

IEEE PSRCC and IEC Standards for Protective Relays

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IEEE PSRCC/JTC Meeting

New Orleans, LA

January 2017

Outline

- What is IEC, as compared to IEEE & PSRCC?
- What is the IEC procedure for writing a standard?
- US approach for interfacing with IEC relay standards.
- IEC TC 95 relay standards.
- IEEE PSRC – IEC TC 95 collaboration.
- IEC standards conclusions for PSRC participants.

What do we do at IEEE PSRCC?

- Write IEEE standards for protective relays (& control systems).
 - “Standards” includes standards, trial-use standards, recommended practices, & application guides.
- Write informational papers & special reports.
- Teach and share experience.
- Support PES meetings & functions.
- Foster professional growth.



*PSRCC, PSCCC, other PES TCs -
communities for standards writing and
mutual professional help.*

Who is IEC?




- The *International Electrotechnical Commission*.
- Mainly *standards* –
“The product shall...”
- Founded in late 19th century (in St. Louis!).
- Over 100 Technical Committees (TCs) focused on specific product areas.
- Central Office in Geneva, Switzerland.
- US is one of many member nations in each TC in which it participates.



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TC 95

Measuring relays and protection equipment

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TC 95 Working Documents since 2016-01-12

Reference, Title	Downloads	Circulation Date	Closing Date	CENELEC	Voting / Comment	Authorized Committees
95/355/MTG Reports and presentations given at the TC 95 plenary meeting (2016-10-21) in Paris, France	3206 kB	2016-11-25		N/A		
95/356/RM Unconfirmed Minutes of the meeting held in La Plaine Saint Denis, France on October 21st 2016	1862 kB	2016-11-25		N/A		
95/346A/DA Revised draft agenda for the meeting to be held in Paris, France on 2016-10-21, from 10:00 AM to 5:00 PM	7146 kB 110 kB 7243 kB	2016-09-30		N/A		
95/352/PW Programme of work of the committee as recorded by the IEC Central Office in its database	33 kB 129 kB	2016-09-30		N/A		
95/353/CC Compilation of comments on 95/343/CD: IEC/IEEE 60255-118-1 Ed.1: Measuring relays and protection equipment - Part 118-1: Synchrophasor for power systems - Measurements	739 kB	2016-09-30		U		
95/354/CD IEC/IEEE 60255-118-1 Ed.1: Measuring relays and protection equipment - Part 118-1: Synchrophasor for power systems - Measurements	2067 kB	2016-09-30	2016-11-25	U	Report of Comments	
95/350/CC Compilation of comments on 95/341/CD: IEC 60255-187-1 Ed.1: Measuring relays and protection equipment - Part 187-1: Functional requirements for restrained and unrestrained differential protection of motors, generators and transformers	159 kB 1068 kB	2016-08-05		Y		

IEC TCs, CIGRÉ, and PSRC

- TC 95, *Measuring Relays and Protection Equipment* - protective relay standards.
- TC 57, *Power System Management And Associated Information Exchange* - relaying communications and power system data communications system standards including IEC 61850.
- TC 38, *Instrument Transformers* – now including IEC 61850 merging units (MUs) as data sources for P&C
- CIGRÉ is *separate* international technical forum – reports and guidance only in Study Committees (SCs).
- IEC TC 95, parts of 38 & 57 + CIGRÉ SC B5 \approx PES–PSRCC
- IEC TC 57 + CIGRÉ SC D2 \approx PES–PSCCC

IEC Standards Making Process

General -

- Formal, legal, procedural.
- International voting at every step.
- Voting limited to nations with an identified interest and history of participation in a TC - participating or P nations.
- One nation = one vote.



IEC Standards Making Process

- Any nation makes a New Work Item Proposal (NWIP) with scope, justification; and optional draft, plan, or existing non-IEC standard.
- P-member nations of TC vote on New Project proposal (NP) & nominate WG members.
- WG official member list - experts from users and manufacturers of many nations (like PSRCC).
- Standard number and schedule established.

