VVSG Recommendations to the EAC

Voluntary Voting System Guidelines Recommendations to the Election Assistance Commission

SEPTEMBER 18, 2012

Prepared at the Direction of the Technical Guidelines Development Committee

WORKING DRAFT
Chapter 1: Requirements by Voting Activity

1.1 Election Programming

Election programming is the process by which central election officials use election databases and manufacturer system software to logically define the voter choices associated with the contents of the ballots.

There are significant variations among the election laws of the 50 states with respect to permissible ballot contents, voting options, and the associated ballot counting logic.

1.1-A Election definition device, ballot definition

The election definition device SHALL provide for the logical definition of the ballot, including the definition of the number of allowable votes for each contest.

Applies to: Election definition device
Test Reference: Error! Reference source not found. “Error! Reference source not found.”
Source: [VSS2002] I.2.3.2.a

1.1-A.1 Election definition device, ballot definition details

The election definition device SHALL be capable of collecting and maintaining:

a. Offices and their associated labels and instructions;
   b. Candidate names and their associated labels; and
   c. Ballot questions and their associated text.

Test Reference: Error! Reference source not found. “Error! Reference source not found.”
Source: [VSS2002] I.2.3.1.1.1.b

1.1-B Election definition device, political and administrative subdivisions

The election definition device SHALL provide for the logical definition of political and administrative subdivisions, where the list of contest choices or contests varies between precincts.

Applies to: Election definition device
Test Reference: Error! Reference source not found. “Error! Reference source not found.”
Source: [VSS2002] I.2.2.6.a and I.2.3.2.b
1.1 Election Programming

1.1-C Election definition device, election districts

The election definition device SHALL enable central election officials to define multiple election districts.

Applies to: Election definition device

Test Reference: Error! Reference source not found. “Error! Reference source not found.”

Source: [VSS2002] I.2.2.6.a

1.1-D Election definition device, voting variations

The election definition device SHALL enable central election officials to define and identify contests, contest choices, candidates, and ballot questions using all voting variations indicated in the implementation statement.

Applies to: Election definition device

Test Reference: Error! Reference source not found. “Error! Reference source not found.”

Source: [VSS2002] I.2.2.6.b, I.2.2.8.2, I.2.3.2.d

1.1-D.1 Election definition device, 1-of-M

In all systems, the election definition device SHALL allow the definition of contests where the voter is allowed to choose at most one contest choice from a list of contest choices.

Test Reference: Error! Reference source not found. “Error! Reference source not found.”

Source: Implicit in [VSS2002]

1.1-D.2 Election definition device, yes/no question

In all systems, the election definition device SHALL allow the definition of contests where the voter is allowed to vote yes or no on a question.

Test Reference: Error! Reference source not found. “Error! Reference source not found.”

Source: New requirement / clarification of [VSS2002] intent

1.1-D.3 Election definition device, indicate party affiliations and endorsements

In all systems, the election definition device SHALL allow the definition of political parties and the indication of the affiliation and/or endorsements of each contest choice.

Test Reference: Error! Reference source not found. “Error! Reference source not found.”

Source: Implicit in [VSS2002]
1.1 Election Programming

1.1-D.4 Election definition device, primary elections, party-specific and non-party-specific contests

Election definition devices of the Primary elections device class SHALL support the definition of both party-specific and non-party-specific contests.

Applies to: Election definition device ∧ Primary elections device
Test Reference: Error! Reference source not found. “Error! Reference source not found.”
Source: Added precision, based on [VSS2002] I.2.2.8.2 and glossary

1.1-D.5 Election definition device, write-ins

Election definition devices of the Write-ins device class SHALL support the definition of contests that include ballot positions for write-in opportunities.

Applies to: Election definition device ∧ Write-ins device
Test Reference: Error! Reference source not found. “Error! Reference source not found.”
Source: [VSS2002] I.2.4.3.1.d

1.1-D.6 Election definition device, straight party voting

Election definition devices of the Straight party voting device class SHALL be capable of defining the necessary straight party contest and recording the endorsements made by each party in the election definition to support the gathering and recording of votes for the slate of contest choices endorsed by a given political party.

Applies to: Election definition device ∧ Straight party voting device
Test Reference: Error! Reference source not found. “Error! Reference source not found.”
Source: Added precision, based on [VSS2002] I.2.2.8.2 and glossary

1.1-D.7 Election definition device, cross-party endorsement

Election definition devices of the Cross-party endorsement device class SHALL be capable of defining the necessary straight party contest and recording the endorsements made by each party in the election definition to support the gathering and recording of votes for the slate of contest choices endorsed by a given political party when a given contest choice is endorsed by two or more different political parties.

Applies to: Election definition device ∧ Cross-party endorsement device
Test Reference: Error! Reference source not found. “Error! Reference source not found.”
Source: Clarification or extension of existing requirements
1.1 Election Programming

1.1-D.8 Election definition device, split precincts, define precincts and election districts

Election definition devices of the Split precincts device class SHALL support the definition of election districts and precincts in such a way that a given polling place may serve two or more election districts.

Applies to: Election definition device ∨ Split precincts device
Test Reference: Error! Reference source not found. “Error! Reference source not found.”
Source: Added precision, based on [VSS2002] I.2.2.8.2 and glossary

1.1-D.9 Election definition device, N-of-M voting

Election definition devices of the N-of-M voting device class SHALL be capable of defining contests where the voter is allowed to choose up to a specified number of contest choices \((N(r) > 1, \text{ per Error! Reference source not found. “Error! Reference source not found.”})\) from a list of contest choices.

Applies to: Election definition device ∨ N-of-M voting device
Test Reference: Error! Reference source not found. “Error! Reference source not found.”
Source: Added precision, based on [VSS2002] I.2.2.8.2, I.2.3.2.a and glossary

1.1-D.10 Election definition device, cumulative voting

Election definition devices of the Cumulative voting device class SHALL be capable of defining contests where the voter is allowed to allocate up to a specified number of votes \((N(r) > 1, \text{ per Error! Reference source not found. “Error! Reference source not found.”})\) over a list of contest choices, possibly giving more than one vote to a given contest choice.

Applies to: Election definition device ∨ Cumulative voting device
Test Reference: Error! Reference source not found. “Error! Reference source not found.”
Source: Added precision, based on [VSS2002] I.2.2.8.2, I.2.3.2.a and glossary

1.1-D.11 Election definition device, ranked order voting

Election definition devices of the Ranked order voting device class SHALL be capable of defining contests where the voter is allowed to rank contest choices in a contest in order of preference, as first choice, second choice, etc.

Applies to: Election definition device ∨ Ranked order voting device
1.1 Election Programming

Test Reference: Error! Reference source not found. “Error! Reference source not found.”
Source: Added precision, based on [VSS2002] I.2.2.8.2 and glossary

1.1-E Election definition device, respect system limits

The election definition device SHALL prevent the defining of any election that would cause the voting system to exceed design limits such as maximum number of contest choices in a contest, maximum number of contests on a ballot, etc.

Applies to: Election definition device
Test Reference: Error! Reference source not found. “Error! Reference source not found.”
Source: New requirement

1.1-F Election definition accuracy

The election definition device SHALL record the election contests, contest choices, issues, and political and administrative subdivisions exactly as defined by central election officials.

Applies to: Election definition device
Test Reference: Error! Reference source not found. “Error! Reference source not found.”
Source: [VSS2002] I.2.2.2.1.a / [VVSG2005] I.2.1.2.a

1.1-G Voting options accuracy

The election definition device SHALL record the options for casting and recording votes exactly as defined by central election officials.

Applies to: Election definition device
Test Reference: Error! Reference source not found. “Error! Reference source not found.”
Source: Reworded from [VSS2002] I.2.2.2.1.b / [VVSG2005] I.2.1.2.b

1.1-H Election definition device, confirm recording of election definition

The election definition device SHALL verify (i.e., actively check and confirm) the correct recording of election definition data to the persistent storage of the device.

Applies to: Election definition device
Test Reference: Error! Reference source not found. “Error! Reference source not found.”
1.2 Ballot Preparation, Formatting, and Production

**DISCUSSION**

"Persistent storage" includes nonvolatile memory, hard disks, optical disks, etc.

*Source:* [VSS2002] I.3.2.3.1.c and e ([VSG2005] I.4.1.3.1.c and e), expanded to include persistent storage

1.1 Election definition device, election definition distribution

The election definition device **SHALL** provide for the generation of master and distributed copies of election definitions as needed to configure each voting device in the system.

*Applies to:* Election definition device

*Test Reference:* Error! Reference source not found. “Error! Reference source not found.”

*Source:* Reworded from [VSS2002] I.2.3.2.e

1.2 Ballot Preparation, Formatting, and Production

1.2-A Election definition device, define ballot styles

The election definition device **SHALL** enable central election officials to define ballot styles.

*Applies to:* Election definition device

*Test Reference:* Error! Reference source not found. “Error! Reference source not found.”

*Source:* [VSS2002] I.2.2.6.e

1.2-A.1 Election definition device, auto-format

The election definition device **SHALL** be capable of automatically formatting ballots in accordance with the requirements for offices and contest choices qualified to be placed on the ballot for each political subdivision and election district.

*Test Reference:* Error! Reference source not found. “Error! Reference source not found.”

*Source:* [VSS2002] I.2.3.1.1.1.a

1.2-A.2 Election definition device, include votable contests

The election definition device **SHALL** provide for the inclusion in a given ballot style of any contest in which the voter would be entitled to vote.

*Test Reference:* Error! Reference source not found. “Error! Reference source not found.”
1.2-Ballot Preparation, Formatting, and Production

Source: Extrapolated from relevant requirements in [VSS2002]

1.2-A.3 Election definition device, exclude nonvotable contests

The election definition device SHALL provide for the exclusion from a given ballot style of any contest in which the voter would be prohibited from voting because of place of residence or other such administrative or geographical criteria.

Test Reference: Error! Reference source not found. "Error! Reference source not found."

Discussion

In systems supporting primary elections, this would include the exclusion of party-specific contests that are not votable by the selected political party.

Source: [VSS2002] I.2.3.2.c

1.2-A.4 Election definition device, nonpartisan formatting

The election definition device SHALL uniformly allocate space and fonts used for each office, contest choice, and contest such that the voter perceives no contest choice to be preferred to any other.

Test Reference: Error! Reference source not found. "Error! Reference source not found."

Source: [VSS2002] I.2.3.1.2.c

1.2-A.5 Election definition device, jurisdiction-dependent content

The election definition device SHALL enable central election officials to add jurisdiction-dependent text, line art, logos and images to ballot styles.

Test Reference: Error! Reference source not found. "Error! Reference source not found."

Source: Reworded from [VSS2002] I.3.2.3.1.d

1.2-A.6 Election definition device, primary elections, associate configurations with parties

Election definition devices of the Primary elections device class SHALL support the association of different ballot configurations with different political parties.

Applies to: Election definition device A Primary elections device

Test Reference: Error! Reference source not found. "Error! Reference source not found."

Discussion

In paper-based systems, open primaries have sometimes been handled by printing a single ballot style that merges the contests from all parties, instructing the voter to vote only in the contests applicable to a single party, and rejecting or discarding votes
that violate this instruction. To satisfy the requirements for Primary elections device, the election definition device must be capable of associating different ballot configurations with different political parties.

Source: Reworded from [VSS2002] I.2.3.1.1.d

1.2-A.7 Election definition device, ballot rotation

Election definition devices of the Ballot rotation device class SHALL support the production of rotated ballots and/or the activation of ballot rotation functions in vote-capture devices through the inclusion of relevant metadata in distributed election definitions and ballot styles.

Applies to: Election definition device \ Ballot rotation device

Test Reference: Error! Reference source not found. “Error! Reference source not found.”

Source: Added precision, based on [VSS2002] I.2.2.8.2 and glossary

1.2-A.8 Election definition device, split precincts, associate ballot configurations

Election definition devices of the Split precincts device class SHALL support the definition of distinct ballot configurations for voters from two or more election districts that are served by a given polling place.

Applies to: Election definition device \ Split precincts device

Test Reference: Error! Reference source not found. “Error! Reference source not found.”

Source: Added precision, based on [VSS2002] I.2.2.8.2 and glossary

1.2-B Election definition device, ballot style distribution

The election definition device SHALL provide for the generation of master and distributed copies of ballot styles as needed to configure each voting device in the system.

Applies to: Election definition device

Test Reference: Error! Reference source not found. “Error! Reference source not found.”

Source: Reworded from [VSS2002] I.2.2.6.d

1.2-B.1 Election definition device, ballot style identification

The election definition device SHALL generate codes or marks as needed to uniquely identify the ballot style associated with any ballot.

Test Reference: Error! Reference source not found. “Error! Reference source not found.”
1.2 Ballot Preparation, Formatting, and Production

DISCUSSION

In paper-based systems, identifying marks would appear on the actual ballots. DREs would make internal use of unique identifiers for ballot styles but would not necessarily present these where the voter would see them.

When different precincts share a common ballot style in a paper-based system, typically it is assumed that the ballots from the two precincts will be kept physically separate, tabulated separately, and attributed to the correct precinct at the time of reporting—even in combined precincts where this imposes procedural overhead.

Source: [VSS2002] I.2.3.1.1.e

1.2-C Election definition device, reuse of definitions

The election definition device SHALL support retention, modification, and reuse of general districting/precinct definitions and ballot formatting parameters within the same election and from one election to the next.

Applies to: Election definition device

Test Reference: Error! Reference source not found. “Error! Reference source not found.”

Source: [VSS2002] I.2.3.1.2.e and g

1.2-D Election definition device, ballot style protection

The election definition device SHALL prevent unauthorized modification of any ballot styles.

Applies to: Election definition device


Source: [VSS2002] I.2.3.1.2.f

1.2.1 Procedures required for correct system functioning

The requirements for voting systems are written assuming that these procedures will be followed.

Paper ballot production: Central election officials must verify that paper ballots are produced in accordance with manufacturer specifications.

Paper ballot production quality: Central election officials must ensure that paper ballots conform to manufacturer specifications for type of paper stock, weight, size, shape, size and location of field used to record votes, folding, bleed through, and ink for printing. ([VSS2002] I.2.3.1.3.1.c)
1.3 Equipment Setup

1.3.1 Logic and accuracy testing

The purpose of logic and accuracy testing is to detect malfunctioning and misconfigured devices before polls are opened. It is not a defense against fraud. (Error! Reference source not found.)

Election personnel conduct equipment and system readiness tests prior to the start of an election to ensure that the voting system functions properly, to confirm that system equipment has been properly integrated, and to obtain equipment status and readiness reports. The content of those reports is defined in Part 1.1.8 "Reporting".

1.3.1-A Support L&A testing

All systems SHALL provide the capabilities to:

a. Verify that all voting devices are properly prepared for an election and collect data that verify equipment readiness;
b. Verify the correct installation and interface of all system equipment; and
c. Verify that hardware and software function correctly.

Applies to: Voting system
Test Reference: Error! Reference source not found. “Error! Reference source not found.”
Source: [VSS2002] 1.2.3.4.1, 1.2.3.5.a2 and b2 (the second a and b, respectively), 1.4.4.2.a

1.3.1-B Built-in self-test and diagnostics

All programmed devices SHALL include built-in measurement, self-test, and diagnostic software and hardware for monitoring and reporting the system’s status and degree of operability.

Applies to: Programmed device
Test Reference: Error! Reference source not found. “Error! Reference source not found.”
Source: [VSS2002] 1.2.2.4.1.j, 1.2.2.8.1.a
1.3 Equipment Setup

1.3.1-C Verify proper preparation of ballot styles

The election definition device SHALL enable central election officials to test that ballot styles and programs have been properly prepared.

Applies to: Election definition device
Test Reference: Error! Reference source not found. "Error! Reference source not found."
Source: [VSS2002] I.2.2.6.f, I.4.4.2.c

1.3.1-D Verify proper installation of ballot styles

Acc-VS, tabulators, and ballot-on-demand printers SHALL include a capability to automatically verify that the software and ballot styles have been properly selected and installed in the equipment and immediately notify an election official of any errors.

Applies to: Acc-VS, Tabulator, Ballot-on-demand printer
Test Reference: Error! Reference source not found. "Error! Reference source not found."

Discussion
At a minimum, notification means an error message, a log entry, and a “failed” result on this portion of the L&A test.

Examples of detectable errors include use of software or data intended for a different type of device and operational failures in transferring the software or data.

Source: [VSS2002] I.2.3.3.b, I.4.4.2.c

1.3.1-E Verify compatibility between software and ballot styles

Acc-VS, tabulators, and ballot-on-demand printers SHALL include a capability to automatically verify that software correctly matches the ballot styles that it is intended to process and immediately notify an election official of any errors.

Applies to: Acc-VS, Tabulator, Ballot-on-demand printer
Test Reference: Error! Reference source not found. "Error! Reference source not found."

Discussion
At a minimum, notification means an error message, a log entry, and a “failed” result on this portion of the L&A test.

Source: [VSS2002] I.2.3.3.c, I.4.4.2.c

1.3.1-F Test ballots

Tabulators SHALL provide the capability for central election officials or election judges to submit test ballots for use in verifying the integrity of the system.

