

## STANDARD INFORMATION

**Standard Number:** UL 83 / CSA C22.2 No 75 / NMX-J-010-ANCE

**Standard Name:** Thermoplastic-Insulated Wires and Cables

**Standard Edition and Issue Date:** 16<sup>th</sup>/11<sup>th</sup>/6<sup>th</sup> Edition dated July 28, 2017

**Date of Revision:** July 28, 2017

**Date of Previous Revision of Standard:** 15<sup>th</sup>/10<sup>th</sup>/5<sup>th</sup> Edition dated March 28, 2014

## EFFECTIVE DATE OF NEW/REVISED REQUIREMENTS

**Effective Date:** **July 20, 2020**

## IMPACT, OVERVIEW, AND ACTION REQUIRED

**Impact Statement:** A review of all Listing Reports is necessary to determine which products comply with new/revise requirements and which products will require re-evaluation. **NOTE:** Effective immediately, this revised standard will be exclusively used for evaluation of new products unless the Applicant requests in writing that current requirements be used along with their understanding that their listings will be withdrawn on Effective Date noted above, unless the product is found to comply with new/revise requirements.

### Overview of Changes:

- Revised 4.1.5.2.6 to permit compressed unilay single input to have other than reversed direction of strand layers. As a result, the title of Table 7 revised. Addition of a reference to the Length of Lay test in UL 2556, CSA C22.2 No. 2556, or NMX-556-ANCE at 4.1.5.2.6 to specify how to determine the length of lay.
- Added a country deviation to 4.2.2, to clarify in Mexico, repairs on finished conductors are not permitted.
- Revised 5.2.1, 5.2.2, 5.3.1.2, 5.3.2, and 5.13 to align with the Standard for Thermoset-Insulated Wires and Cables, UL 44/CSA C22.2 No. 38/NMX-J-451
- Revised 5.3.1.2 to cover cases where the center strand consists of more than one wire and situations for non-compliance.
- Revised 5.5 and 5.6 for clearer interpretation of the LTIR test procedure and stability requirements in Long Term Insulation Resistance and stability acceptance criteria.
- Revised Heat Shock, Cold Bend, FT1, and Oil Resistance tests and addition of new tables 27 and 28 (and subsequent tables renumbered) for deep-well submersible pump cable requirements.
- Revised Vertical specimen test in 5.12.3.1.1 to clarify the requirements apply only to the vertical flame aspect of the test, not the horizontal flame portion.
- Revised optional marking requirement for Gasoline and Oil Resistance in 5.15.1 to specify the marking is only for wet rated conductors.
- Revised 5.18 to state the maximum number of specimens that are permitted to fail.
- Addition of 6.1.5 to specify that wire is required to be marked when other than those with ASTM Class B, C or SIW stranding.
- Addition of Note to 6.1.10 to show it is a requirement in Canada that wires must be marked FT1 or FT4. Table C1 in Annex C is also revised.



- Addition of a note to indicate in Canada, the -40°C rating is required as specified in the Canadian Electrical Code, Part I. As a result, 7.3.1, 7.3.2, and 7.4.4 have also been revised.

Specific details of new/revised requirements are found in table below.

**If the applicable requirements noted in the table are not described in your report(s), these requirements will need to be confirmed as met and added to your report(s) such as markings, instructions, test results, etc. (as required).**

**Client Action Required:**

**Information** – To assist our Engineer with review of your Listing Reports, please submit technical information in response to the new/revised paragraphs noted in the attached or explain why these new/revised requirements do not apply to your product (s).

