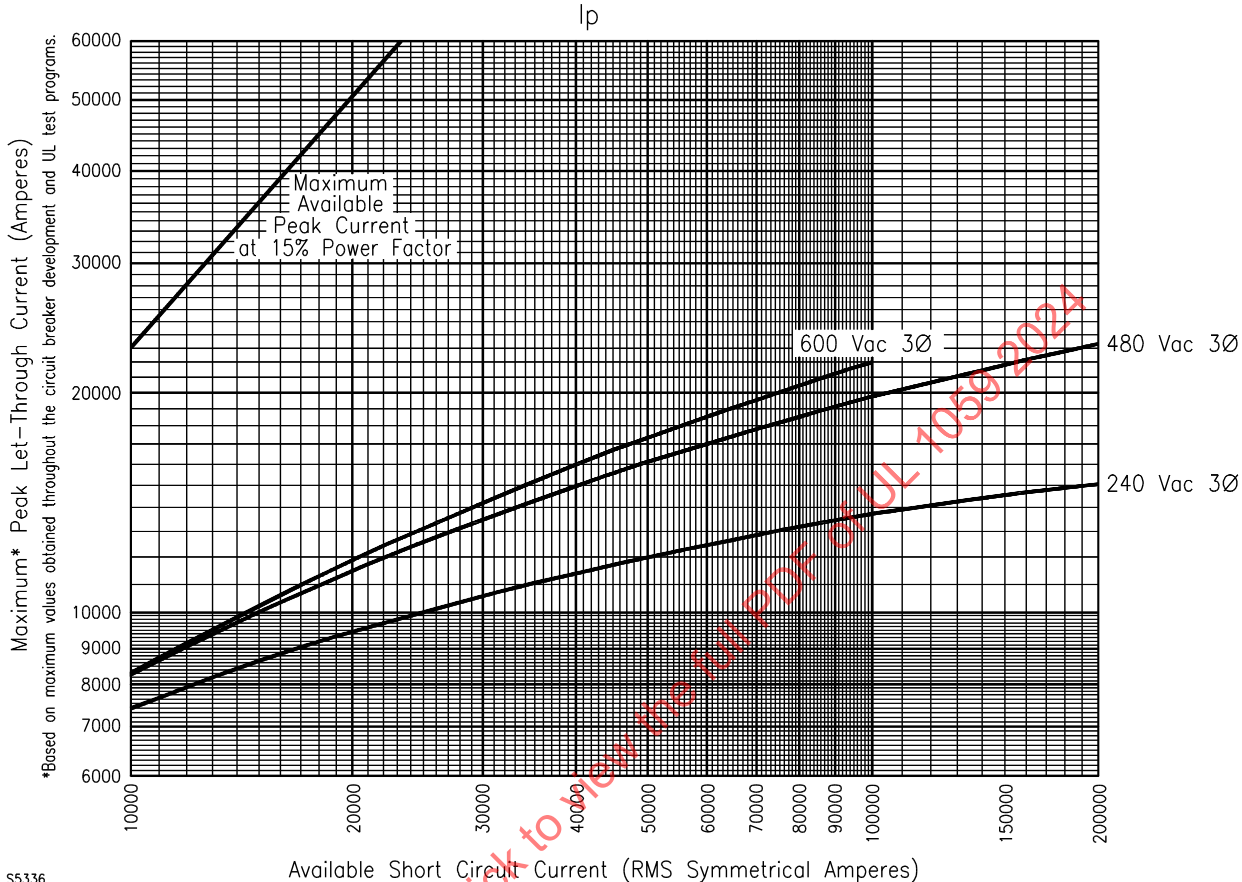
Notes:

1) A current-limiting circuit breaker is one that does not employ a fusible element and, when operating within its current-limiting range, limits the let-through I^2t to a value less than the I^2t of a 1/2-cycle wave of the symmetrical prospective current. Current-Limiting type circuit breakers are marked “Current-Limiting.”