Applies to: Tabulator
1.3 Equipment Setup

Test Reference:  *Error! Reference source not found. “Error! Reference source not found.”*
Source:  *[VSS2002] I.2.4.3.3.s, generalized from DREs; I.4.4.2.d and f

→  **1.3.1-G** Test all ballot positions

**Optical scanners** **SHALL** support testing that uses all potential ballot positions as active positions.

Applies to:  Optical scanner

Test Reference:  *Error! Reference source not found. “Error! Reference source not found.”*
Source:  *[VSS2002] I.2.3.4.2.a, I.4.4.2.f

→  **1.3.1-H** Optical scanner, testing calibration

**Optical scanners** **SHALL** support the use of test ballots to test the calibration of the paper-to-digital conversion (i.e., the calibration of optical sensors, the density threshold, and/or the logical reduction of scanned images to binary values, as applicable).

Applies to:  Optical scanner

Test Reference:  *Error! Reference source not found. “Error! Reference source not found.”*
Source:  Interpretation of *[VSS2002] I.2.3.4.2.b

→  **1.3.1-I** Ballot marker readiness

**EBMs** **SHALL** include a means of verifying that the ballot marking mechanism is properly prepared and ready to use.

Applies to:  EBM

Test Reference:  *Error! Reference source not found. “Error! Reference source not found.”*
Source:  *[VSS2002] I.2.4.1.2.1.a

→  **1.3.1-J** L&A testing, no side-effects

Logic and accuracy testing functions **SHALL** introduce no effects on operation during the election other than audit log entries, status changes to note that the tests have been run with a successful or failed result, separate storage of test results, changes in the “protective counter” or “life-cycle counter” (if the device has one), and normal wear and tear.

Applies to:  Voting device


**PART 0: TESTING REQUIREMENTS | CH 1 Requirements by Voting Activity**
1.4 Opening Polls

**DISCUSSION**
Requirements in the next section preclude the device from actually serving in the election unless these tests are successful. Apart from that safeguard, it should be impossible (by design) for the L&A testing to have any influence on the operation of the device during the election or on the results that are reported for the election. Most notably, election results must never include any test votes that were counted during L&A testing.

*Source: [VSS2002] I.2.3.4.1.b2 (the second b), significantly revised*

### 1.4 Opening Polls

**1.4-A** Programmed device, verify L&A performed

*Programmed devices* **SHALL** provide an internal test or diagnostic capability to verify that the applicable tests specified in *Part 1:1.3 “Equipment Setup”* have been successfully completed.

*Applies to:* Programmed device

*Test Reference:* Error! Reference source not found. “Error! Reference source not found.”

*Source:* [VSS2002] I.2.4.1.1.a

**1.4-B** Programmed device, disable untested devices

*Programmed devices* **SHALL NOT** enter an election mode unless and until the readiness test has been performed successfully and any steps necessary to isolate test data from election data have been performed successfully.

*Applies to:* Programmed device

*Test Reference:* Error! Reference source not found. “Error! Reference source not found.”

**DISCUSSION**
If a device has not been tested, has failed its L&A test or the test data have not been isolated (i.e., test votes could end up being included in election results), then the device is "not ready" for use in the election and should "fail safe" so that it cannot contaminate election results.

*Source:* [VSS2002] I.2.4.1.1.b; EAC RFI 2008-07

**1.4-B.1** Non-zero totals

*Tabulators* **SHALL NOT** enter an election mode unless and until the logic and accuracy test has been performed successfully, any steps necessary to isolate test data from election data have been performed successfully, and all vote counters have been zeroed. An attempt to open polls with non-zero totals **SHALL** be recorded in the audit log, and a clear notification of the event **SHALL** be communicated to an election official.
1.4 Opening Polls

Applies to: Tabulator
Test Reference: Error! Reference source not found. “Error! Reference source not found.”

DISCUSSION
Jurisdictions that allow “early voting” before the nominal election day should note that a distinction is made between the opening and closure of polls, which can occur only once per election, and the suspension and resumption of voting between days of early voting. The open-polls operation, which requires zeroed counters, is performed only when early voting commences; the resumption of voting that was suspended overnight does not require that counters be zeroed again.

Source: [VSS2002] I.2.4.1.1.b; EAC RFI 2008-07

1.4-C Optical scanner tabulator activation

Optical scanners SHALL include a means of activating the ballot counting device.

Applies to: Optical scanner
Test Reference: Error! Reference source not found. “Error! Reference source not found.”

Source: [VSS2002] I.2.4.1.2.a

1.4-D Optical scanner, verify activation

Optical scanners SHALL include a means of verifying that the ballot counting device has been correctly activated and is functioning properly.

Applies to: Optical scanner
Test Reference: Error! Reference source not found. “Error! Reference source not found.”

Source: [VSS2002] I.2.4.1.2.b

1.4-E Programmed vote-capture device, open poll function

Programmed vote-capture devices SHALL provide designated functions for opening the poll.

Applies to: Vote-capture device △ Programmed device
Test Reference: Error! Reference source not found. “Error! Reference source not found.”

Source: [VSS2002] I.2.4.1.3, generalized

1.4-E.1 Programmed vote-capture device, protect open poll function

Programmed vote-capture devices SHALL include access control to prevent the inadvertent or unauthorized actuation of the poll-opening function.
1.5 Casting

These functional capabilities include all operations conducted at the polling place by voters and officials while polls are open.

1.5.1 Issuance of voting credentials and ballot activation

DWF 2011-03-10: Assuming that this section is to be revised by Andy.

The term “ballot activation” is sometimes used in a broad sense to cover the general activities of (1) determining what type of ballot must be presented to the voter, and (2) activating the voting system to present the ballot style that is appropriate for that voter. In this section, “issuance of voting credentials” is used for the first activity, and “ballot activation” is used exclusively for the second activity.

Voting credentials are those data items sufficient for the voting system to activate the appropriate ballot for the voter. The credentials consist of an indication of the ballot style and ballot configuration as well as any additional ballot options that the voting system may be capable of presenting if selected by the voter, such as a magnified ballot for a voter with low vision. If the voting system is used for provisional voting, the credentials may also include an identifier that effectively would link the voter’s identity with the voter’s cast ballot. The credentials must also indicate the election for which the credentials are valid. Lastly, there is usually a code calculated on the
credentials so that the voting system can verify their integrity and verify that an authorized activation device issued the credentials.

An activation device (e.g., an epollbook) stores the credentials on a token (e.g., a memory card) so that the voter can carry them to the vote-capture device – a DRE or EBP. Thus, there is typically an “air gap” required between the activation device and the vote-capture device. The requirements in this section do not prohibit, however, the activation device from being connected to a network of DREs or EBPs. In this case, the credentials and token would be represented by whatever signaling and data is exchanged across the network between the activation device and the DREs/EBPs. Credential issuance also may be performed pre-election by a DRE or EBP in a ballot activation mode (for example, a series of memory cards could be activated for certain ballot styles and ballot configurations in advance of opening the polls).

Preserving privacy of the ballot is a paramount consideration in issuance of voter credentials and ballot activation because knowledge of the voter’s identity is involved. The requirements in this section mandate that privacy of the ballot be protected throughout the entire process of credential issuance and ballot activation, and that no information be maintained in reports or logs that could assist in identifying a voter’s cast ballot (except for provisional voting on a DRE).

Provisional voting using a DRE must, however, “violate” voter privacy because it is necessary to link the DRE’s CVR with the voter’s identity. If an epollbook or other programmable activation device is used also for provisional voting, then it is possible that the epollbook could keep a record of provisional voters and include, with the voting credentials, an identifier associated with each provisional voter’s identification. The DRE might then associate that identifier with that voter’s CVR. This should only happen if the activation device and the vote-capture device are in a “provisional voting” mode; no linkage of voter identity to voter CVRs should be possible otherwise. While this may be an acceptable method for associating a voter’s identity with the voter’s CVR for provisional voting, at the same time this privacy violation is cause for special concern when implemented in software, and the source code associated with these activities on the activation device and the vote-capture device should receive extra scrutiny. As well, this general process should be considered fair game for OEVT.

This section also contains requirements that permit a ballot activation device to connect to an external voter registration database via a network. Network connectivity is inherently difficult to secure and make reliable, therefore the requirements in this section mandate that the external connectivity must be enabled/disabled by an authorized election official, and that a backup mechanism be in place if the connectivity fails. A ballot activation device or DRE/EBP used as an activation device cannot be connected simultaneously to both an internal (to the voting site) network of DREs or EBPs, and an external network. (The ballot activation device cannot include more than one network interface.) Any external network connectivity should be considered fair game for OEVT and, in particular, network vulnerability and penetration testing.
For provisional voting, if the linkage between the voter’s identity and the voter’s CVR is recorded in the external voter registration database, this may also be considered as fair game for OEVT.

1.5.1.1 Credential issuance and ballot activation

1.5.1.1-A Activation device, DRE, EBP, ballot activation

DREs and EBP s SHALL support ballot activation.

Applies to: Activation device, DRE, EBP

Test Reference: Error! Reference source not found. Error! Reference source not found.

DISCUSSION

All DREs and EBP s, in addition to activation devices, must support ballot activation, as defined in the following subrequirements.

Source: [VSS2002] I.2.4

1.5.1.1-A.1 Activation device, DRE, EBP, credential issuance

DREs or EBP s MAY function exclusively as an activation device and issue ballot activation credentials.

Applies to: DRE, EBP

Test Reference: Error! Reference source not found. Error! Reference source not found.

DISCUSSION

A DRE or EBP could be configured, pre-election, to function exclusively as an activation device. During elections, a DRE or EBP cannot be used as both an activation device and a vote-capture device.

Source: New requirement but existing practice

1.5.1.1-A.2 Activation device, DRE, EBP, at most one cast ballot per session

Activation devices, DREs, and EBP s SHALL enable poll workers either to initiate, or to provide the voter with the credentials sufficient to initiate, a voting session in which the voter may cast or print at most one ballot.

Applies to: Activation device, DRE, EBP


DISCUSSION

A voting session on an EBP may culminate with the printing of the ballot. Activation devices, DREs, and EBP s must prevent re-use of the credentials, e.g., by erasing a memory token used to carry ballot activation information.
1.5.1.1-B Activation device, contemporaneous record

**Activation devices** may create contemporaneous records of credential issuance to a voter. The record, once made, **shall not** be able to be modified by the voting system.

**Applies to:** Activation device

**Test Reference:** Error! Reference source not found. “Error! Reference source not found.”

**Discussion**

The voting system must create a record at the time when credentials are issued to voters so that the collection of records can be compared to the number of ballots voted. This may be done if the activation device prints a record, or by using a paper pollbook.

**Source:** New requirement

1.5.1.1-C Activation device, DRE, EBP, control ballot configuration

**Activation devices, DREs, and EBP** shall enable poll workers to control the ballot configuration(s) made available to the voter, whether presented in printed form or electronic display, such that each voter is permitted to record votes only in contests in which that voter is authorized to vote.

**Applies to:** Activation device, DRE, EBP

**Test Reference:** Error! Reference source not found. “Error! Reference source not found.”

**Discussion**

For an electronic display, poll workers control the ballot configuration using an activation device and issuing credentials. See also Requirement Part 1:1.2-A.2, Requirement Part 1:1.2-A.3, and Requirement Part 1:1.5.7-C.

**Source:** [VSS2002] 1.2.4.2.a

1.5.1.1-C.1 Activation device, DRE, EBP, enable only applicable contests

**DREs and EBP** shall activate all portions of the ballot upon which the voter is entitled to vote and **shall** disable all portions of the ballot upon which the voter is not entitled to vote.

**Applies to:** DRE, EBP

**Test Reference:** Error! Reference source not found. “Error! Reference source not found.”

**Discussion**

In paper-based systems, open primaries have sometimes been handled by printing a single ballot style that merges the contests from all parties, instructing the voter to
vote only in the contests applicable to a single party, and rejecting or discarding votes that violate this instruction. To use that approach on a DRE or EBP would violate this requirement.

Source: [VSS2002] I.2.4.2.g., [VSS2002] I.2.4.2.h

1.5.1.1-C.2 Activation device, DRE, EBP, select ballot configuration for party in primary elections

DREs and EBPs SHALL enable the selection of the ballot configuration that is appropriate to a party affiliation declared by the voter in a primary election.

Applies to: DRE ∧ Primary elections device, EBP ∧ Primary elections device

Test Reference: Error! Reference source not found. “Error! Reference source not found.”

Source: [VSS2002] I.2.4.2.f

1.5.1.2 Secrecy of the ballot

1.5.1.2-A Activation device, ballot secrecy

Activation devices, DREs, EBPs SHALL preserve secrecy of the ballot throughout the process of issuing credentials and activating the ballot and the keeping of records associated with ballot activation.

Applies to: Activation device, DRE, EBP


DISCUSSION

Secrecy of the ballot must be preserved during all operations associated with activation of the ballot, including during the creation of the ballot activation credential and information, during the process of activating the ballot, and in all keeping of associated records, reports, and logs. It must not be possible to identify a voter’s ballot or in some way violate secrecy of the ballot by aggregating records from different devices.

For example, an epollbook cannot retain and associate any information written to a ballot activation token with the voter’s identification information, and a vote-capture device cannot retain information from the token and associate it with the CVR – or else it would be possible to link the sets of records and identify the voter.

Note that Requirement Part 1:1.5.1.2-A.3 modifies this requirement if the activation device is used with provisional voting on a DRE.

Source: New requirement
1.5 Casting

1.5.1.2-A.1 DRE and EBP, open primaries, party selection should be private

In an open primary on a DRE or EBP, the voter SHOULD be allowed to choose a party affiliation in private at the start of the voting session and vote the appropriate ballot configuration (i.e., the choice of affiliation SHOULD be private as well as the selection of votes on the ballot).

Applies to: DRE ⋀ Open primaries device, EBP ⋀ Open primaries device

Test Reference: Error! Reference source not found. “Error! Reference source not found.”

DISCUSSION

In an open primary, the voter may be able to choose a party affiliation at the start of the voting session, therefore more than one ballot configuration may be available to the voter. The voter should be able to select the ballot configuration corresponding to the voter’s chosen party affiliation in privacy.

Source: New requirement

1.5.1.2-A.2 Activation device, records preserve secrecy of the ballot

Activation devices SHALL NOT create or retain information that can be used to identify a voter’s ballot, including the order and time at which a voter uses the voting system.

Applies to: Activation device, DRE, EBP


DISCUSSION

The activation device must not create or retain any information that could be used for the purposes of identifying a voter’s ballot, or the time at which the voter arrived at the polls, or the specific vote-capture device used by the voter.

Source: New requirement

1.5.1.2-A.3 Activation device, ballot activation provisional voting

Credential issuance, only when used during provisional voting, MAY permit the voter’s name to be associated with the voter’s ballot for the purposes of deciding whether to count the ballot. The mechanism used for this association SHALL itself not identify the voter.

Applies to: Activation device, DRE, EBP


DISCUSSION

For provisional voting, the voter’s identity is associated with the voter’s ballot so as to permit a subsequent decision whether to count the ballot. As an example, the
activation device may create an identifier and associate it with the provisional voter’s identity, and then include this identifier with other information necessary to activate the ballot. The vote-capture device may store this identifier with the ballot so as to trace the ballot back to the voter’s identity for the purposes of deciding whether the count the ballot. The identifier must not itself identify the voter. For example, it must not include the voter’s identity or other information associated with the voter such as an SSN or other identifying information.

Source: New requirement

1.5.1.3 Credentials and tokens

1.5.1.3-A Activation device, credentials and tokens

The sole purpose and use of the ballot activation credentials and token SHALL be for the purpose of activating the ballot.

Applies to: Voting device

Test Reference: Error! Reference source not found. “Error! Reference source not found.”

DISCUSSION

The credentials and associated token are to be used only for ballot activation and not for other purposes. For example, the token or credentials cannot be used to convey additional information to the vote-capture device or other devices, or to convey information from the vote-capture device to other devices in the case of re-usable tokens.

Source: New requirement

1.5.1.3-A.1 Activation device, token limited in capacity

The token SHOULD have the capacity to contain only the information sufficient to activate the ballot.

Applies to: Activation device

Test Reference: Error! Reference source not found. “Error! Reference source not found.”

DISCUSSION

The token should be limited to containing only the necessary information and nothing more – on memory card, possibly several bytes or less. This requirement addresses the threat of the token being used to pass other information to and from the vote-capture device, which should be considered especially if the activation device is connected to an external network (to connect to a registration database).

Source: New requirement
1.5.1.3-A.2 Activation device, DRE, EPB, token de-activated after casting

DREs and EPBs SHALL de-activate ballot activation credentials on the token after the voter has successfully cast the ballot.

**Applies to:** DRE, EBP

**Test Reference:** Error! Reference source not found. “Error! Reference source not found.”

**DISCUSSION**
The token and credentials are considered as authorization to cast a ballot and therefore must be de-activated after that ballot has been cast (and not before). It may be useful for the token to carry state information, such as:

1. Inactive - ready to be used in an activation device;
2. Active - loaded with credentials and able to activate the ballot;
3. In use - has been used to activate the ballot but the ballot has not yet been cast;
4. Closed successfully - has been used to activate the ballot and the ballot has been cast successfully; and
5. Closed unsuccessfully - has been used to activate the ballot but the ballot was not successfully cast for some reason.