***Current Listings Not Active? – Please immediately identify any current Listing Reports or products that are no longer active and should be removed from our records. We will do this at no charge as long as Intertek is notified in writing prior to the review of your reports.***

## STANDARD INFORMATION

CLAUSE	VERDICT	COMMENT
<i>Additions to existing requirements are <u>underlined</u> and deletions are <del>shown lined</del> out below.</i>		
4	Info	<b>Construction</b>
4.1		<b>General</b>
4.1.5		<b>Sizes and stranding</b>
4.1.5.2		<b>Stranding</b>
		Every stranded conductor other than a compact-stranded conductor or a bunch-stranded conductor twisted as a single bunch shall comply with the following:
4.1.5.2.6		<p>a) The direction of lay of the strands, members, or ropes in a 13.3 – 1010 mm<sup>2</sup> (6 AWG – 2000 kcmil) conductor, other than a <u>compressed unilay single input wire</u>, combination unilay or a compressed unilay or compressed unidirectional lay conductor, shall be reversed in successive layers. Rope-lay conductors with bunch-stranded or concentric-stranded members shall be either unidirectional or reversed. All unidirectional lays and the outer layer of reversed lays shall be in the left-hand direction.</p> <p>b) For a bunch-stranded member of a rope-lay-stranded conductor in which the members are formed into rope-stranded components that are then cabled into the final conductor, the length of lay of the individual members within each component shall not be more than 30 times the outside</p>



diameter of one of those members.

- c) For a concentric-stranded member of a rope-lay-stranded conductor, the length of lay of the individual strands in a member shall be 8 – 16 times the outside diameter of the member. The direction of lay of the strands in each member shall be reversed in successive layers of the member.
- d) The length of lay of the strands in both layers of a 19-wire combination round-wire unilay-stranded copper or aluminum conductor shall be 8 – 16 times the outside diameter of the completed conductor. Otherwise, the length of lay of the strands in every layer of a concentric-lay- stranded conductor consisting of fewer than 37 strands shall be 8 – 16 times the outside diameter of the conductor.
- e) The length of lay of the strands in the outer two layers of a concentric-lay-stranded conductor consisting of 37 or more strands shall be 8 – 16 times the outside diameter of the conductor.
- f) The length of lay of the members or ropes in the outer layer of a rope-lay-stranded conductor shall be 8 – 16 times the outside diameter of that layer.

The length of lay shall be determined in accordance with the test, Length of lay, in UL 2556, CSA C22.2 No. 2556, or NMX-556-ANCE

4.2	Info	<b>Insulation</b>
4.2.2	Info	<b>Repairs</b>
4.2.2.1		Where a repair is made in the insulation, the insulation applied to the repaired section shall be equivalent to that removed, <del>and the repaired section of the finished conductor shall comply with the same electrical and thickness requirements specified in this Standard.</del>
		<b><i>New clause added;</i></b>
4.2.2.2		In Canada and the United States, the repaired section of the finished conductor shall comply with the same electrical and thickness requirements specified in this Standard.  In Mexico, repairs to finished conductors are not permitted.
5	Info	<b>Test requirements</b>
5.2	Info	<b>Conductor resistance</b>
5.2.2		A twisted conductor assembly <u>or multiple-conductor cable</u> shall not exceed the value tabulated in Tables 14 – 23 as applicable, for a single conductor multiplied by whichever of the following factors is applicable: <ul style="list-style-type: none"> <li>a) Cabled in one layer: 1.02;</li> <li>b) Cabled in more than one layer: 1.03; or</li> </ul>



c) Cabled as an assembly of other pre-cabled units: 1.04.

