RODE C37.75 Switchgear Enclosure Integrity Working Group Meeting Minutes

April 24, 2018 – Orlando, Florida

Chair: Anil Dhawan **Vice Chair**: Karla Trost

Meeting Minutes

1. Call to Order Anil Dhawan

Anil called the meeting to order at 3:18 PM.

2. 6.3.2 Call for Patents Anil Dhawan

No patents were disclosed.

3. Introduction of Members and Guests

Self-introductions were made by the attendees.

4. Attendance and Quorum Check

Sign-in sheets were circulated. Quorum was verified.
There were 30 people present, 12 of which were members.
One member, Al Pruitt, was added by request.

5. Per request, Anil presented the PAR and scope.

It was noted the scope helps define the question that was brought up in the C37.68 meeting.

6. Approval of Agenda Anil Dhawan

Karla explained the changes to the agenda since it was sent out.
No changes to the agenda were requested.

7. Approval of Previous meeting minutes Anil Dhawan

http://www.ewh.ieee.org/soc/pes/switchgear/minutes/2017-2/F17RODEa10REV0.pdf
No comments on the minutes. The minutes were approved as written.

8. Review of Action Items

- Expand David's spreadsheet to also include RODE standard call-outs. Steve Meiners
  Steve's work was presented, see the attached power point and Annex 2.
- Review / Gap Analysis of Section 4 & Pry Bar David Beseda
  David presented the work completed, see the attached power point and Annex 3.

David asked for feedback on the section 4 statement about a missing pentahead bolt. A manufacturer said there has been verbiage for this concept since the beginning. (If a pentahead bolt is missing there must be a blind-boss.) There was a history from when the threads would be damaged/cross-threaded and the bolt would be removed and the enclosure would be locked. A user said he thought the NESC required at least one method of locking and the blind-boss and the pentahead provide two (redundant.) Group decision is to keep the text from -2014 allowing for a missing pentahead bolt, but the verbiage may be contradictory. Possible verbiage change may be to say – "If the access door is able to be fully latches, but the pentahead bolt is missing…." *It was noted that the 1988 version of C57.12.28 had different verbiage (this was preferred by the group.)*

David asked a secondary question on pentahead devices (not just a bolt) – are the statements made just applicable to the bolts and not the devices?

It was pointed out that it states the "device or bolt shall not be readily removable until the padlock has been removed" which means it could be readily removable. *It was suggested that the pentahead device/bolt could be required to be captive.*

Section 4.3.7 – The team represents a change to Section 4.3.7 – the time-based retest interval. They would like feedback on should this be 5 years, 10 years, or no requirement?

The working group agrees to the change requirement, but proposes to remove the time-based testing.

There is a need to add five new sections. One on lifting devices and one on external windows. It was pointed out there may be a need to add something for window impact.

It was mentioned that there may be a need to include requirements for louvers.

In addition, new sections for coastal/harsh-environments, IP ratings, and shipping. In regards to shipping, the working group would need to evaluate RODE equipment requirements for shipping. (Requirements would be shipment to the end-user.)

Action Item: David Baseda will draft a potential statement for review at the next meeting.

- Review / Gap Analysis – Controls — Karla Trost

Karla reviewed that no control standards exist in the current standards. Annex 4 documents detail areas that will need work and possible reference documents.

- Review / Gap Analysis of Section 5 — Anil Dhawan

Anil reviewed the work the team was done. There are several areas to be discussed:

Tim noted that they have had submersible equipment that ends up being stored outside (requirements need to take that into account.)

A proposal was made to include a table (similar to the excel comparison shown) which would tell the user which requirements are applicable to which use (Pad-

mount vs coastal vs pole mount, etc). Anil suggested it may be possible to create universal standards. After discussion, there will be further discussion on Section 5 in the fall meeting.

9. New Items:

- Copyright Information
  Action Item: Karla will create a table showing content source and discuss with IEEE.

10. 11. Next Meeting

- The next working group meeting will take place at the Fall Switchgear Committee Meeting the week of October 14th, 2018 in Kansas City, MO.

12. Adjournment

The meeting was adjourned at 6:05PM

Annex 1: Attendance

Role	First Name	Last Name	Company	4/24/2018
Chair	Anil	Dhawan	ComEd	X
Member	Chris	Ambrose	Federal Pacific (Div. of Electro-Mechanical Corp.)	
Member	Robert	Behl	ABB	X
Member	David	Beseda	S&C Electric Co.	X
Member	Antone	Bonner	PAS Consulting	
Member	Katherine	Cummings	G&W Electric	X
Member	William	Ernst	Thomas & Betts	X
Member	Mark	Feltis	Schweitzer Engineering Laboratories, Inc	X
Member	Paul	Found	BC Hydro	X
Member	Travis	Johnson	Xcel Energy	X
Member	Robert	Lau	Pentair Technical Solutions	
Member	Steven	Meiners	GE	
Member	Al	Pruitt	The Durham Company	X
Member	Ian	Rokser	Eaton Corp	X
Member	Francois	Soulard	Hydro-Quebec	X
Vice-Chair	Karla	Trost	G&W Electric	X
Guest	Edwin	Almeida	Southern California Edison	X
Guest	Krystle	Carstens	Thomas & Betts	X
Guest	Michael	Culhane	Eaton	X
Guest	Kennedy	Darko	G&W Electric Co	X
Guest	Jeffrey	Gieger	Thomas & Betts	X
Guest	Ilya	Glinsky	Southern California Edison	X
Guest	Brendan	Kirkpatrick	Southern California Edison	X
Guest	Donald	Martin	G&W Electric Co.	X
Guest	Jacob	Midkiff	Dominion Energy	X
Guest	Brian	ONeil	CE Power Engineered Services	X
Guest	Stephen	Pell	Siemens	X
Guest	Timothy	Royster	Dominion Virginia Power	X
Guest	Craig	Thompson	SEL	X
Guest	Nenad	Uzelac	G&W Electric	X
Guest	Bruce	Venne	Rockwell Automation	X
Guest	Randy	Ward	Aluma-Form	X
Guest	Jerry	Wen	BC Hydro	X
Guest	Danish	Zia	UL LLC	X

Annex 2: Steve's Action Item (following pages)

