INTRODUCTION

The Traction Power Systems Standards Subcommittee (TPS) is in its seventeenth year of operation since it was formed in 2002. The TPSSC is working on developing new standards, recommended practices, and guides; coordinating with other organizations such as APTA and AREMA and within IEEE; providing up-to-date information on professional activities of interest to the electrified rail and transit industry; and soliciting recommendations, ideas and suggestions that would improve industry practices. The TPS is a subcommittee of the Rail Transportation Standards Committee (RTSC) within the IEEE Vehicular Technology Society (VTS). The TPS meets bi-annually at various transit properties in the United States and Canada.

The TPS consist of electrified transit and railway industry leaders in the public and private sectors dedicated to writing national consensus standards, recommended practices, and guides which will govern manufacturing, supply, installation, testing, commissioning, and operation of traction power substation equipment.

Since its formation, the TPS has grown and working groups are now addressing technical traction power systems beyond substations. At the Cleveland 2019 meeting, the group decided to rename the subcommittee to the Traction Power Systems Standards Subcommittee.

PURPOSE

The purpose of this meeting was to update the TPS membership on status of TPS activities including Working Groups (WG) and Task Forces (TF), to share the progress of their work, to conduct working sessions, and to outline future plans for continuing their work on standards, recommended practices and guides.

The following are brief notes of May 21st and 22nd, 2019 meeting.

WELCOME INTRODUCTIONS

Mr. Gary Touryan called the meeting to order

Michael Schipper, Deputy General Manager, Engineering & Project Management, of RTA gave a welcome introduction and a description of the RTA network.

Gary Touryan gave a welcome introduction and an overview of the IEEE rules. He also requested the attendees who are not yet members to please join VTS and made the following points:

- The RTSC committee is an umbrella for traction power, OCS, signal, and vehicles
- The signal group focuses primarily on CBTC and conventional signals.
- The vehicle group has number of good standards, practices, and guides.
- Every 10 years each standard must be reinstated, and it has an expiration date. It is important to not allow standards to expire
APTA & AREMA UPDATES

Ethan Kim, Chair of the Power, Signal, Comms technical forum for APTA provided updates:

- Participation is encouraged for TCRP research proposals

Steve Bezner, the chair of the traction power group within APTA provided updates and explained there is also a standards development group in APTA geared more towards maintenance.

Benjamin Stell gave the following update on AREMA Committee 33, Electric Energy Utilization:

- Each meeting focuses on one part of Engineering Manual in Chapter 33
- The March 2019 meeting was focused on clearances, rail electrification, and ancillary power
- There are 60 members, primarily based in the Northeast who are mostly focused on ac railway power systems

Other AREMA committees cover track, signals, etc. and seem to have more participation than Committee 33.

Steve Norton provided the following OCS committee meeting update:

- The OCS committee meets 3 times per year with the next meeting scheduled in Toronto on the 27th
- P1627 Standards for Grounding Practices for dc Electrification is finally in review and the committee hopes to have it fully passed in the next month
- P1671 Recommended Practice for Terminology for OCS is going back up for review in September
- P1833 OCS Design is reviewing line by line at the meeting in Toronto
- The next joint meeting with the OCS and TPSSC will be in October in New Orleans; OCS is Monday and Tuesday October 21st and 22nd, TPSSC is Wednesday and Thursday October 23rd and 24th.

GENERAL

There was discussion of removing the email addresses from the sign-in sheet.

The next TPSS meeting is scheduled for Wednesday and Thursday on October 23rd and 24th in New Orleans.

There was a request to move future October meetings due to the Power & Energy Society transformer committee meeting that is held on the last week of October.

The previous minutes were approved.

IEEE Standard Association (SA) Review and Approval Process - Ted Burse, Vice Chair, IEEE SA Standards Board

Ted Burse presented the following general information on the IEEE SA:

- Please nominate IEEE colleagues for awards
- Contact other senior members to become a senior member
- About 3% of the people who are nominated can become a fellow
- Overview of New Standards Committee (NESCOM) Conventions and Guidelines
Ted Burse presented the following information on balloting:

- How to use myProject page to submit a PAR
- IEEE SA Standards Board operations Manual, Section 5.3 Standards Developments Meetings
  - https://standards.ieee.org/about/policies/opman/set5.html
- Be familiar with the IEEE Style Manual
  - Copyright permissions
- IEEE SA Standards board operations manual, section 5.4 standards development meetings
- Comment resolution group must be formal and in the minutes
- Responding to ballot comments
  - REVCOM checklist and conventions (available on IEEE website)

Ted Burse presented the following information on the IEEE SA Standards Board Approval Overview:

- Editorial process
- Publication – 10 year life (Editors may change punctuation and accidentally change the meaning – be careful and review / respond quickly. Document approval was the day it was approved, not the day it was published)
- Post publication – the “oops!” process (does not extend the document life)
  - Errata – when your balloted draft does not match the published draft. An error introduced by the editor and does not require balloting
  - Corrigendum – used to fix things that are technically incorrect
  - Amendment – flexible
- Can ask for continuous revision without putting in another PAR to avoid paperwork for more detailed items

All interested in more information regarding the IEEE SA Standard Review and Approval process contact tburse@ieee.org.