5.3	Info	<b>Tests on aluminum conductors</b>
5.3.1	Info	<b>Physical properties</b>
5.3.1.1		All aluminum conductors shall have a minimum elongation at break of 10 percent. Wires (strands) removed from a finished stranded conductor shall have a tensile strength of 98 – 159 MPa (14,250 – 23,100 lbf/in <sup>2</sup> ). The tensile strength of all other conductors shall be 103 – 152 MPa (15,000 – 22,000 lbf/in <sup>2</sup> ). Compliance shall be determined in accordance with the test, Physical properties of conductors –Maximum tensile strength and elongation at break, in UL 2556, <u>or</u> CSA C22.2 No. 2556, <del>or NMX-J-556-ANCE.</del>
5.3.1.2		Compliance with the <del>foregoing</del> requirements <u>in 5.3.1.1</u> for stranded conductors shall be determined either on wires taken prior to stranding into conductors, <del>strands any strand(s)</del> taken from a stranded conductor, or the stranded conductor as a whole, at the option of the manufacturer. <u>In case of non-compliance, the results from specimens taken from a center strand only shall be considered for referee purposes.</u>
5.3.2		<b>High-current heat cycling [3.31 – 8.37 mm<sup>2</sup> (12 – 8 AWG) conductors only]</b>
5.3.2.2		Compliance shall be determined in accordance with the test, High-current heat cycling for aluminum conductors, in UL 2556, <u>or</u> CSA C22.2 No. 2556, <del>or NMX-J-556-ANCE.</del>
5.5		<b>Long-term insulation resistance in water – <u>acceptance criteria</u></b>
		<b><del>Minimum acceptable value</del></b>
5.5.1		The insulation, <u>without protective covering</u> , of wet-rated single-conductor cable and of the individual single conductors of <del>multiconductor</del> <u>multiple-conductor</u> cable shall have <u>an</u> insulation resistance at the <del>specified</del> temperature <u>specified in 5.5.2</u> in tap water <u>that</u> is not less than specified in Table 24 at any time <del>during immersion</del> , <u>in accordance with the test, Insulation resistance, in UL 2556, CSA C22.2 No. 2556, or NMX-J-556-ANCE while immersed.</u> The period of immersion shall be 12 weeks or more if the insulation resistance <u>during throughout</u> the last 6 weeks of the <u>initial 12-week immersion</u> period is <del>higher</del> <u>greater</u> than 3 GΩ·m (10 MΩ·1000 ft). The period of immersion shall be <del>24 – 36 weeks</del> <u>at least 24 weeks and no more than 36 weeks, unless requested by the manufacturer,</u> if the insulation resistance is less than 3 GΩ·m (10 MΩ·1000 ft) <u>at any point during the last 6 weeks of the initial 12-week immersion period,</u> but equals or exceeds the value <del>indicated</del> <u>specified</u> in Table 24. An a-c voltage <del>of</del> <u>equal to the voltage rating of the wire (600 V or 1000 V rms)</u> shall be applied to the <del>insulation</del> <u>insulated conductor</u> at all times other than while <del>reading</del> <u>measuring</u> the insulation resistance.
		In the case of <del>nylon-covered-jacketed</del> wires, the nylon shall be removed prior to testing. <u>These tests are accelerated tests. The values in Table 24 apply only to conductor types with the corresponding insulation thicknesses specified in this Standard.</u>



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5.5.3		<p>During the extended immersion, the <del>The</del> maximum <u>weekly</u> decrease in insulation resistance <del>per week, as determined from a curve (derived from the best fit using the method of least squares representing the average of actual values), for every continuous period of 3 weeks during the latter half of the specified immersion time shall be not as determined in 5.5.4 shall not be</del> more than 4 percent if <del>and while</del> the insulation resistance <u>throughout the last 6 weeks of the immersion period is 3 GΩ·m (10 MΩ·1000 ft) or more, and shall be not not be</u> more than 2 percent if the insulation resistance is less than 3 GΩ·m (10 MΩ·1000 ft), but more than the <del>value indicated</del> <u>values specified in Table 24. If the results of the test do not meet either of these criteria, but are more than the values specified in Table 24, the period of immersion may be extended by one week intervals at the request of the manufacturer, subject to the minimum test period established in 5.5.1. If the insulation resistance falls below the values specified in Table 24, the test shall be discontinued and considered a failure.</u></p>
<hr/> <p><b><i>New clause added;</i></b></p>		
5.5.4		<p>The maximum weekly decrease in insulation resistance shall be calculated as the slope of a least squares best fit straight line curve drawn through a three-week moving average of the last six weeks of raw test data. Each three-week moving average data point for the least squares best fit straight line curve shall be calculated as the average of the raw data for the current week and the previous two weeks (for example, the week 12 data point would be the average of the weeks 10, 11 and 12 raw data values).</p>
<hr/> <p><b><i>New clause added;</i></b></p>		
5.5.5		<p>Compliance with 5.5.1 – 5.5.4 shall be determined in accordance with the test, Long-term insulation resistance (Method 1), in UL 2556, CSA C22.2 No. 2556, or NMX-J-556-ANCE.</p>
5.6	Info	<b>Long-term insulation resistance in air for 90°C rated conductors</b>
5.6.2		<b><u>Maximum acceptable rate of decrease</u> Acceptance criteria</b>