Item	standard	date	section	page	section title	where in section	text
1	C37.74	2014	2	1	Normative References		ANSI C57.12.28 - 'Enclosure Integrity'
2	C37.74	2014	2	2	Normative References		IEEE std. C57.12.26 - 'Pad-Mounted Compartmental Type'
3	C37.74	2014	9.7	38	Parking Stands		parking stands shall meet IEEE std C57.12.26.'
4	C37.74	2014	9.9	38	Enclosure Construction - submersible and padmounted equipment		DSG equipment ….shall meet …ANSI C57.12.28-2005.'
5	C37.74	2014	9.1	39	Enclosure construction - padmounted equipment security	1st paragraph	Padmounted equip ….meet security …ANSI C57.12.28-2005.'
6	C37.74	2014	9.1	39	Enclosure construction - padmounted equipment security	3rd paragraph	Unless otherwise specified…pentahead bolt securing features … ANSI C57.12.28-2005.'
7	C37.74	2014	Annex B	43	Bibliography	B3	ANSI C57.12.29
8	C37.74	2014	Annex B	43	Bibliography	B4	ANSI C57.12.32
9	C37.62	D5 Sept-17	2	2	Normative References	#9 - line 60	ANSI/IEEE C57.12.28-2014 Padmount Enclosure integrity
10	C37.62	D5 Sept-17	3.6	3	Definitions	line 100	Note to entry references 'pad-mounted enclosure' lso in 3.9 of IEEE Std C57.12.28-2005…'
11	C37.62	D5 Sept-17	6.14.1	15	Protection of persons against access to hazardous parts….	line 369	Conformance to clause 4 IEEE Std C57.12.28-2014…'
12	C37.62	D5 Sept-17	6.14.1	15	Protection of persons against access to hazardous parts….	line 371	In NOTE 'Conformance to IEEE Std C57.12.28 shall….'
13	C37.62	D5 Sept-17	6.14.2	15	Protection of persons against ingress of water (IP coding)	line 374	Conformance to IEEE Std C57.12.28 shall….'
14	C37.62	D5 Sept-17	6.14.101	15	Enclosure design and coating system requirements	line 380	The requirements of Clause 5 of IEEE Std C57.12.28-2014 are applicable….'
15	C37.63	2013	2	2	Normative References	bottom of page	IEEE Std C57.12.28-2005 - Pad-Mounted Enclosure Integrity'
16	C37.63	2013	2	2	Normative References	bottom of page	IEEE Std C57.12.32, Submersible Enclosure Integrity.'
17	C37.63	2013	6.104.2	13	Tank construction - pad-mounted sectionalizers	1st paragraph	Pad-mounted enslosures shall meet … of IEEE C57.12.28.'
18	C37.63	2013	6.104.2	13	Tank construction - pad-mounted sectionalizers	3rd paragraph	Unless otherwise specified …pentahead bolt ….shown in IEEE C57.12.28.'
19	C37.63	2013	6.104.2	13	Tank construction - pad-mounted sectionalizers	3rd paragraph	last sentence ''Padmounted equipment enclosure coating system ...IEEE C57.12.28.'
20	C37.63	2013	6.104.3	13	Tank construction - submersible sectionalizers	first sentence	Submersible equipment shall meet ….of ANSI C57.12.32.'
21	C37.60/62271-111	1/18/2009	3.1.106	15	Pad-mount rerclosers	Note 2	The term pad-mount enclosure is also defined in IEEE Std C57.12.28 as follows…..'
22	C37.60/62271-111	1/18/2009	6.14.2.2	38	Requirements for equipment in publicly accessible areas	NOTE 2	In some jurisdictions and when specified …conformance to IEEE Std C57.12.28.xx …'
23	C37.60/62271-111	1/18/2009	Annex L.2	134	Reference documents	4th bullet	IEEE Std C57.12.28 IEEE standard for pad-mounted equipment…'
24	C37.60/62271-111	1/18/2009	Annex L.2	134	Reference documents	5th bullet	IEEE Std C57.12.29 IEEE standard for pad-mounted equipment…'
25	C37.60/62271-111	1/18/2009	Annex L.2	134	Reference documents	6th bullet	IEEE Std C57.12.30 IEEE standard for pole-mounted equipment…'
26	C37.60/62271-111	1/18/2009	Annex L.2	134	Reference documents	7th bullet	IEEE Std C57.12.31 IEEE standard for pole-mounted equipment…'
27	C37.60/62271-111	1/18/2009	Bibliography	135	Bibliography	4	IEEE Std C57.12.28 IEEE standard for pad-mounted equipment…'
28	C37.60/62271-111	1/18/2009	Bibliography	136	Bibliography	30	IEEE Std C57.12.29 IEEE standard for pad-mounted equipment…'
29	C37.60/62271-111	1/18/2009	Bibliography	136	Bibliography	31	IEEE Std C57.12.30 IEEE standard for pole-mounted equipment…'
30	C37.60/62271-111	1/18/2009	Bibliography	136	Bibliography	32	IEEE Std C57.12.31 IEEE standard for pole-mounted equipment…'

Annex 3: David's Action Item (following pages)

Summary of Agreements and Discussion Points from March 6 Conference Call

4.1 Test Requirements (applicable to pad-mounted enclosures or enclosures directly accessible to the general public)

- Use text from C57.12.28**- 2005**

  In addition to passing the tests defined in this standard, the construction of pad-mounted enclosures shall comply with the requirements of 4.1.1 through 4.1.9.

4.1.1 Enclosure mounting

- Use text from C57.12.28-2014

  The bottom edge of the enclosure shall provide for flush mounting on a flat, rigid mounting surface.(5)

  (5) The security of the interface between the mounting surface and the equipment is the responsibility of the installer/user.

4.1.2 Water resistance

- Use text from C57.12.28-2014

  The enclosure shall restrict the entry of water (other than flood water) into the enclosure so as not to impair the operation of the apparatus inside.

➢ **There were some questions about additional testing and IP ratings.**

4.1.3 Sharp corners

- Use text from C57.12.28-2014

  External sharp corners and projections shall be minimized.

4.1.4 Panel assembly

- Use text from C57.12.28-2014

  Panels shall be fastened or hinged to resist disassembly, breaking, or prying open from the outside with the doors in the closed and locked position. Normal entry shall be possible only with the use of proper access tools. There shall be no exposed screws, bolts, or other fastening devices that are externally removable (with the exception of

pentahead bolts provided for extra security) that would provide access to energized parts in the enclosure.

- **Francois raised question about the control panel and lifting lug holes.**
  - **Add lifting devices as a separate numbered entry (proposed text TBD)**
  - **Add viewing windows as a separate numbered entry (proposed text TBD)**

4.1.5 Door hardware

- Use text from C57.12.28-2014

  Locking bolts and associated threaded receptacles, hinges, and hinge pins shall be AISI(6) type 304 stainless steel or material of equivalent corrosion resistance.

  (6) AISI Publications are available from the American Iron & Steel Institute, 25 Massachusetts Avenue, NW, Suite 800 Washington DC 20001.

4.1.6 Handhole covers

- Use text from C57.12.28-2014

  If handhole covers are exposed, they shall be secured from the inside of the enclosure.

4.1.7 Locking/latching devices

- Use text from C57.12.28-2014

  The latching device(s) shall be designed and constructed of such a material so as to resist breaking or bending. The provision for locking device(s) on the enclosure door(s) shall be designed and located as to comply with the defined tests.

- **Proposed adding note in C37.60- 6.14.2.1 in Draft / 5.13.1 in current version**

  NOTE The IP45 protection level specifies a probe >1 mm in diameter which is slightly smaller than the number 14 gauge wire (1,63 mm) specified in IEEE Std C57.12.28. Refer to IEC 60529 [17].

