Successful Factory Testing: Customer Perspective
Customers – Why Require a Factory Test?

Ensure purchase of a quality asset:

- Prove apparatus meets industry standards, Supplier internal standards, and Customer standards
- Demonstrate guaranteed performance characteristics are met
- Opportunity to identify failed subcomponents
A successful factory test begins before a purchase order is issued:

- Test requirements in the material specification
  - Special tests, acceptance criteria, or specific test sequence
  - Manufacturer protocol if test failure occurs
    - Notification of customer
    - Information is required
    - Test requirements after repairs (including any tests that need to be repeated)
Customer – After the PO is issued

Continuing to work toward a successful factory test:

• Let the manufacturer know of plan to witness factory tests
  – Test schedule dates can (likely will) change
  – Review factory test plan in advance
  – Verify specification requirements are covered
  – Ensure comments are properly dispositioned
• Require regular schedule updates and follow up to make sure you receive them
Customer – During the Factory Test

Actively participate when possible
- Witness testing at factory - include new personnel for training purposes
  - Efficient resolution of issues
  - Vendor may have remote video capability
- Be prepared
  - Know tests and proper sequence
  - Have necessary references available
  - Ensure the factory is using the correct test plan
- When witness testing in person:
  - Inspect the equipment
  - Check conformance to drawings and specification

If using a web conference to remotely witness factory testing, try using the system in advance. Do not let this happen to you on test day!
Example – Factory Test Failure

230-120-13.2kV, 250MVA Transformer

- Impulse test failure & confirmed by DGA
- Failure in LTC selector switch
- Repairs completed & transformer was in oil refill preparation

- Customer notified of failure ~4 days after the initial test failure & after repairs were completed
  - Customer required immediate notification
  - No opportunity to inspect failure or provide input / questions on repairs

- Transformer successfully passed retest after repairs
After the Factory Test

Review the test results in detail

- Require review/approval prior to shipment
- Prompt review of results
  - Ensure all testing passed and required information provided
  - Create a checklist for review
Example – Test results need to be reviewed!

70-25kV, 14MVA Transformer

• Testing completed and the final test report compiled and sent to the customer prior to shipment

• Customer identified discrepancy in the lightning impulse test results - H2 chopped waves mismatch

• Manufacturer indicated signs of arcing on the test equipment were observed explaining discrepancy - retest to verify not performed
Example – Test results need to be reviewed!

70-25kV, 14MVA Transformer

• The manufacturer moved transformer off test floor while the test report was compiled

• Transformer moved back and successfully retested

Retest Results
Supplier’s Point of View
What do Suppliers Think and Recommend?

We want to satisfy our customer’s needs:
• Suppliers want to prove that the supplied equipment is up to standard
• Most suppliers are flexible on acceptance testing
  • Tests to be performed
  • Method for testing
  • Schedule requirements (if reasonable)
• Tell us what you require
  • Specify in the specification which tests are required and how they should be performed
  • Notify the supplier regarding any special scheduling requirements/restrictions
• Let us know if you have any test report formatting requirements
Know The Test Plan/Specification

Requirements per specification:
• IEEE/ANSI Standard tests only? Additional requests?
• Special test and/or requirements should be outlined in test plan
• Agree on test plan and schedule prior to testing (Including sequence of tests)
• Be familiar with the test plan before arrival

Special requirements:
• Specific order of tests
• Specific conditions for test(s)
• Nonstandard test(s)
• Additional test(s)
Streamlined Testing

Eliminate duplicate tests:
- Are only routine tests required?
- Are any type or design tests required?
- Is temperature rise test required for each component?
- Is SFRA needed for final and shipping configuration (for power transformers)?
Dos and Don’ts

Dos:
• Be onsite, on time for testing
• Be available for witnessing of tests when they are set up
• Do witness and observe data logging (especially for PD and loss tests)
• Do make it clear in advance if you want to witness test set up or device inspections
• Have someone that can make decision at witnessing

Don’ts:
• DO NOT release for next test if you have doubt regarding recorded results
• Do not make changes to test plan at last minute, unless test results prompted additional/alternative testing
• Do not be on phone calls or meetings while witnessing tests
Example: Miscommunication and Missing Test Timeslots

2 x 10MVA 69/34.5kV Power Transformers:

- Kickoff meeting was held prior to design
- Customer decided not attend FAT in person – remote video witnessing
- Test plan was agreed to – no dates or times on test plan
- Customer spec required tests to be performed according to Class II requirements
- Test plan showed PD test will be performed according to Class II requirements
- Factory performed PD test per IEEE Std for Class I transformers – deviation from test plan
- Customer was not logged on to witness PD test when it was performed
- Customer did not realize this until final report was issued
Example: Miscommunication and Missing Test Timeslots

...Continued...

Lessons Learned:

• Test plan/Schedule should be complete, with agreed to dates and times
• When tests are falling behind schedule, supplier should update schedule immediately
• Customer should be available when tests requiring witnessing are performed
• Supplier should pay attention to what is required versus what is being done
• Customer should speak up during test if something seems wrong
• Both sides at fault here – customer and supplier
Keys for a Successful FAT

Customer:

• Specify exactly which tests are required (if not according to IEEE/ANSI)
• Specify how tests need to be performed if there are special requirements
• Comment and finally approve test plan and schedule
• Review test results immediately and resolve any issues before moving on to next test if witnessing testing
• Review final test plan in detail as soon as possible
Keys for a Successful FAT
...Continued...

Supplier:
- Adhere to customer’s requirements in specification
- Provide detailed test plan (including special requirements) and schedule (with dates and times)
- Incorporate customer comments in test plan and schedule
- Notify customer immediately when/if schedule changes
- Test according to agreed upon test plan and schedule
- Value the input from customer during testing and address all concerns, answer all questions
- Be transparent regarding any issues or failures during testing
Thank you very much for your attention

David Calitz
Transformer Specialist Engineer
TP TR
Email: david.calitz@siemens.com

Brady Nesvold
Xcel Energy
Substation Engineering
Email: brady.a.nesvold@xcelenergy.com

siemens.com
Disclaimer

This document contains forward-looking statements and information – that is, statements related to future, not past, events. These statements may be identified either orally or in writing by words as “expects”, “anticipates”, “intends”, “plans”, “believes”, “seeks”, “estimates”, “will” or words of similar meaning. Such statements are based on our current expectations and certain assumptions, and are, therefore, subject to certain risks and uncertainties. A variety of factors, many of which are beyond Siemens’ control, affect its operations, performance, business strategy and results and could cause the actual results, performance or achievements of Siemens worldwide to be materially different from any future results, performance or achievements that may be expressed or implied by such forward-looking statements. For us, particular uncertainties arise, among others, from changes in general economic and business conditions, changes in currency exchange rates and interest rates, introduction of competing products or technologies by other companies, lack of acceptance of new products or services by customers targeted by Siemens worldwide, changes in business strategy and various other factors. More detailed information about certain of these factors is contained in Siemens’ filings with the SEC, which are available on the Siemens website, www.siemens.com and on the SEC’s website, www.sec.gov. Should one or more of these risks or uncertainties materialize, or should underlying assumptions prove incorrect, actual results may vary materially from those described in the relevant forward-looking statement as anticipated, believed, estimated, expected, intended, planned or projected. Siemens does not intend or assume any obligation to update or revise these forward-looking statements in light of developments which differ from those anticipated.

Unrestricted

Trademarks mentioned in this document are the property of Siemens AG, it’s affiliates or their respective owners.