



# Smart Grid Standards Information

Version 1.7

Wednesday, August 18, 2010

## Section I: Use and Application of the Standard

### Identification and Affiliation

|  |  |
|--|--|
| Number of the standard                         | C37.104  |
| Title of the standard                          | IEEE Guide for Automatic Reclosing of Line Circuit Breakers for AC Distribution and Transmission Lines   |
| Name of owner organization                     | IEEE   |
| Latest versions, stages, dates                 | 12 September 2002  |
| URL(s) for the standard                        | <a href="http://standards.ieee.org">http://standards.ieee.org</a>  |
| Working group / committee                      | Power System Relaying Committee  |
| Original source of the content (if applicable) |  |
| Brief description of scope                     | This guide describes current automatic reclosing practices for ac distribution and transmission lines. Included within this description are application considerations and coordination practices for reclosing. |

### Level of Standardization

|    |  |   |
|----|--|---|
| 1. | Names of standards development organizations that recognize this standard and/or accredit the owner organization | IEEE, ANSI  |
|    | Has this standard been adopted in regulation or legislation, or is it under consideration for adoption?          | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No   |
|    | Has it been endorsed or recommended by any level of government? If "Yes", please describe                        | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No   |
|    | Level of Standard (check all that apply)   | <input checked="" type="checkbox"/> International <input type="checkbox"/> National <input type="checkbox"/> Industry <input type="checkbox"/> de Facto <input type="checkbox"/> Single Company |
|    | Type of document   | <input type="checkbox"/> Standard <input type="checkbox"/> Report <input checked="" type="checkbox"/> Guide <input type="checkbox"/> Technical Specification                                    |
|    | Level of Release   | <input checked="" type="checkbox"/> Released <input type="checkbox"/> In Development <input type="checkbox"/> Proposed  |

### Areas of Use

|    |   |  |
|----|---|--|
| 1. | Currently used in which domains? (check all that apply) | <input type="checkbox"/> Markets <input type="checkbox"/> Operations <input type="checkbox"/> Service Providers<br><input type="checkbox"/> Generation <input checked="" type="checkbox"/> Transmission <input checked="" type="checkbox"/> Distribution <input type="checkbox"/> Customer |
|----|---|--|

## Section I: Use and Application of the Standard

|  |   |
|--|---|
| Planned for use in which domains? (check all that apply)                               | <input type="checkbox"/> Markets <input type="checkbox"/> Operations <input type="checkbox"/> Service Providers<br><input type="checkbox"/> Generation <input checked="" type="checkbox"/> Transmission <input checked="" type="checkbox"/> Distribution <input type="checkbox"/> Customer  |
| Please describe the Smart Grid systems and equipment to which this standard is applied | <p>Autoreclosing may be applied for the purpose of restoring distribution and transmission lines to service subsequent to automatic tripping of their associated circuit breakers due to electrical faults. Experience indicates that many faults on the overhead power system are temporary. In the absence of autoreclosing, longer duration outages could be experienced unnecessarily. Successful autoreclosing can enhance stability margins and overall system reliability. However, autoreclosing into a permanent fault can adversely affect system stability, damage equipment, or have adverse effects on customers; hence, due consideration shall be given to this aspect of any application.</p> |

### Relationship to Other Standards or Specifications

|    |  |  |
|----|--|--|
| 1. | Which standards or specifications are referenced by this standard? | <p>ANSI C37.06TM-2000, American National Standard for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis—Preferred Ratings and Related Required Capabilities. IEEE Std C37.04TM-1999, IEEE Standard Rating Structure for AC High-Voltage Circuit Breakers. IEEE Std C37.010TM-1999, IEEE Application Guide for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis. IEEE Std C37.2TM-1996 (Reaff 2001), IEEE Standard Electrical Power System Device Function Numbers and Contact Designations. IEEE Std C37.60TM-1981 (Reaff 1992), IEEE Standard Requirements for Overhead, Pad Mounted, Dry Vault, and Submersible Automatic Circuit Reclosers and Fault Interrupters for AC Systems. IEEE Std C37.61TM-1973 (Reaff 1992), IEEE Standard Guide for Application, Operation, and Maintenance of Automatic Circuit Reclosers. IEEE Std C37.90TM-1989 (Reaff 1994), IEEE Standard for Relays and Relay Systems Associated with Electric Power Apparatus. IEEE Std C37.100TM-1992 (Reaff 2001), IEEE Standard Definitions for Power Switchgear.</p> |
|    | Which standards or specifications are related to this standard?    |  |

## Section I: Use and Application of the Standard

|  |  |  |
|--|--|--|
|  | Which standards or specifications cover similar areas (may overlap)? |  |
|  | What activities are building on this work?                           |  |

