

Requirements related to Fault Recording

Do you agree with the other Fault Recording requirements in R4 through R6 of this proposed standard? If no, provide specific suggestions that would make the requirements acceptable to you.

Summary Consideration:

Organization	Yes or No	Question 9 Comment
Northeast Power Coordinating Council	No	<p>Referring to Requirement 4.1, the number of phases to be monitored is excessive. It will not provide any analytical benefit. Monitoring every transmission line in a ring bus is excessive. The second bullet referring to a breaker-and-a-half arrangement needs clarification. What is the "outer bus" in that arrangement? Definitions should be provided when references are made to substation designs or equipment that could have different names or designations in the industry. As we commented in Question 5, we do not feel that the 200kV threshold is an appropriate criteria for assessing criticality, nor the single or generating plant capacity specifications. This needs to be reflected in Table 4-1. Referring to Requirement R4.2, the intent of measuring neutral current needs to be clarified, specifically with regard to transformers (see R5.3 in PRC-002-2). Referring to Requirement R5, the comments to R4.1 and R4.2 are applicable. In Table 5-1 the requirements that refer to the high side of critical GSU's should be directed at Transmission Owners, not Generation Owners. Referring to Requirement R6.1, the second bullet does not provide for the recording of adequate information (see response to Question 8).</p>
<p>Response: Monitoring of all three phases is necessary for the analysis of all fault types. Monitoring all three phases, or two phases and the residual, will provide enough data to derive all three phases and the residual. An FAQ document is being developed to clarify voltage monitoring requirements on ring busses and breaker-and-a-half arrangements. The standard is also being revised to more clearly indicate what equipment each G. O. and T. O. must monitor.</p>		
IRC Standards Review Committee	No	<p>The SRC agrees with the data itself. The SRC does not agree that each data item listed in R4 must be an independent requirement. The SRC supports compliance with R4, but that the suggested sub-requirements be bullet items and that those items be handled through VSLs. Similarly with R5, the data items should be bulleted rather than being shown as independent. Similarly with R6, the data items should be bulleted rather than being shown as independent.</p>
<p>Response: The SDT is revising the standard and will take your suggestions into consideration.</p>		

Organization	Yes or No	Question 9 Comment
SPP System Protection and Control Working Group	Yes	
Members of the WECC Disturbance Monitoring Work Group	No	Table 4-1 should also be modified to identify Substations containing any combination of five (5) or more elements. See response to question 7 above.
Response: The SDT is reviewing the location criteria. See our answer to question 7 above.		
Southern Company - Transmission	Yes	No further comment.
SERC Engineering Committee Planning Standards Subcommittee		
SERC Protection and Controls Subcommittee	Yes	Re-label heading of Table 4-1 to indicate: for substation equipment owned by Transmission Owner?
Response: The SDT is revising the standard and table 4.1 will be relabeled to indicate that it is for T. O. owned equipment.		
PacifiCorp		
Dominion	Yes	Re-label heading of table 4-1 to indicate:" for substation equipment owned by Transmission Owner"
Response: The SDT is revising the standard and table 4.1 will be relabeled to indicate that it is for T. O. owned equipment.		
Bonneville Power Administration	No	BPA does not believe the individual phase voltage of each line is required if Bus voltage at the station is recorded. We think the R4.1 may say that, but maybe change the wording order to "The three phase to neutral voltages on each main bus or monitored line as follows:", It shouldn't be required to monitor the voltages on a transfer bus in a main and auxiliary (transfer) bus scheme. The number of element criteria may be too stringent, change to 5 elements.
Response: The recording of every line and bus voltage is not explicitly stated. What is stated is that the voltages must be able to be derived. As long as an adequate number of voltages are recorded, such as every other bus or line on a ring bus, and circuit breaker position is known, all voltages can be derived. How an individual company chooses to comply with the requirements may vary from one G. O. or T.O. to the next. The SDT is reviewing the FR location requirements.		