4.1.8 Enclosure access

- Use text from C57.12.28-**2005**

  All access doors shall be fastened with a device that uses a pentahead tool to permit unlatching the door only after the padlock has been removed. This pentahead device or bolt shall be coordinated such that the padlock may not be inserted into the hasp until

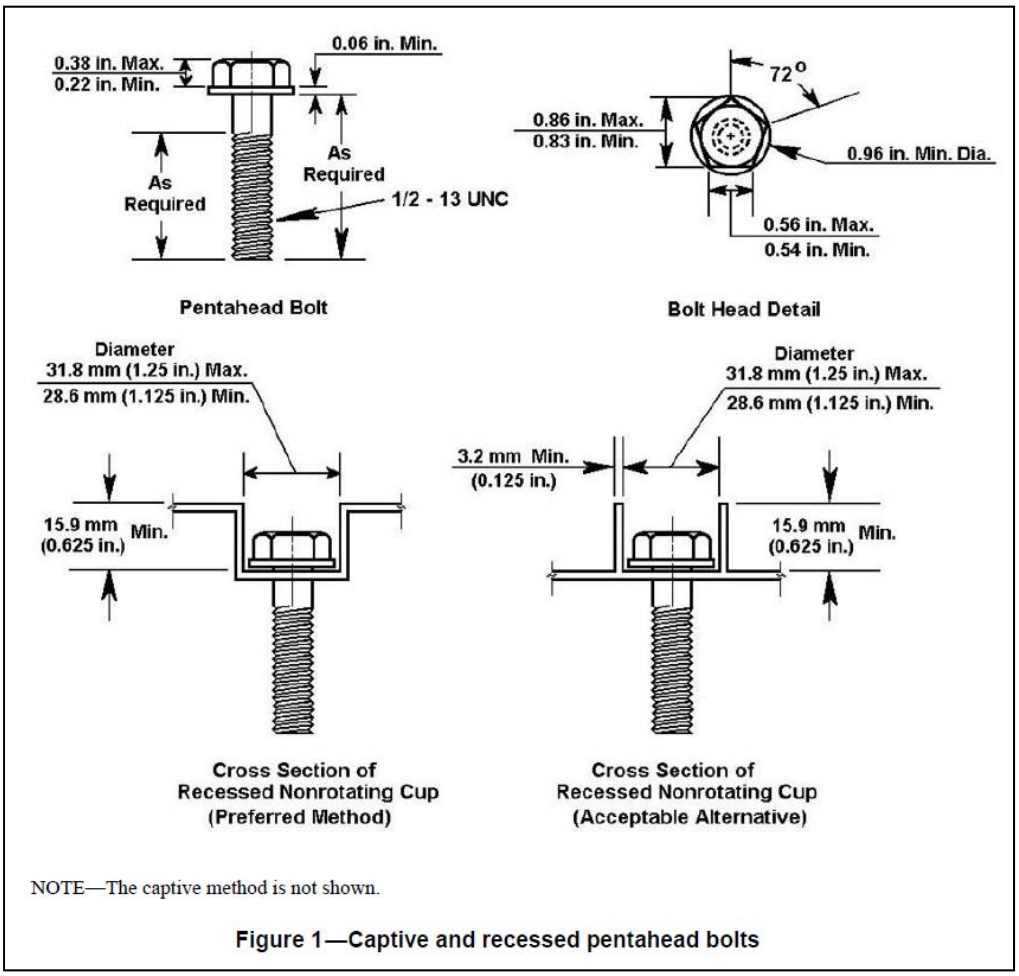
the access door is fully latched and the pentahead device is securely engaged.

Enclosures without latches shall have padlock and pentahead bolt provisions and shall be coordinated to prevent insertion of a padlock until the access door is fully closed and the pentahead device or bolt is securely engaged. The padlock shall be removed before the pentahead bolt can be disengaged.

A minimum of one pentahead device or bolt and padlocking means shall be provided. The pentahead device or bolt shall be surrounded by a nonrotating guard or shall be recessed such that the pentahead device or bolt can be engaged only by the proper tool. The dimensions of the pentahead bolt and nonrotating recess shall comply with Figure 1. The pentahead device or bolt shall not be readily removable until the padlock has been removed. More than one door may be fastened with a single padlock and pentahead device or bolt.

Figure 1 -- Captive and recessed pentahead bolts

- Use version in C57.12.28-2014



NOTE—The captive method is not shown.

Figure 1—Captive and recessed pentahead bolts

4.1.9 Fire resistance

- Use text from C57.12.28-2014

  The enclosure shall be constructed of fire-resistant material.

4.2 Test equipment

- Use text from C57.12.28-2014

  The tests for enclosure security shall be conducted with the following equipment or equivalent.

4.2.1 Pry bar

- Use text from C57.12.28-2014

  The pry bar shall be constructed with the pry tip shown in Figure 2. The pry bar shall be capable of accurately indicating the axial force and prying leverage specified in Table 1.

Table 1 —Test values

Test	Value	Used in Clause
Inward axial force	222 N (50 lbf)	4.3.2
Prying leverage tests	102 N·m (900 lbf-inch)	4.3.2
Pull test	667 N (150 lbf)	4.3.3
Deflection test	445 N (100 lbf)	4.3.5

Figure 2 -- Pry bar tip

- Use version in C57.12.28-2014

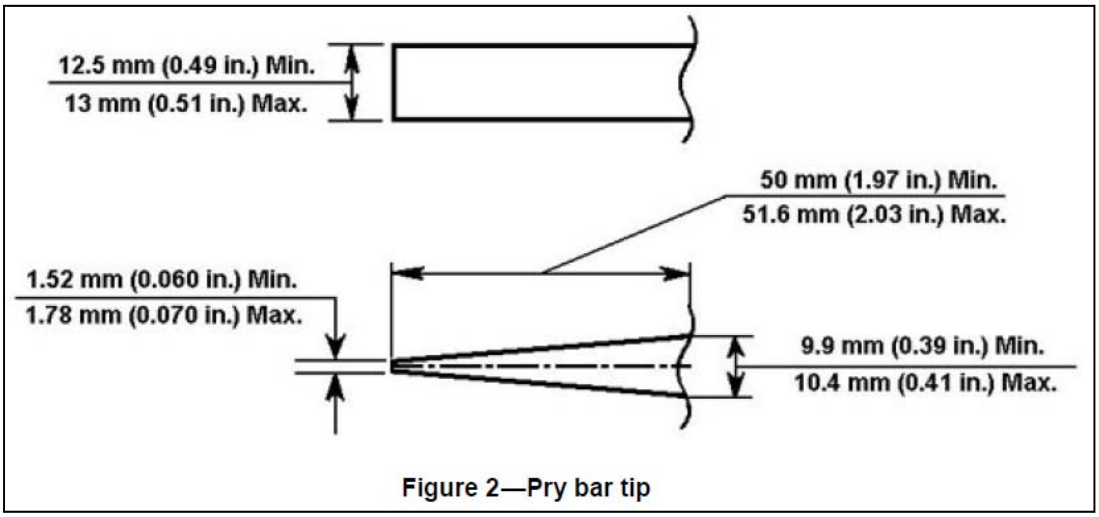


Figure 2—Pry bar tip

4.2.1.1 Tool

- Use text from C57.12.28-2014

The axial force and prying leverage indication may be obtained from a variety of readily available or custom made tools. Annex B includes a complete set of detail drawings for one set of such tools. Other pry bar designs complying with 4.2.1 are acceptable.

4.2.1.2 Measurement

- Use text from C57.12.28-2014

The prying leverage applied can be measured indirectly by measuring the deflection of the pry bar. The indicator is mounted on the pry bar and set to measure the deflection of a certain length of the bar. A calibration can be made that will result in a table or curve showing prying leverage versus reading of the
indicator.

4.2.2 Pull tool

- Use text from C57.12.28-2014

The device shown in Figure 3 shall be used in the pull tests(7).

(7) Typical device: Iron Man scales No. 1756T4, or equivalent. This information is given for the convenience of users of this standard and does not constitute an endorsement by the IEEE of this product.