### Dept of Energy Smart Grid Characteristics

Please describe how this standard may encourage each of the following:

|    |  |   |
|----|--|---|
| 1. | Enables informed participation by customers                          | <input type="checkbox"/> Yes <input type="checkbox"/> No            |
| 2. | Accommodates all generation and storage options                      | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No |
| 3. | Enables new products, services and markets                           | <input type="checkbox"/> Yes <input type="checkbox"/> No            |
| 4. | Provides the power quality for a range of needs                      | <input type="checkbox"/> Yes <input type="checkbox"/> No            |
| 5. | Optimizes asset utilization and operating efficiency                 | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No |
| 6. | Operates resiliently to disturbances, attacks, and natural disasters | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No |



## Priority Areas Previously Mentioned by FERC and NIST

Please describe if and how this standard may be applied in each of the following areas. Note that there is space in section Error: Reference source not found to discuss any other significant areas where the standard may be applied.

|    |   |   |
|----|---|---|
| 1. | Cybersecurity and physical security                           | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No |
| 2. | Communicating and coordinating across inter-system interfaces | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No |
| 3. | Wide area situational awareness                               | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No |
| 4. | Smart grid-enabled response for energy demand                 | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No |
| 5. | Electric storage  | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No |
| 6. | Electric vehicle transportation                               | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No |
| 7. | Advanced metering infrastructure                              | <input type="checkbox"/> Yes <input type="checkbox"/> No            |
| 8. | Distribution grid management                                  | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No |

## Openness

|     |  |  |
|-----|--|--|
| 1.  | Amount of fee (if any) for the documentation   | \$45   |
| 2.  | Amount of fee (if any) for implementing the standard   | None   |
| 3.  | Amount of fee (if any) to participate in updating the standard   | None   |
| 4.  | Is the standard documentation available online?  | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No URL: <a href="http://shop.ieee.org">http://shop.ieee.org</a> |
| 5.  | Are there open-source or reference implementations?  | <input type="checkbox"/> Yes <input type="checkbox"/> No Not applicable  |
| 6.  | Are there open-source test tools?  | <input type="checkbox"/> Yes <input type="checkbox"/> No Not applicable  |
| 7.  | Would open-source implementations be permitted?  | <input type="checkbox"/> Yes <input type="checkbox"/> No Not applicable  |
| 8.  | Approximately how many implementers are there?   |  |
| 9.  | Approximately how many users are there?  |  |
| 10. | Where is the standard used outside of the USA?   | IEC 62271  |
| 11. | Is the standard free of references to patented technology?   | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No  |
| 12. | If patented technology is used, does the holder provide a royalty-free license to users of the standard? | <input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Not Patented                        |
| 13. | Can an implementer use the standard without signing a license agreement?                                 | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No  |
| 14. | Are draft documents available to the public at no cost?  | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No  |
| 15. | How does one join the working group or committee that controls the standard?                             |  |
| 16. | Is voting used to decide whether to modify the standard? If Yes, explain who is permitted to vote.       | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No  |
| 17. | Is an ANSI-accredited process used to develop the standard?  | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No  |
| 18. | What countries are represented in the working group or committee that controls the standard?             |  |

## Support, Conformance, Certification and Testing

|     |  |  |
|-----|--|--|
| 1.  | Is there a users group or manufacturers group to support this standard?  | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No  |
| 2.  | What is the name of the users group or manufacturers group (if any)?   |  |
| 3.  | What type of test procedures are used to test this standard? (please check all that apply)   | <input type="checkbox"/> Internal to the lab<br><input type="checkbox"/> Published by standards organization<br><input type="checkbox"/> Published by users group<br><input checked="" type="checkbox"/> No procedures, informal testing |
| 4.  | Are there test vectors (pre-prepared data) used in testing? (please check all that apply)  | <input type="checkbox"/> Internal to the lab<br><input type="checkbox"/> Published by standards organization<br><input type="checkbox"/> Published by users group<br><input checked="" type="checkbox"/> No procedures, informal testing |
| 5.  | What types of testing programs exist? (check all that apply)   | <input type="checkbox"/> Interoperability Testing<br><input type="checkbox"/> Conformance Testing<br><input type="checkbox"/> Security Testing<br><input checked="" type="checkbox"/> No Testing   |
| 6.  | What types of certificates are issued? (check all that apply)  | <input type="checkbox"/> Interoperability Certificate<br><input type="checkbox"/> Conformance Certificate<br><input type="checkbox"/> Security Certificate (text document)<br><input checked="" type="checkbox"/> No Certificates        |
| 7.  | Are there rules controlling how and when to use the logo?  | <input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Standard has no logo  |
| 8.  | Is there a program to approve test labs?   | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No  |
| 9.  | Approximately how many test labs are approved (if any)?  |  |
| 10. | Is there a defined process for users to make technical comments on the standard or propose changes to the standard and have these issues resolved? | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No  |
| 11. | Is there a published conformance checklist or table?   | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No  |
| 12. | Are there defined conformance blocks or subsets?   | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No  |
| 13. | Approximately how many vendors provide test tools?   |  |
| 14. | Are there tools for pre-certification prior to testing?  | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No  |
| 15. | Can vendors self-certify their implementations?  | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No  |
| 16. | Is there application testing for specific uses?  | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Not applicable  |
| 17. | Is there a "golden" or "reference" implementation to test against?   | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No  |
| 18. | Who typically funds the testing? (check all that apply)  | <input checked="" type="checkbox"/> User <input type="checkbox"/> Users Group <input type="checkbox"/> Vendor<br><input type="checkbox"/> Confidential   |
| 19. | Is there a method for users and implementers to ask questions about the standard and have them answered? (check all that apply)                    | <input checked="" type="checkbox"/> Yes, official interpretations<br><input type="checkbox"/> Yes, informal opinions<br><input type="checkbox"/> No  |
| 20. | Does the users' group (or some other group) fund specific tasks in the evolution of the standard?  | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No  |
| 21. | Is the users' group working on integration, harmonization or unification with other similar standards?   | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No  |