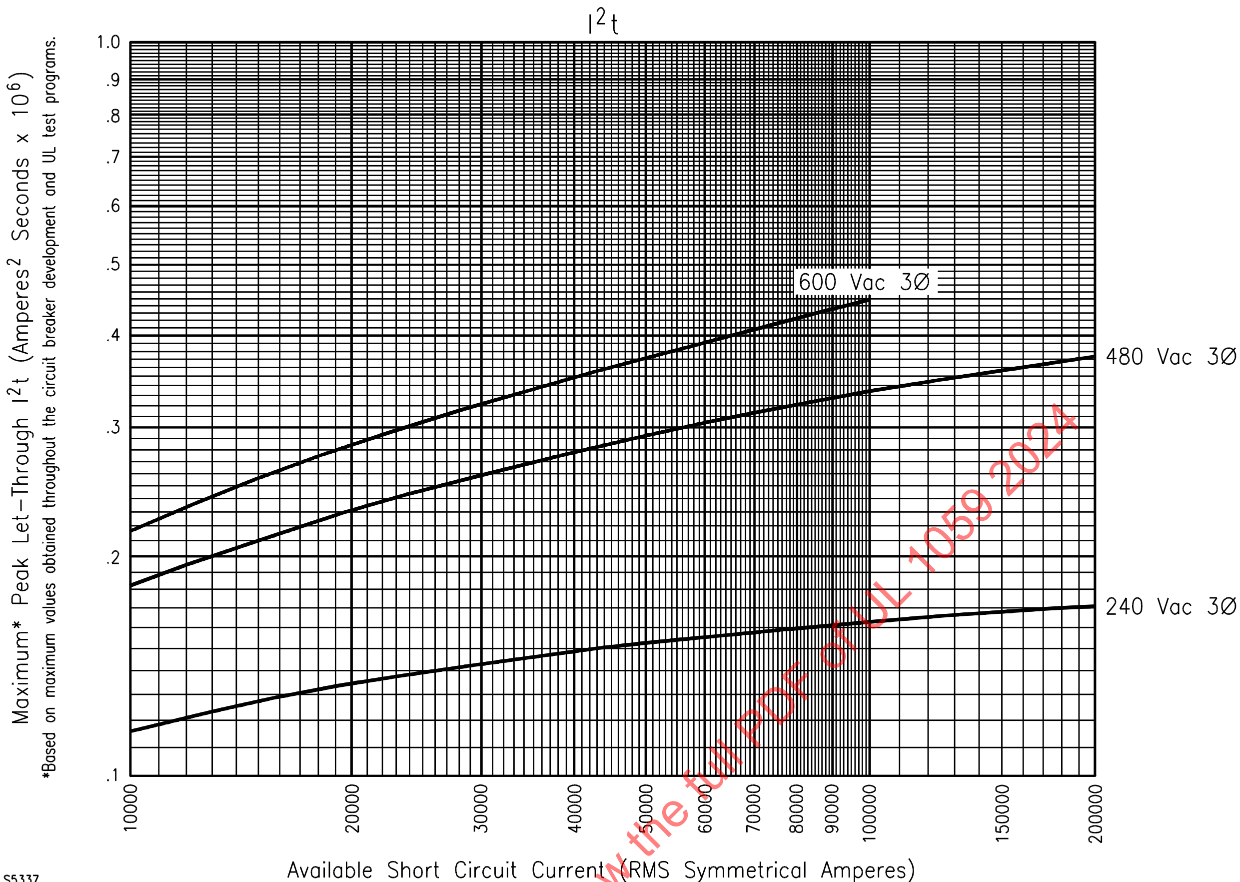
2) See published let-through values for current-limiting circuit breakers provided by the manufacturer. Figure A2.1 may be used to assist in determining the peak let-through current and I^2t from the manufacturer’s data sheets.

Figure A2.1

Sample Plots of Current Limiting Circuit Breakers Let-Through Values



S5336



S5337

To determine peak let-through current and I^2t value:

a) Obtain plots of the peak let-through values for the specific current-limiting circuit breaker from the manufacturer;

b) Select the available short-circuit current along the horizontal axis at the bottom of the chart that is equal to the short-circuit current rating of the terminal block;

c) Move vertically to the intersection with the curve corresponding to the rated voltage of the circuit breaker that is not less than the rated voltage of the terminal block.

d) Move horizontally left to intersection with the vertical axis to determine the peak let-through current or I^2t value.

A2.2 Sample preparation

A2.2.1 The terminal block is to be mounted to a metal plate. Line and load conductors are not required to be equal in length so long as the total conductor length per terminal does not exceed 8 feet (2.44 m). Load side conductor may be a continuous (loop) conductor between terminal blocks under test. See Figure A2.2. The conductors shall be braced together and secured to the mounting plane at a distance from the load and load sides of the clamping unit as noted in Table A2.2 and Figure A2.2. There shall be no lashing or additional support of the conductors.

Looped load wire must be cut to perform Dielectric Voltage-Withstand Test following the Short Circuit Test.

Exception No. 1: Line and Load conductors longer than 8 feet (2.44 m) may be used if the additional length is included in the circuit calibration.

Exception No. 2: The terminal block may be mounted in an enclosure with conductors routed through conduit, no greater than 12 inches (305 mm) in length installed on the enclosure. If an enclosure is used, there shall be no lashing or additional support of the conductors within the enclosure. For additional requirements for mounting within an enclosure, see Section 50.2 of UL 508.

Exception No. 3: Non-Isolated PCTB's shall be mounted to a nonconductive plate.

Table A2.2
Conductor Bracing

Conductor Cross Section, AWG/ Kcmil (mm^2)	30 – 2/0 (0.05 – 70)	3/0 – 4/0 (85 – 107)	250 (120 – 127)	300 – 350 (152 – 185)	400 – 500 (203 – 253)	600 – 2000 (300 – 1,010)
Distance "X", inches (mm)	9-13/16 (250)	11-13/16 (300)	13-3/4 (350)	15-3/4 (400)	17-3/4 (450)	19-11/16 (500)