Soo Kim Manager of the Operational Program Management of the Standards Association gave an overview of the process of PAR approval and is available to assist WG chairs in the process and pre-balloting.

All interested in getting help to navigate PAR process contact Soo Kim s.h.kim@ieee.org

WG UPDATES


Ethan Kim gave the following updates on 1653.1:

- The latest revision was published in 2016 and there are still several years before the 10 year anniversary
• The group decided last meeting not to wait 10 years before revising the document and to continue working on developing the content to approve the standard
• Meetings are scheduled on the first Thursday of every month at 9:30 pacific time; anyone interested in participating please contact Ethan and gain access to iMeet, the tool used for collaboration
• If you would like to vote on the standards and guides, you need to become a member of IEEE, VTS
• The goal is to come up with a date for the next PAR (project authorization request) at the next meeting
• Before spring 2020 the working group plans to come up with project scope, purpose, and be ready for the PAR. The target for finalizing the next revision is Spring 2024
• The agenda for this meeting is to discuss the ping test and snubber circuits, overload cycles and coordination with other IEEE standards, temperature rise tests and how to address harmonics, and have an open floor discussion

There was a discussion of the ping test surrounding the following main points:

  o The background of the ping test; The ping test is used to determine if system is susceptible to transients caused by breaker restrikes. Snubbers are used to prevent the transients from damaging the transformers.
  o What railroads currently use; Most railroad agencies do not use the PING test as a requirement; some specify snubbers when they are replacing traction power transformers in their substations. NYCT has stopped using the PING test because they cannot find anyone to perform the test.
  o Smaller amplitude and less destructive testing; There was mention of the duration of the transients being in the sub-microsecond range and suggestion to use a smaller amplitude test. ABB is an example of a company looking at the interaction with less destructive testing. There was mention of TRV analysis software driven around breakers and possible application to determine the value of snubbers.
  o Suggestion to mention ping tests and reference the C57.142 IEEE Guide to describe the occurrence and mitigation of switching transients inducted by Transformers, Switching Devices, and System Interaction that already has a working group. There was discussion of coordination with 1653.2 and C57.18.10 (in final revision before ballot).
  o Practical issues; the distance of transformers in each installation is unique and the impedance of cables, upstream distribution differs. Therefore, snubbers are not alike for all transformers and laboratory tests are not exact as compared to field operation & actual distances.
  o Suggestion that mitigating arrestors are also an option and that snubbers are not the only alternative.

There were several discussion items regarding 1653.1:

• Discussion of how the overload rating impacts the transformer as compared to the rectifier; short time changes apply mainly to rectifiers and long-time changes apply to both rectifiers and transformers. Suggestion to put the definition of the overloads in short time section for rectifiers, then define overload in 1653.2
• Suggestion to reference 1653.2 in 1653.1 and C57.18.10 draft should reference both 1653.1 and 1653.2. Refer to C57.18.10 for harmonics language
• Add rush hour information /overload definition for purposes of sizing the transformer, including contingency operation
• Suggestion not to mix RI-9 in with this standard because it is for rectifiers only based on diode heating, and does not apply to transformer ratings; For transformers – all we really care about the RMS equivalent value, but we have to be careful if the rectifier and transformers are tested together (if rectifier is oversized for heating and transformer is not)
• Proposal of WG: add requirements to address harmonic losses and heating effects in the design and testing of transformers
• Minor editorial comments will be posted in working group minutes of meeting

All interested in taking part in this Working Group contact ekim@ltk.com.

1653.2 – 2009 – IEEE Standard for Uncontrolled Traction Power Rectifiers for Substation Application up to 1500 Volts dc Nominal Output Benjamin Stell / Steve Bezner

Benjamin Stell gave the following updates on 1653.2:

• The revision PAR request was approved at the Dec 5 2017 NesCom meeting
• Added IEEE Circuit 24 to Annex A; “informative annexes” useful for standards to provide information but must avoid saying “shall”
• Rectifier short circuit current limit (Denning papers referenced) – manufacturers need to determine the coupling factor and other relevant design parameters for 3 or more rectifiers on one bus, otherwise the available short circuit current may exceed the rating of the switchgear
• Contributor table added
• Will go out for ballot soon

All interested in taking part in this Working Group contact Benjamin.stell@stvinc.com.