|     |   |   |
|-----|---|---|
| 22. | What other standards is this standard being integrated, harmonized, or unified with (if any)?                             |   |
| 23. | Are there application notes, implementation agreements, or guidelines available describing specific uses of the standard? | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Not applicable |

**J. Notes**

Please present here any additional information about the standard that might be useful:

|    |  |
|----|--|
| 1. |  |
|----|--|

## Section II: Functional Description of the Standard

### GridWise Architecture: Layers

Please identify which layers this standard specifies, as described in

[http://www.gridwiseac.org/pdfs/interopframework\\_v1\\_1.pdf](http://www.gridwiseac.org/pdfs/interopframework_v1_1.pdf), and the applicable section of the standard. Note the mapping to the Open Systems Interconnect (OSI) model is approximate.

|    |   |   |
|----|---|---|
| 1. | <b>Layer 8: Policy</b>                                      | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No |
| 2. | <b>Layer 7: Business Objectives</b>                         | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No |
| 3. | <b>Layer 6: Business Procedures</b>                         | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No |
| 4. | <b>Layer 5: Business Context</b>                            | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No |
| 5. | <b>Layer 4: Semantic Understanding (object model)</b>       | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No |
| 6. | <b>Layer 3: Syntactic Interoperability (OSI layers 5-7)</b> | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No |
| 7. | <b>Layer 2: Network Interoperability (OSI layers 3-4)</b>   | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No |
| 8. | <b>Layer 1: Basic Connectivity (OSI layers 1-2)</b>         | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No |

### GridWise Architecture: Cross-Cutting Issues

Please provide an explanation in the box beside the heading for any questions answered "Not applicable". If the question is not applicable because the function is provided in another layer or standard, please suggest any likely candidates. Note that "the standard" refers to the technology specified by the standard, not the documents themselves.

|     |  |  |
|-----|--|--|
|     | <b>Shared Meaning of Content</b>   |  |
| 1.  | Do all implementations share a common information model?                 | <input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Not applicable            |
| 2.  | Can data be arranged and accessed in groups or structures?               | <input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Not applicable            |
| 3.  | Can implementers extend the information model?                           | <input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Not applicable            |
| 4.  | Can implementers use a subset of the information model?                  | <input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Not applicable            |
|     | <b>Resource Identification</b>   |  |
| 5.  | Can data be located using human-readable names?                          | <input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Not applicable            |
| 6.  | Can names and addresses be centrally managed without human intervention? | <input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Not applicable            |
|     | <b>Time Synchronization and Sequencing</b>                               |  |
| 7.  | Can the standard remotely synchronize time?                              | <input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Provided in another layer |
| 8.  | Can the standard indicate the quality of timestamps?                     | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Provided in another layer |
|     | <b>Security and Privacy</b>  |  |
| 9.  | Where is security provided for this standard?                            | <input type="checkbox"/> Within this standard<br><input checked="" type="checkbox"/> By other standards                |
| 10. | Does the standard provide authentication?                                | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No  |
| 11. | Does the standard permit role-based access control?                      | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No  |