**Source:** New requirement

1.5.1.3-A.3 Activation device, token should be non-reusable

The ballot activation token SHOULD be non-reusable by activation devices.

**Applies to:** Activation device

**Test Reference:** Error! Reference source not found. “Error! Reference source not found.”

**DISCUSSION**
The token should be one-way in that it is used only once to activate the ballot and cannot be recycled and used again by an activation device to activate a subsequent ballot. This eliminates the threat of passing other information from the vote-capture device back to the activation device, which should be considered especially if the activation device is connected to an external network (to connect to a registration database).

**Source:** New requirement

1.5.1.3-A.4 Activation device, integrity and authenticity of ballot activation information

Ballot activation credentials SHALL be created in such a manner that the vote-capture device can verify their integrity and authenticity for the current election and for that vote-capture device.

**Applies to:** Activation device, DRE, EBP
1.5 Casting

Test Reference:  *Error! Reference source not found. “Error! Reference source not found.”*

**DISCUSSION**

The vote-capture device must verify the integrity of the credentials and their validity for the election, but also must verify whether they were created from a trusted activation device and for use on the vote-capture device. This means essentially that some trust relationship must exist between the vote-capture device and the activation device. One approach for implementing this cryptographically is for each activation device to calculate, for each credential issued, a keyed-hash message authentication code, or HMAC, on the credentials, and for the vote-capture device to verify the HMAC. If cryptography is used, key sizes are determined by cryptography requirements in *Error! Reference source not found. “Error! Reference source not found.”*.

Source:  New requirement

### 1.5.1.4 Activation devices connected to remote registration databases

#### 1.5.1.4-A Activation device, may access remote registration database

The activation device may connect to an external network for the purposes of accessing and updating information from a remote voter registration database.

Applies to:  Activation device \^ Electronic device

Test Reference:  *Error! Reference source not found. “Error! Reference source not found.”, Error! Reference source not found.*

**DISCUSSION**

External is used here to mean "a public or private network extending beyond the voting site.” An activation device may include the capability to access an external network for the purposes of accessing voter identification information in a remote voter registration database. Note that this is the only remote access permitted; network access cannot be used for other purposes such as for accessing web sites, email, etc. See also related requirements in *Error! Reference source not found. “Error! Reference source not found.”, Error! Reference source not found.*  pertaining to secure system and network configurations for the ballot activation device.

Source:  New requirement

#### 1.5.1.4-A.1 Activation device, cannot connect to multiple networks

The activation device shall connect to at most one network; either a network connection to vote-capture devices or an external network for the purposes of accessing information in a remote voter registration database, but not both.

Applies to:  Activation device \^ Electronic device
1.5 Casting


Source: New requirement

1.5.1.4-A.2 Activation device, access to remote registration database configurable

The activation device SHALL have the capability to access an external network only if so authorized by an administrator.

Applies to: Activation device ^ Electronic device


DISCUSSION
An election official must have the ability to enable or disable the remote access capability, i.e., its network interface and associated logic.

Source: New requirement

1.5.1.4-A.3 Activation device, notification of access to remote registration database

The activation device SHALL display a continuous indication to the poll worker during the period it is enabled to access an external network.

Applies to: Activation device ^ Electronic device


DISCUSSION
The notification must be continuous and obvious to the poll worker.

Source: New requirement

1.5.1.4-A.4 Activation device, remote access failure backup capability

The voting system SHALL include a backup capability to activate ballots if access to a remote registration database fails.

Applies to: Voting system


DISCUSSION
If the remote database is unavailable, the voting system must include some backup capability so that it may continue to activate ballots, e.g., a cached local copy of the voter registration database or a paper pollbook.

Source: New requirement
1.5.1.4-A.5 Activation device, connects to router/firewall

If externally networked, the activation device SHALL connect to a router with network firewall capabilities using a wired connection and the TCP/IP communications protocol.

Applies to: Activation device ^ Electronic device


DISCUSSION

This requirement prohibits the activation device from connecting directly to the external network and possibly using a wireless connection. The device must connect to a router over a wire (e.g., Ethernet). The router must have firewall capability and be configured to block or filter unneeded services and protocols. See [NIST02] for suggested firewall configuration information.

Source: New requirement

1.5.1.4-B Activation device, source code reviews

Activation devices SHALL be free of vulnerabilities that may be exploited by remote attackers over the network.

Applies to: Activation device ^ Electronic device


DISCUSSION

The source code review must consider that the activation device may be accessed via an external network. Certain aspects of the software may be significantly more vulnerable to attack than if there were no external network connectivity. The test lab must review the source code of activation device software and inspect COTS configuration data to search for vulnerabilities that might be exploitable through the external network.

Source: New requirement

1.5.2 General voting functionality

1.5.2-A No advertising

The ballot presented to the voter SHALL NOT display or link to any advertising or commercial logos of any kind, whether public service, commercial, or political, unless added by central election officials using the functionality described in Requirement part1:7.2-A.5.

Applies to: Vote-capture device
1.5.2-B Capture votes

All vote-capture devices SHALL record the selection and non-selection of individual contest choices for each contest.

Applies to: Vote-capture device


Source: Clarification of [VSS2002] I.2.3.1.3.1.b

1.5.3 Voting variations

1.5.3-A Vote-capture device, voting variations

All vote-capture devices SHALL support the gathering of votes using all voting variations indicated for them in the implementation statement.

Applies to: Vote-capture device

Test Reference: Error! Reference source not found. Error! Reference source not found.

Source: Extrapolated from [VSS2002] I.2.4.3.1.c

1.5.3-A.1 Vote-capture device, 1-of-M

All vote-capture devices SHALL be capable of gathering and recording votes in contests where the voter is allowed to choose at most one contest choice from a list of contest choices.

Test Reference: Error! Reference source not found. Error! Reference source not found.

Source: [VSS2002] I.2.4. Extended [VSS2002] I.2.4.2.e to all systems

1.5.3-A.2 Vote-capture device, yes/no question

All vote-capture devices SHALL be capable of gathering and recording votes in contests where the voter is allowed to vote yes or no on a question.

Test Reference: Error! Reference source not found. Error! Reference source not found.

Source: New requirement / clarification of [VSS2002] intent
1.5.3-A.3 Vote-capture device, indicate party affiliations and endorsements

All vote-capture devices SHALL be capable of indicating the affiliation and/or endorsements of each contest choice.

Test Reference: Error! Reference source not found. Error! Reference source not found.

Source: Added precision

1.5.3-A.4 Vote-capture device, closed primaries

Vote-capture devices of the Closed primaries device class SHALL be capable of gathering and recording votes within a voting process that assigns different ballot styles depending on the registered political party affiliation of the voter and supports both party-specific and non-party-specific contests.

Applies to: Vote-capture device \& Closed primaries device

Test Reference: Error! Reference source not found. Error! Reference source not found.

Source: Added precision, based on [VSS2002] I.2.2.8.2 and glossary

1.5.3-A.5 Vote-capture device, open primaries

Vote-capture devices of the Open primaries device class SHALL be capable of gathering and recording votes within a voting process that assigns different ballot styles depending on the political party chosen by the voter at the time of voting and supports both party-specific and non-party-specific contests.

Applies to: Vote-capture device \& Open primaries device

Test Reference: Error! Reference source not found. Error! Reference source not found.

DISCUSSION

In paper-based systems, open primaries have sometimes been handled by printing a single ballot style that merges the contests from all parties, instructing the voter to vote only in the contests applicable to a single party, and rejecting or discarding votes that violate this instruction. To satisfy the requirements for Open primaries device, the vote-capture device must be capable of handling the case where different ballot configurations are associated with different political parties.

Source: Added precision, based on [VSS2002] I.2.2.8.2 and glossary
1.5 Casting

Appplies to: Vote-capture device \(\land\) Write-ins device
Test Reference: Error! Reference source not found. “Error! Reference source not found.”
Source: [VSS2002] I.2.4.3.1.d

1.5.3-A.7 Vote-capture device, support write-in reconciliation

Vote-capture devices of the Write-ins device class **SHALL** be capable of gathering and recording votes within a voting process that allows for reconciliation of aliases and double votes.

Appplies to: Vote-capture device \(\land\) Write-ins device
Test Reference: Error! Reference source not found. “Error! Reference source not found.”

**DISCUSSION**

Reconciliation of aliases means allowing central election officials to declare two different spellings of a candidate’s name to be equivalent (or not). Reconciliation of double votes means handling the case where, in an N-of-M contest, a voter has attempted to cast multiple votes for the same candidate using the write-in mechanism. See Part 1:1.7.2.4 “Logic for reconciling write-in double votes” for details.

Source: Added precision based on clarification of write-in reconciliation process

1.5.3-A.8 Vote-capture device, ballot rotation

Vote-capture devices of the Ballot rotation device class **SHALL** be capable of gathering and recording votes when the ordering of contest choices in ballot positions within each contest is variable.

Appplies to: Vote-capture device \(\land\) Ballot rotation device
Test Reference: Error! Reference source not found. “Error! Reference source not found.”
Source: Added precision, based on [VSS2002] I.2.2.8.2 and glossary

1.5.3-A.9 Ballot rotation, equal time for each contest choice

Programmed vote-capture devices that enable ballot rotation in a given contest **SHALL** alter the ordering of contest choices in such a manner that no contest choice **SHALL** ever have appeared in any particular ballot position two or more times more often than any other.

Appplies to: Vote-capture device \(\land\) Programmed device \(\land\) Ballot rotation device
Test Reference: Error! Reference source not found. “Error! Reference source not found.”
DISCUSSION
This is less restrictive than requiring sequential rotation. For a contest of M contest choices, the order may be shuffled randomly after each batch of M ballots and rotated sequentially within each batch.

Source: Clarification or extension of existing requirements

1.5.3-A.10 Vote-capture device, straight party voting

Vote-capture devices of the Straight party voting device class SHALL be capable of gathering and recording votes for a special contest in which the selection of a political party implies votes for the contest choices endorsed by that party in all straight-party-votable contests on the ballot.

Applies to: Vote-capture device ∨ Straight party voting device
Test Reference: Error! Reference source not found. “Error! Reference source not found.”
Source: Added precision, based on [VSS2002] I.2.2.8.2 and glossary

1.5.3-A.11 Vote-capture device, cross-party endorsement

Vote-capture devices of the Cross-party endorsement device class SHALL be capable of gathering and recording straight-party votes when a given contest choice is endorsed by two or more different political parties.

Applies to: Vote-capture device ∨ Cross-party endorsement device
Test Reference: Error! Reference source not found. “Error! Reference source not found.”
Source: Clarification or extension of existing requirements

1.5.3-A.12 Vote-capture device, split precincts

Vote-capture devices of the Split precincts device class SHALL be capable of gathering and recording votes in a precinct where there are distinct ballot styles for voters from two or more election districts.

Applies to: Vote-capture device ∨ Split precincts device
Test Reference: Error! Reference source not found. “Error! Reference source not found.”
Source: Added precision, based on [VSS2002] I.2.2.8.2 and glossary

1.5.3-A.13 Vote-capture device, N-of-M voting

Vote-capture devices of the N-of-M voting device class SHALL be capable of gathering and recording votes in contests where the voter is allowed to choose up to a specified number of contest choices (N(r) > 1, per Error! Reference source not found. “Error! Reference source not found.”) from a list of contest choices.
1.5 Casting

Applies to: Vote-capture device \land N-of-M voting device

Test Reference: Error! Reference source not found. “Error! Reference source not found.”

Source: Added precision, based on [VSS2002] I.2.2.8.2 and glossary

1.5.3-A.14 Vote-capture device, cumulative voting

Vote-capture devices of the Cumulative voting device class SHALL be capable of gathering and recording votes in contests where the voter is allowed to allocate up to a specified number of votes \((N(r) > 1)\) per Part 1 per Error! Reference source not found. “Error! Reference source not found.”) over a list of contest choices, possibly giving more than one vote to a given contest choice.

Applies to: Vote-capture device \land Cumulative voting device

Test Reference: Error! Reference source not found. “Error! Reference source not found.”

Source: Added precision, based on [VSS2002] I.2.2.8.2 and glossary

1.5.3-A.15 Vote-capture device, ranked order voting

Vote-capture devices of the Ranked order voting device class SHALL be capable of gathering and recording votes in contests where the voter is allowed to rank contest choices in a contest in order of preference, as first choice, second choice, etc.

Applies to: Vote-capture device \land Ranked order voting device

Test Reference: Error! Reference source not found. “Error! Reference source not found.”

Source: Added precision, based on [VSS2002] I.2.2.8.2 and glossary

1.5.3-A.16 Vote-capture device, provisional / challenged ballots

Vote-capture devices of the Provisional / challenged ballots device class SHALL be capable of gathering and recording votes within a voting process that allows the decision whether to count a particular ballot to be deferred until after election day.

Applies to: Vote-capture device \land Provisional / challenged ballots device

Test Reference: Error! Reference source not found. “Error! Reference source not found.”

DISCUSSION

Unique identification of each provisional / challenged ballot is required. See Requirement Part 1:1.7.2-A.5.

Source: Added precision, based on [VSS2002] I.2.2.8.2 and glossary
1.5.3-A.17 DRE, categorize provisional ballots

DREs of the Provisional / challenged ballots device class SHALL provide the capability to categorize each provisional / challenged ballot.

Applies to: DRE+VVPAT ∧ Provisional / challenged ballots device

Test Reference: Error! Reference source not found. “Error! Reference source not found.”

D I S C U S S I O N
Categories (e.g., "regular provisional," "extended hours provisional," "regular extended hours") would be jurisdiction-dependent.

Source: [P1583] 5.6.5.2.s.2 “Error! Reference source not found.”

1.5.3-A.18 Vote-capture device, review-required ballots

Vote-capture devices of the Review-required ballots device class SHALL be capable of gathering and recording votes within a voting process that requires certain ballots to be flagged or separated for review.

Applies to: Vote-capture device ∧ Review-required ballots device

Test Reference: Error! Reference source not found. “Error! Reference source not found.”

D I S C U S S I O N
In some systems and jurisdictions, all ballots containing write-in votes require flagging or separation for review. Support for the class indicates that the system can flag or separate ballots in this manner and include the results of the review in the reported totals (see Error! Reference source not found. “Error! Reference source not found.”). Other reasons for which ballots are flagged or separated are jurisdiction-dependent. It is assumed that ballot presentation is unchanged for review-required ballots.

Source: Extrapolated from [VSS2002] I.2.5.2

1.5.4 Recording votes

1.5.4-A Record votes as voted

Vote-capture devices SHALL record each vote precisely as indicated by the voter.

Applies to: Vote-capture device

Test Reference: Error! Reference source not found. “Error! Reference source not found.”

Source: [VSS2002] I.2.2.2.1.c / [VVSG2005] I.2.1.2.c
1.5.4-A.1 Records consistent with feedback to voter

All CVRs and logs SHALL be consistent with the feedback given to the voter.

Test Reference: Error! Reference source not found. “Error! Reference source not found.”

Source: Added precision

DISCUSSION
This does not mean that every message displayed to the voter during an interactive session must be included in every log. It just means that the records and the interactive messages must not be in conflict with one another. E.g., It is not permissible to show a vote for candidate X on the display and then record a vote for candidate Y.

1.5.4-B DRE, confirm votes recorded

DREs SHALL verify (i.e., actively check and confirm) the correct addition of votes to the persistent storage of the device.

Applies to: DRE+VVPAT


“Error! Reference source not found.”

DISCUSSION
“Persistent storage” includes nonvolatile memory, hard disks, optical disks, etc.

Source: [VSS2002] I.3.2.4.3.3.c, expanded to include persistent storage

1.5.4-C Casting

All systems SHALL support the casting of a ballot.

Applies to: Voting system

Test Reference: Error! Reference source not found. “Error! Reference source not found.”

DISCUSSION
This does not entail retaining a ballot image. DREs are required to retain ballot images (see Error! Reference source not found. “Error! Reference source not found.”) but other devices might not.

Source: [VSS2002] I.2.4. Extended [VSS2002] I.2.4.2.e to all systems

1.5.4-C.1 Equipment allows each eligible voter to vote

All systems SHALL make it possible for each eligible voter to cast a ballot, provided that the limits declared in the implementation statement for each device are not exceeded.

Test Reference: Error! Reference source not found. “Error! Reference source not found.”
1.5.4-C.2 Paper-based, must have secure ballot boxes

Discussions
See also Requirement Part 1:1.5.7.
Source: [VSS2002] I.2.4.2.b, generalized to all systems

1.5.4-D DRE, cast is committed

DREs SHALL prevent modification of the voter’s vote after the ballot is cast.

Applies to: DRE+VVPAT

Test Reference: Error! Reference source not found. “Error! Reference source not found.”