4.2.3 Push tool

- Use text from C57.12.28-2014

A device that has a 12.7 mm × 12.7 mm (0.5 inch × 0.5 inch) square face as shown in Figure 4 with associated indicator to measure axial force shall be used to perform the deflection test.

Figure 3 -- Pull hook

- Use version in C57.12.28-2014
-

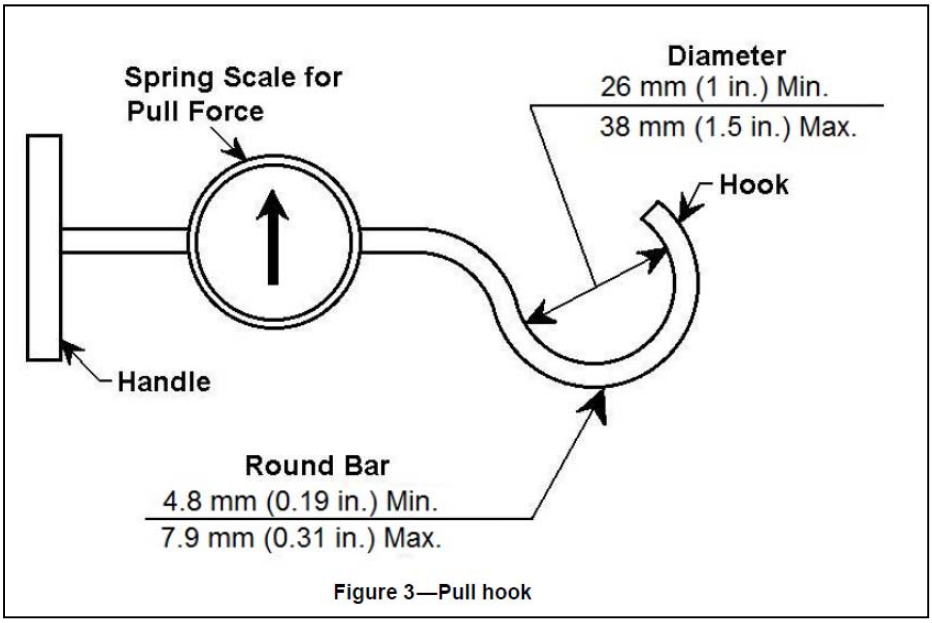


Figure 3—Pull hook

Figure 4 -- Pushing tool

- Use version in C57.12.28-2014

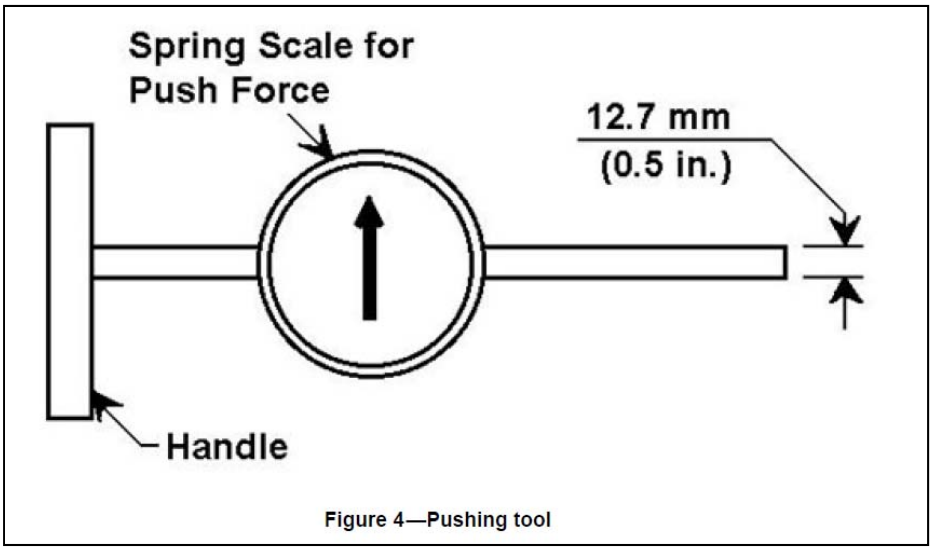


Figure 4—Pushing tool

4.2.4 Probe wire

- Use text from C57.12.28-2014

The probing wire shall be bare number 14 AWG soft-drawn solid copper wire 3 m (10 feet) long.

4.3 Resistance to foreign objects

- Use text from C57.12.28-2014

The following tests are to be performed on the enclosure. The enclosure shall resist the entry of foreign objects such as sticks, rods or wires.

- **Consider IP ratings**
- **Reference IP ratings C37.60 - 6.14.2.1 in Draft / 5.13.1 in current version**

4.3.1 General

- Use text from C57.12.28-2014

The pad-mounted enclosure shall be mounted on a flat surface according to the manufacturer's
specification. With the access door(s) closed and locked using a padlock with an 8 mm (5/16 inch) diameter
shackle, the following sequence of tests shall be performed:
a) Pry tests
b) Wire probe tests
c) Pull tests
d) Repeat wire probe tests
e) Deflection tests
f) Operation test

4.3.2 Pry tests

- Use text from C57.12.28-2014

The pry bar shall be used on all joints, crevices, hinges, locking means and other objects that exist between the enclosure components, including the enclosure/pad interface. The pry bar shall be permitted to be placed at any angle to the enclosure surface. The tip of the bar shall first be inserted in the opening being tested using the value of axial force specified in Table 1. Then, with that axial force being maintained, the prying force specified in Table 1 applied alternatively first in one direction and then in the opposite

direction (i.e. once in each direction). Application of either or both axial and prying force shall be maintained so long as relaxation is occurring. When relaxation ceases, or if no relaxation occurs, the pry bar shall be removed and pry test reapplied at the same location. When relaxation ceases or no relaxation occurs after the second test, the pry bar shall be removed and applied at an untested location.

4.3.3 Pull tests

- Use text from C57.12.28-2014

A pulling force shall be applied to the critical points of all enclosure parts that can be engaged by the pulling hook. A pulling force indicated in Table 1 shall be exerted at any angle to the enclosure surface. This force is to be maintained during any relaxation. When relaxation ceases, or if no relaxation occurs, the pull test shall be terminated. The hook shall then be inserted into any other part in which it can engage, and the test shall be repeated at the new location. All parts that can be engaged by the pull hook shall be tested once.

4.3.4 Wire probe tests

- Use text from C57.12.28-2014

Following the pry tests and pull tests described in 4.3.2 and 4.3.3, an attempt to penetrate the enclosure with the probe wire shall be made. This penetration shall be attempted at all crevices and joints. The wire shall be straight with no prebends and shall be gripped by the tester with his or her bare hands. If the wire enters the joint, the wire shall be continually pushed and bent until either it can no longer be pushed or it has entered the enclosure completely. This test is passed if an inspection determines the probing wire either has not entered the enclosure, or if visible, the probing wire is restricted by a barrier from intrusion into the interior.

4.3.5 Deflection tests

- Use text from C57.12.28-2014

The deflection test shall be applied to all sides and walls of the enclosure. This test is passed if the specific force (see Table 1) applied perpendicularly to the surface of the enclosure does not impair the dielectric, mechanical or corrosion performance of the equipment.