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The 90°C rated insulation of the individual conductors without covering shall have insulation resistance in air at  $97 \pm 1^\circ\text{C}$  that is not less than ~~indicated~~ specified in Table 25 at any time during an extended period in an acceptable full-draft circulating-air oven ~~under the following conditions~~. The period in the oven shall be 12 weeks or more, to a maximum of 36 weeks, if the insulation resistance throughout the last 6 weeks of the initial 12-week period in the oven is greater than  $3 \text{ G}\Omega\cdot\text{m}$  ( $10 \text{ M}\Omega \cdot 1000 \text{ ft}$ ) or higher. The period in the oven shall be at least 24 weeks and no more than 36 weeks, unless requested by the manufacturer, # if the insulation resistance is less than  $3 \text{ G}\Omega\cdot\text{m}$  ( $10 \text{ M}\Omega \cdot 1000 \text{ ft}$ ) at any point during the last 6 weeks of the initial 12-week period in the oven, but equals or exceeds the value specified in Table 25, the period in the oven shall be 24 weeks or more to a maximum of 36 weeks. An a-c voltage equal to the voltage rating of the wire ( $600 \text{ V}$  or  $1000 \text{ V rms}$ ) voltage shall be applied to the insulated conductor at all times other than while ~~reading~~ measuring the insulation resistance. In the case of nylon-jacketed wires, the nylon shall be removed prior to testing. These tests are accelerated tests. The values in Table 25 apply only to conductor types with the corresponding insulation thicknesses specified in this Standard.

5.6.2.1

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The insulation resistance shall be measured between the conductor and an electrode consisting of either graphite powder, a snug-fitting close-weave copper braid of minimum 90 percent coverage applied over the insulation, or other equivalent means.

5.6.2.2

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***New clause added;***

The maximum weekly decrease in insulation resistance as determined in 5.6.2.4 shall not be more than 4 percent if the insulation resistance throughout the last 6 weeks of the period in the oven is  $3 \text{ G}\Omega\cdot\text{m}$  ( $10 \text{ M}\Omega \cdot 1000 \text{ ft}$ ) or more, and shall not be more than 2 percent if the insulation resistance at any point during the last 6 weeks of the initial 12-week period in the oven is less than  $3 \text{ G}\Omega\cdot\text{m}$  ( $10 \text{ M}\Omega \cdot 1000 \text{ ft}$ ), but more than the values specified in Table 25. If the results of the test do not meet either of these criteria, but are more than the values specified in Table 25, the period of immersion may be extended by one week intervals at the request of the manufacturer, subject to the minimum test period established in 5.5.3. If the insulation resistance falls below the values specified in Table 25, the test shall be discontinued and considered a failure.

5.6.2.3

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***New clause added;***

The maximum weekly decrease in insulation resistance shall be calculated as the slope of a least squares best fit straight line curve drawn through a three-week moving average of the last six weeks of raw test data. Each three-week moving average data point for the least squares best fit straight line curve shall be calculated as the average of the raw data for the current week and the previous two weeks (for example, the week 12 data point would be the average of the weeks 10, 11 and 12 raw data values).

5.6.2.4

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**New clause added;**

5.6.2.5 Compliance with 5.6.2.1 – 5.6.2.4 shall be determined in accordance with the test, Long-term insulation resistance (Method 2), in UL 2556, CSA C22.2 No. 2556, or NMX-J-556-ANCE.