Source: [VSS2002] I.2.4.1.2.1.c

1.5.4-E EBM, ballot orientation

EBMs SHALL either:

a. Correctly mark ballots regardless whether they are loaded upside down, right side up, forward, or reversed; or

b. Detect and reject ballots that are oriented incorrectly.

Applies to: EBM

Test Reference: Requirement Error! Reference source not found. -F.1

Source: New requirement

1.5.5 Redundant records

This section contains design requirements to enhance the recoverability of DRE devices. This is a separate concern from auditability, which is addressed in Error! Reference source not found. “Error! Reference source not found.”. However, in some systems, the same records might satisfy both these requirements and auditability requirements.
1.5 Casting

1.5.5-A DRE, at least two separate copies of CVR

DREs **SHALL** record and retain at least two machine-countable copies of each CVR.

* Applies to: DRE+VVPAT

* Test Reference: [Error! Reference source not found. “Error! Reference source not found.”]

**DISCUSSION**

Besides data stored in electronic memory, a paper record with barcodes or EBM-style markings or a paper record printed in a machine-readable font would qualify as machine-countable.

* Source: [VSS2002] I.2.2.2.2, I.2.2.4.2 and I.3.2.4.3.2.c

1.5.5-A.1 DRE, redundant CVRs on physically separate media

These redundant records **SHALL** be written to media that are physically separate from one another (e.g., two separate memory cards or one electronic record and one paper record).

* Test Reference: [Error! Reference source not found. “Error! Reference source not found.”]

**DISCUSSION**

For improved auditability, it is preferable for the processes and paths used to record separate records to themselves to be as separate as possible, so that the opportunities for a single error to corrupt multiple records in the same way are minimized.

* Source: [VSS2002] I.2.2.4.2 and I.3.2.4.3.2.c

1.5.5-A.2 DRE, redundant records created contemporaneously

These redundant records **SHALL** be created contemporaneously.

* Test Reference: [Error! Reference source not found. “Error! Reference source not found.”]

**DISCUSSION**

This subrequirement is to prohibit the unintended approach of building a second copy from the first after close of polls, which creates a single point of failure.

* Source: New requirement

1.5.6 Respecting limits

1.5.6-A Tabulator, prevent counter overflow

When a tabulator can no longer accept another ballot without the potential of overflowing a vote counter or otherwise compromising the integrity of the counts, it **SHALL** notify the user or operator and cease to accept new ballots.
1.5 Casting

Applies to: Tabulator


DISCUSSION

Assuming that the counter size is large enough such that the value will never be reached is not adequate. Systems are required to detect and prevent an impending overflow condition.

Source: Clarification of [VSS2002] II.5.4.2.g

1.5.6-A.1 DRE, stop when full

When a DRE can no longer accept another ballot without the potential of overflowing a vote counter or otherwise compromising the integrity of the counts, it SHALL emit appropriate warnings and audit events and cease to activate new ballots.

Applies to: DRE+VVPAT


DISCUSSION

A DRE must not initiate a voting session if there is the possibility that the next ballot could not be properly cast and recorded. If there exists a way of voting the ballot that would exceed one of the limits, then the ballot must not be activated.

Source: Clarification of [VSS2002] II.5.4.2.g

1.5.7 Procedures required for correct system functioning

The requirements for voting systems are written assuming that these procedures will be followed.

Process allows each eligible voter to vote: The voting process must allow each eligible voter to cast a ballot. ([VSS2002] I.2.4.2.b, generalized from DRE systems to the voting process.) See also Requirement Part 1:1.5.4-C.1.

At most one cast ballot per voter: The voting process must prevent a voter from casting more than one ballot in the same election. ([VSS2002] I.2.4.2.d, generalized from DRE systems to the voting process.) See also Requirement Part 1:1.5.1.1-A.2.

Process ensures correct ballot style: The voting process must prevent a voter from voting a ballot style to which he or she is not entitled. ([VSS2002] I.2.4.2.c, generalized from DRE systems to the voting process.) See also Requirement Part 1:1.2-A.2, Requirement Part 1:1.2-A.3 and Requirement Part 1:1.5.1-C.
1.6 Closing Polls

Process prevents vote tampering: The voting process must prevent modification of the voter's vote after the ballot is cast. ([VSS2002] I.2.4.3.3.n, generalized.) See also Requirement Part 1:1.5.4-D, cast ballot.

Early voting, ballot accounting: In the presence of a witness, election judges must record the value of the ballot counter from each tabulator at the end of each active period. (Issue #1366, Issue #2143) See Error! Reference source not found. “Error! Reference source not found.” This procedure might be facilitated by designated functions of the voting equipment (i.e., printing of special early-voting end-of-day reports that include the timestamp, the value of the ballot counter, and little else).

Early voting, resumption practices: Election judges returning equipment to the ready state after it has been placed in the suspended state must perform this operation in the presence of a witness, confirm that the equipment recorded no activity, and confirm that the ballot counter is unchanged from the value that was recorded when voting was suspended. See Error! Reference source not found. “Error! Reference source not found.” This procedure might be facilitated by designated functions of the voting equipment (i.e., printing of special early-voting resumption reports that include the timestamp, the value of the ballot counter, confirmation that nothing happened overnight, and little else).

1.6 Closing Polls

→ 1.6-A DRE, no CVRs before close of polls

DREs SHALL prevent access to CVRs until after the close of polls.

Applies to: DRE+VVPAT


DISCUSSION

This does not apply to paper-based devices because the ballot is subject to handling beyond their control; however, a locked ballot box (per Requirement Part 1:1.5.4-C.2 and Requirement Error! Reference source not found. serves the same purpose. See also Requirement Part 1:1.6.1-A.

Source: [VSS2002] I.2.4.3.3.r

→ 1.6-B Programmed vote-capture devices, poll-closing function

Programmed vote-capture devices SHALL provide designated functions for closing the polls.

Applies to: Vote-capture device ∧ Programmed device

Test Reference: Error! Reference source not found. “Error! Reference source not found.”
1.6 Closing Polls

Source: Reworded from [VSS2002] I.2.5

1.6-B.1 Programmed vote-capture devices, no voting when polls are closed

Programmed vote-capture devices SHALL prevent the further enabling, activation or marking of ballots by those devices once the polls have closed.


DISCUSSION
An EBM cannot prevent a voter from marking a paper ballot with a writing utensil after polls have closed. This must be prevented through procedures.

Source: Reworded from [VSS2002] I.2.5.1.a

1.6-B.2 DRE, no ballot casting when polls are closed

DREs SHALL prevent the further casting of ballots once the polls have closed.

Applies to: DRE+VVPAT


Source: Reworded from [VSS2002] I.2.5.1.a

1.6-B.3 Programmed vote-capture devices, poll closing integrity check

Programmed vote-capture devices SHALL provide an internal test that verifies that the prescribed closing procedure has been followed and that the device status is normal.

Test Reference: Error! Reference source not found. “Error! Reference source not found.”

Source: Reworded from [VSS2002] I.2.5.1.b

1.6-B.4 Programmed vote-capture devices, report on poll closing process

Programmed vote-capture devices SHALL provide a means to produce a diagnostic test record that verifies the sequence of events and indicates that the poll closing process has been activated.

Test Reference: Error! Reference source not found. “Error! Reference source not found.”

Source: Reworded from [VSS2002] I.2.5.1.d
1.6-B.5 Programmed vote-capture devices, prevent reopening polls

Programmed vote-capture devices SHALL prevent reopening of the polls once the poll closing has been completed for that election.

Test Reference: Error! Reference source not found. “Error! Reference source not found.”

Source: Revised from [VSS2002] I.2.5.1.e; made consistent with [VSS1990] 2.2.3.1

1.6-C Precinct reporting device, post-election reports

Precinct reporting devices SHALL provide designated functions for generating precinct post-election reports.

Applies to: Precinct reporting device

Test Reference: Error! Reference source not found. “Error! Reference source not found.”

Source: Reworded from [VSS2002] I.2.5

1.6.1 Procedures required for correct system functioning

The requirements for voting systems are written assuming that these procedures will be followed.

Process, no early reporting: The voting process must prevent access to voted ballots until after the close of polls. ([VSS2002] I.2.4.3.3.r, generalized.) See also Requirement Part 1:1.6-A.

1.7 Counting

1.7.1 Integrity

1.7.1-A Detect and prevent ballot style mismatches

All voting systems SHALL detect ballot style mismatches and prevent votes from being tabulated or reported incorrectly due to such a mismatch.

Applies to: Voting system

Test Reference: Requirement Error! Reference source not found.-F.1

Discussion

For example, if the ballot styles loaded on a tabulator disagree with the ballot styles that were used by vote-capture devices, the system must raise an alarm and prevent the incorrect ballot styles from being used during tabulation. Otherwise, votes could be ascribed to the wrong contest choices.
1.7 Counting

Such a mismatch should have been detected and prevented in L&A testing (see Requirement Part 1:1.3.1-C, Requirement Part 1:1.3.1-D and Requirement Part 1:1.3.1-E), but if it was not, it must be detected and prevented before tabulation commences.

*Source:* Amplification of existing requirements

→ **1.7.1-B Detect and reject ballots that are oriented incorrectly**

**Optical scanners** SHALL either:

1. Correctly count ballots regardless of whether they are fed upside down, right side up, forward, or reversed; or
2. Detect and reject ballots that are oriented incorrectly.

*Applies to:* Optical scanner

*Test Reference:* Requirement Error! Reference source not found.-F.1

*Source:* New requirement

**1.7.2 Voting variations**

→ **1.7.2-A Tabulator, voting variations**

*All tabulators* SHALL support all voting variations indicated in the implementation statement.

*Applies to:* Tabulator

*Test Reference:* Error! Reference source not found. “Error! Reference source not found.”

*Source:* [VSS2002] I.2.2.8.1 plus I.2.2.8.2

← **1.7.2-A.1 Tabulator, 1-of-M**

*All tabulators* SHALL be capable of tabulating votes, overvotes, and undervotes in contests where the voter is allowed to choose at most one contest choice from a list of contest choices.

*Test Reference:* Error! Reference source not found. “Error! Reference source not found.”

**DISCUSSION**

In a device where overvoting is prevented entirely, there are no overvotes to tabulate. Nevertheless, the total of zero overvotes may need to be recorded, reported, and/or exported by that device to support the precinct- and jurisdiction-wide tabulation processes. The production of this zero total where needed satisfies the requirement for such a device to “tabulate overvotes.” Note that overvotes can be produced by write-in reconciliation even when direct overvoting is prevented (see Part 1:7.7.2.4).

*Source:* Implicit in [VSS2002]
1.7 Counting

1.7.2-A.2 Tabulator, yes/no question

All tabulators SHALL be capable of tabulating votes, overvotes, and undervotes in contests where the voter is allowed to vote yes or no on a question.

Test Reference:  Error! Reference source not found. “Error! Reference source not found.”

DISCUSSION
See discussion in Part 1:7.7.2-A.1 regarding tabulation of overvotes when overvoting is prevented.

Source: New requirement / clarification of [VSS2002] intent

1.7.2-A.3 Tabulator, absentee voting

Tabulators of the Absentee voting device class SHALL be capable of tabulating votes, overvotes, and undervotes from absentee ballots.

Applies to: Tabulator ∧ Absentee voting device

Test Reference: Error! Reference source not found. “Error! Reference source not found.”

DISCUSSION
See discussion in Part 1:7.7.2-A.1 regarding tabulation of overvotes when overvoting is prevented.

Source: Added precision, based on [VSS2002] I.2.2.8.1, I.2.2.8.2 and glossary

1.7.2-A.4 Tabulator, provisional / challenged ballots

Tabulators of the Provisional / challenged ballots device class SHALL be capable of tabulating votes, overvotes, and undervotes in contests where the decision whether to count a particular ballot is deferred until after election day.

Applies to: Tabulator ∧ Provisional / challenged ballots device

Test Reference: Error! Reference source not found. “Error! Reference source not found.”

DISCUSSION
See discussion in Part 1:7.7.2-A.1 regarding tabulation of overvotes when overvoting is prevented.

Source: Added precision, based on [VSS2002] I.2.2.8.1, I.2.2.8.2 and glossary

1.7.2-A.5 Tabulator, accept or reject provisional / challenged ballots individually

Tabulators of the Provisional / challenged ballots device class SHALL support the independent acceptance and rejection of individual provisional / challenged ballots.
1.7 Counting

Applies to: Tabulator ∨ Provisional / challenged ballots device
Test Reference: Error! Reference source not found. “Error! Reference source not found.”

**DISCUSSION**

This is meant to rule out the mode of failure in which the IDs assigned to provisional ballots fail to be unique, rendering the system incapable of accepting one without also accepting the others with the same ID.

Source: Added precision, based on [VSS2002] I.2.2.8.1, I.2.2.8.2 and glossary

1.7.2-A.6 Tabulator, accept or reject provisional / challenged ballots by category

Tabulators of the Provisional / challenged ballots device class SHALL support the acceptance and rejection of provisional / challenged ballots by category.

Applies to: Tabulator ∨ Provisional / challenged ballots device
Test Reference: Error! Reference source not found. “Error! Reference source not found.”

**DISCUSSION**

For “category,” see Requirement Part 1:1.5.3-A.17. The behavior when an individual acceptance/rejection conflicts with a categorical acceptance/rejection is system-dependent and should be documented by the manufacturer.

Source: [P1583] 5.6.5.2.s.3

1.7.2-A.7 Tabulator, primary elections

Tabulators of the Primary elections device class SHALL be capable of keeping separate totals for each political party for the number of ballots read and counted.

Applies to: Tabulator ∨ Primary elections device
Test Reference: Error! Reference source not found. “Error! Reference source not found.”

**DISCUSSION**

In paper-based systems, open primaries have sometimes been handled by printing a single ballot style that merges the contests from all parties and instructing the voter to vote only in the contests applicable to a single party. This approach requires additional logic in the tabulator to support the rejection or discarding of votes that violate these special instructions, while the approach of assigning different ballot configurations to different parties does not. Support for the merged ballot approach is not required for a tabulator to satisfy the requirements for Primary elections device. See Part 1:1.7.2.1 “Merged ballot approach to open primaries”.

This requirement to separate by party applies only to the number of read ballots and counted ballots. It does not apply to contest choice vote totals.

Source: Added precision, based on [VSS2002] reporting requirements
1.7 Counting

1.7.2-A.8 Tabulator, write-ins

Tabulators of the Write-ins device class SHALL be capable of tabulating votes for write-in candidates, with separate totals for each candidate.

Applies to: Tabulator \( \land \) Write-ins device

Test Reference: Error! Reference source not found. “Error! Reference source not found.”

Source: Added precision, based on [VSS2002] I.2.2.8.1, I.2.2.8.2 and glossary

1.7.2-A.9 Tabulator, support write-in reconciliation

Tabulators of the Write-ins device class SHALL be capable of tabulating votes within a voting process that allows for reconciliation of aliases and double votes.

Applies to: Tabulator \( \land \) Write-ins device

Test Reference: Error! Reference source not found. “Error! Reference source not found.”

Discussion
Reconciliation of aliases means allowing central election officials to declare two different spellings of a candidate’s name to be equivalent (or not). Reconciliation of double votes means handling the case where, in an N-of-M contest, a voter has attempted to cast multiple votes for the same candidate using the write-in mechanism. See Part 1:1.7.2.4 “Logic for reconciling write-in double votes” for details.

Source: Added precision based on clarification of write-in reconciliation process

1.7.2-A.10 Tabulator, ballot rotation

Tabulators of the Ballot rotation device class SHALL be capable of tabulating votes when the ordering of contest choices in ballot positions within each contest is variable.

Applies to: Tabulator \( \land \) Ballot rotation device

Test Reference: Error! Reference source not found. “Error! Reference source not found.”

Discussion
This simply means that ballot rotation must not impact the correctness of the count. A mode of failure would be getting confused about the mapping from ballot positions to contest choices.

Source: Added precision, based on [VSS2002] I.2.2.8.1, I.2.2.8.2 and glossary
1.7 Counting

1.7.2-A.11 Tabulator, straight party voting

Tabulators of the Straight party voting device class SHALL be capable of tabulating straight party votes.

Applies to: Tabulator \& Straight party voting device

Test Reference: Error! Reference source not found. “Error! Reference source not found.”

Source: Added precision, based on [VSS2002] I.2.2.8.1, I.2.2.8.2 and glossary

1.7.2-A.12 Tabulator, cross-party endorsement

Tabulators of the Cross-party endorsement device class SHALL be capable of tabulating straight-party votes when a given contest choice is endorsed by two or more different political parties.

Applies to: Tabulator \& Cross-party endorsement device

Test Reference: Error! Reference source not found. “Error! Reference source not found.”

Source: Added precision, based on [VSS2002] I.2.2.8.1, I.2.2.8.2 and glossary

1.7.2-A.13 Tabulator, split precincts

Tabulators of the Split precincts device class SHALL be capable of tabulating votes for two or more election districts within the same precinct.

Applies to: Tabulator \& Split precincts device
1.7 Counting

Test Reference:  Error! Reference source not found. “Error! Reference source not found.”

