

C37.100.6 Working Group
MINUTES OF THE FALL 2019 MEETING
Catamaran Resort, San Diego, CA

Attendance:

18 people were in attendance
7 of 13 total WG members participated, thus Quorum was met (54%)
11 guests participated

Membership and attendance status was updated in AMS system.

=====

A. Call to order

Meeting was called to order by WG Chair, Eddie Wilkie, at 10:18 AM

B. Introduction of attendees

Complete

C. Approval of Agenda

Agenda was reviewed by WG, motion brought by Terry Woodyard (1st) and Chris French (2nd) and approved unanimously

D. Approval of Minutes from previous meetings

Minutes were reviewed by WG, motion brought by Tom Hawkins (1st) and Terry Woodyard (2nd) and approved unanimously

E. Rules and guidelines for conducting working group meetings

No patent issues were voiced by the meeting attendees

F. Working group P&Ps

Working Group Chair reviewed IEEE-SA approved Working Group Policies

G. Document Status

Par was approved on February 8, 2019 with an expiration date of December 31, 2023.

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H. Document Review

Discussion of PAR scope and equipment types missing from the PAR:

- *C37.30 – Requirements for High-Voltage Switches*
- *C37.016 – IEEE Standard for AC High Voltage Circuit Switchers Rated 15.5 kV through 245 kV*

AC156

- *Structural Features, Mounting Features and Subassemblies must be similar within a product line*
- *Individual components are not in the scope of this document, but, perhaps if they had a seismic rating it would allow them to be used in the equipment.*

Example: Metal Clad Switchgear

- *Typical elements include; circuit breakers, instrument transformers, protective relays, sensing devices, meters, instrumentation and control components*
- *Determine essential components or sub-assemblies*
- *Determine formula to quantify least resistant enclosure configuration, suggestion: $Least\ resistant = (weight * Vcog) / (width * depth)$*
- *Differentiating indoor equipment may not be necessary provided the indoor equipment is a subset of the outdoor equipment*
- *Define selection tables or methods for selecting least resistant typical elements; circuit breakers, instrument transformers, VTs, CTs, and CPTs. For instrumentation, control devices, accessories and protective relays, a proposal to not define as principal components (based on mass and style variation) and include as representative components was discussed.*
- *C37.98 is a standard for qualification of protective relays for nuclear 1E applications which could be helpful, also IEC 60255-21 might be another*
- *OSHPD has an exemption for components. " Equipment and components weighing not more than 50lbs., surface mounted on building structures or components not requiring special seismic certification."*

I. Action Items / Schedule

- a) Eddie Wilkie will create a template for typical elements and distribute to individuals to populate them.
- b) Jeff Gatscher to assist in creating a draft document.

J. Adjourn

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Meeting adjourned at 12:03 PM.

Reported by: Darryl Moser – Secretary

Attendance record:

Role	First Name	Last Name	Company
Chair	Eddie	Wilkie	Eaton
Secretary	Darryl	Moser	ABB
Member	Christopher	French	Eaton Corporation
Member	Jeffrey	Gatscher	Schneider Electric
Member	Tom	Hawkins	Siemens Industry, Inc.
Member	Dave	Riffe	Westinghouse Electric Company
Member	Terrance	Woodyard	Siemens Industry Inc.
Guest	Bianca	Cosby	San Diego Gas & Electric
Guest	Adam	Franklin	WEGAI
Guest	Scott	Lanning	S&C Electric
Guest	Robert	Lau	nVent Hoffman
Guest	Anthony	Natale	HICO America
Guest	Laura	Reid	Hubbell Power Systems
Guest	Dustin	Sullivan	Hubbell Power Systems
Guest	John	Webb	ABB
Guest	Torsten	Wirz	ABB AG
Guest	Charles	Worthington	Hubbell Power Systems
Guest	Xi	Zhu	GE Energy Management

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IEEE C37.100.6

Guide for Determination of Test Specimens for Seismic Qualification for
Building Code Applications

Par Scope

Scope: This guide establishes selection criteria that is used to determine representative components or devices and assembly specimen configurations (both indoor and outdoor) to test as part of seismic qualification efforts for attaining building code seismic conformance for nonstructural equipment in commercial and industrial applications. Additionally, guidance for specific acceptance criteria is provided. Equipment types covered by this guide include those covered by the following standards:

- IEEE Std C37.04, AC High-Voltage Circuit Breakers with Rated Maximum Voltages above 1000 V
- IEEE Std C37.20.1, Metal-Enclosed Low-Voltage (1000 Vac and below, 3200 Vdc and below) Power Circuit Breaker Switchgear
- IEEE Std C37.20.2, Metal-Clad Switchgear
- IEEE Std C37.20.3, Metal-Enclosed Interrupter Switchgear (1 kV-38 kV)
- IEEE Std C37.20.9, Metal-Enclosed Switchgear Rated 1 kV to 52 kV Incorporating Gas Insulating Systems
- IEEE Std C37.21, Control Switchboards
- IEEE Std C37.23, Metal-Enclosed Bus
- IEEE Std C37.74, Subsurface, Vault, and Padmounted Load-Interrupter Switchgear and Fused Load-Interrupter Switchgear for Alternating Current Systems up to 38 kV
- IEEE Std C37.121, IEEE Guide for Switchgear - Unit Substation - Requirements

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AC156 Criteria – Structural Features

4.5.1 Structural Features: A rationale shall be provided explaining that the selected UUT's structural configurations are offering the least seismic capacity compared to other options that are available within the product line being qualified. The UUT's force-resisting systems shall be similar to the major structural configurations being supplied in the product line. If more than one major structure is a configurable option, then these other structural configurations shall be considered in the component product line extrapolation and interpolation rationalization process.

AC156 – Mounting Features

4.5.2 Mounting Features: A rationale shall be provided that explains that the selected UUT's mounting configurations are offering the least seismic capacity compared to other mounting options that are available within the product line being qualified. The configuration mounting of the UUT to the shake-table shall simulate mounting conditions for the product line. Seismic testing of components may be conducted using the smallest diameter tie-down bolt size (or minimum weld size) that can be accommodated with the provided tie-down clearance holes (or base structural members) on the components. If several mounting configurations are used, they shall be simulated in the test.

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AC156 – Subassemblies

“Typical” component list in
informative annex

Define essential
subassembly

- Anything in the primary current path
- Protective elements (relays, voltage sensing, ct’s)
- Synchronizing equipment
- Control power
- Essential control schemes
- Operability of components

4.5.3 Subassemblies: A rationale shall be provided explaining that the selected UUT’s subassemblies are representative of production hardware and offer the least seismic capacity of the UUT compared to other subassembly options that are available within the product line being qualified. The major subassembly components shall be included in the UUT. These components shall be mounted to the specimen structure at locations similar to those specified for proposed installations. The components shall be mounted to the structure using the same type of mounting hardware specified for proposed installations. Substitution of nonhazardous materials and fluids is permitted for verification of components or subassemblies that contain hazardous materials or fluids, provided the substitution does not reduce the functional demand on the component or subassembly.

1. Define essential versus non-essential components
2. Although maybe not essential, may need to be included due to impact of mass

Consider annex for
component qualification

AC156 – Mass Distribution

4.5.4 Mass Distribution: A rationale shall be provided explaining that the selected UUT’s mass distribution is one contributing to the least seismic capacity of the UUT compared to other mass distribution options that are available within the product line being qualified. The weight and mass distribution shall be similar to the typical weight and mass distribution of the component being represented. Weights equal to or greater than the typical weight shall be acceptable.

AC156 – Component Variations

4.5.5 Component Variations: A rationale shall be provided explaining that the selected UUT's overall variations contribute to the least seismic capacity of the UUT compared to other variations that are available within the product line being qualified. Other component variations, such as number of units/components in production assemblies, indoor and outdoor applications, etc., shall be considered in the component product line extrapolation and interpolation rationalization process.