Mr. Gerzeny provided the following update on the status of C37.14.

• The working group has gone through 3 updates of latest release version draft 3
• New terms have been added
• Considered typical TPSS power system configurations defining breaker “use”; for example:
  o Breaker use (feeder, rectifier, tie, gap)
  o Breaking characteristic (high speed, semi high speed, none, delayed)
  o Interruption direction (unidirectional, bidirectional, none)
• The next step is to incorporate the terminology and breaker type into the preferred ratings tables in Annex C of the current standard
• Proposal for Table C2: Preferred Ratings and Test Circuit values of Heavy-Duty Feeder DC Power Circuit Breakers (based on transit systems with low frequency bonds
• Point in the process of revising the standard where we should talk more and confirm the numbers are what we want to present

C37.14 DC Circuit Breaker Design Test Criteria

Jeffrey Ross gave the following update about describing the difference between high speed and semi-high speed dc circuit breakers:
- No manufacturer makes separate frames for high speed and semi high speed breakers (only slight difference in thermal characteristics)
- The C37.16-2015 chart has the following information:
  - Full load current
  - Sustained fault current 12x full load current
  - Peak fault current 1.65 x sustained fault current
  - High speed <8.3ms – interrupts prior to short circuit peak
  - Semi-high speed >8.3 ms – interrupts after short circuit peak
  - Source power assumptions
  - Cathodes 6MW, feeders 8MW
- When developing the table we made assumptions for the time constant / inductance and resistance on a system 210ms per mile
- The cathode breaker only provides a protective function in reverse, so we want to differentiate between a cathode breaker and a normal breaker

All interested in taking part in this Working Group contact brian.gerzeny@powellind.com.

Mr. Heatherington provided the following update on the status of 1653.3:
- There was one meeting in the past 6 months
- Balloting by the end of the year
- Discussion of regen braking last time

There were several discussion items regarding 1653.3:
- Not going into how to model wayside energy storage because there is another guide, but if there is regen braking the default position would be to model it without unless there is a strong reason to model it with
- We do not go into hardware details in the standard, for example-controlled rectifiers
- Is there a way to incorporate a percent of accuracy in a software model; do we need to recommend some sort of tolerance on the output and say that you should not expect that the peak load or the minimum voltage you have identified with the model is accurate to more than a percentage of the actual value, aiming at a recommendation of trusting it to + or - 10%.
- Depending on the model to size the substation equipment and energy usage (owners wanting to put liquidated damages on energy consumption)
- Estimated annual energy use
- Need to add some sort of disclaimer – good for sizing equipment and that’s it
- Validation and verification section – every software needs to be validated once and one of the methods of validation is ideally real data
- Once validated, concerned with verifying the model (data is correctly inputted)

All interested in taking part in this Working Group contact david.hetherington@mottmac.com.

1653.4 - 2011 – IEEE Standard for dc Traction Power System Field Testing and Acceptance Criteria for System Applications up to 1500 Volts dc Nominal - Paul Forquer / Tom Young
• Started as a standard, turned into a recommended practice because standard is too strong for field testing
• Some updates to get it to a recommended practice
• Next steps – send it out for comments, start a PAR
• Comment from Soo - IEEE will provide an editable document of the most recently published standard

All interested in taking part in this Working Group contact pforquer@systra.com.

1653.6 - 2013 – IEEE Trial-Use Recommended Practice for Grounding of dc Equipment Enclosures in Traction Power Distribution Facilities - Ethan Kim / Andrew Jones / Sam Bista

Mr. Kim provided the following update on the status of 1653.6:
• Systems grounding has been brought up in the discussions again
• Monthly conference calls 1st Thursday of the month at 8AM
• iMeet central used for collaboration and document sharing
• 1653.6 published in 2013 as trial-use, converted to full-use in 2018
• WG decided to work on an amendment that addressed:
  o Low resistance ground fault detection insulation changes
  o Shop equipment enclosure grounding practices
  o System diagram to better explain the scope and relation to systems grounding
• October 2017 meeting – WG decided to develop another document for systems grounding
• Goals for systems grounding document: discuss systems grounding, review existing systems and grounding practices, request information where missing, note recommendations