Organization	Yes or No	Question 9 Comment
FirstEnergy	Yes	
Florida Power & Light	Yes	
Los Angeles Department of Water & Power		
MRO NERC Standards Review Subcommittee	Yes	Table 5-1 has a type-o - Row 2, Column 2, bullet 1 extra 'd'.
Response: Thank you. This has been corrected.		
PG&E System Protection	No	Table 4-1 should also be modified to identify Substations containing any combination of five (5) or more elements. See response to question 7 above.
Response: The SDT is reviewing the location requirements. See the answer to question 7 above.		
US Bureau of Reclamation	Yes	
NERC	No	R4.1 It is important for forensic analysis to have both bus and line quantities for DFR quantities. Bullets 2 and 3 should read: On breaker-and-a-half arrangements, the outer bus voltages, and the individual line voltages. On straight buses, common bus voltages and the individual line voltages.
Response: There are multiple ways to determine every line and every bus voltage. If the two sets of bus voltages in a breaker-and-a-half scheme are recorded, and the status of every circuit breaker is known, all line-bus and line voltages can be determinedderived.		
TransAlta		
Grant County PUD	Yes	
NYISO	No	R4.1 requires monitoring of 3 phase voltages on all bus sections of ring buses. We believe this is excessive. Reduce requirements to enough to be able derive all the quantities during normal maintenance conditions (outages).R5.5, second row in table: This puts the responsibility to monitor a transmission substation on the generator owner. Change the requirement such that the substation owner needs to monitor this.

Organization	Yes or No	Question 9 Comment
		<p>Response: The standard states that those voltages must be able to be derived, not that every line or bus voltage absolutely needs to be recorded. As long as an adequate number of voltages are recorded, and circuit breaker status is known, it is possible to be able to derive all voltages without recording every line or bus individually. The SDT is revising the standard to more clearly differentiate G.O. and T. O. monitoring requirements.</p>
Tri-State Generation and Transmission Association	No	The R4.1 and R5.4 ring bus requirements to monitor three-phase voltages on each transmission line seems unnecessary for reliability or for post-event analysis. Voltages from opposite locations on a ring bus should ensure that sufficient quantities are available to perform any required calculations.
		<p>Response: The standard states that those voltages must be able to be derived, not that every line or bus voltage absolutely needs to be recorded. As long as an adequate number of voltages are recorded, and circuit breaker status is known, it is possible to be able to derive all voltages without recording every line or bus individually.</p>
Cowlitz County PUD	Yes	
Portland General Electric	No	The following comments are those filed by the DMWG which we are filing in support: Table 4-1 should also be modified to identify Substations containing any combination of five (5) or more elements. See response to question 7 above.
		<p>Response: The SDT is reviewing location requirements. See our answer to question 7 above.</p>
Progress Energy Florida	No	Monitoring of GSU transformer currents on units >500MVA is the correct approach. However, peaking generation locations will have many generating units of less than 500MVA. The aggregate combination of 1500MVA will encompass many GSU transformers. Monitoring of each of the GSUs' currents (even though they are >200kV) will require extensive DME equipment additions at locations remote to the transmission network where the DME equipment is (and should be) located. We believe these total aggregate generation currents should be monitored at the location where they are introduced to the transmission network. This location may be at an exit point from a generating unit bus or a transmission line the feeds the generation power into another remote transmission substation bus.
		<p>Response: The SDT is reviewing your suggestion. If the SOE is on the breakers the monitoring the GSU aggregate is acceptable. NOTE: The Sub team will take the lead on determining a position on GSU monitoring to incorporate into the standard and respond to this comment.</p>
Puget Sound Energy	No	Table 4-1 should also be modified to identify Substations containing any combination of five (5) or more elements. See response to question 7 above.