4.3.6 Operation test

- Use text from C57.12.28-2014

Following all of the above tests, the unit shall be lifted at least one meter in accordance with manufacturer's standard lift instructions and then set again on the flat surface. The doors shall be easily opened, closed, latched and locked without requiring adjustments to the cabinet, latch mechanism and/or enclosure door(s). All of the door latch points must fully engage when the door is closed.

4.3.7 Test Repetition (new - 2014)

- Use text from C57.12.28-2014, modified as follows:

These design tests shall be repeated whenever the enclosure design is changed so as to modify performance, or at least every **ten** years, whichever is shorter.

➢ **5 year (as in -2014), 10 years (as proposed), or remove.**

4.4 Test values

- Use text from C57.12.28-2014

The minimum test values for which entry shall be prevented are provided in Table 1.

5.0 Special Considerations for Coastal Applications and other Corrosive Service Applications

➢ **New section to house galling as a subset.**

5.1 Galling

- Use text from C57.12.29-2014 (4.1)

Steps must be taken in the design and manufacture of enclosures to prevent galling. Two commonly used methods are listed below, but are not specifically required separately or in combination. Alternative methods may be used if proven to be equally effective:

a) Use of dissimilar materials in threaded joints such as silicon-bronze with stainless steel, brass with stainless steel, etc.

b) Use of anti-seize compounds or materials.

Please let me know if there are any changes or revisions that need to be made.

Additional open items. Whoever suggested these should provide a proposal to the group or, at the very least, flesh out these items

Proposed "new columns"

- **Please provide rationale, proposed text, and proposed number location.**

  A - Lifting Devices

  B - Viewing Windows

Also, there was a reference to **7.1 - Shipment**

- **Please provide rationale and text**

Paul - Is there anything else you'd like to add on the IP ratings?

Thank you all for your support and input.

Respectfully,

Chris Ambrose
276-645-8221
chris_ambrose@ieee.org

Annex 4: Karla's Action Item (following pages)

	A	B	C	D	E	F	G	H
1			**C57.12.29-2014**		**UL 508A 2nd Edition with updates through July 11, 2017**		**NEMA 250-2014 (Based on IEC reference, > NEMA 1 and NEMA 3/4/6 or 12 for Pub Acc.)**	
2	**Galling**		Steps must be taken in the design and manufacture of enclosures to prevent galling.					
3	**Mounting**		The bottom edge of the enclosure shall provide for flush mounting on a flat, rigid, mounting surface.				If mounting means are provided… shall be external to the equipment cavity. *Exception…..* (Section 3.7)	
4	**Water Resistance**		The enclosure shall restrict the entry of water (other than flood water) into the enclosure so as not to impair the operation of the apparatus inside.				Depends on enclosure type.	

	A	B	C	D	E	F	G	H
5	**Sharp Corners**		External sharp corners and projections shall be minimized.				An enclosure, frame, guard, handle or similar features shall not have accessible edges that are sharp……. (3 Exceptions.) (Section 3.16)	
6	**Panel Assembly**		Panels shall be fastened or hinged to resist disassembly, breaking, or prying open from the outside with the doors in the closed and locked position. Normal entry shall be possible only with the use of proper access tools. There shall be no exposed screws, bolts, or other fastening devices that are externally removable (with the exception of pentahead bolts provided for extra security) that would provide access to energized parts in the enclosure.					
7	**Door hardware**		Locking bolts and associated threaded receptacles, hinges, and hinge pins shall be AISI5 type 304 stainless steel or material of equivalent corrosion resistance.				3.5.2 Outdoor Corrosion Protection Types 3, 3X, 3R, 3RX, 3S, 3SX, 4, 4X, 6, and 6P ferrous enclosures, and external ferrous parts attached to these enclosure types, shall be protected against corrosion by one of the coatings or finishes in 3.5.2.1 through 3.5.2.4 or shall be tested to comply with 5.9. For additional corrosion protection requirements for 3X, 3RX, 3SX, 4X, and 6P, see 3.5.7.	

	A	B	C	D	E	F	G	H
8	**Handhole covers**		If handhole covers are exposed, they shall be secured from the inside of the enclosure.		19.3 Openings provided in enclosures for mounting components shall be covered with components intended for such mounting. For an enclosure type specified in column 1 of Table 19.2, openings provided for components, including ventilation openings, or observation windows, shall be closed with components that have been evaluated for one of the enclosure Types in column 2 of Table 19.2.			
9	**Locking/latching devices**		The latching device(s) shall be designed and constructed of such a material so as to resist breaking or bending. The provision for locking device(s) on the enclosure door(s) shall be designed and located as to comply with the defined tests.		63.2 Covers and doors 63.2.1 A cover or door shall be provided with means, such as latches, locks, or screws, of securing it in place. The means shall be so located or used in such quantity to hold the cover or door closed over its entire length. 63.2.2 A door shall be provided with captive fasteners, such as snap latches, a multi-point latch, multi- or partial-turn fasteners, that remain attached to the enclosure when the door is open. A captive fastener shall be operable by hand or by a simple hand tool such as a screwdriver. 63.2.3 A door that is more than 48 inches (1.2 m) long on the hinged side shall be provided with one or more captive fasteners that hold the door closed at two or more points on the enclosure.		All closing hardware for Type 5, 12, and 12k shall be captive.	
10	**Enclosure access**		All access doors shall be fastened with a device that uses a pentahead tool to permit unlatching the door only after the padlock has been removed. This pentahead device or bolt shall be coordinated such that the padlock cannot be inserted into hasp until the access door is fully latched and the pentahead device is securely engaged. Enclosures without latches shall have padlock and pentahead bolt provisions, and shall be coordinated to prevent insertion of a padlock until the access door is fully closed and the pentahead device or bolt is securely engaged. The padlock shall be removed before the pentahead bolt can be disengaged.		66.1.2 A door of an enclosure that gives access to uninsulated live parts operating at 50 volts rms ac or 60V dc or more shall be interlocked with the disconnecting means such that none of the doors can be opened unless the power is disconnected. One exception is then listed. 66.1.3 descibes the interlocking requirements 66.6 describes the requirements of the disconnecting means		3.12 ACCESS TO INTERIOR Type 3, 3X, 3R, 3S, 3SX, 5, 12, and 12k enclosures shall require the use of a tool to gain access to the equipment cabity or shall have provisions for locking.	

	A	B	C	D	E	F	G	H
11	**Fire resistance**		The enclosure shall be constructed of fire-resistant material.				Polymeric materials that comply with UL 746C 127mm Flammability. (Section 3.4a/b)	
12	**Test Equipment/ Pry Bar**		Test Value Used in Clause Inward axial force 222 N (50 lbf) Prying leverage tests 102 N·m (900 lbf-in)					
13	**Test Equipment/ Pull Tool**		Pull test 667 N (150 lbf)					
14	**Test Equipment/ Push tool**		Deflection test 445 N (100 lbf)		63.1 specifies sheet metal thicknesses and has an exception for enclosures that comply with the deflection test in UL 50.			
15	**Test Equipment/ Probe wire**		The probing wire shall be bare number 14 AWG soft-drawn solid copper wire 3 m (10 feet) long.		Table 20.1 Size of probe depends on distance from opening to live parts.		1,0mm	
16	**Resistance to foreign objects**		The following tests are to be performed on the enclosure. The enclosure shall resist the entry of foreign objects such as sticks, rods, or wires.		Depends on enclosure type as defined in UL 50		Depends on enclosure type.	
17	**Resistance to mechanical impacts**							