Discussion of the separate document for systems grounding/ scope of the document:
• dc systems – negative pole. How to not ground the neutral on the secondary of a transformer
• Should 1653.4 be integrated
• Include wayside metallic structures
• Utility metering – suggestion to include it; one transit agency currently using isolation to prevent stray current from impacting the utility
• Overview of definitions used in the standard; contact line refers to third rail and OCS
• Electrification system arrangements
  o dc third rail – no deliberate connection to ground
  o dc fourth rail – resistive divider +420 -210, resistors only used at select locations
  o automated people mover
  o ac one side of the single phase is grounded at the substation and impedance bonds
  o ac three phase railway
  o dc trolley bus – positive grounded at one TPSS, positive pole grounded at one TPSS, resistive divider with center grounded
  o dc parallel three wire system – grounding practice unknown
• Suggested it should be a guide, not recommended practice
• Should the system grounding be integrated with 1653.6?
• Next step, create a PAR

All interested in taking part in this Working Group contact ekim@ltk.com.
P1653.5 Recommended Practice for Controlled Rectifiers for Traction Power Substation Applications - Vitaly Gelman

Mr. Gelman provided the following update on 1653.5:

- Going to ballot soon
- Table 2 thyristor-controlled rectifier tests are classified as:
  - Design
  - Production
  - Installation
- Should use the standard names for the test definitions as IEEE 1653.2 standard for uncontrolled power rectifiers
- Rather than factory test, we use design and production
- Special test for controlled rectifiers you do not use with diode rectifiers – phasing the system

There were several discussion items regarding 1653.5:

- Discussion of using the word “production” vs. “factory” to describe a test, and “installation” vs. “field” to describe a test. Suggestion that 1653.2 uses factory and field
- Comment to refer to IEC standards – normally we do not refer to European standards
- Discussion of table 2, which should be under design vs. production
- Discussion of commutation failure and testing
- Suggestion not to mention IEEE Std 519 but only provide the current & voltage harmonic characteristics of the device to the system designer
- Discussion of the pros and cons of measuring harmonics on the secondary side of the transformer vs. the primary side
- Dc filter capacitors, discussion of frequency and avoiding resonant frequency
- Not a standard, recommended practice. To remove point of contention – it was suggested that the working group reduce the paragraph about dc filter and testing, and move it to an annex

All interested in taking part in this Working Group contact vgelman@vgcontrols.com.

TCRP C-24, Transit Traction Power Cables: Replacement Guidelines- Dr. Korkmaz

Dr. Korkmaz is managing an FTA-sponsored Transportation Cooperative Research Program (TCRP) project that is developing guidelines for traction power cable replacement. Dr. Korkmaz requested information from transit agencies regarding their current practices for assessing insulation aging of traction cables and for cable inspection and maintenance. He handed out a form for attendees to fill out indicating their interest area and their contact information.

P1884 Guide for Stray Current Corrosion Mitigation for DC Rail Transit Systems - Edwin Wetzel/Bob Wilson

Mr. Wetzel gave the following updates on P1884:

- The working group is looking for more volunteers
- Commitment to publish / ballot by the end of this year
- The table of contents close to finalized
- Suggestion to find NACE affiliated people to assist / contribute to the standard
- Ed said NACE only has one standard that is geared toward pipelines which needed to be renewed
Should we apply for an extension or another PAR?

Agencies should use remote monitoring for stray currents

Specifications should be updated to use the modern technology, as many are referencing obsolete technology

Discussion of European and UMTA standards for corrosion

Walk through of each section to see which sections need the most work and where volunteers can contribute

Discussion of bonds to the negative bus and measurements

Mention of negative drainage equipment not connected in many substations

10B189 state of the art stray current report, NACE international, about the tolerance level of stray current measurements (anything over 150mV is severe and must be mitigated)

Use average and Barnes layer method for calculations

Note from IEEE representative: need to start sponsor ballot process by end of August for an extension

All interested in taking part in this Working Group contact ewetzel@systra.com.


Mr. Nutt provided the following update:

- Released the guide in February 2017
- Question for the group – where do we want to go with this next since the group hasn’t met after the release
- Transient stability not included in the guide, perhaps it should be considered to ensure the energy storage device works well with other devices on the system
- IEC standard includes this type of information
- Performance-based guide; it does not get into how energy storage systems should be designed. It is more about considerations in performance, technologies, topologies, how to model, metrics, interoperability, safety, testing and commissioning
- Someone mentioned running rail potential mitigation a year ago
- We are insulating rail so well, that we could end up with a positive to earth fault (safety issue)
- Suggestion for a reference guide on voltage limiting devices
- Control, measure, monitor, integrate

All interested in taking part in this Working Group contact ken.nutt@rail.bombardier.com.