Definitions (Proposed)

- Product Line – A range of products that a common function as defined by a product standard, has a similar force resisting (structural) system and utilizes components or subassemblies that are common throughout the range.
- Ganged Assemblies – A group (>1) of individual enclosures mechanically coupled together to form a larger assembly.
- Essential Function –
- Sub-assemblies -
- Mounting Features -

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Example

Metal-Clad Switchgear (C37.20.2)

Metal-Clad Content

- Typical Elements
 - Circuit Breakers
 - Instrument Transformers
 - VT's
 - CPT's
 - CT's
 - Alternate Sensing Devices – Voltage Dividers
 - Protective Relays
 - Meters (non essential)
 - Instrumentation & Control
 - Control Relays, Switches, PLC's, Timers, Power Supplies, Pilot Devices, HMI's

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Metal-Clad Switchgear

Metal-Clad Switchgear Enclosure Configuration Selection (Force Resisting System)									
Enclosure Configurations	Tie Down Points	Width (in.)	Depth (in.)	Height (in.)	Weight (lbs)	V (COG)	$(Weight * V_{max}) / (Width * Depth)$	Configuration Notes	Least Resistant
Indoor <u>Single</u> Section	6	20	96	96	1524	55.4	43.87		No
	6	26	96	96	2803	57.3	64.35		Yes
	6	30	96	96	2925	55.4	56.27		No
	6	36	96	96	3564	55.4	57.13		No
	6	36	108	96	3745	55.4	53.36		No
	6	38	108	96	4225	43.2	44.47		No
	6	42	108	96	5023	55.4	61.35		No
	6	42	120	96	5623	55.4	61.81		No
Outdoor <u>Single</u> Section	8	20	96	96	1753	55.4	50.57		No
	8	26	96	96	3223	57.3	74.00		Yes
	8	30	96	96	3364	55.4	64.71		No
	8	36	96	96	4099	55.4	65.70		No
	8	36	108	96	4307	55.4	61.37		No
	8	38	108	96	4859	43.2	51.14		No
	8	42	108	96	5776	55.4	70.55		No
	8	42	120	96	6466	55.4	71.08		No

- Notes:
1. If product is not configured as a single enclosure, at least (2) enclosures with (1) being the least resistance is required for testing.
 2. Assumes common force resisting system

Metal Clad Switchgear

**Metal Clad Switchgear
Breaker Selection Table**

Frame Size (Amperes)	Model Line	Model	Maximum Voltage (Vac)	Width (in.)	Height (in.)	Depth (in.)	Weight (lbs.)	Mounting	Manufacturer	Least Resistant
1200	ABC	K00000-1	5000	19	30	31.4	350	Draw-out	Company A	
		K00000-2	5000	29	30	31.4	350	Draw-out	Company A	
		K00000-3	5000	29	30	31.4	460	Draw-out	Company A	
		K00000-4	5000	29	30	31.4	575	Draw-out	Company A	Yes
		K00000-5	7500	29	30	31.4	375	Draw-out	Company A	
		K00000-6	15000	29	30	31.4	350	Draw-out	Company A	
		K00000-7	15000	29	30	31.4	350	Draw-out	Company A	
		K00000-8	15000	29	30	31.4	460	Draw-out	Company A	
		K00000-9	15000	29	30	31.4	575	Draw-out	Company A	Yes
		2000	ABC	Y00000-1	5000	29	30	31.4	430	Draw-out
Y00000-2	5000	29		30	31.4	490	Draw-out	Company A		
Y00000-3	5000	29		30	31.4	575	Draw-out	Company A	Yes	
Y00000-4	7500	29		30	31.4	430	Draw-out	Company A		
Y00000-5	15000	29		30	31.4	430	Draw-out	Company A		
Y00000-6	15000	29		30	31.4	430	Draw-out	Company A		
Y00000-7	15000	29		30	31.4	490	Draw-out	Company A		
Y00000-8	15000	29		30	31.4	575	Draw-out	Company A	Yes	
3000	ABC	Z00000-1	5000	29	30	31.4	525	Draw-out	Company A	
		Z00000-2	5000	29	30	31.4	525	Draw-out	Company A	
		Z00000-3	5000	29	30	31.4	575	Draw-out	Company A	Yes
		Z00000-4	7500	29	30	31.4	525	Draw-out	Company A	
		Z00000-5	15000	29	30	31.4	525	Draw-out	Company A	
		Z00000-6	15000	29	30	31.4	525	Draw-out	Company A	
1200	DEF	U00000-1	5000	22.52	27	25.76	250	Draw-out	Company B	
		U00000-2	5000	22.52	27	25.76	440	Draw-out	Company B	
		U00000-3	15000	22.52	27	25.76	250	Draw-out	Company B	
		U00000-4	15000	22.52	27	25.76	440	Draw-out	Company B	Yes
		U00000-5	5000	22.52	27	25.76	440	Draw-out	Company B	Yes
		U00000-6	5000	22.52	27	25.76	440	Draw-out	Company B	Yes
		U00000-7	15000	22.52	27	25.76	440	Draw-out	Company B	Yes
		U00000-8	15000	22.52	27	25.76	440	Draw-out	Company B	Yes