## Section II: Functional Description of the Standard

|                                      |   |   |
|--------------------------------------|---|---|
| 12.                                  | Does the standard provide encryption?   | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No   |
| 13.                                  | Does the standard detect intrusions or attacks?   | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No   |
| 14.                                  | Does the standard facilitate logging and auditing of security events?   | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No   |
| 15.                                  | Can the security credentials be upgraded remotely?  | <input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> No Credentials   |
| 16.                                  | Can the security credentials be managed centrally?  | <input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> No Credentials   |
| 17.                                  | Please list any security algorithms and standards used  |   |
| 18.                                  | Please provide additional information on how the standard addresses any "Yes" answers above                     |   |
| 19.                                  | Please provide additional information about why any of the questions listed above do not apply to this standard | The standard does not appear to address access, authorization, and auditing. It also does not address the "IT" aspect of autoreclosing.   |
| <b>Logging and Auditing</b>          |   |   |
| 20.                                  | Does the standard facilitate logging and auditing of critical operations and events?                            | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No   |
| 21.                                  | Can the standard gather statistics on its operation?  | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Not applicable   |
| 22.                                  | Can the standard report alerts and warnings?  | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Not applicable   |
| <b>Transaction State Management</b>  |   |   |
| 23.                                  | Can the standard remotely enable or disable devices or functions?   | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Not applicable   |
| <b>System Preservation</b>           |   |   |
| 24.                                  | Can the standard automatically recover from failed devices or links?  | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Not applicable<br><input type="checkbox"/> Provided in another layer   |
| 25.                                  | Can the standard automatically re-route messages?   | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Not applicable<br><input type="checkbox"/> Provided in another layer   |
| 26.                                  | Can the standard remotely determine the health (as opposed to just connectivity) of devices or software?        | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Not applicable   |
| <b>Other Management Capabilities</b> |   |   |
|                                      | Please describe any other system or network management capabilities the standard provides.                      |   |
| <b>Quality of Service</b>            |   |   |
| 27.                                  | Is data transfer bi-directional?  | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No   |
| 28.                                  | Can data be prioritized?  | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Not applicable   |
| 29.                                  | What types of reliability are provided?   | <input type="checkbox"/> Reliable <input type="checkbox"/> Non-guaranteed<br><input type="checkbox"/> Both <input checked="" type="checkbox"/> Either<br><input type="checkbox"/> Provided in another layer |
| 30.                                  | Can information be broadcast to many locations with a single transmission?                                      | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Not applicable   |
|                                      | Please describe any other methods the standard uses to manage quality of service.                               |   |

## Section II: Functional Description of the Standard

| <b>Discovery and Configuration</b>                                   |  |   |
|--|--|---|
| 31.  | Can the software or firmware be upgraded remotely?   | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Not applicable |
| 32.  | Can configuration or settings be upgraded remotely?  | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Not applicable |
| 33.  | Can implementations announce when they have joined the system?   | <input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Not applicable |
| 34.  | Can implementations electronically describe the data they provide?   | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Not applicable |
| <b>System Evolution and Scalability</b>                              |  |   |
| 35.  | What factors could limit the number of places the standard could be applied?   |   |
| 36.  | What steps are required to increase the size of a system deploying this standard?  |   |
| 37.  | Is the information model separate from the transport method?   | <input type="checkbox"/> Yes <input type="checkbox"/> No  |
| 38.  | Does the standard support alternate choices in the layers(s) below it?   | <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> No layers below           |
| 39.  | List the most common technology choices for layers implemented below this standard   |   |
| 40.  | Does the standard support multiple technology choices in the layers above it?  | <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> No layers above           |
| 41.  | List the technologies or entities that would most commonly use this standard in the layer above  |   |
| 42.  | Please describe any mechanism or plan to ensure the standard is as backward-compatible as possible with previous versions  |   |
| 43.  | Please describe how the design of this standard permits it to be used together with older or legacy technologies   |   |
| 44.  | Please describe how the design of this standard permits it to co-exist on the same network or in the same geographic area with similar technologies, and give examples |   |
| 45.  | <b>Electromechanical</b>   |   |
| <b>Architectural Principles</b>                                      |  |   |
| Please describe how this standard may apply any of these principles: |  |   |
| 1.   | Symmetry – facilitates bi-directional flow of energy and information   | This standard is designed to ensure the availability of electrical flow without manual intervention         |
| 2.   | Transparency – supports a transparent and auditable chain of transactions  |   |
| 3.   | Composition – facilitates the building of complex interfaces from simpler ones   |   |
| 4.   | Loose coupling – can support bilateral and multilateral transactions without elaborate pre-arrangement   |   |

## Section II: Functional Description of the Standard

|    |   |  |
|----|---|--|
| 5. | Shallow integration – does not require detailed mutual information to interact with other components  |  |
| 6. | Please list any other architectural models, reference architectures or frameworks this standard was designed to be compliant with, e.g. W3C, IEC TC57, OSI and how it fits those models |  |