Source:  Added precision, based on [VSS2002] I.2.2.8.1, I.2.2.8.2 and glossary

1.7.2-A.15 Tabulator, N-of-M voting

Tabulators of the N-of-M voting device class SHALL be capable of tabulating votes, overvotes, and undervotes in contests where the voter is allowed to choose up to a specified number of contest choices (N(r) > 1, per Error! Reference source not found. “Error! Reference source not found.”) from a list of contest choices.

Applies to:  Tabulator \(\land\) N-of-M voting device

Test Reference:  Error! Reference source not found. “Error! Reference source not found.”

DISCUSSION

See discussion in Part 1:7.7.2-A.1 regarding tabulation of overvotes when overvoting is prevented.

Source:  Added precision, based on [VSS2002] I.2.2.8.1, I.2.2.8.2 and glossary

1.7.2-A.16 Tabulator, cumulative voting

Tabulators of the Cumulative voting device class SHALL be capable of tabulating votes, overvotes, and undervotes in contests where the voter is allowed to allocate up to a specified number of votes (N(r) > 1, per Error! Reference source not found. “Error! Reference source not found.”) over a list of contest choices however he or she chooses, possibly giving more than one vote to a given contest choice.

Applies to:  Tabulator \(\land\) Cumulative voting device

Test Reference:  Error! Reference source not found. “Error! Reference source not found.”

DISCUSSION

See discussion in Part 1:7.7.2-A.1 regarding tabulation of overvotes when overvoting is prevented.

Source:  Added precision, based on [VSS2002] I.2.2.8.1, I.2.2.8.2 and glossary

1.7.2-A.17 Central reporting device, ranked order voting

Central reporting devices of the Ranked order voting device class SHALL be capable of determining the results of a ranked order contest for each round of tabulation.

Applies to:  Central reporting device \(\land\) Ranked order voting device
1.7 Counting

Test Reference:  Error! Reference source not found. “Error! Reference source not found.”

DISCUSSION
This requirement is minimal. Since ranked order voting is not currently in wide use, it is not clear what, other than the final result, must be computed. See Part 1:1.7.2.5 “Logic for ranked order voting”.

Source:  [VSS2002] I.2.2.8.1 plus I.2.2.8.2

The following subsections discuss cases for which tabulation logic is not specified in the VVSG.

1.7.2.1 Merged ballot approach to open primaries

In paper-based systems, open primaries have sometimes been handled by printing a single ballot style that merges the contests from all parties and instructing the voter to vote only in the contests applicable to a single party. This approach requires additional logic in the tabulator to support the rejection or discarding of votes that violate these special instructions, while the approach of assigning different ballot configurations to different parties does not.

Support for the merged ballot approach is not required for a tabulator to satisfy the requirements in these Guidelines for support of open primaries. Voting systems may provide this option as an extension to the Guidelines without breaking conformance.

1.7.2.2 Recall candidacy linked to recall question

In some jurisdictions, a vote for a candidate to replace a recalled official is counted only if the recall question on the same ballot was voted, and sometimes only if it was voted in the affirmative. Voting systems may provide this option as an extension to the Guidelines without breaking conformance.

1.7.2.3 Logic for counting straight party overrides

Although initially it seems obvious that a straight party override in a 1-of-M race should take precedence over a straight party vote, it is less obvious after considering the generalized case of an N-of-M race in which the number of candidates endorsed by the selected party might be less than N. Approaches supported by commercially available technology include (1) all straight party votes are cancelled when an explicit vote exists; (2) both straight party and explicit votes are counted; (3) both straight party and explicit votes are counted unless this exceeds N, in which case only the explicit votes are counted; (4) both straight party and explicit votes are counted unless this exceeds N, in which case straight party votes from the bottom of the list are dropped until the number of votes is reduced to N.

These Guidelines do not specify any particular approach to resolving straight party overrides, but the approach(es) supported are required to be described in the Voting Equipment User Documentation. See Requirement Error! Reference source not found.-B.
1.7.2.4 Logic for reconciling write-in double votes

Reconciliation of double votes means handling the case where, in an N-of-M contest, a voter has attempted to cast multiple votes for the same candidate using the write-in mechanism. If the voter has selected a ballot position for a given candidate but also written in that candidate's name, or if the voter has written in the same candidate twice using the same spelling or different legal spellings, some corrective action is required—possibly counting only one of the votes, possibly considering the contest to be overvoted. Which action should be specified by jurisdiction election law.

Given a sufficiently robust mechanism for reconciliation of aliases, the reconciliation of double votes can be automated. Once it is known that the name written in identifies the same candidate as the previous ballot position, the tabulator can take whatever action is specified by election law.

These Guidelines do not specify any particular approach to reconciling double votes, but the approach(es) supported are required to be described in the Voting Equipment User Documentation. See Requirement Error! Reference source not found.-C.

1.7.2.5 Logic for ranked order voting

The single-winner case of ranked order voting, known by various names including instant runoff voting, requires the definition of criteria for breaking ties. Whereas in plurality voting the voting system need only report the vote totals, a voting system supporting ranked order voting must implement tie-breaking logic in order to be certain of reaching a reportable result.

It is also necessary to decide whether voters may assign equal rankings to two contest choices, whether voters are required to rank every choice, and how to compute a result in the case where they do not.

The multiple-winner generalization, called single transferable vote, has two additional adjustable parameters: the vote quota (the number of votes required to declare a candidate elected) and the weighting or distribution of votes transferred from contest choices that exceed the quota.

Finally, to the extent that a particular ranked order variant defines certain voter responses to be partly or wholly invalid, the manner in which the votes from the affected ballots are to be accounted for and reported (analogous to the reporting of overvotes in plurality contests) must be decided.

Ranked order voting has had insufficient use in the United States to establish clear precedent on how these questions are to be answered; consequently, it would be premature to standardize any particular algorithm or set of algorithms, or attempt to accommodate every possible interpretation.

1.7.3 Ballot separation

See also Error! Reference source not found. and Requirement Error! Reference source not found.-A.
1.7.3-A CCOS, ballot separation

In response to designated conditions, CCOS SHALL (a) outstack the ballot (i.e., divert to a stack separate from the ballots that were normally processed), (b) stop the ballot reader and display a message prompting the election official to remove the ballot, or (c) mark the ballot with an identifying mark to facilitate its later identification.

Applies to: CCOS
Test Reference: Error! Reference source not found. “Error! Reference source not found.”
Source: [VSS2002] I.3.2.5.1.2

1.7.3-A.1 CCOS, unreadable ballots

All CCOS SHALL perform this action in response to an unreadable ballot.

Test Reference: Error! Reference source not found. “Error! Reference source not found.”
Source: [VSS2002] I.3.2.5.1.2

1.7.3-A.2 CCOS, write-ins

CCOS of the Review-required ballots device class SHALL be able to perform this action in response to a ballot containing write-in votes.

Applies to: CCOS ∧ Review-required ballots device
Test Reference: Error! Reference source not found. “Error! Reference source not found.”

DISCUSSION

The requirement to separate ballots containing write-in votes is not applicable in systems in which an EBM encodes write-in votes in machine-readable form and an optical scanner generates individual tallies for all written-in candidates automatically. Separation of ballots containing write-in votes is only necessary in systems that require the allocation of write-in votes to specific candidates to be performed manually. Such systems do not conform to the Write-ins class. See Error! Reference source not found. “Error! Reference source not found.”.

Source: [VSS2002] I.3.2.5.1.2

1.7.3-A.3 CCOS, overvotes, undervotes, blank ballots

CCOS SHALL provide a capability that can be activated by central election officials to perform this action in response to ballots containing overvotes, blank ballots, and ballots containing undervotes in a designated contest.

Test Reference: Error! Reference source not found. “Error! Reference source not found.”
Source: [VSS2002] I.3.2.5.1.2
1.7 Counting

### 1.7.3-B PCOS, write-ins

**PCOS** of the **Review-required ballots device** class **SHELL** have the capability, when presented with a ballot containing a **write-in** vote, to segregate the ballot or mark the ballot with an identifying mark to facilitate its later identification.

**Applies to:** PCOS ⋀ Review-required ballots device

**Test Reference:** *Error! Reference source not found. “Error! Reference source not found.”*

**DISCUSSION**

The requirement to separate ballots containing **write-in** votes is not applicable in systems in which an **EBM** encodes **write-in** votes in machine-readable form and an **optical scanner** generates individual tallies for all written-in candidates automatically. Separation of ballots containing **write-in** votes is only necessary in systems that require the allocation of **write-in** votes to specific candidates to be performed manually. Such systems do not conform to the **Write-ins** class. See *Error! Reference source not found. “Error! Reference source not found.”*. 

**Source:** 

[**VSS2002**] I.3.2.5.1.3.b

### 1.7.3-C React to marginal marks and overvotes on EBM-marked ballots

**PCOS** **SHOULD** provide a capability to alert an **election official** when an electronically-marked ballot that is scanned appears to contain **marginal marks** or overvotes.

**Applies to:** PCOS

**Test Reference:** *Error! Reference source not found. “Error! Reference source not found.”*

**DISCUSSION**

If a ballot that was marked by an **EBM** appears to contain **marginal marks** or overvotes, either the **EBM** is broken or the scanner is broken. Either way, an **election official** should be notified immediately. However, if the scanner is used for a mixture of electronically-marked and manually-marked ballots and cannot distinguish the two, then this functionality is not applicable.

**Source:** New requirement

### 1.7.4 Misfed ballots

#### 1.7.4-A Optical scanner, ability to clear misfeed

If multiple feed or misfeed (jamming) occurs, an **optical scanner** **SHELL** halt in a manner that permits the operator to remove the ballot(s) causing the error and reinsert them in the input hopper (if unread) or insert them in the ballot box (if read).
1.7 Counting

Applies to: Optical scanner


DISCUSSION
See also Requirement part1:7.7.4-B and Part 1 Section 7.7.7.

Source: [VSS2002] I.3.2.5.1.4.a, expanded to include jamming and ballots that were read

→ 1.7.4-B Optical scanner, indicate status of misfed ballot

If multiple feed or misfeed (jamming) occurs, an optical scanner SHALL clearly indicate whether or not the ballot(s) causing the error have been read.

Applies to: Optical scanner


DISCUSSION
A similar issue arises with DREs that hang just as the voter presses the "cast ballot" button. See Requirement Error! Reference source not found. -F. See also Requirement Part 1:1.7.4-A and Part 1:1.7.7 “Procedures required for correct system functioning.”

Source: [MISS05] 14.2.5.3 (page 46)

1.7.5 Accuracy

Requirement Error! Reference source not found. -B applies to all voting systems and need not be repeated here. The following requirements elaborate the general requirement with respect to issues that are unique to paper-based systems.

→ 1.7.5-A Optical scanner, ignore unmarked voting targets

Optical scanners SHALL ignore (i.e., not record as votes) unmarked voting targets to the satisfaction of Requirement Error! Reference source not found. -B.

Applies to: Optical scanner

Test Reference: Part 3:5.3.4

DISCUSSION
"Unmarked" in this requirement means containing no marks of any kind other than those designed to be present as part of the ballot style. This includes extraneous perforations, smudges, folds, and blemishes in the ballot stock. See Requirement Part 1:1.7.5-D, Requirement Part 1:1.7.5-E and Requirement Part 1:1.7.5-F.
1.7 Counting

Source: [VSS2002] I.3.2.5.2, “Recognize vote punches or marks, or the absence thereof”

→ 1.7.5-B Optical scanner, accurately detect perfect marks

**Optical scanners** **SHALL** detect marks that conform to manufacturer specifications to the satisfaction of Requirement **Error! Reference source not found.-B**.

Applies to: Optical scanner
Test Reference: Part 3.5.3.4
Source: [VSS2002] I.3.2.5.2.a and I.3.2.6.1.1

→ 1.7.5-C Optical scanner, accurately detect imperfect marks

**Optical scanners** **SHALL** detect a 1 mm thick line that is made with a #2 pencil that crosses the entirety of the voting target on its long axis, that is centered on the voting target, and that is as dark as can practically be made with a #2 pencil, to the satisfaction of Requirement **Error! Reference source not found.-B**.

Applies to: Optical scanner
Test Reference: Part 3.5.3.4

**DISCUSSION**

Different optical scanning technologies will register imperfect marks in different ways. Variables include the size, shape, orientation, and darkness of the mark; the location of the mark within the voting target; the wavelength of light used by the scanner; the size and shape of the scanner's aperture; the color of the ink; the sensed background-white and maximum-dark levels; and of course the calibration of the scanner. The mark specified in this requirement is intended to be less than 100 % perfect, but reliably detectable, i.e., not so marginal as to bring the uncontrolled variables to the forefront. In plain language: scanning technologies may vary, but as a minimum requirement, all of them should be capable of reliably reading this mark.

Source: Many issues and public comments. Specification of mark originated with recommendation in Issue #1322, changed to reduce ambiguity.

→ 1.7.5-D Optical scanner, ignore extraneous outside voting targets

**Optical scanners** **SHALL NOT** record as votes any marks, perforations, smudges, or folds appearing outside the boundaries of voting targets.

Applies to: Optical scanner
Test Reference: **Error! Reference source not found. “Error! Reference source not found.”**
DISCUSSION

In previous iterations of these VVSG it was unclear whether "extraneous perforations, smudges, and folds" included perforations, smudges and folds appearing within voting targets. Those appearing within voting targets are now discussed in Requirement Part 1:1.7.5-E and Requirement Part 1:1.7.5-F. Those other requirements are "SHOULD" not "SHALL"—technology in wide use as of 2006 cannot reliably distinguish extraneous marks within voting targets from deliberate marks.

Marks that conflict with timing marks may cause a tabulator to reject a ballot. This is conforming behavior, as it does not result in the recording of bogus votes.

Source: Clarified from [VSS2002] I.3.2.5.2.b

→ 1.7.5-E Optical scanner, ignore extraneous inside voting targets

Optical scanners SHOULD NOT record as votes imperfections in the ballot stock and similar insignificant marks appearing inside voting targets.

Applies to: Optical scanner

Test Reference: Error! Reference source not found. "Error! Reference source not found."

DISCUSSION

With technology that is in wide use as of 2006, insignificant marks appearing inside voting targets can be detected as votes. This problem should be minimized.

Source: Clarified from [VSS2002] I.3.2.5.2.b

→ 1.7.5-F Optical scanner, ignore hesitation marks

Optical scanners SHOULD NOT record as votes hesitation marks and similar insignificant marks.

Applies to: Optical scanner

Test Reference: Error! Reference source not found. "Error! Reference source not found."

DISCUSSION

With technology that is in wide use as of 2006, it may be possible to reliably detect reasonable marks and reliably ignore hesitation marks if the scanner is calibrated to a specific marking utensil. Unfortunately, in practice, optical scanners are required to tolerate the variations caused by the use of unapproved marking utensils. Thus, lighter marks of a significant size are detected at the cost of possibly detecting especially dark hesitation marks. Emerging technologies for context-sensitive ballot scanning may solve this problem. It is also solvable through procedures that ensure that all voters use only the approved marking utensil.

Source: Clarified from [VSS2002] I.3.2.5.2.b
1.7.5.1 Marginal marks

A **marginal mark** is a mark within a voting target that does not conform to manufacturer specifications for a reliably detectable vote. The word “marginal” refers to the limit of what is detectable by an **optical scanner**, not the margin of the page. Marks that are outside of voting targets are called extraneous marks.

A **marginal mark** is neither clearly countable as a vote nor clearly countable as a non-vote. It is an ambiguous vote, analogous to dimpled chad on a punchcard.

The voter should always be instructed to make an ideal mark, which in a typical optical scan system means completely filling the oval with a #2 pencil. To allow for variations in the marks that diligent voters actually make when trying to follow this instruction, the accidental use of non-approved marking utensils, *et cetera*, **optical scanners** are configured to accept a relatively wide range of marks as votes (Requirement **Part 1:1.7.5-C**). **Marginal marks** are below this range. They happen when voters do not follow instructions or the instructions are inadequate.

Although the criteria are not necessarily simple, manufacturers are required to specify what constitutes a reliably detectable mark versus a marginal mark (Requirement **Error! Reference source not found.-A.2**). If this cannot be accomplished, then the voting system is counting votes using a mystery algorithm. Such a system cannot be found compliant.

A ballot that was marked with an **EBM** should never contain **marginal marks**. If it does, an equipment malfunction has occurred, and it should be handled as such (Requirement **Part 1:1.7.3-C**).

In the case of precinct counting of **manually-marked paper ballots**, the precinct count scanner should be configured to reject ballots containing **marginal marks** (Requirement **Error! Reference source not found.-E**). For example, a hypothetical **optical scanner** that detected marks based only on overall darkness could be configured so that a mark that was more than (30 ± 2) % dark would count as a vote, a mark that was less than (10 ± 2) % dark would count as a non-vote, and anything in between would be rejected as marginal. (These numbers are just examples to clarify the general intent, and are not necessarily fit for use in an any given election.)