P2720 Rail Potential Management Guide for Direct Current Traction Electrification Systems - Benjamin Stell

Mr. Stell gave a presentation and provided the following update and overview of contents:

- Draft 7
- Primary focus is on the identification and management of touch and step voltages
- PAR expires December 31, 2020
- Not many updates since the last one
- Focused on the EN standard 50122-1 since there are no US standards
- Table from the load flow guide showing transit systems and rail potential control methods - request to agencies to contribute and update table
- If you have a neutral grounding device or negative grounding device, how long does it stay closed? Is there a defined time or current? BART response – there is no duration to remain closed on NGD, it is a current threshold (20-30A)
- Comment – all transit systems in table are heavy rail, should light rail be included? For light rail there is more public access and touch potential hazard, so it seems more critical
- Comment – add clearing time for each agency
- Suggestion – Benjamin to come up with a questionnaire to be sent out with the minutes
- Proposed next steps: add a section on passenger platform design guidelines for rail potential management (present the electrical isolation and the EN 50122-1 approaches) and put document into current IEEE standards template
- Obtain agreement on moving to balloting
- Typically when you connect dc negative at one location the voltage will rise in another location (why the Europeans put NGDs at the stations also – but we are not recommending it because you would be installing an equipment grounding conductor the entire right of way, means a lot of maintenance and expense)

All interested in taking part in this Working Group contact Benjamin.stell@stvinc.com.

TF on Smart Substations - Mark Curry/Steve Halford

- Starting to develop an open guide for best principles/ best practices for substation automation
- Already exist for utilities but not for TPSS
- Started the PAR process for this one and substation protection
- Mark has been talking to Ted Burse and once the PAR is completed (target – September) then we can form a working group
- We should have an outline in IEEE format by the time it is approved
- We are missing operators in the substation automation task force. If there are any operators that would like to contribute it would be helpful
- 2 PARs – one on the architecture of the substation , one on the protection systems
- 61850 as an example for open standard protocols (not specific to one manufacturer)
- Incorporates cybersecurity based on ANSI, IEC because want to use best practices that already exist rather than write a cybersecurity standard
- Staying at the architecture layer and referencing data layer terminologies
- Next step – send an email to recruit participation
- So far the task force group has NJT WMATA and AMTRAK for agency representation

All interested in taking part in this task force contact mark.curry@powellind.com.

TF Primary Power Distribution and Control Centers in Passenger Rail Car Maintenance Facilities
- Benjamin Stell

- Addresses stinger systems / shop power distribution
- Request for participation from people who have experience designing stinger systems
- Considering changing the name
- There are many different options for rail car maintenance facilities, such as the stationary stinger and the movable stinger, plugs and bugs, cable reels, dc contactors, dc disconnect switches, and
various enclosure material options (fiberglass vs. stainless steel for example) that need to be addressed as part of a guide or standard.

All interested in taking part in this task force contact benjamin.stell@stvinc.com.

General Discussion

Mr. Touryan led the following general discussion:

- Proposal: Task force for third rail in time for New Orleans
- Proposal: changing the name from “Traction Power Sub Stations Standards Sub-Committee” to “Traction Power Systems Sub-Committee”
- Overview of parent committee “Rail Transportation Standards Committee”
- Request for participation in CBTC/Signals and Railcar Vehicle Crossover sub committee

Adjourn the second day of the meeting

Prior to adjourning Mr. Touryan thanked GCRTA for hosting the meeting and the tours to their facilities. Mr. Touryan expressed the TPS appreciation of the Mr. Schipper welcoming words, Mr. Shaffer hosting the meeting, and Robert Piggery and GCRTA staff for organizing and taking care of every detail to make our meeting successful in Cleveland.

tour the ICC, and a traction power substation with a most informative comprehensive presentation by your staff.

In the afternoon of second day at RTA headquarters, the attendees split off into groups and had the benefit of touring the control room and traction power substation 11 at East 55th Street under the most knowledgeable and enthusiastic guidance of Robert Piggery.

CONCLUSION

We had over 100 participants. It was great to see a very strong representation from the transit and rail agencies such as, TriMet, GCRTA, NYCT, PATH, BART, Santa Clara VTA, and LA MTA. This gave all participants an opportunity to exchange the best practices in our industry.
TPSSC thanks all meal sponsors for their continuous support:

SYSTRA
Powell Electrical Systems
Myers Controlled Power
Virginia Transformer
Sécheron
Hawker Siddeley Switchgear
Siemens
Hatzel & Buehler
General Electric
DNV GL KEMA Laboratories
Kapsch

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