	A	B	C	D	E	F	G	H
18	**Accessibility**		The enclosure shall be designed such that all exterior surfaces are accessible for proper surface preparation and the application of a uniform amount of the coating materials. Additionally, all exterior surfaces of the enclosure shall be accessible for the purposes of inspection and maintenance of the enclosure over the life of the equipment.					
19	**Contaminant accumulation**		The enclosure shall be designed to shed water and minimize areas where corrosive elements can accumulate					
20	**Welds—surface preparation**		All welds shall be treated to prepare the weld area and the heat-affected zones for coating. Weld splatter shall be removed. All welds shall be made in accordance with appropriate industrial welding standards.					
21	**Substrate**		The substrate shall be a material that, when coated or otherwise processed, will maintain the structural integrity of the enclosure over the life of the apparatus.		63.1 Metal thickness			
22	**Corrosion resistant (only)**		The apparatus enclosure substrate shall exhibit a general corrosion rate not to exceed 0.03 mm (0.001 in) per year and a maximum pit depth not to exceed 0.13 mm (0.005 in) over the life of the apparatus, when exposed to natural corrosive environments.		General control Panels - 8.1 Iron and steel parts shall be protected against corrosion by enameling galvanizing, plating, or other equivalent means. This applies to all springs and other parts required for proper mechanical operation. Three exceptions Specific Use Control Panels - 63.3.1 Both the inside and outside surfaces of an enclosure, including means for fastening, that are made of iron or steel shall be protected against corrosion by enameling, galvanizing, or plating. One exception listed for moving hinge parts and for parts made of aluminum, brass, or stainless.		No materials which cause galvanic action. Copper, Bronze, brass containing 80% pure material) or aluminum do not require additional protection. Section 5.8, 5.9, and 5.10 Tests	
23	**Crosshatch adhesion test**		ASTM D3359.					
24	**Humidity test**		1000 hours in accordance with ASTM D4585					

	A	B	C	D	E	F	G	H
25	**Ultraviolet accelerated weathering tes**		The following test is required for all coated surfaces on the exterior of the enclosure. Expose two test panels, per Figure 8, for 500 hours per ASTM D4587, utilizing the FS-40 bulb with a cycle of 4 hours ultraviolet at 60 °C (140 °F) followed by 4 hours condensation at 50 °C (122 °F). Loss of gloss shall not exceed 50% of original gloss per ASTM D523. The coating shall not exhibit cracking per ASTM D661 or checking per ASTM D660 under unaided visual inspection.					
26	**Abrasion resistance Taber Abraser**		One coated panel, shown in Figure 9, having the minimum dry film thickness of the total coating system shall be tested using CS-10 wheel, 1000 g weight, in accordance with ASTM D4060.					
27	**Gravelometer**		ASTM D3170 at room temperature using 414 kPa (60 psig) gauge air pressure.					
28	**Drainage Openings**		n/a				See section 3.6.3	
29	**Conduit connection**				19 Enclosure Openings		See section 3.8	
30	**hubs and fittings**						See section 3.9	
31	**Knockouts**						See section 3.10	
32	**Gaskets**						See section 3.14	
33	**Observation Windows**				19 Enclosure Openings - specifically 19.3 23 Observation Windows 63.6 Observation Windows		See section 3.15	
34	**External Icing Test**						See section 5.6	
35	**Electrical continuity**				14 Grounding – General 24 Bonding			
36	**Hinge Strength**							

	I	J	K	L	M
1	**UL 50 Thirteeth Edition, October 16, 2015** **UL 50E First Edition, September 4, 2007**		**IEC 60529 Ed2.2 2018-08** **(Referenced to IP1XB and IP4X Pub. Acc)**		**IEC 62262 Ed. 1.0 b:2002** **(IK codes)**
2					
3	UL 50: 6.1.2 All enclosures, other than those designed to be free standing or those designed for a specific installation, such as a cast-metal box intended to be installed in poured concrete, shall be provided with means for mounting. UL50: 6.3.4 Mounting openings 6.3.4.1 For Type 1, 2, 3R, 3RX, or 5 enclosures, mounting means may be provided internal to the equipment cavity if the mounting openings comply with Table 2. 6.3.4.2 If mounting openings other than as noted in Table 2 are provided in Type 1, 2, 3R, 3RX, or 5 enclosures, instructions shall be included with the enclosure that indicate how to maintain the environmental integrity of the enclosure when mounted. 6.3.4.3 Mounting openings for enclosures constructed from a polymeric material shall additionally comply with Clause 6.6.5. Mounting openings requirements for enclosure Types 3, 3X, 3S, 3SX, 4, 4X, 6, 6P,12, 12K, and 13 are in Clause 7.3.4 of Annex B, Ref. No. 15.				
4	UL 50E: Depends on enclosure type.				

	I	J	K	L	M
5	UL 50: 6.1.4 An enclosure, frame, or similar device shall not have accessible edges that are sharp or pointed such that they constitute a risk of injury to persons during normal installation, maintenance, and use, unless: a) Accessible edges are protected by guards or the use of handles to minimize access to sharp edges or points, or b) An accessible edge or portion of an accessible edge is required to be sharp in order to perform a working function, or c) If it is possible to avoid the hazard through proper procedures, then signs, labels or the manufacturer's instructions shall describe the procedure to avoid the hazard during installation, maintenance, and use. When considering sharp edges and points, all stages of the installation process shall be considered. 6.1.5 Whenever referee measurements are necessary to determine that a part as mentioned in Clause 6.1.4 is not sufficiently sharp to constitute a risk of injury to persons,				
6	UL 50: 6.7 Covers and doors, 6.8 Hinges, 6.9 Latches and handles				
7	UL 50:E 8.8 Outdoor corrosion protection				

	I	J	K	L	M
8	UL50: 6.3.1.1 Other than as covered in Clause 6.3.1.2, openings provided in any enclosure type shall comply with the applicable tests in Annex B, Ref. No. 15 , with these openings unfilled. UL 50E: 9.6 Equipment openings				
9	UL 50: 6.9 Latches and handles UL 50E: 7.6.2 All closing hardware for Type 5, 12, and 12K enclosures shall be captive				
10	UL 50: 6.9 Latches and handles UL 50E: 7.6 Access to interior				

	I	J	K	L	M
11	UL50: 6.6.1.1 Other than as detailed in Clauses 6.6.1.3 and 6.6.1.4, a polymeric electrical enclosure or polymeric part (such as a plug or other closure) that is relied upon to complete and maintain the integrity of an electrical enclosure shall comply with the: a) Flammability – 5 inch (127 mm) flame test specified in Annex B, Ref. No. 2;				
12					
13	UL 50: Polymeric enclosures – rigid metallic conduit connection test. 8.6.2.1 The enclosure shall be suspended by a length of rigid conduit installed in one wall of the enclosure or mounted as intended in service and a pulling force of 890 N (200 pounds) shall be applied for 5 minutes to a length of conduit in the opposite wall.				
14	UL 50: 8.1 Comparative deflection test (enclosure) UL50: 8.10 Crushing resistance test				
15	UL 50: 8.9 Rod entry test UL 50E: 8.14 Rod entry test		1XB (50mm & 50N), 4X (1,0mm x 100mm & 1N)		
16	Depends on enclosure type.		1XB (50mm & 50N), 4X (1,0mm x 100mm & 1N)		
17	UL50: Applies to Observation Windows (6.2) and polymeric materials (6.6)				**IK Code** **Joules of Impact Energy** IK01 0.14 IK02 0.2 IK03 0.35 IK04 0.5 IK05 0.7 IK06 1 IK07 2 IK08 5 IK09 10 IK20 20 In general, the degree of protection applies to the complete enclosure. If parts of the enclosure have differing degrees of protection, the latter shall be indicated seperately.