The uncertainty at both ends of the marginal zone is of no consequence. A mark that was exactly 30 % dark would either be accepted as a vote or rejected as marginal and returned to the voter for clarification. Either way, it would not be mistaken for a non-vote. Similarly, a mark that was exactly 10 % dark would either be accepted as a non-vote or rejected as marginal and returned to the voter for clarification. Either way, it would not be mistaken for a vote. (Detectable marks in the lower range are typically **hesitation marks**, accidental smudges, or damage to the paper.)

In the central count case, rejection of **marginal marks** is helpful only if someone is going to examine each affected ballot and judge the intent of the voter. If this is not going to occur, then it is preferable to disable the detection of **marginal marks** so that every mark is counted either as a vote or as a non-vote. Unfortunately, it is not technically possible to do this without creating the potential for irreproducible
tabulation results. For example, if a hypothetical optical scanner that detected marks based only on overall darkness were calibrated to distinguish votes from non-votes using a threshold of \((25 \pm 2)\)\% darkness, the detection of marks that were between 23 \% and 27 \% dark would not reproduce on a different scanner of the same kind. Moreover, the detection of marks that happened to fall very close to the actual detection threshold of the scanner as calibrated would not repeat on the same scanner. As the darkness of a mark (or whatever the scanner is measuring) approaches the detection threshold, the signal-to-noise ratio approaches zero. At some point, the noise determines the result that is tabulated.

Short of banning the use of manually-marked paper ballots, which would create a crisis for absentee voting, the best that can be done for this central count case is to prohibit bias in the detection of marginal marks (Requirement Part 1:1.7.5.1-A) and advise that the detection of marginal marks be made as repeatable as possible (Requirement Part 1:1.7.5.1-B).

### 1.7.5.1-A Optical scanner, marginal marks, no bias

The detection of marginal marks from manually-marked paper ballots SHALL NOT show a bias.

**Applies to:** Optical scanner

**Test Reference:** Error! Reference source not found. “Error! Reference source not found.”

**DISCUSSION**

Bias errors are not permissible in any system ([VSS1990] 7.3.3.3). An example of bias would be if marginal marks in the first ballot position were detected differently than marginal marks in the second ballot position.

**Source:** New requirement

### 1.7.5.1-B Optical scanner, marginal marks, repeatability

The detection of marginal marks from manually-marked paper ballots SHOULD be repeatable.

**Applies to:** Optical scanner

**Test Reference:** Error! Reference source not found. “Error! Reference source not found.”

**DISCUSSION**

It is difficult to have confidence in the equipment if consecutive readings of the same ballots on the same equipment yield dramatically different results. However, it is technically impossible to achieve repeatable reading of ballots containing marks that fall precisely on the sensing threshold. See Part 1:1.7.5.1 “Marginal marks”.

**Source:** New requirement
1.7.6 Consolidation

1.7.6-A Precinct reporting device consolidation

Precinct reporting devices SHALL consolidate the data contained in each unit into a single report for the polling place when more than one vote-capture device or PCOS is used.

Applies to: Precinct reporting device

Test Reference: Error! Reference source not found. “Error! Reference source not found.”

Discussion
For requirements on report content see Part 1.1.8 “Reporting”.

Source: Reworded from [VSS2002] I.2.5.3.2

1.7.6-A.1 Consolidate in 5 minutes

If the consolidation of polling place data is done locally, the precinct reporting device SHALL perform this consolidation in a time not to exceed 5 minutes per DRE or PCOS.

Test Reference: Error! Reference source not found. “Error! Reference source not found.”

Source: Reworded from [VSS2002] I.3.2.6.2.1

1.7.7 Procedures required for correct system functioning

The requirements for voting systems are written assuming that these procedures will be followed.

Optical scanner, clearing misfeeds when ballot was read: If it is necessary to clear a misfed ballot that was read by an optical scanner but became stuck on its way to the ballot box, election judges or central election officials must perform this task in the presence of a witness. If an audit found that the contents of the ballot box and the records from the tabulator did not match, one would want to be able to rule out the possibility that something made its way into the ballot box while the tabulator was disconnected.
1.8 Reporting

1.8.1 General reporting functionality

→ **1.8.1-A Reports are time stamped**

All reports **shall** include the date and time of the report’s generation, including hours, minutes, and seconds.

Applies to: Voting system

Test Reference: *Error! Reference source not found. “Error! Reference source not found.”*

**Discussion**

Even if the clock’s accuracy leaves something to be desired, second precision is useful to have if two reports are generated in quick succession.

Source: New requirement

→ **1.8.1-B Timestamps should be ISO 8601 compliant**

Timestamps in reports **should** comply with ISO 8601 [ISO04], providing all four digits of the year and including the time zone.

Applies to: Voting system

Test Reference: *Error! Reference source not found. “Error! Reference source not found.”*

Source: New requirement

→ **1.8.1-C Reporting is non-destructive**

All programmed devices **shall** prevent data, including data in transportable memory, from being altered or destroyed by report generation.

Applies to: Programmed device

Test Reference: *Error! Reference source not found. “Error! Reference source not found.”*

**Discussion**

The appending of an audit record reflecting the fact that a report has been generated is not considered an alteration.

Source: From [VSS2002] I.2.2.6.h, I.2.5.3.1.g, and I.2.5.3.2.d
1.8 Reporting

1.8.2 Audit, status, and readiness reports

→ 1.8.2-A Audit reports

All systems **SHALL** be capable of producing reports of the event logs defined in Part 1 Section 5.7.

**Applies to:** Voting system

**Test Reference:** Error! Reference source not found. “Error! Reference source not found.”

**Source:** [VSS2002] I.2.2.6.i and I.2.5.3.1.f

→ 1.8.2-B Pre-election reports

The **election definition device** **SHALL** provide the capability to obtain a report that includes:

- a. The allowable number of votes in each contest;
- b. The counting logic (e.g., N-of-M, cumulative, or ranked order) that is used for each contest;
- c. The inclusion or exclusion of contests as the result of split precincts;
- d. Any other characteristics that may be peculiar to the jurisdiction, the election or the precincts;
- e. Manual data maintained by election personnel;
- f. Samples of all final ballot styles; and
- g. Ballot preparation edit listings.

**Applies to:** Election definition device

**Test Reference:** Error! Reference source not found. “Error! Reference source not found.”

**DISCUSSION**

For the logging of auditable events during election programming see Error! Reference source not found. “Error! Reference source not found.”.

**Source:** [VSS2002] I.4.4.1 / [VVSG2005] I.5.4.1

→ 1.8.2-C Status reports

All **programmed devices** **SHALL** provide the capabilities to obtain status and equipment readiness reports.

**Applies to:** Programmed device

**Test Reference:** Error! Reference source not found. “Error! Reference source not found.”

**DISCUSSION**

These reports typically are generated during pre-voting logic and accuracy testing; see Part 1:1.3.1 “Logic and accuracy testing”.

**Source:** Reworded from [VSS2002] I.2.3.4.1.b
1.8 Reporting

1.8.2-D Readiness reports, per polling place

Readiness reports **shall** include at least the following information for each polling place:

- a. The election’s identification data;
- b. The identification of the precinct and polling place;
- c. The identification of all voting devices deployed in the precinct;
- d. The identification of all ballot styles used in that precinct;
- e. Confirmation that no hardware or software failures were detected during setup and testing, or a record of those that occurred; and
- f. Confirmation that all _vote-capture devices_ are ready for the opening of polls, or identification of those that are not.

*Applies to:* In-person voting

*Test Reference:* _Error! Reference source not found. “Error! Reference source not found.”_

**Discussion**

In jurisdictions where there are no _programmed devices_ in the precincts, confirmation of equipment readiness could occur through a manual check and signoff by election judges. These readiness reports could take the form of checklists, fill-in forms and signature sheets supplied to the precincts by a central authority.

*Source:* [VSS2002] I.2.3.5, separated generic precinct vs. precinct tabulator reqs, modified to deal with failures

1.8.2-E Readiness reports, precinct tabulators

Readiness reports **shall** include the following information for each PCOS, DRE, and precinct reporting device:

- a. The election’s identification data;
- b. The identification of the precinct and polling place;
- c. The identification of the tabulator;
- d. The contents of each active _contest choice_ register at all storage locations;
- e. Confirmation that no hardware or software failures were detected during setup and testing, or a record of those that occurred; and
- f. Any other information needed to confirm the readiness of the equipment and to accommodate administrative reporting requirements.

*Applies to:* PCOS, DRE+VVPAT, Precinct reporting device

*Test Reference:* _Error! Reference source not found. “Error! Reference source not found.”_

*Source:* [VSS2002] I.2.3.5, separated generic precinct vs. precinct tabulator reqs, harmonized with Requirement Part 1:1.8.2-F, modified to deal with failures, deleted “special voting options”

1.8.2-F Readiness reports, central tabulators

Readiness reports **shall** include the following information for each CCOS and central reporting device:
1.8 Reporting

- The election’s identification data;
- The identification of the tabulator;
- The identification of all ballot styles used in the system extent;
- The contents of each active contest choice register at all storage locations;
- Confirmation that no hardware or software failures were detected during setup and testing, or a record of those that occurred; and
- Any other information needed to confirm the readiness of the equipment and to accommodate administrative reporting requirements.

Applies to: CCOS, Central reporting device

Test Reference: Error! Reference source not found. “Error! Reference source not found.”

Source: [VSS2002] I.2.3.6, harmonized with Requirement Part 1:1.8.2-E, modified to deal with failures, deleted “special voting options”

1.8.2-G Readiness reports, public network test ballots

Systems that send ballots over a public network SHALL provide a report of test ballots that includes:
- The number of test ballots sent;
- When each test ballot was sent;
- The identity of the machine from which each test ballot was sent; and
- The specific votes contained in the test ballots.

Applies to: Voting system

Test Reference: Error! Reference source not found. “Error! Reference source not found.”

Source: [VSS2002] I.4.4.2.g / [VVSG2005] I.5.4.2.g

1.8.3 Vote data reports

The requirements in this section specify a minimum set of information that a voting system must report. They do not prohibit any voting system from reporting additional information that may be required by jurisdictions or merely found to be useful.

Similarly, the identification of four “standard” reporting contexts (tabulator, precinct, election district, and system extent) requires voting systems to support these at a minimum, but does not prohibit any voting system from supporting additional reporting contexts or from offering a generalized facility through which central election officials may define arbitrary reporting contexts.

1.8.3.1 General functionality

1.8.3.1-A Reporting, ability to produce text

All devices used to produce reports of the vote count SHALL be capable of producing:
- Alphanumeric headers;
1.8 Reporting

b. Election, office and issue text; and
c. Alphanumeric entries generated as part of the audit record.

Applies to: Voting system
Test Reference: *Error! Reference source not found. “Error! Reference source not found.”*
Source: *[VSS2002]* I.3.2.7.2 / *[VVSG2005]* I.4.1.7.2

1.8.3.1-B Report all votes cast

All systems **SHALL** be able to produce an accurate, human-readable report of all votes cast.

Applies to: Voting system
Test Reference: *Error! Reference source not found. “Error! Reference source not found.”*

**DISCUSSION**

Binary document formats and text containing markup tags are not considered human-readable. The system may generate such documents, but it must also provide the functionality to render those documents in human-readable form (e.g., by including the necessary reader application).

Source: *[VSS2002]* I.2.2.2.1.c as expanded by *[P1583]* 5.2.1.1.c

1.8.3.1-C Account for all cast ballots and all valid votes

All systems **SHALL** produce vote data reports that account for all cast ballots and all valid votes.

Applies to: Voting system

1.8.3.1-D Vote data reports, discrepancies can't happen

Vote data reports **SHALL** be completely consistent, with no discrepancy among reports of voting device data at any level.

Applies to: Voting system

Source: Reworded from *[VSS2002]* I.3.2.6.2.2, extended to all systems
1.8 Reporting

1.8.3.1-D.1 Discrepancies that happen anyway must be flagged

Any discrepancy that is detectable by the system SHALL be flagged by the system by an annotation or error message in the affected report(s) and/or a separate discrepancy report.


DISCUSSION

If this requirement is applicable, then the system has failed to satisfy Requirement part1:7.8.3.1-D and is therefore non-conforming. Nevertheless, in practice it is essential that discrepancies be flagged by the system as much as possible so that they are not overlooked by election judges. The system cannot detect discrepancies if no single voting device is ever in possession of a sufficient set of data.

Source: New requirement in response to Issue #1366

1.8.3.1-D.2 Discrepancies that happen anyway must be explainable

Any discrepancy in reports, regardless of source, SHALL be resolvable to a specific cause.


DISCUSSION

If this requirement is applicable, then the system has failed to satisfy Requirement Part 1:1.8.3.1-D and is therefore non-conforming. Nevertheless, in practice it is essential that a specific cause be determinable.

Source: Reworded and generalized from [VSS2002] I.3.2.6.2.2

1.8.3.1-E Reporting, combined precincts

All systems SHOULD be capable of generating reports that consolidate vote data from selected precincts.

Applies to: Voting system

Test Reference: Error! Reference source not found. “Error! Reference source not found.”

DISCUSSION

Jurisdictions in which more than one precinct may vote at the same location on either the same ballot style or a different ballot style may desire reports that consolidate the voting location.

Source: Derived from [ND06] 5.04.05.g, [UT04] Requirement 23 and [MISS05] 14.3.2.3
1.8 Reporting

1.8.3.1-F Precinct reporting devices / DREs, no tallies before close of polls

Precinct reporting devices and DREs **SHALL** prevent the printing of vote data reports and the extraction of vote tally data prior to the close of polls.

**Applies to:** Precinct reporting device, DRE+VVPAT

**Test Reference:** Error! Reference source not found. “Error! Reference source not found.”

**DISCUSSION**

Providing ballot counts does not violate this requirement. The prohibition is against providing vote totals. Ballot counts are required for ballot accounting, but early extraction of vote totals is an enabler of election fraud.

**Source:** Revised from [VSS2002] I.2.5.3.2

1.8.3.2 Ballot counts

Source for Requirement **Part 1:1.8.3-A** through Requirement **Part 1:1.8.3.3-I:** These requirements were distilled, refactored, and clarified from overlapping, subtly differing requirements appearing several places in Chapters 2 and 4 of [VSS2002], including: I.2.2.2.1.c (produce an accurate report of all votes cast), I.2.2.6.h (printed report of everything in I.2.5), I.2.2.9 (ballot counter), I.2.5.2 (means to consolidate vote data), I.2.5.3.1.a (geographic reporting), I.2.5.3.1.b (printed report of number of ballots counted by each tabulator), I.2.5.3.1.c (contest results, overvotes, and undervotes for each tabulator), I.2.5.3.1.d (consolidated reports including other data sources), I.4.4.4.a (number of ballots cast, using each ballot configuration, by tabulator, precinct, and political subdivision), I.4.4.4.b (candidate and measure totals for each contest, by tabulator), I.4.4.4.c (number of ballots read within each precinct and for additional jurisdictional levels, by configuration, including separate totals for each party in primary elections), I.4.4.4.d (separate accumulation of overvotes and undervotes for each contest, by tabulator, precinct, and additional jurisdictional levels), and I.4.4.4.e (for paper-based systems, the total number of ballots both processed and unprocessable, and the total number of cards read).

**DWF 2012-09-18:** Question whether ballot count breakdowns for absentee ballots and other categories are a required line item in all reporting contexts. Taken together, 2002 VSS I.2.5.2 / VVSG 1.0 I.2.4.2 plus 2002 VSS I.2.5.3.1.d / VVSG 1.0 I.2.4.3.d say that the optional support for absentee and other “ballot sources” would incur a requirement to report broken-out ballot counts for them, analogous to the requirements below to provide counts for provisional ballots. However, it has previously been considered an acceptable approach, particularly in blended systems, to assign all absentee ballots to a synthetic precinct (absentee precinct), in which case there’s no special line item for them in every other reporting context. One option is to say the requirement should be only at the district and/or system extent levels. Another option is to say that all future systems should fully support ballot categorization so that synthetic precincts are not needed.
1.8 Reporting

1.8.3.2-A Report cast ballots

All voting systems SHALL report the number of cast ballots in the precinct, election district, and system extent reporting contexts, both in total and broken down by ballot configuration.

Applies to: Voting system

Test Reference: Error! Reference source not found. “Error! Reference source not found.”

DISCUSSION

In the case of 100% DRE systems, it would suffice to provide a single total that is noted to represent both the number of cast ballots and the number of read ballots, since these are necessarily equal. Only when there is a tangible (i.e., paper) ballot is it possible to cast a ballot that is never read. There is no subrequirement for separate reporting of provisional cast ballots because the system is unlikely to know whether a ballot is provisional until it is successfully read.

1.8.3.2-B Report read ballots

All systems SHALL report the number of read ballots in each reporting context (tabulator, precinct, election district, and system extent), both in total and broken down by ballot configuration.

Applies to: Voting system


1.8.3.2-B.1 Report read ballots, multi-page

Systems that include optical scanners SHALL, if there are multiple card/page ballots, report the number of cards/pages read in each reporting context (tabulator, precinct, election district, and system extent), both in total and broken down by ballot configuration.

Test Reference: Error! Reference source not found. “Error! Reference source not found.”