Organization	Yes or No	Question 9 Comment
Response: The SDT is reviewing location criteria. See our response to question 7 above.		
Schneider Electric	Yes	
Independent Electricity System Operator	No	Please see our comments on R6, above.
Response: See our response to R6 above.		
American Electric Power	Yes	
NextEra Energy Resources (formerly FPL Energy)	No	<p>Section R4.1 Recommend changing the first bullet to read On ring buses, the voltages of bus sections connected to transmission lines, or the individual line voltages.</p> <p>Section R4.2 Recommend removing the word transformer from the qualifying sentence and changing the wording to The three phase currents and the residual or neutral currents of each monitored element as noted in Table 4-1. Table 4-1 Recommend changing the single generating unit level to 750MVA or higher to avoid unnecessary Fault Recording Equipment installations.</p> <p>Section R5.1 Recommend removal of language restricting the location of where to monitor for three phase to neutral voltages or phase to phase voltages associated with the GSU. Statement should allow for monitoring at T-line level as well.</p> <p>Section R5.2 Recommend removal of language restricting the location of where to monitor for three phase to neutral voltages or phase to phase voltages associated with the GSU. Statement should allow for monitoring at T-line level as well.</p> <p>Section R5.4 Recommend changing the first bullet to read On ring buses, the voltages of bus sections connected to transmission lines, or the individual line voltages.</p> <p>Section R5.5 Recommend removing the word transformer from the qualifying sentence and changing the wording to The three phase currents and the residual or neutral currents of each monitored element as noted in Table 4-1.</p> <p>Table 5-1 Recommend changing the single generating unit level to 750MVA or higher to avoid unnecessary Fault Recording Equipment installations.</p>
Response: The standard states that line voltages must be able to be derived. Where someone may choose to record those is up to them. The standard		

Organization	Yes or No	Question 9 Comment
		is specifically worded to allow recording of voltages and currents on either side of a GSU. The generating size criteria is being reviewed. <u>Note: the Sub team will draft responses to the various wording suggestions made by the commenter.</u>
National Grid		
Manitoba Hydro	Yes	
Exelon Generation LLC	No	<p>Comments on PRC-002-2---Disturbance Monitoring and Reporting Requirements Draft 1, January 30, 2009</p> <p>1. Requirement R5.4: Requirements identified in this section for monitoring bus and line voltages belong to TO and not to GO unless GO owns the Substation. The revision should clearly state that.</p> <p>2. Requirement R5.4: We heard during the Q&A session of the webinar on 3/12/09 that GSU neutral current can be recorded by the residual current (sum of three phase currents). The revision should clearly state that.</p> <p>3. Requirement R5.4: Please clarify that recording of Generator Step Up transformer (GSU) phase currents can be done by deriving these currents from the GSU output breaker(s) currents. The revision should be modified to state this and that the GSU neutral current can be recorded by deriving this current from the GSU output breaker(s) phase currents. (Most of our GSUs are connected to the switchyard thru two output breakers in a ring bus. It makes lot more sense from a schedule and cost view point to use the quantities from the CTs of these output breakers rather than from the GSU CTs. It also makes sense from reliability viewpoint as less cabling means more reliability for the equipment, especially when with less additional cabling/wiring; we are recording the required quantities.)</p> <p>4. Requirement R5.5: Requirements identified in this section for monitoring line three phase currents and the residual and monitored current belong to TO and not GO unless GO owns the Substation. The revision should clearly state that.</p>
		<p>Response: 1) The standard is being revised to clearly indicate what equipment each G. O and T. O. should monitor. 2 and 3) If your GSU is delta on the low side and wye on the high side, the GSU neutral current cannot be determined by deriving the residual current on the low side. The neutral current can be determined by deriving the residual current on the high side. The intention of the standard is to tell each G. O. and T. O. what quantities are needed, not how to record them since each entity may use a different approach that suits their needs. 4) The standard has been modified to explicitly state what equipment a G. O. and T. O. is to monitor.</p>
NV Energy	Yes	
DTE Energy/Detroit Edison	No	<p>Consider change to allow high side GSU voltage to be monitored at the high side bus of the same voltage. Present wording can be taken to imply that voltage must be monitored directly at GSU high side terminals. Also, can parallel GSUs be allowed to be monitored at a common point rather than individually? Likewise, can two GSUs connected at a common point at 200 kV or above be allowed to be monitored together at the</p>