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5.9 Info **Heat shock**

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5.9.1 ~~When tested in accordance with the test, Heat shock, in UL 2556, CSA C22.2 No. 2556, or NMX-J-190-ANCE, Neither the insulation of single-insulated conductors nor the nylon jacket (if present) shall not show any cracks, on the surface or internally, after a specimen of finished wire or cable is wound around a mandrel after conditioning in an air-circulating oven for 1 hour to a temperature of 121 ±1°C. For single conductors, with a the mandrel diameter shall be as specified in Column A of Table 26 after conditioning in an air-circulating oven for 1 h to a temperature of 121 ±1°C. Compliance shall be determined in accordance with the test, Heat Shock, in UL 2556, CSA C22.2 No. 2556, or NMX-J-190-ANCE.~~

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5.12 Info **Flame and smoke**

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**FT1**

5.12.2 In Canada, when tested in accordance with the test, FT1, in UL 2556, CSA C22.2 No. 2556, or NMX-J-556193-ANCE, a finished conductor shall not convey flame or continue to burn for more than 60 s after five 15 s applications of the test flame. If more than 25 percent of the extended portion of the indicator is burned, the conductor shall be considered to have conveyed flame.

In the United States and Mexico, compliance with this requirement shall be optional.

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5.12.3 **FV-2/VW-1 (optional)**

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5.12.3.1 **Vertical specimen**

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**For wires to be marked VW-1**

5.12.3.1.1 For a given size of a finished wire or cable to be marked VW-1, that size and 2.08 mm<sup>2</sup> (14 AWG) copper or 3.31 mm<sup>2</sup> (12 AWG) aluminum shall comply with the requirements of the horizontal flame test described in 5.12.3.2, and with the requirements of 5.12.3.1.2 when tested in accordance with the test, FV-2/VW-1, in UL 2556, CSA C22.2 No. 2556, or NMX-J-192-ANCE. and shall be judged not capable of conveying flame along its length or in its vicinity when tested in accordance with the test, FV-2/VW-1, in UL 2556, CSA C22.2 No. 2556, or NMX-J-192-ANCE. If any specimen shows more than 25 percent of the indicator flag burned away or charred (soot that can be removed with a cloth or the fingers and brown scorching area shall be ignored) after any of the five applications of flame, the wire or cable shall be judged capable of conveying flame along its length. If any specimen emits flaming or glowing particles or flaming drops at any time that ignite the cotton on the burner, wedge, or floor of the enclosure (flameless charring of the cotton shall be ignored), the wire or cable shall be judged capable of conveying flame to combustible materials in its vicinity. If any specimen continues to flame longer than

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~~60 s after any application of the gas flame, the wire or cable shall be judged capable of conveying flame to combustible materials in its vicinity.~~

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***New clause added;***

Each specimen shall be judged not capable of conveying flame along its length or in its vicinity if the following conditions apply:

- 5.12.3.1.2
- a) The specimen does not show more than 25 percent of the indicator flag burned away or charred (soot that can be removed with a cloth or the fingers and brown scorching area shall be ignored) after any of the five applications of flame;
  - b) The specimen does not emit flaming or glowing particles or flaming drops at any time that ignite the cotton on the burner, wedge, or floor of the enclosure (flameless charring of the cotton shall be ignored); and
  - c) The specimen does not continue to flame longer than 60 seconds after any application of the gas flame.
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5.14 Info **Oil resistance (optional)**

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5.14.2 Info **Oil resistance at 75°C**

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**To be marked PR II**

5.14.1 To be marked PR II, in addition to complying with the requirements of 5.14.1, the retention of tensile strength and elongation of the insulation shall be not less than 65 percent of the unconditioned value after immersion of the finished wire or cable in IRM 902 oil for 60 d at 75°C. Compliance shall be determined in accordance with the applicable clauses of the test, Oil resistance, in UL 2556, CSA C22.2 No. 2556, or NMX-J-556-ANCE.