- Each Family or Model Line requires testing
- Breakers tested in highest mounting position
- Does "Model" or "Model Line" need a definition
- Accessories needed
- Thoughts on minimum # of test units
- Different mounting methods, require additional test samples, ex: cradle mounted versus roll on the floor.

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Metal-Clad Switchgear, CPT's

Metal-Clad Switchgear CPT's, Specimen Selection Table								
Size (kV)	Winding Material	Mourning	Part Number	Width (in.)	Depth (in.)	Height (in.)	Weight (lbs.)	Loss Resistant
CPT 5 KVA 1PH 12470/240-120V	Copper	14 3/8-16		16.5	10.25	14.75	127	ABC No
CPT 5 KVA 1PH 13200/240-120V	Copper	14 3/8-16		16.5	10.25	14.75	127	ABC No
CPT 5 KVA 1PH 13800/240-120V	Copper	14 3/8-16		16.5	10.25	14.75	127	ABC No
CPT 5 KVA 1PH 2400/240-120V	Copper	14 3/8-16		16.5	10.25	14.75	127	ABC No
CPT 5 KVA 1PH 4160/240-120V	Copper	14 3/8-16		16.5	10.25	14.75	127	ABC No
CPT 5 KVA 1PH 4760/240-120V	Copper	14 3/8-16		16.5	10.25	14.75	127	ABC No
CPT 5 KVA 1PH 4800/240-120V	Copper	14 3/8-16		16.5	10.25	14.75	127	ABC No
CPT 5 KVA 1PH 7200/240-120V	Copper	14 3/8-16		16.5	10.25	14.75	127	ABC No
CPT 5 KVA 1PH 8320/240-120V	Copper	14 3/8-16		16.5	10.25	14.75	127	ABC No
CPT 10 KVA 1PH 12470/240-120V	Copper	14 3/8-16		11.63	17.5	15.63	215	ABC No
CPT 10 KVA 1PH 13200/240-120V	Copper	14 3/8-16		11.63	17.5	15.63	215	ABC No
CPT 10 KVA 1PH 13800/240-120V	Copper	14 3/8-16		11.63	17.5	15.63	215	ABC No
CPT 10 KVA 1PH 2400/240-120V	Copper	14 3/8-16		11.63	17.5	15.63	215	ABC No
CPT 10 KVA 1PH 4160/240-120V	Copper	14 3/8-16		11.63	17.5	15.63	215	ABC No
CPT 10 KVA 1PH 4760/240-120V	Copper	14 3/8-16		11.63	17.5	15.63	215	ABC No
CPT 10 KVA 1PH 4800/240-120V	Copper	14 3/8-16		11.63	17.5	15.63	215	ABC No
CPT 10 KVA 1PH 7200/240-120V	Copper	14 3/8-16		11.63	17.5	15.63	215	ABC No
CPT 15 KVA 1PH 12470/240-120V	Copper	14 3/8-16		11.63	17.5	15.63	250	ABC Yes
CPT 15 KVA 1PH 13200/240-120V	Copper	14 3/8-16		11.63	17.5	15.63	250	ABC Yes
CPT 15KVA 1PH 12470/240-120V	Copper	14 3/8-16		11.63	17.5	15.63	250	ABC Yes
CPT 15 KVA 1PH 4160/240-120V	Copper	14 3/8-16		11.63	17.5	15.63	250	ABC Yes
CPT 15 KVA 1PH 4760/240-120V	Copper	14 3/8-16		11.63	17.5	15.63	250	ABC Yes
CPT 15 KVA 1PH 4800/240-120V	Copper	14 3/8-16		11.63	17.5	15.63	250	ABC Yes
CPT 15 KVA 1PH 7200/240-120V	Copper	14 3/8-16		11.63	17.5	15.63	250	ABC Yes
CPT 15 KVA 1PH 8320/240-120V	Copper	14 3/8-16		11.63	17.5	15.63	250	ABC Yes