IEC Standards Making Process

- WGs meet individually or in small related groups.
- TC 95 history: US employers are not willing to send experts to international meeting locations.
- *Result* – little US participation.
- US members can host meetings here, and international participants like to come to US.
- WG membership and participation is always the best way to influence the content and direction of IEC standards.
- **First result is *Committee Draft* (CD).**

IEC Standards Making Process

- CD1 is circulated to member nations for formal comments (handled like a ballot).
- All comments documented and recirculated.
- If there are many issues of substance, the CD is returned to the WG - make a new CD2.
- When issues are minor, draft returned to WG to make a Committee Draft for Vote (CDV).
- By this point, technical issues should have been resolved – avoid tampering with technical *approach* from here on.

IEC Standards Making Process

- CDV is circulated for vote as to whether it should be made into a Final Draft International Standard (FDIS), plus any new comments.
- If CDV wins a majority of P-nations voting, the WG edits it into an FDIS.
- FDIS is circulated for voting.
- If FDIS wins a majority of P-nations voting, it becomes an International Standard (IS).
- Editorial fixes throughout the process.
- *Consensus not required.*
- *One nation, one vote.*

IEC Standards Making Process

- Decisions on proceeding through the voting steps by TC Chairman; or by the entire TC if controversial.
- TC comprises representative delegations from each P- or O-member nation, with one vote per P-nation.
- TC meets separately from the WGs. TC 95 meets once every 1 to 2 years; all else by correspondence.

National Committees

- National Committees (NCs) handle the paperwork, deal with the participants, pay the participation bills from Geneva.
- Most non-US NCs supported by governments.
- USNC is housed by ANSI in New York.
- Old ANSI and NEMA funding gone for 18 years.
- *Participants* are taxed by USNC.

US Technical Advisory Group

- USNC has Technical Advisor (TA) for each TC.
 - Provides the votes and comments to USNC.
 - Organizes the Technical Advisory Group (TAG).
- TA to USNC for TC 95 - Eric Udren
- Deputy TA – Murty Yalla
- TA Group (TAG) – included in PSRC WG I4, IEC Advisory WG - a TAG home and meeting place.
- Each TAG member is taxed by USNC to pay administrative and IEC dues expenses.
 - TA to USNC for TC 57 – Scott Neumann.

IEC TC 95, Measuring Relays and Protection Equipment

- Chair Murty Yalla (US) for TC 95 internationally.
- Secretary Thierry Bardou(France).
- 18 participating countries
- Product physical and electrical design requirements, EMC, safety.
- New development focus – *Functional Standards* – testing how products do their intended jobs.

Development in MTs or WGs:

Maintenance Teams

MT 1	Vocabulary and terminology
MT 2	Electromagnetic Compatibility (EMC) Requirements
MT 3	Common requirements for measuring relays and protection equipment
MT 4	Functional standards
MT DLMT	Dual Logo Maintenance Team (IEC/IEEE 60255-24) Common format for transient data exchange (COMTRADE) for power systems

Joint Working Groups

JWG 1 IEC/IEEE, Synchrophasor measurements for power systems

IEC versus IEEE Relay Standards

- Limited areas of overlap:
 - Basic relay standards (C37.90 vs 60255-1)
 - Both have oscillatory and fast transient surges, EMI susceptibility, electrostatic discharge immunity.
 - *Only IEC* has EMI emissions, power frequency magnetic fields, power-frequency conducted influence, impulse testing of insulation, energy testing of surge protectors, auxiliary supply quality.
 - *Only IEC* has vibration, shock & bump tests. Both have seismic standards.
 - Only IEC has product safety standard for relays.

IEC and IEEE Relay Standards

Circa 2000 - IEC TC 95 and IEEE PSRC operated independently:



- No US participation in IEC WGs.
- One US vote had no influence on content.
- Significant and uncoordinated overlap of IEC versus “ANSI” standards requirements.
- Uneven market adoption internationally.
- Evaluation challenges for users.
- More complicated product development and testing by manufacturers.

IEC and IEEE Relay Standards

Today, IEEE PSRCC and IEC TC 95 are coordinating activities and creating shared standards content...

How did we get here?