	I	J	K	L	M
18					
19	UL 50E: Annex D – Water Immersion Test				
20					
21	UL 50: 6.4 Sheet metal enclosures, including thinckness charts. UL 50: 6.6 Polymeric materials				
22	UL 50E: 7.2 Corrosion protection UL 50E: 8.8 Outdoor corrosion protection UL 50E: 8.9 Additional corrosion protection for type 4X and 6P				
23					
24					

	I	J	K	L	M
25	UL50E: 7.1 Polymeric materials - refer to UL 746C				
26					
27					
28	UL 50E: 7.3.3 Drainage openings				
29	UL 50: 6.3.5 Breakouts, knockouts and conduit openings UL50E 7.4 Conduit connection				
30	UL 50: 6.11 Conduit hubs UL 50E: 7.4.2 Hubs and fittings				
31	UL 50: 6.3.5 Breakouts, knockouts and conduit openings UL 50: 8.4 Multiple knockouts test UL 50E: 7.4.3 Knockouts and breakouts				
32	UL 50E: 7.7 Gaskets UL 50E: 8.13 Gasket tests				
33	UL 50: 6.2 Observation windows				
34	UL 50E: 8.5 External icing test				
35	UL 50: 6.6.2 Electrical continuity				
36	UL 50: 8.3 Hinge strength test				

C37.75 Working Group – Control Enclosure Gap Analysis:
Task: Review C57.12.28/29 and determine where there are gaps in regard to controls.

Section 4:

4.1.1 Enclosure Mounting:
(We have to include Padmounted – Wall Mount, Padmounted – Pedestal, Pole Mounted, Wall Mount – Vault)

Possible references:

- UL 508A, maybe UL50
- ANSI SCTE-77 for below grade, H-20 for Traffic related, Western Underground Committee https://dta0yqvfnusiq.cloudfront.net/westernunderground/2015/08/3-6.pdf
- AASHTO (typically H20) for traffic rated

4.1.2 Water resistance:

Do we want to list minimum NEMA or IP ratings?
What would the minimum be?

Travis: referencing the IP would be helpful for the section around accessibility.

4.1.3 Keep
4.1.4 Panel Assembly, refer to C37.60-"2017" (6.14.2.2)

4.1.5 Door Hardware: This statement is almost identical to 6.14.2.2 from C37.60-"2017"
Gaps in regards to equipment in publicly accessible areas could be pulled from C37.60-"2017".

4.1.7 Locking/latching devices:
Gap: if control enclosure is publicly accessible need 3 point latching or similar requirement.

4.1.8 Enclosure access:
Gap: if control enclosure is publicly accessible need requirements.

Add definition for publicly accessible: See C37.60-"2017"

4.1.9 Fire resistance:

Is there anything in NEMA or IP? (Bob – not in NEMA)
Question to Travis & Paul: Do we need to specify this for controls?
Travis suggests the limit may be that it is a self-extinguishing material.

4.2: 4.2.1, 4.2.2, and 4.2.3 we need to wait until that TF is complete.

4.2.4 Probe Wire – the IP test would be better to reference.

4.3 – See C37.60-"2017" Section 6.14.2.1 and 6.14.2.2.

4.3.5 & 4.3.6: The UL construction standards talk a little about this.

For section 5 we should review: IK Standards and Impact Resistance Standards

5.1 Enclosure design requirements–objective

Control enclosures are not limited to carbon and stainless steel.
Other environments: submersible, or control cabinets within low voltage enclosures, also controls mounted in high voltage compartments within pad-mount enclosures

5.1.1 Accessibility

All exterior surfaces may not be viewable for mounted control enclosures.
Possibly using LVE over the control enclosure may negate the need for this.

5.1.2 Contaminant accumulation

Need to address LVE over control enclosure.
Address condensation and ingress that may occur within the LVE/HVE for control enclosures.
Question – does this come into 37.68 or 75? Suggestion is for enclosure (C37.75) to address envelope requirements and control (C37.68) to address internal environment to mitigate and manage condensation.
Maybe suggestions about design considerations of the LVE/HVE to help eliminate issues for the control enclosures.

5.1.3 Welds–surface preparation

Aluminum welding standard is D1.2 Fiberglass material for enclosures is specified by UL 746C. The construction must pass the requirements in Sections 30 – 43, and marking requirements in 49.1 – 49.6 applicable to the enclosure environmental Type(s) in the Standard for Enclosures for Electrical Equipment, UL 50.

5.3, 5.4, and 5.5 for control cabinets are Covered by NEMA 250 and UL 50 / UL 50E

Other standards to consider for appropriate verbiage:

- ASTM A123, latest revision for hot-dip galvanized fabricated steel.
- ASTM A153, latest revision for hot-dip galvanized steel hardware.
- ASTM D3359, latest revision, classification 5A or 5B, substrate fusing adhesion (no lifting of coating).
- ASTM 3170, latest revision, at 10 deg F, shall meet Classification 7A (10-24 chips less than 1mm in diameter).
- ASTM D523, latest revision, 180 deg bend around ¼" mandrel.
- ASTM D523, latest revision, 60 deg gloss meter reading shall be 50-60%.
- ASTM D822, latest revision, 1-year South Florida 45 deg exposure shall have a 90% gloss retention and less than 5 MacAdam units of color change.
- Steel Structural Painting Council SSPC-SP7, or better, for surface preparation.
- ANSI C62.41 - 2010, (or latest) - IEEE Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.
- ASTM B117 - 2011, (or latest) - Standard Practice for Operating Salt Spray (Fog) Apparatus.
- ASTM D256- 2010, (or latest) - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics.
- US DOT: Traffic Control Systems: https://ops.fhwa.dot.gov/publications/fhwahop06006/chapter_7.htm

- AASHTO (typically H20) for traffic rated
- ANSI/SCTE-77
- Western Underground Committee Specification Guidelines: https://dta0yqvfnusiq.cloudfront.net/westernunderground/2015/08/3-6.pdf
- NEMA 250-2014 (https://www.nema.org/Standards/Pages/Enclosures-for-Electrical-Equipment.aspx)
- IEC 60529:1989 (AMD2: 2013) https://webstore.iec.ch/publication/2452

Annex: Meeting Presentation (following pages)

C37.75 Working Group Meeting
April, 2018

Anil Dhawan (chair),
Karla Trost (vice-chair)

Call for Patents

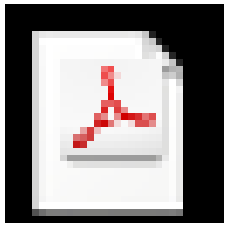
- The chair or the chair's delegate of an IEEE standards-developing working group or the chair of an IEEE standards Sponsor shall be responsible for informing the participants at a meeting that if any individual believes that Patent Claims might be Essential Patent Claims, that fact should be made known to the entire working group and duly recorded in the minutes of the working group meeting. This request shall occur at every standards-developing meeting once the PAR is approved by the IEEE-SA Standards Board.