Organization	Yes or No	Question 9 Comment
		common connection point?
<p>Response: The standard has been modified to indicate that either high or low side voltages and current can be recorded. As the standard is presently written, all GSU transformers must be recorded separately.</p>		
<p>Wisconsin Electric</p>	<p>No</p>	<p>In R5.4 and R5.5, the Generator Owner is required to record Fault Recording data for equipment in the substation connected to a generating station of a specified capacity, in addition to that for the GSU. This appears to be an unnecessary duplication of equipment already being monitored by the Transmission Owner in R4. If this is a correct interpretation, we believe this requirement is redundant, and technically and financially unjustified. We strongly oppose requiring duplication of monitoring equipment for the same facility by both Transmission Owners and Generator Owners.</p> <p>Response: The standard is being revised to clearly state that a G. O. is to monitor equipment that the G. O. owns, and the T. O. is to monitor the equipment the T. O. owns.</p> <p>Also, In R5.2, the statement is given that the three-phase current data from the "generator bus" is sufficient for monitoring. Does this mean that the three-phase currents from generator current transformers will meet this requirement?</p> <p>Response: Yes, this is the intent of Requirement 5.2</p>
<p>Response: The standard is being revised to clearly state that a G. O. is to monitor equipment that the G. O. owns, and the T. O. is to monitor the equipment the T. O. owns.</p>		
<p>ITC Transmission, METC</p>	<p>Yes</p>	
<p>City of Tallahassee (TAL)</p>	<p>No</p>	<p>R4.1, Bullet #1 appears too restrictive for a ring bus. It will require a fault recorder on each bus section with a line going to it. This is also a potential conflict with R7, which allows a recorder up to 2 busses away. Table 4-1.</p> <p>Response: The standard states that those voltages must be able to be derived, not that every line or bus voltage absolutely needs to be recorded. As long as an adequate number of voltages are recorded, and circuit breaker status is known, it is possible to be able to derive all voltages without recording every line or bus individually. R7 is only for dynamic disturbance recording, not for fault recording, so there is no conflict. Your assumption is incorrect regarding transformation and number of lines. If you have three 230 kV lines, and no transformers, you meet the "three or more elements" criteria. A substation with one 230 kV line, one 500 kV line, and a 500/230 kV transformer also meets the criteria.</p>