1.8.3.2-B.2 Report read ballots by party

Systems conforming to the Primary elections class SHALL report separate totals for each party in primary elections.

Applies to: Primary elections

Test Reference: Error! Reference source not found. “Error! Reference source not found.”

DISCUSSION

This requirement to report by party applies only to the number of read ballots. It does not apply to contest choice vote totals.
1.8 Reporting

1.8.3.2-B.3 Report read provisional ballots

Systems conforming to the Provisional / challenged ballots class SHALL report the number of provisional / challenged read ballots in each reporting context (tabulator, precinct, election district, and system extent), both in total and broken down by ballot configuration.

Applies to: Provisional / challenged ballots

Test Reference: Error! Reference source not found. “Error! Reference source not found.”

1.8.3.2-C Report counted ballots

All systems SHALL report the number of counted ballots in each reporting context (tabulator, precinct, election district, and system extent), both in total and broken down by ballot configuration.

Applies to: Voting system


DISCUSSION

See also Requirement Part 1:1.8.3.2-D, which breaks down counted ballots by contest.

1.8.3.2-C.1 Report counted ballots by party

Systems conforming to the Primary elections class SHALL report separate ballot counts for each party in primary elections.

Applies to: Primary elections

Test Reference: Error! Reference source not found. “Error! Reference source not found.”

DISCUSSION

This requirement to report by party applies only to the number of counted ballots. It does not apply to contest choice vote totals.

1.8.3.2-C.2 Report counted provisional ballots

Systems conforming to the Provisional / challenged ballots class SHALL report the number of provisional / challenged counted ballots in each reporting context (tabulator, precinct, election district, and system extent), both in total and broken down by ballot configuration.

Applies to: Provisional / challenged ballots

Test Reference: Error! Reference source not found. “Error! Reference source not found.”
### 1.8.3.2-C.3 Report blank ballots

All systems **SHOULD** report the number of blank ballots (ballots containing no votes) that were counted in each reporting context (tabulator, precinct, election district, and system extent), both in total and broken down by ballot configuration.

*Test Reference:* Error! Reference source not found. “Error! Reference source not found.”

**Discussion**

Some jurisdictions find this information to be useful. Blank ballots sometimes represent a protest vote.

### 1.8.3.2-D Report counted ballots by contest

All systems **SHALL** report the number of counted ballots for each relevant N-of-M or cumulative voting contest, in each reporting context (tabulator, precinct, election district, and system extent), per the definition of \( K(j, r, t) \) in Error! Reference source not found.  

*Test Reference:* Error! Reference source not found. “Error! Reference source not found.”

**Discussion**

See definition of **relevant contest** in Appendix A.

This is by **contest**, while Requirement Part 1:1.8.3.2-C is the overall count. The count by **contest** could be inferred from the other counts that are broken down by ballot configuration, but providing this figure explicitly will make it easier to account for every vote per Error! Reference source not found. “Error! Reference source not found.”.

**N-of-M** in this requirement includes the most common type of **contest**, 1-of-M.

### 1.8.3.3 Vote totals

For the source of these requirements, please see the note in Part 1:1.8.3.2 Ballot counts.

#### 1.8.3.3-A Report votes for each contest choice

All systems **SHALL** report the vote totals for each contest choice in each relevant N-of-M or cumulative voting contest, in each reporting context (tabulator, precinct, election district, and system extent), per the definition of \( T(c, j, r, t) \) in Error! Reference source not found. and Error! Reference source not found. “Error! Reference source not found.”.

*Applies to:* Voting system
1.8 Reporting


DISCUSSION
See definition of relevant contest in Appendix A.

N-of-M in this requirement includes the most common type of contest, 1-of-M.

1.8.3.3-B Report overvotes for each contest

All systems SHALL report the number of overvotes for each relevant N-of-M or cumulative voting contest, in each reporting context (tabulator, precinct, election district, and system extent), per the definition of O(j,r,te) in Error! Reference source not found. and Error! Reference source not found. “Error! Reference source not found.”.

Applies to: Voting system


DISCUSSION
See definition of relevant contest in Appendix A.

N-of-M in this requirement includes the most common type of contest, 1-of-M.

[VSS2002] required the reporting of overvotes even on 100 % DRE systems where overvoting is prevented (Requirement Error! Reference source not found. -A); that requirement is retained here, though it may be redundant.

Overvotes are defined in Error! Reference source not found. “Error! Reference source not found.”. Consistent with the definition of undervotes (see Requirement Part 1:1.8.3.3-C), the count is of votes lost to overvoting, not of ballots containing overvotes. This means that a ballot that overvotes an N-of-M contest would contribute N to the count of overvotes for that contest.

1.8.3.3-B.1 Reporting overvotes, ad hoc queries

All systems SHALL be capable of producing a consolidated report of the combination of overvotes for any contest that is selected by an authorized official (e.g., the number of overvotes in a given contest combining candidate A and candidate B, combining candidate A and candidate C, etc.).

Test Reference: Error! Reference source not found. “Error! Reference source not found.”

Source: From [VSS2002] I.2.2.6.h and I.2.5.3.1.e
1.8 Reporting

1.8.3.3-C Report undervotes for each contest

All systems SHALL report the number of undervotes for each relevant N-of-M or cumulative voting contest, in each reporting context (tabulator, precinct, election district, and system extent), per the definition of \( U(j,r,t) \) in Error! Reference source not found. "Error! Reference source not found."

Applies to: Voting system

Test Reference: Error! Reference source not found. "Error! Reference source not found."

DISCUSSION
See definition of relevant contest in Appendix A.

N-of-M in this requirement includes the most common type of contest, 1-of-M.

Undervotes are defined in Error! Reference source not found. "Error! Reference source not found." as needed to enable accounting for every vote. Counting ballots containing undervotes instead of votes lost to undervoting is insufficient.

1.8.3.3-D Ranked order voting, report results

Systems conforming to the Ranked order voting class SHALL report the contest choice vote totals for each ranked order contest for each round of tabulation at the system extent level.

Applies to: Ranked order voting

Test Reference: Error! Reference source not found. "Error! Reference source not found."

DISCUSSION
This requirement is minimal. Since ranked order voting is not currently in wide use, it is not clear what must be reported, how bogus orderings are reported, or how it would be done in multiple reporting contexts. See Part 1:1.7.2.5 “Logic for ranked order voting”.

1.8.3.3-E Include in-person votes

Systems conforming to the In-person voting class SHALL include all votes collected from in-person voting in the consolidated reports.

Applies to: In-person voting

Test Reference: Error! Reference source not found. "Error! Reference source not found."

DISCUSSION
"Include" simply means that the final totals must reflect them. It does not entail separate totals for the different kinds of votes.
1.8.3.3-F Include absentee votes

Systems conforming to the Absentee voting class SHALL include all votes from absentee ballots in the consolidated reports.

Appplies to: Absentee voting


**DISCUSSION**

"Include" simply means that the final totals must reflect them. It does not entail separate totals for the different kinds of votes.

1.8.3.3-G Include write-in votes

Systems conforming to the Write-ins class SHALL include all write-in votes in the consolidated reports.

Appplies to: Write-ins


**DISCUSSION**

"Include" simply means that the final totals must reflect them. It does not entail separate totals for the different kinds of votes.

1.8.3.3-H Include accepted provisional / challenged votes

Systems conforming to the Provisional / challenged ballots class SHALL include all votes from accepted provisional / challenged ballots in the consolidated reports.

Appplies to: Provisional / challenged ballots


**DISCUSSION**

"Include" simply means that the final totals must reflect them. It does not entail separate totals for the different kinds of votes. See also Requirement Part 1:1.7.2-A.4, Requirement Part 1:1.8.3.2-B.3 and Requirement Part 1:1.8.3.2-C.2.

1.8.3.3-I Include accepted reviewed votes

Systems conforming to the Review-required ballots class SHALL include all votes from accepted reviewed ballots in the consolidated reports.

Appplies to: Review-required ballots
1.8 Reporting


DISCUSSION
"Include" simply means that the final totals must reflect them. It does not entail separate totals for the different kinds of votes.

1.8.4 Procedures required for correct system functioning

The requirements for voting systems are written assuming that these procedures will be followed.

Ballot accounting: All precincts must account for all ballots pursuant to the current best practices for ballot accounting.

Label unofficial reports: Any unofficial reports must be clearly labeled as unofficial. ([VSS2002] I.2.5.4.c, converted to procedural requirement.)
Chapter 2: Reference Models

2.1 Process Model (informative)

DWF, 2012-01-05: This model was developed because there was a plan to organize VVSG 2.0 according to the elections process, and in response to TGDC Resolution #33-05. It was not used for the planned purpose and is not referenced in the normative text, but in the public review it became apparent that it would draw attention and need a lot of maintenance. It is advisable, therefore, that Section 8.1 be deleted in its entirety. If there is an unrelated need for a voting process model, it could be spun off into a separate project and possibly transferred to another standards-developing organization.

2.1.1 Introduction

This section contains 16 diagrams describing the elections and voting process. The diagrams are expressed in Unified Modeling Language (UML) version 2.1.1 [OMG07].

A brief and incomplete guide to the notation is provided in Part 1: Table 2-1. It is not possible to explain accurate and full semantics for UML without extensive discussion which would be inappropriate here. For a complete and formal introduction, please see [OMG07].

Table 2-1 Guide to UML Activity Diagram notation

<table>
<thead>
<tr>
<th>SHAPE</th>
<th>MEANING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capsule</td>
<td>Action</td>
</tr>
<tr>
<td>Rectangle</td>
<td>Object</td>
</tr>
<tr>
<td>Arrow</td>
<td>Control or object flow</td>
</tr>
<tr>
<td>Bar</td>
<td>Fork/join</td>
</tr>
<tr>
<td>Diamond</td>
<td>Decision/merge</td>
</tr>
<tr>
<td>Dog-eared rectangle</td>
<td>Note</td>
</tr>
</tbody>
</table>

To simplify the diagrams, the following shortcuts have been taken:

- The expansion regions around actions that are performed for every precinct or every voter are not shown.
- When a particular object may or may not exist depending on system and jurisdiction-specific factors (e.g., paper-based vs. DRE), that
object is modeled as an optional parameter to an action. This does not capture the constraint that subsequent actions must wait on this object in those jurisdictions where it applies (i.e., in some jurisdictions it is mandatory).

- Objects that flow downstream in an obvious manner through many actions are not shown as inputs/outputs of all of those actions.

- The propagation of the registration database from one election cycle to the next is not shown. The database appears as an input to the Register voters activity with no indication of its origin.

- Many actions produce reports and other objects that eventually flow into the Archive action. These flows into the archive are not shown.
2.1.2 Diagrams

Figure 2-1  Administer elections
2.1 Process Model (informative)

This action refers to configuring the voting system to realize the precincts as defined by state law.

Figure 2-2 Prepare for election
Present credentials
Check identity of voter
Check voter eligibility
Update poll book
Issue ballot or provisional ballot
Provide private voting station

Mark ballot
[blank]

Review ballot

[else]

Vote [Fled voter]

Present / submit ballot

[else]

Spoil ballot

[Not OK]

[OK]

This activity occurs once per voter.

Ballot [completed]

Validate ballot

[Not OK]

[OK]

Accept ballot

Ballot [accepted]

Figure 2-3 Gather in-person vote (paper-based)
This activity occurs once per voter.

Voter

Present credentials

Mark ballot

[else]

Correct ballot

[Not OK]

Review ballot

[OK]

Cast ballot

Ballot image

Poll worker / Election judge

Voter lists

Check identity of voter

Check voter eligibility

Update poll book

Provide private voting station

[Fled voter]

Handle abandoned ballot

Figure 2-4  Gather in-person vote (DRE)
This activity occurs once per precinct. Absentee / remote ballots may be handled and processed as a separate precinct under this activity.

**Figure 2-5**  Wrap up voting (precinct)
Figure 2-6  Wrap up voting (central)
2.1 Process Model (informative)

**Register voters**
- Registration database [original]
  - Register new voters
  - Update voter information
  - Purge ineligible, inactive, or dead voters
- Registration database [updated]
  - Generate voter lists
  - Voter lists

**Wrap up election**
- Deactivate equipment
- Conduct post-mortem

**Top level**
- Administer elections
- Audit / observe elections
- Archive
  - All of the reports that are generated by various activities are archived.

**Deactivate equipment**
- Pack up equipment
  - Transport equipment
  - Put equipment in storage

**Conduct post-mortem**
- Analyze election results
  - Lessons learned
  - Refine needs and requirements
    - Make revisions / changes to existing hardware, software, processes, procedures, and testing

**Figure 2-7  Miscellaneous activities (1)**
2.1 Process Model (informative)

Audit / observe elections

- Involve independent observers
- Conduct official audits
- Conduct personnel checks
- Conduct equipment checks
- Conduct procedural checks

Prepare ballots

- Election definition
  - Produce ballots is analogous
  - Define regular ballots
  - Define provisional ballots
  - Define absentee / remote ballots
  - Ballot styles

Prepare for voting (precinct)

- Equipment
  - Set up polling place
  - Set up precinct equipment (precinct)
  - Configure & calibrate precinct equipment (precinct)
  - Test precinct equipment (precinct)
  - Open poll
  - Reports

Prepare for voting (central)

- Equipment
  - Set up central equipment (central)
  - Configure & calibrate central equipment (central)
  - Test central equipment (central)
  - Reports

Figure 2-8 Miscellaneous activities (2)
APPENDIX A: Glossary

Prepared at the Direction of the Technical Guidelines Development Committee

WORKING DRAFT
Appendix A: Glossary

This section of the VVSG defines words (terms) that are used in the other parts of the VVSG, particularly in requirements text.

**NOTE:** Readers may already be familiar with definitions for many of the words in this section, but the definitions here often may differ in small or big ways from locality usage because they are used in special ways in the VVSG.

Terminology for standardization purposes must be sufficiently precise and formal to avoid ambiguity in the interpretation and testing of the standard. Terms must be defined to mean exactly what is intended in the requirements of the standard, no more and no less. Consequently, this terminology may differ from common election and plain English usage, and may be unsuitable for applications that are beyond the scope of the VVSG. Readers are especially cautioned to avoid comparisons between this terminology and the terminology used in election law.

Any term that is defined neither in this terminology standard nor in any of the referenced documents has its regular (i.e., dictionary) meaning.

Each term is followed by a normative definition. Some terms are further explained with informative text following the indicator "Discussion."

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-of-M</td>
<td>N-of-M voting where N = 1.</td>
</tr>
<tr>
<td>absentee ballot</td>
<td>(1) Ballot provided to an absent voter. (2) Ballot resulting from absentee voting.</td>
</tr>
<tr>
<td>absentee voting</td>
<td>Voting that can occur unsupervised at a location chosen by the voter.</td>
</tr>
<tr>
<td>accessible voting station</td>
<td>Voting station equipped for individuals with disabilities referred to in 42 USC 15481 (a)(3)(B).</td>
</tr>
<tr>
<td>Acc-VS</td>
<td>Accessible voting station.</td>
</tr>
<tr>
<td>activation device</td>
<td>Programmed device that creates credentials necessary to initiate a voting session using a specific ballot configuration. Discussion: This covers a range of devices such as electronic pollbooks and card activators that encode a token with credential information necessary to determine the appropriate ballot configuration for the voter (e.g., affiliation or precinct). The credentials on the token are used to call up and display the correct ballot on a DRE or EBP.</td>
</tr>
<tr>
<td>active period</td>
<td>Span of time during which a vote-capture device either is ready to begin a voting session or is in use in a voting session. See Part 1 Section 8.2.</td>
</tr>
<tr>
<td>administrator</td>
<td>Role defined in Part 1 Section 5.4.</td>
</tr>
<tr>
<td>affiliation</td>
<td>Association with a political party. Discussion: Affiliation with a political party does not imply endorsement by that political party. See also, endorsement.</td>
</tr>
<tr>
<td>alert time</td>
<td>Amount of time that a voting device will wait for detectible voter activity after issuing</td>
</tr>
</tbody>
</table>
an alert before going into an inactive state requiring poll worker intervention.

**Application logic:** Software, firmware, or hardwired logic from any source that is specific to the voting system, with the exception of border logic.

Archival: (Media) Able to preserve content for a period of time without significant loss.

**Archivalness:** Ability of a medium to preserve its content for a period of time without significant loss. Discussion: In the context of voting, the relevant period of time is usually 22 months. See Part 1 Section 6.5.3.

**ATI:** Audio-tactile interface.

**Audio-tactile interface:** Electronic voter interface that does not require visual reading of a ballot.

**Audit:** Verification of statistical or exact agreement of records from different processes or subsystems of a voting system.

**Average Voter Confidence:** Mean confidence level expressed by voters that the system successfully recorded their votes. Discussion: This metric is used in the VPP, but not to pass or fail systems.

**Average Voting Session Time:** Mean time taken per voter to complete the process of activating, filling out, and casting the ballot. Discussion: This metric is used in the VPP, but not to pass or fail systems.