- The chair or the chair's delegate shall ask any patent holder or patent applicant of a Patent Claim that might be or become an Essential Patent Claim to complete and submit a Letter of Assurance PDF format in accordance with Clause 6 of the IEEE-SA Standards Board Bylaws. Information about the draft standard will be made available upon request.

Agenda

Microsoft Word Document

Approval of Minutes



PDF File

C57.12 Standards vs RODE product standards

Microsoft Excel Worksheet

Review / Gap Analysis of Section 4 & Pry Bar

Microsoft Word Document

C37.75 – Section 4 Recommendations

- Conference Call on March 6 to discuss proposals for Section 4, Enclosure Security
- Participants:
  - Chris Ambrose (Federal Pacific)
  - David Beseda (S&C Electric Company)
  - Kennedy Darko (G&W Electric)
  - Paul Found (BC Hydro)
  - François Soulard (Hydro-Quebec)

C37.75 – Section 4 Recommendations

- The group reviewed all Section 4, “Enclosure Security” sections of C57.12.28/29/30/31/32.
- Proposed changes are highlighted in this slide presentation along with points we’d like to discuss.

C37.75 – Section 4 Recommendations

Section	Summary of Changes Relative to C57.12.28 - 2014
4. Enclosure Security	No Changes
4.1 Test Requirements	No Changes
4.1.1 Enclosure Mounting	No Changes
4.1.2 Water Resistance	No Changes
4.1.3 Sharp Corners	No Changes
4.1.4 Panel Assembly	No Changes
4.1.5 Door Hardware	No Changes
4.1.6 Handhole Covers	No Changes
4.1.7 Locking/Latching Devices	No Changes
4.1.8 Enclosure Access	Use the C57.12.28-2005 version for this section
4.1.9 Fire Resistance	No Changes
4.1.10 Lifting devices	New Section
4.1.11 External windows	New Section

C37.75 – Section 4 Recommendations

- 4.1.8 Enclosure Access
  - The group proposes to use C57.12.28-2005 wording.
  - Next slide shows C57.12.28-2014 text. The text in red is what was added from the 2005 version.
  - The circumstances under which the last paragraph is written implies that the penta access hardware is broken or not fastened. This is inherently an accessible cabinet and any access requirements do not make sense.
    - Looking for feedback to see if there are circumstances under which we should keep this paragraph.

C37.75 – Section 4 Recommendations

All access doors shall be fastened with a device that uses a pentahead tool to permit unlatching the door only after the padlock has been removed. This pentahead device or bolt shall be coordinated such that the padlock cannot be inserted into hasp until the access door is fully latched and the pentahead device is securely engaged.

Enclosures without latches shall have padlock and pentahead bolt provisions, and shall be coordinated to prevent insertion of a padlock until the access door is fully closed and the pentahead device or bolt is securely engaged. The padlock shall be removed before the pentahead bolt can be disengaged.

A minimum of one pentahead device or bolt and padlocking means shall be provided. The pentahead device or bolt shall be surrounded by a non-rotating guard or shall be recessed such that the pentahead device or bolt can be engaged only by the proper tool. The dimensions of the pentahead bolt and nonrotating recess shall comply with Figure 1. The pentahead device or bolt shall not be readily removable until the padlock has been removed. More than one door may be fastened with a single padlock and pentahead device or bolt. In the event that the pentahead bolt is missing, the design shall be such that direct access into the cabinet through the bolt hole shall be restricted. In cases where access to the bolthole within the non-rotating guard or recess is not restricted by means of a pad-lockable cover plate, the bolt hole shall be blocked from the back and all sides to prevent wire probe entry.

C37.75 – Section 4 Recommendations

- 4.1.10 Lifting Devices (new section)
  - Add a section to specifically address lifting devices.
  - External removable parts with standard hardware can be utilized for lifting. However, if these components are removed, all of the enclosure security requirements must be met.
- 4.1.11 External Windows (new section)
  - Add a section to specifically address external windows.
  - If external windows are utilized, the enclosure/window must still meet all enclosure security requirements.

C37.75 – Section 4 Recommendations

Section	Summary of Changes Relative to C57.12.28 - 2014
4.2 Test Equipment	No Changes
4.2.1 Pry Bar	No Changes
4.2.1.1 Tool	No Changes
4.2.1.2 Measurement	No Changes
4.2.2 Pull Tool	No Changes
4.2.3 Push Tool	No Changes
4.2.4 Probe Wire	No Changes

C37.75 – Section 4 Recommendations

Section	Summary of Changes Relative to C57.12.28 - 2014
4.3 Resistance to Foreign Objects	No Changes
4.3.1 General	No Changes
4.3.2 Pry Test	No Changes
4.3.3 Pull Tests	No Changes
4.3.4 Wire Probe Tests	No Changes
4.3.5 Deflection Tests	No Changes
4.3.6 Operation Test	No Changes
4.3.7 Test Repetition	Need to evaluate time-based retest interval

C37.75 – Section 4 Recommendations

- 4.3.7 Test Repetition
  - New section added to C57.12.28/29 in 2014:
    - "These design tests shall be repeated whenever the enclosure design is changed so as to modify performance, or at least every five years, whichever is shorter."
  - The group agreed with re-test on design changes.
  - The group wanted to discuss time based interval:
    - Five years (no change to C57.12.228-2014)
    - Ten years
    - No requirement

C37.75 – Section 4 Recommendations

Section	Summary of Changes Relative to C57.12.28 - 2014
4.4 Test Values	No Changes
4.5 Special Considerations for Coastal Applications and Other Corrosive Service Applications	New Section to contain coastal or harsh-environment requirements.
4.5.1 Galling	No Changes - Same as C57.12.29-2014, section 4.1
4.6 IP Ratings	New section to relate to IP ratings (reference IEC 60529)
7.1 Shipping	New section regarding requirements for Shipping/Handling

C37.75 – Section 4 Recommendations

- 4.5 Special Considerations for Coastal Applications and Other Corrosive Service Applications
  - Create a special section to include requirements for special service conditions.
  - If we were to get specific on other corrosive service applications, this would likely have an effect on the coating requirements section.
  - This new section would include the Galling section of C57.12.29.

C37.75 – Section 4 Recommendations

- 4.6 IP Ratings
  - New section to define IP ratings.
  - Would likely reference IEC 60529.
  - Additional guidelines would likely need to be developed on how the requirements in C37.75 (document under development) relate to IP ratings.

C37.75 – Section 4 Recommendations

- 7.1 Shipping Requirements
  - <add info>

Review / Gap Analysis of Section 4 & 5 - Controls

Microsoft Word Document

Microsoft Excel Worksheet

Review / Gap Analysis of Section 5

Copyright

- We strongly recommend that you reference IEEE Standards and do not excerpt information from them. If you must use a figure or two or some verbiage, please fill out the following form:
- http://standards.ieee.org/ipr/copyright_permissions_form.html

- How does group want to handle? Too many "Clause XXX.XX applies" may prevent approval.

Proposed Next Steps

- Gap research and proposals by Fall 2018
  - Proposed Action Items:
    - 1 or 2 people to review questions on Section 4 and propose verbiage
    - 1 or 2 people to review questions on Section 5 and propose verbiage
    - Team to review control questions and standards and propose verbiage
- Draft process by Spring 2019
- Ballot version by Spring 2020