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		<p>Am I correct in assuming that if there is no transformation with both sides >200kV, I do not need recording no matter how many lines are there. <u>Note: The sub-team will come up with proposed language to address the comment.</u> Same concern with "plant" vs. "site".</p> <p><u>Response: The standard does not address sites but rather Transmission switching stations, transmission substations, generating stations, HVAC converter stations, HVDC converter stations.</u></p>
<p>Response: The standard states that those voltages must be able to be derived, not that every line or bus voltage absolutely needs to be recorded. As long as an adequate number of voltages are recorded, and circuit breaker status is known, it is possible to be able to derive all voltages without recording every line or bus individually. R7 is only for dynamic disturbance recording, not for fault recording, so there is no conflict. Your assumption is incorrect regarding transformation and number of lines. If you have three 230 kV lines, and no transformers, you meet the "three or more elements" criteria. A substation with one 230 kV line, one 500 kV line, and a 500/230 kV transformer also meets the criteria.</p>		
PHI (PEPCO Holdings Inc.)	Yes	FR triggering requirements are not addressed.
<p>Response: After a review of triggering practices among many utilities, the SDT decided to allow companies to continue to use whatever method they have found to work well for them. What works for one T. O. or G. O. may or may not work for another T.O. or G. O. R4 and R5 states that each T. O. and G. O. must have a process in place to derive fault data, and the SDT feels that to do this triggering requirements are inherently required.</p>		
NV Energy (fka Sierra Pacific Resources)	No	Table 4-1 should also be modified to identify Substations containing any combination of five or more elements. See response to Q7 previous.
<p>Response: The SDT is reviewing the location requirements. See our answer to Q7 previous.</p>		
Salt River Project	No	Table 4-1 should also be modified to identify Substations containing any combination of five (5) or more elements. See response to question 7 above.
<p>Response: The SDT is reviewing the location requirements. See our answer to Q7 above.</p>		
Pacific Northwest National Laboratory		
Progress Energy Carolina, Inc.	No	Monitoring of GSU transformer currents on units >500MVA is the correct approach. However peaking generation locations will have many generating units of less than 500MVA. The aggregate combination of 1500MVA will encompass many GSU transformers. Monitoring of each of the GSUs' currents (even though they are >200kV) will require extensive DME equipment additions at locations remote to the transmission network where the DME equipment is (and should be) located. We believe these total aggregate generation

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		currents should be monitored at the location where they are introduced to the transmission network. This location may be at an exit point from a generating unit bus or a transmission line the feeds the generation power into another remote transmission substation bus.
Response: The SDT is reviewing the criteria for generator size and aggregate combination, and your comments will be used as input for this review.		
Hydro-Québec TransEnergie (HQT)	No	Referring to Requirement 4.1, the number of phases to be monitored is excessive. It will not provide any analytical benefit. Monitoring every transmission line in a ring bus is excessive. The second bullet referring to a breaker-and-a-half arrangement needs clarification. What is the "outer bus" in that arrangement? Definitions should be provided when references are made to substation designs or equipment that could have different names or designations in the industry. As we commented in Question 5, we do not feel that the 200kV threshold is an appropriate criteria for assessing criticality, nor the single or generating plant capacity specifications. This needs to be reflected in Table 4-1. Referring to Requirement R4.2, the intent of measuring neutral current needs to be clarified, specifically with regard to transformers (see R5.3 in PRC-002-2). Referring to Requirement R5, the comments to R4.1 and R4.2 are applicable. In Table 5-1 the requirements that refer to the high side of critical GSU's should be directed at Transmission Owners, not Generation Owners. Referring to Requirement R6.1, the second bullet does not provide for the recording of adequate information (see response to Question 8).
Response: Monitoring of all three phases is necessary for the analysis of all fault types. Monitoring all three phases, or two phases and the residual, will provide enough data to derive all three phases and the residual. An FAQ document is being developed to clarify voltage monitoring requirements. The standard states that line voltages must be able to be derived. Where someone may choose to record those is up to them. The standard is specifically worded to allow recording of voltages and currents on either side of a GSU. The generating size criteria is being reviewed.		
Brazos Electric Power Cooperative, Inc.	No	Clarify criteria and remove Tables.
Response: The standard is being revised to clearly state what equipment each G. O and T. O. should monitor. The SDT will continue to strive to make the criteria as clear as possible.		
WECC		
Entergy Services, Inc	No	R4.1 should include provisions to exclude 3 phase potential monitoring for line/bus elements employing line protection schemes, such as current differential relaying, where 3 phase potentials are not presently available and would not needed but for the requirements. Adjacent or remote end element monitoring should be