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5.15 **Gasoline and oil resistance (optional)**

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**To be marked GR I or GR II**

5.15.1 To be marked GR I or GR II, the retention of tensile strength and elongation of wet rated insulated conductors found to be in compliance with the requirements of 5.14.1 or 5.14.2, respectively, shall not be less than 65 percent after 30 d immersion in water saturated with equal volumes of iso-octane and toluene (ASTM Reference Fuel C) maintained at 23 ±1°C. Compliance shall be determined in accordance with the applicable clauses of the test, Gasoline resistance, in UL 2556, CSA C22.2 No. 2556, or NMX-J-556-ANCE.

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**Abrasion resistance (~~nylon-covered~~ nylon-jacketed types or insulations other than PVC)**

5.16

The insulation and nylon jacket (if present) on solid 2.08 mm<sup>2</sup> (14 AWG) conductors shall not wear through to expose the conductor on any of 6 specimens subjected to 800 cycles of abrasion by means of a weight that exerts a force of 3.3 ±0.1 N or 340 ±13 gf (12.0 ±0.5 ozf), in accordance with the procedure described in the test, Abrasion resistance, in UL 2556, CSA C22.2 No. 2556, or NMX-J-556-ANCE.

~~In Mexico, the abrasion resistance test is not required.~~

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**Impact resistance (~~nylon-covered~~ nylon-jacketed types or insulations other than PVC)**

5.18

A free-falling steel weight that impacts with an energy of 2.7 J (2 ft-lbs) upon the insulation and nylon jacket (if present) of a solid 2.08 mm<sup>2</sup> (14 AWG) specimen shall not expose the conductor or cause triggering of the indicator in more than two out of ten specimens when tested in accordance with the test, Impact resistance, in UL 2556, CSA C22.2 No. 2556, or NMX-J-556-ANCE.

6

Info

**Marking**

6.1

**Marking on product**

*New clause added;*

6.1.5

**Conductor stranding**

A wire employing other than ASTM Class B, C, or SIW stranding shall be marked with the conductor class or classes and the number of strands. Example: 2 AWG (259w Class H)

6.1.10

**Flame test marking (optional)**

**General**

Insulated conductors with the following markings shall meet the requirements of the corresponding clauses:

6.1.10.1

- a) "FT1": 5.12.2 applies;
  - b) "VW-1" or "FV-2": 5.12.3 applies;
  - c) "CT": 5.12.4 or 5.12.5 applies (see 6.1.10.2 for applicability);
  - d) "FT4" or "FT4/IEEE 1202": 5.12.5 or 5.12.6 applies using the FT4 Vertical-Tray Flame exposure;
  - e) "ST1": 5.12.6 applies;
  - f) "LS": 5.12.7 applies; and
  - g) "RPI": 5.12.7.3 applies.
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Note: The FT1 or FT4 marking is required where specified in the CE Code, Part I, and the National Building Code of Canada.

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7 Info **Deep-well submersible water pump cable**

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7.1 The construction of deep-well submersible water pump cable shall consist of assemblies comprising two or more insulated circuit conductors having a wet rating, and an optional insulated equipment grounding conductor, with or without an overall jacket. These cables shall be of the twisted or parallel configuration ~~with the option of having a low temperature rating of -40°C.~~

Note: In Canada, the -40°C rating is required as specified in the CE Code, Part I.

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7.3 Info **Marking**

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**Marking on product**

Deep-well submersible water pump cable shall be legibly and durably marked to indicate the following:

- 7.3.1
- a) The manufacturer's identification;
  - b) The number of circuit conductors (in the case of jacketed constructions);
  - c) The conductor size in accordance with 6.1.4;
  - d) The word "AL", if aluminum conductors are used. The additional marking "ACM" shall be optional;
  - e) The designation "SUBMERSIBLE PUMP CABLE" as applicable (required on jacketed constructions, optional on conductors of non-jacketed constructions);
  - f) The nominal voltage rating, in accordance with 6.1.8;
  - g) The low-temperature rating, ~~marked in accordance with Clause 6.1.8~~ "-40°C", for cables complying with 7.4.4;
  - h) The type designation of individual conductors, either on the conductor insulation surface or the outer jacket. In the case of polyethylene-insulated conductors, the marking "PE 75C" shall be applied on the outer jacket;
  - i) For other than polyethylene-insulated conductors, marking of the maximum operating dry and wet temperature rating of insulation as applicable shall be optional; and
  - j) Optional markings specified in 6.1 as applicable.