- Each Family or Model Line requires testing
- CPT's tested in highest mounting position
- Thoughts on minimum # of test units
- Similar table needed for VT's, CT's, Alternate Sensing Devices

Protective Relays Discussion

ModelDescription

- [SEL-487E Transformer Protection Relay](#)
- [SEL-387 Current Differential and Overcurrent Relay](#)
- [SEL-387E Current Differential and Voltage Relay](#)
- [SEL-387A Current Differential and Overcurrent Relay](#)
- [SEL-587 Current Differential Relay](#)
- [SEL-787 Transformer Protection Relay](#)
- [SEL-787-2/-3/-4 Transformer Protection Relay](#)
- [SEL-451 Protection, Automation, and Bay Control System](#)
- [SEL-2414 Transformer Monitor](#)
- [SEL-487B Bus Differential and Breaker Failure Relay](#)
- [SEL-587Z High-Impedance Differential Relay](#)
- [SEL-352 Breaker Failure Relay](#)
- [SEL-487V Capacitor Protection and Control System](#)

ModelDescription

- [SEL-351S Protection System](#)
- [SEL-351 Protection System](#)
- [SEL-351A Protection System](#)
- [SEL-451 Protection, Automation, and Bay Control System](#)
- [SEL-751 Feeder Protection Relay](#)
- [SEL-751A Feeder Protection Relay](#)
- [SEL-4520 Arc-Flash Test Module](#)
- [SEL-501 Dual Universal Overcurrent Relay](#)
- [SEL-551 Overcurrent/Reclosing Relay](#)
- [SEL-551C Overcurrent/Reclosing Relay](#)

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Protective Relays Discussion

ModelDescription

[SEL-700GGenerator Protection Relay](#)

[SEL-300GGenerator Relay](#)

[SEL-2664Field Ground Module](#)

[SEL-2664SStator Ground Protection Relay](#)

[SEL-547Distributed Generator Interconnection Relay](#)

[SEL-587Current Differential Relay](#)

[SEL-387Current Differential and Overcurrent Relay](#)

[SEL-2600RTD Module](#)

Control Circuit Components

- PLC's, Control Relays, Timers, Control Switches, Power Supplies, HMI's
 - Widely varied and subject to change based on schemes
 - Specified by customers
 - What should we list as typical?
- Could result in frequent test programs to address gaps
- How to address
 - Weight based
 - Mounting, door versus panel, din rail versus bolted

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Post Test Validation

- Defer to C27.20.2, section 6.3 (Production Tests)?
- Subset of production tests?
- What is intent of code?

4.4 Functionality Requirements: A listing and detailed description shall be provided of the functionality requirements and/or tests used to verify pre- and post-seismic-testing functional compliance of components.

Each test and/or requirement should be listed as a separate line item.

6.6 Post-test Inspection: The UUT shall be visually examined and results documented upon completion of the multi-frequency seismic simulation tests performed in accordance with Section 6.5 to determine whether the UUT has adequate seismic capacity. The following conditions shall apply:

6.6.1 Structural integrity of the component attachment system shall be maintained. Limited yielding of the attachments shall be acceptable. Component design must ensure that the anchored UUT will not leave its mounting and cause damage to other building components or injury to personnel during the seismic event.

6.6.2 Components Force-resisting System: Structural integrity of the component force-resisting system shall be maintained. Structural damage, such as limited yielding, to UUT force-resisting members is acceptable and structural members and joints not comprising the UUT force-resisting system shall be allowed minor fractures and anomalies.

6.7 Post-test Functional Compliance Verification: Based upon the specified UUT importance factor in Section 4.2, the component being qualified must be capable of performing its intended functions after the seismic event.

6.8 Functionality requirements and/or tests, as specified in Section 4.4, shall be performed on the UUT to verify post-test functional compliance. Functional testing

Near Term Goals

- Review Annex Drafts at Spring Meeting
 - Requires one completed Annex to scroll and replicate
- Draft for main body