Organization	Yes or No	Question 9 Comment
		allowable for these cases.
<p>Response: Even with a current differential scheme, back-up relaying must include elements to detect and clear downstream faults in a time delayed manner. As long as those voltages can be derived in some manner, the requirements can be met without installing monitoring on every CCVT or VT. Table 4.1 allows for monitoring at remote terminals.</p>		
Northeast Utilities	No	Referring to Requirement 4.1 and 5.4, monitoring the voltage every transmission line in a ring bus is excessive. Referring to Requirement R4.2, the intent of measuring neutral current needs to be clarified, specifically with regard to transformers (see R5.3 in PRC-002-2).
<p>Response: The standard states that those voltages must be able to be derived, not that every line or bus voltage absolutely needs to be recorded. As long as an adequate number of voltages are recorded, and circuit breaker status is known, it is possible to be able to derive all voltages without recording every line or bus individually. Transformer neutral currents do not necessarily need to be monitored if they can be derived from the three phase currents. Neutral currents are frequently desirable for the analysis of ground faults.</p>		
San Diego Gas and Electric Co.	Yes	Agree, except for the comment made in question 7 above about changing the SOE criteria from three lines to five lines.
<p>Response: See answer to question 7 above. The SDT is reviewing the location requirements.</p>		
New York Independent System Operator	No	(R4.1) Requiring monitoring 3 phase voltages of all ring bus bus sections is excessive. Reduce requirements to enough to be able derive all the quantities during normal maintenance conditions.(R5.5, second row of table) This puts the responsibility to monitor a transmission substation on the genertator owner. The gen owner likely does not own the transmission substation. Make monitoring this equipment the responsibility or the transmission owner.(following R6.) We note that there is no mention of FR triggering. While this is specific to the various manufacturers trigger algorithms and specific also to the location, there does need to be a statement that the FR is to trigger for near-by faults, system disturbances, and relay operations. While this type of consideration is difficult to address in a standard, it would be misleading to leave out entirely a statement that reliable FR triggering is necessary. We request that the team add a new provision stating that all required FR channels at a location should be recorded whenever a trigger asserts on any one of them.
<p>Response: The standard states that those voltages must be able to be derived, not that every line or bus voltage absolutely needs to be recorded. As long as an adequate number of voltages are recorded, and circuit breaker status is known, it is possible to be able to derive all voltages without recording every line or bus individually. The SDT is revising the standard to clearly state that the owner of the equipment is to do the monitoring. The SDT feels that since the standard states that each T. O. and each G. O. must have a process in place to derive fault data, triggering is inherently required.</p>		

Organization	Yes or No	Question 9 Comment
<p>Rather than explicitly prescribing how to trigger records, the SDT feels that each company already knows what works, and the standard was written to allow each company to continue to do what they know works. Additionally, if every location has fault recording equipment, it would serve little purpose to require every fault recorder to record faults past the next substation. If protective relays are used to meet the FR requirements, cross triggering throughout the substation to make every relay record a fault on all other transmission lines would also serve little purpose.</p>		
E.ON U.S.	Yes	The SDT should explain the applicability of this requirement to the GO.
<p>Response: The standard has been revised to clearly state what equipment each G. O and T. O. should monitor</p>		
Arizona Public Service Co.	Yes	<p>There should be a provision for the case if the quantities aren't able to be measured (CT not available for example). In requirement R5.3 it makes the generator owner responsible to record the neutral current of the GSU high voltage winding. Sometimes, generators that have DFRs applied do not have this quantity available as they mostly have access to the low voltage quantities. In addition, if a generator owner has a fault recorder but doesn't have available channels for this additional quantity, he shouldn't be required to drop a channel he feels is important to make room for these mandated channels. For instance, one only needs two voltages and two currents to measure MW so a generator may have fault recording that measures 2 line voltages and 2 line currents and there may not be room to add the additional channels specified. Generally with two of the values you can derive the third so why force them to record all indicated quantities. These requirements might be acceptable for new generator installations but there are existing installations that would find this onerous.</p>
<p>Response: The SDT wrote the current recording requirements such that the currents may be derived, not necessarily monitored. However, it is difficult to imagine that any piece of power equipment does not have adequate current transformers to provide sufficient quantities for protective relaying. It is not possible to derive all three phase quantities and neutral current by recording only two of the four, and the standard was written accordingly.</p>		
JEA	Yes	
Tucson Electric Power	No	Table 4-1 should also be modified to identify Substations containing any combination of five (5) or more elements. See response to question 7 above.
<p>Response: The SDT is reviewing location requirements. See our answer to Question 7 above.</p>		
Alberta Electric System Operator	No	The AESO supports the IRC SRC comments.
<p>Response: As stated above to the IRC SCR, the SDT is revising the standard and will take your suggestions into consideration.</p>		