The above markings shall be surface ink-printed, indented, or embossed at intervals of not more than 0.6 m. Indent markings shall be such that the minimum specified

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thickness of the jacket or insulation is maintained.

**Marking on package**

Each packaged coil or reel of cabled or parallel assembly, and of jacketed cables, shall be tagged or marked to indicate legibly the following:

- a) Manufacturer’s name;
- b) Month and year of manufacture;
- c) Product designation “SUBMERSIBLE PUMP CABLE”;
- d) Conductor size in accordance with 6.1.4;
- e) “AL”, if aluminum conductors are used. The additional marking “ACM” shall be optional;
- f) Nominal voltage rating, in accordance with 6.1.8;
- g) The low-temperature ~~Low-temperature~~ rating marking “-40°C”, in accordance with ~~Clause 6.1.8~~, for cables in compliance with 7.4.4;
- h) In the United States and Canada, the notation “For Wiring Only Between Equipment Located at Water Well Heads and Motors of Installed Deep-Well Submersible Water Pumps”.  
  
In Mexico, this marking does not apply;
- i) Type designation of the individual conductors. In the case of polyethylene-insulated cables, the marking “PE 75C” shall be applied on the jacket; and
- j) For other than polyethylene-insulated conductors, marking of the maximum operating dry and wet temperature rating of insulation as applicable shall be optional.

7.3.2

7.4	Info	<b>Tests</b>
7.4.3	Info	<b>Insulation resistance</b>
7.4.4		<b><i>New section added;</i></b>
		<b>Heat shock</b>
7.4.4.1		For cable assemblies with an overall jacket, the insulation and jacket shall not show any cracks, on the surface or internally, after a specimen of finished cable assembly is wound around a mandrel after conditioning in an air-circulating oven for 1 hour to a temperature of 121 ±1°C.



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7.4.4.2 The mandrel diameter and the number of turns shall be as specified in Table 27. For flat cable, the minor cross-sectional dimension of the cable shall be used in determining the mandrel diameter, and the cable shall be wound or bent flatwise around the mandrel. Compliance shall be determined in accordance with the test, Heat Shock, in UL 2556, CSA C22.2 No. 2556, or NMX-J-190-ANCE.

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***New section added;***

**Cold bend**

7.4.5 For cable assemblies with an overall jacket, the insulation and nylon covering jacket (if present) and jacket shall not show any cracks when tested in accordance with the test, Cold bend, in UL 2556, CSA C22.2 No. 2556, or NMX-J-193. The mandrel diameter and number of turns shall be as specified in Table 28.

In Canada, conditioning shall be at a temperature of  $-40 \pm 1^\circ\text{C}$ .

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***New clause added;***

7.4.8 **FT1 flame test**

In Canada, a finished cable assembly with an overall jacket shall meet the requirements of 5.12.2.

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***New clause added;***

**Deformation**

7.4.9 The thickness of the jacket on a cable assembly with an overall jacket shall not decrease more than 50 percent when subjected to a temperature of  $121 \pm 1^\circ\text{C}$  while under a load of 2000 g. Compliance shall be determined in accordance with the test, Deformation, in UL 2556, CSA C22.2 No. 2556, or NMX-J-498-ANCE

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***New clause added;***

7.4.10 A finished cable assembly with an overall jacket shall meet the requirements of Clause 5.19.

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**CUSTOMERS PLEASE NOTE: This Table and column "Verdict" can be used in determining how your current or future production is or will be in compliance with new/revised requirements.**

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