IEC Secretary Serge Volut, retiring in January 2017:



"I keep a good souvenir of our collaboration in TC95 and I am confident that Thierry and Murty together will continue the same way. I have really appreciated the feedback given by Eric at our last plenary meeting – 'In decades past - developments were uncoordinated or conflicting but today - strong collaboration and harmonization'"

Harmonization Journey Step 1 – *De Facto Coordination by Experts*

- IEEE and IEC both have WGs.
- Shared experts, or informal sharing channel during development.
- Separate management and voting.
- Tough coordination of timing.
- Result is separate IEEE and IEC standards that happen to say the same thing.

This is how some IEEE and IEC standards were coordinated in the past.

- Example – IEEE or IEC COMTRADE 60255-24.

Harmonization Journey Step 2 – *Joint Working Groups and Dual Logo Standards*

- JWG 1 (Ken Martin) Synchrophasor Standard writing 60255-118-1.
- Result is a *dual logo* IEC-IEEE standard

Dual logo standard is a single harmonized result that meets everyone's needs.

Dual-logo standards *also* result when IEC adopts an IEEE standard as-is, or vice versa, per an agreement between IEC and IEEE.

Harmonization Journey Step 3 - *PSRCC Working Groups support TC 95 projects*

Today's effective tool to improve North American input to TC 95 standards

- WG D21 – Supported 60255-121, Functional Standard for Distance Relays.
- WG K19 – Supports 187-1, Functional Standards for Differential Relays – motor, generator, transformer.
- WG D34 - Supports IEC 60255 -187-3 Functional Requirements for Line Current Differential Protection
- New PSCCC WGs to be created for TC 95 projects with major new content.

Result is an IEC TC 95 international standard that meets everyone's needs.

IEC and IEEE Relay Standards

- Limited areas of overlap today:
 - Basic relay standards (e.g. IEEE C37.90 and subparts vs IEC 60255-1, -26)
 - Both have oscillatory and fast transient surges, EMI susceptibility, electrostatic discharge immunity.
 - *Only IEC* has EMI emissions, power frequency magnetic fields, power-frequency conducted influence, impulse testing of insulation, energy testing of surge protectors, auxiliary supply quality.
 - *Only IEC* has vibration, shock & bump tests. Both have seismic standards.
 - *Only IEC* has product safety standard for relays.

TC 95 Functional Standards

- Type-testing standards to show relays work correctly in their application situations – assure proper design and expected behavior/performance.
- This is the work led in IEC by Dr. Murty Yalla that leads to better relays with predictable performance in real-world P&C applications.
- Neither had these standards before, and each is a joint creation of IEC and IEEE experts.

TC 95 Functional Standards

Type-testing standards to show relays work correctly in their application situations – assure proper design and expected behavior/performance:

- 151 – Functional requirements for over/under current protection (legacy IEC & IEEE curves with reset)
- 121 – Functional requirements for distance protection
- 127 – Functional requirements for over/under voltage protection
- 149 – Functional requirements for thermal protection
- 181 – Functional requirements for frequency protection
- 187 – Functional requirements for restrained and unrestrained differential protection
 - Part 1 – motor, generator, transformer diff relays
 - Part 2 – bus differential relays
 - Part 3 – line differential relays

PSRC Working Groups support TC 95

Today's effective new way to get North American input to TC 95 standards

- D21 – Supported 60255-121, Functional Standard for Distance Relays.
- K19 – Supports 187-1, Functional Standards for Differential Relays – motor, generator, transformer.
- D34 Supports IEC 60255 -187-3 Functional Requirements for Line Current Differential Protection
- New WGs needed for new TC 95 projects.

Result is an IEC TC 95 international standard that meets everyone's needs.

- This is most fair to manufacturers, and protects users!

IEC and IEEE Standards Conclusions

- In decades past - developments were uncoordinated or conflicting.
- Today – strong collaboration & harmonization.
- Two current methods for harmonization.
 - Joint working groups and Dual Logo standards
 - PSRCC parallel support working groups that review drafts and contribute content.
- Result is a single international standard that meets all needs.
- Users and manufacturers need harmonized or single standards to survive the mass of requirements!