Organization	Yes or No	Question 9 Comment
Beckwith Electric Co	Yes	
Duke Energy	Yes	
CenterPoint Energy	No	The requirements to record all three phase to neutral voltages and all four currents on each transmission line are prescriptive and excessive. The monitoring of two sets of line voltages, in all substation configurations, is a common industry practice which has met the industry's needs. It is unnecessary and excessive to require monitoring of more than two sets of three phase to neutral voltages in any substation arrangement.
<p>Response: The standard states that those voltages must be able to be derived, not that every line or bus voltage absolutely needs to be recorded. As long as an adequate number of voltages are recorded, and circuit breaker status is known, it is possible to be able to derive all voltages without recording every line or bus individually. In the northeast blackout of 2003, two sets of voltages in many cases were not sufficient, so the standard has been written to require adequate voltages for analysis.</p>		
Xcel Energy	No	As with Question 7, R5 is written such that it appears that the Generator Owner will have to duplicate the fault recording assigned to the Transmission Owner in R4. We assume that was not the SDT's intent, so we recommend that the second line of Table 5-1 include a clarifying statement such as "if not already monitored by the Transmission Owner."
<p>Response: See answer to question 7 above. Additionally, the standard has been revised to clearly what equipment each G. O and T. O. should monitor.</p>		
Utility System Efficiencies, Inc.	No	Table 4-1 should also be modified to identify Substations containing any combination of five (5) or more elements operated between 200 kV and 300 kV and for substations with three or more elements operated at voltages over 300 kV. See my response to question 7 above.
<p>Response: The SDT is reviewing location requirements. See answer to question 7 above.</p>		
British Columbia Transmission Corporation	No	Table 4-1 should also be modified to identify Substations containing any combination of five (5) or more elements. See response to question 7 above.
<p>Response: The SDT is reviewing location requirements. See answer to question 7 above.</p>		
Kansas City Power & Light	No	It is not necessary to require voltages on every line and bus for a ring bus configuration. Suggest requiring at least 33% with a of lines or busses for a ring bus configuration and no less than 2 will be a reasonable

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		<p>assurance there is a voltage collection for fault recording for events. It is unlikely under normal conditions 33% of the lines or busses in a ring would be out of service concurrently. So, for ring configuration stations with up to 6 lines, 2 voltage measures would be required. Ring configuration stations between 7 and 9 lines would require 3 voltage measures. Ring configuration stations with 10 to 12 lines, 4 voltage measures would be required. And so on.</p>
<p>Response: The SDT will consider your suggestion. However, the recording of every line and bus voltage is not explicitly stated. What is stated is that the voltages must be able to be derived. As long as an adequate number of voltages are recorded, such as every other bus or line on a ring bus, and circuit breaker position is known, all voltages can be derived. How an individual company chooses to comply with the requirements may vary from one G. O. or T.O. to the next.</p>		
PNM	No	<p>R5.3 requires recording current at the neutral bushing of wye-connected GSU transformer high-side windings. That does not have enough value to be a requirement. With the defined time synch. requirements and abundance of recorded voltages correlation of values is accomplished. It may have some value where only low-side generator currents are monitored but not where high-side GSU currents are monitored.</p>
<p>Response: The standard states that these values may be derived, not necessarily monitored. As written, the high side neutral current is only required if low side phase currents are recorded instead of the high side phase currents.</p>		