**Ballot:** (1) Collection of votes produced by one voter in one voting session (as in “ballot summary” or “rejected ballot record”). (2) Collection of all votes cast by one voter in one voting session (as in “cast ballot”). (3) Cast vote record (as in “evidence that the ballot was available for review by the voter”). (4) Ballot configuration (as in “ballot definition”). (5) Ballot style (as in “ballot design”). (6) Presentation of every contest included in a particular ballot style, possibly with votes (as in “For privacy, the ballot must be visible only to the voter”). (7) Collection of one or more pieces of paper that presents every contest included in a particular ballot style and, when cast, serves as a cast vote record. (8) Function of interacting with a voter to potentially create a ballot (as in “ballot activation”) or mark an existing ballot.

**Ballot Configuration:** Set of contests in which voters of a particular group (e.g., political party and/or election district) are entitled to vote.

**Ballot Image:** Electronically produced record of all votes cast by a single voter. Discussion: A ballot image might be an uninterpreted bitmap image, a transient logical representation of the votes, or an archival record (a cast vote record).

**Ballot-on-Demand Printer:** Programmed device that supports the creation of votable paper ballots on an as-needed basis. Discussion: Given the election definition, the selection of a particular ballot style, and blank ballot stock, a ballot-on-demand printer outputs an unvoted ballot of the selected ballot style. Unlike an ERP, which interacts with voters and outputs voted ballots, a ballot-on-demand printer would be used only by election officials.

**Ballot Question:** Contest in which the choices are Yes and No.

**Ballot Rotation:** Process of varying the order of the contest choices within a given contest.
### References

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ballot style:</strong></td>
<td>Concrete presentation of a particular ballot configuration. Discussion: A given ballot configuration may be realized by multiple ballot styles, which may differ in the language used, the ordering of contests and contest choices, etc.</td>
</tr>
<tr>
<td><strong>benchmark:</strong></td>
<td>Quantitative point of reference to which the measured performance of a system or device may be compared.</td>
</tr>
<tr>
<td><strong>border logic:</strong></td>
<td>Software, firmware, or wired logic that is developed to connect application logic to COTS or third-party logic. Discussion: Although it is typically developed by the voting system manufacturer, border logic is constrained by the requirements of the third-party or COTS interface with which it must interact. For this reason, border logic should be minimized relative to application logic and where possible, wrapped in a conforming interface. An example of border logic that could not be so wrapped is a customized boot manager that connects a bootable voting application to a COTS BIOS.</td>
</tr>
<tr>
<td><strong>callable unit:</strong></td>
<td>(Of a software program or analogous logical design) Function, method, operation, subroutine, procedure, or analogous structural unit that appears within a module.</td>
</tr>
<tr>
<td><strong>candidate:</strong></td>
<td>Person contending in a contest for office. Discussion: A candidate may be explicitly presented as one of the contest choices or may be a write-in candidate.</td>
</tr>
<tr>
<td><strong>cast ballot:</strong></td>
<td>Ballot in which the voter has taken final action in the selection of contest choices and irrevocably confirmed his or her intent to vote as selected. See also read ballot and counted ballot.</td>
</tr>
<tr>
<td><strong>cast vote record:</strong></td>
<td>Archival record of all votes produced by a single voter. Discussion: Cast vote records may be in electronic, paper, or other form. Electronic cast vote records are also called ballot images.</td>
</tr>
<tr>
<td><strong>CCOS:</strong></td>
<td>Central-count optical scanner.</td>
</tr>
<tr>
<td><strong>central-count optical scanner:</strong></td>
<td>Optical scanner used to count votes from multiple precincts at a central location. Discussion: Most machines in this class are special purpose machines that use reflected light to identify marks at specific locations on the ballot. They are designed to read stacks of ballots at a time.</td>
</tr>
<tr>
<td><strong>central election official:</strong></td>
<td>Role defined in Part 1 Section 5.4.</td>
</tr>
<tr>
<td><strong>central reporting device:</strong></td>
<td>Reporting device that consolidates and reports votes from multiple precincts at a central location.</td>
</tr>
<tr>
<td><strong>challenged ballot:</strong></td>
<td>Ballot cast by a voter whose eligibility to vote is disputed by someone who is not an election official. See also provisional ballot.</td>
</tr>
<tr>
<td><strong>choice:</strong></td>
<td>Contest choice.</td>
</tr>
<tr>
<td><strong>CIF:</strong></td>
<td>Common Industry Format.</td>
</tr>
<tr>
<td><strong>class:</strong></td>
<td>Identified set of voting systems or voting devices sharing a specified characteristic or characteristics. See Part 1 Section 2.5.</td>
</tr>
<tr>
<td><strong>closed primary:</strong></td>
<td>Primary election in which the voter receives a ballot containing only those party-specific contests pertaining to the political party with which the voter is affiliated, along with non-party-specific contests presented at the same election. Discussion:</td>
</tr>
</tbody>
</table>
References

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Usually, unaffiliated voters are permitted to vote only on non-party-specific contests.</td>
<td></td>
</tr>
<tr>
<td>combined precinct</td>
<td>Two or more precincts assigned the same polling place.</td>
</tr>
<tr>
<td>completed system response time</td>
<td>Amount of time from when the voter performs some detectible action to when the voting device completes its response and settles into a stable state (e.g., finishes &quot;painting&quot; the screen with a new page).</td>
</tr>
<tr>
<td>configuration data</td>
<td>Non-executable input to software, firmware, or hardwired logic, not including vote data.</td>
</tr>
<tr>
<td>conformity assessment</td>
<td>Demonstration that specified requirements relating to a product, process, system, person or body are fulfilled. ([ISO04a])</td>
</tr>
<tr>
<td>contest</td>
<td>(1) A single decision being put before the voters (e.g., the selection of candidates to fill a particular public office or the approval or disapproval of a constitutional amendment). Discussion: This term subsumes other terms such as &quot;race,&quot; &quot;question,&quot; and &quot;issue&quot; that are sometimes used to refer to specific kinds of contests. (2) Subdivision of a ballot pertaining to a single decision being put before the voters.</td>
</tr>
<tr>
<td>contest choice</td>
<td>That with which a vote in a given ballot position is associated (e.g., a candidate, or the value Yes or the value No).</td>
</tr>
<tr>
<td>core logic</td>
<td>Subset of application logic that is responsible for vote recording and tabulation.</td>
</tr>
<tr>
<td>COTS</td>
<td>Software, firmware, device or component that is used in the United States by many different people or organizations for many different applications and that is incorporated into the voting system with no manufacturer- or application-specific modification. Discussion: (1) The expansion of COTS as Commercial Off-The-Shelf is no longer helpful, since much of what satisfies the requirements is non-commercial software that is not available in stores. The acronym COTS is used here only because it is familiar to the audience. (2) By requiring &quot;many different applications,&quot; this definition deliberately prevents any application logic from receiving a COTS designation.</td>
</tr>
<tr>
<td>counted ballot</td>
<td>Read ballot whose votes are included in the vote totals. Discussion: A provisional or challenged ballot that is not accepted may be read, but it is not counted. See cast ballot, read ballot.</td>
</tr>
<tr>
<td>credential issuance</td>
<td>Determination of what ballot configuration is appropriate for a given voter and creation of the voting credentials necessary for ballot activation.</td>
</tr>
<tr>
<td>cross-party endorsement</td>
<td>Endorsement of a given contest choice by two or more political parties.</td>
</tr>
<tr>
<td>cumulative voting</td>
<td>Voting variation in which the voter is entitled to allocate a fixed number of votes (N) over a list of M contest choices or write-ins. Discussion: Unlike N-of-M voting, cumulative voting allows the voter to allocate more than one vote to a given contest choice. The voter is not obliged to allocate all N votes.</td>
</tr>
<tr>
<td>CVR</td>
<td>Cast vote record.</td>
</tr>
</tbody>
</table>
device: Physical contrivance and any supporting supplies, materials, and logic that together form a functional unit that performs assigned tasks as an integrated whole.

DRE: (Orig. Direct Record Electronic or Direct Recording Electronic) Combination Acc-VS and tabulator that gathers votes via an electronic voter interface, records voting data and ballot images in memory components, and produces a tabulation of the voting data. Discussion: A typical DRE presents contest choices to the voter on an electronic monitor, and after the voter finishes the ballot the voter's votes are stored locally on the computer.

DRE+VVPAT: DRE with an attached VVPAT.

EBM: Electronically-assisted ballot marker.

EBP: Electronic ballot printer.

election definition device: Programmed device used to prepare ballots and programs for use in casting and counting votes. Discussion: This covers the pre-election portion of Election Management System functionality.

election district: Administrative division in which voters are entitled to vote in contests that are specific to that division, such as those for state senators and delegates. Discussion: An election district may overlap multiple precincts, and a precinct may overlap multiple election districts (see split precinct).

election judge: Role defined in Part 1 Section 5.4.

election official: Central election official, election judge, or poll worker.

election verification: Confirmation that all recorded votes were counted correctly. See also voter verification.

electronically-assisted ballot marker: Acc-VS that produces an executed, human-readable paper ballot as a result, and that does not make any other lasting record of the voter's votes. Discussion: One kind of EBM presents contest choices to the voter on an electronic monitor; after the voter finishes the ballot, the voter's choices are printed on a paper ballot that is the only record of the voter's choices. However, vote-by-telephone systems that are in use at the time of this writing are also EBMs. The voter uses an audio interface (remotely) and a paper ballot is produced (centrally). An EBM may mark ballot positions on a pre-printed ballot or it may print an entire ballot (the latter kind are called EBPs); however, in any event, the ballot produced is assumed to be human-readable and comparable to an MMPB.

electronic device: Voting device that uses electricity.

electronic voter interface: Component of an electronic vote-capture device that communicates ballot information to the voter and accepts input from the voter.

endorsement: Approval by a political party (e.g., as the candidate that the party elects to field in a particular contest and/or as the candidate that should receive straight party votes). Discussion: A contest choice may be endorsed by more than one party. See also, affiliation.

end-to-end: (1) (Security) Supporting both voter verification and election verification. (2) (Generically) Covering the entire elections process, from election definition through the reporting of final results.
<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>e-pollbook</td>
<td><strong>Programmed device</strong> that partially automates the process of checking in voters and assigning them the correct ballot style.</td>
</tr>
<tr>
<td>error rate</td>
<td>Ratio of the number of errors that occur to the volume of data processed. ([VSS2002] I.3.2.1) Discussion: The specific error rate used in the benchmark for voting system accuracy is report total error rate.</td>
</tr>
<tr>
<td>failure</td>
<td>(Voting system reliability) Event that results in (a) loss of one or more functions, (b) degradation of performance such that the device is unable to perform its intended function for longer than 10 seconds, (c) automatic reset, restart or reboot of the voting device, operating system or application software, (d) a requirement for an unanticipated intervention by a person in the role of poll worker or technician before the test can continue, or (e) error messages and/or audit log entries indicating that a failure has occurred. (Source: Expanded from [VSS2002] I.3.4.3.) Discussion: In plain language, failures are equipment breakdowns, including software crashes, such that continued use without service or replacement is worrisome to impossible. Normal, routine occurrences like running out of paper are not considered failures. Misfeeds of ballots into optical scanners are handled by a separate benchmark (Requirement part1:6.3.3-A), so these are not included as failures for the general reliability benchmark.</td>
</tr>
<tr>
<td>failure rate</td>
<td>Ratio of the number of failures that occur to the volume of data processed. Discussion: Failures may be divided, for example, into user-serviceable and non-user-serviceable categories, and the measure of volume varies by device class.</td>
</tr>
<tr>
<td>fault</td>
<td>Flaw in design or implementation that may result in the qualities or behavior of the voting system deviating from the qualities or behavior that are specified in the VVSG and/or in manufacturer-provided documentation.</td>
</tr>
<tr>
<td>find</td>
<td>Determine and deliver a finding. (Based on [Oxford93] definition #11.)</td>
</tr>
<tr>
<td>finding</td>
<td>Result of a formal evaluation by a test lab or accredited expert; verdict. (Based on [Oxford93] definition #6.)</td>
</tr>
<tr>
<td>hardwired logic</td>
<td>Logic implemented through the design of an integrated circuit; the programming of a Programmable Logic Device (PLD), Field-Programmable Gate Array (FPGA), Peripheral Interface Controller (PIC), or similar; the integration of smaller hardware components; or mechanical design (e.g., as in lever machines).</td>
</tr>
<tr>
<td>hesitation mark</td>
<td>Small dot made by resting the point of a writing utensil on a ballot.</td>
</tr>
<tr>
<td>implementation statement</td>
<td>Statement by a manufacturer indicating the capabilities, features, and optional functions and extensions that have been implemented in a voting system.</td>
</tr>
<tr>
<td>independent voter-verifiable record</td>
<td>Record produced by an IVVR vote-capture device supporting voter verification (e.g., DRE+VVPAT and EBM), containing at a minimum a summary of the electronic CVR. Discussion: A voter-verifiable paper record is an independent voter-verifiable record.</td>
</tr>
<tr>
<td>initial system response time</td>
<td>Amount of time from when the voter performs some detectible action (such as pressing a button) to when the voting device begins responding in some obvious way (such as an audible response or any change on the screen).</td>
</tr>
<tr>
<td>innovation class submission</td>
<td>Voting system that includes one or more distinct innovative devices. Discussion: See Part 1 Section 2.7.2, Innovation Class Submissions.</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
<td>------</td>
<td>------------</td>
</tr>
<tr>
<td>in-person:</td>
<td>Voting that occurs at a polling place under the supervision of poll workers. Discussion: Also known as poll-site voting.</td>
</tr>
<tr>
<td>inspection:</td>
<td>Examination of a product design, product, process or installation and determination of its conformity with specific requirements or, on the basis of professional judgment, with general requirements. ([ISO04a])</td>
</tr>
<tr>
<td>instant runoff:</td>
<td>Ranked order voting.</td>
</tr>
<tr>
<td>IVVR:</td>
<td>(1) Independent voter-verifiable record. (2) Voting system that achieves software independence through independent voter-verifiable records.</td>
</tr>
<tr>
<td>IVVR vote-capture device:</td>
<td>Vote-capture device that achieves software independence through independent voter-verifiable records.</td>
</tr>
<tr>
<td>logic defect:</td>
<td>Fault in software, firmware, or hardwired logic.</td>
</tr>
<tr>
<td>manually-marked paper ballot:</td>
<td>(1) IVVR vote-capture device consisting of a paper ballot and a writing utensil. (2) Paper ballot that was marked by a person using a writing utensil.</td>
</tr>
<tr>
<td>manufacturer:</td>
<td>Entity with ownership and control over a voting system submitted for testing.</td>
</tr>
<tr>
<td>marginal mark:</td>
<td>Mark within a voting target that does not conform to manufacturer specifications for a reliably detectable vote. Discussion: See Part 1 Section 7.7.5.1. The word &quot;marginal&quot; refers to the limit of what is detectable by an optical scanner, not the margin of the page. Marks that are outside of voting targets are called extraneous marks.</td>
</tr>
<tr>
<td>misfeed rate:</td>
<td>Ratio of the misfeed total to the total ballot volume (see Requirement part3:5.3.5-B).</td>
</tr>
<tr>
<td>MMPB:</td>
<td>Manually-marked paper ballot.</td>
</tr>
<tr>
<td>module:</td>
<td>Structural unit of software or analogous logical design, typically containing several callable units that are tightly coupled. Discussion: Modular design requires that inter-module coupling be loose and occur over defined interfaces. A module should contain all elements needed to compile or interpret successfully and have limited access to data in other modules. A module should be substitutable with another module whose interfaces match the original module. In software, a module typically corresponds to a single source code file or a source code / header file pair. In object-oriented languages, this typically corresponds to a single class of object.</td>
</tr>
<tr>
<td>N-of-M:</td>
<td>Voting variation in which the voter is entitled to allocate a fixed number of votes (N) over a list of M contest choices or write-ins, with the constraint that at most 1 vote may be allocated to a given contest choice. See also cumulative voting. Discussion: The voter is not obliged to allocate all N votes.</td>
</tr>
<tr>
<td>non-executable:</td>
<td>Declarative or informative in nature; not subject to interpretation or compilation as programming language instructions.</td>
</tr>
<tr>
<td>non-party-specific contest:</td>
<td>Contest such that eligibility to vote in that contest is independent of political party affiliation or lack thereof.</td>
</tr>
<tr>
<td>observational test:</td>
<td>Operational test conducted on voting devices during an election, by real voters, to establish confidence that the VVPR is produced correctly when assistive technology is used. Discussion: Devices subjected to observational testing are used for normal collection of votes; the votes so collected are included in the election tally.</td>
</tr>
</tbody>
</table>
open primary: **Primary election** in which the voter may choose a political party at the time of voting and vote in **party-specific contests** associated with that party, along with **non-party-specific contests** presented at the same election. Discussion: Also known as pick-your-party primary. Some states require voters to publicly declare their choice of party at the polling place, after which the **poll worker** provides or activates the appropriate ballot. Other states allow the voters to make their choice of party within the privacy of the voting booth. Voters also are permitted to vote on **non-party-specific contests** that are presented at the same election.

operational test: Test conducted on voting equipment in an active (operational) state.

optical scanner: **Tabulator** that counts votes recorded by means of marks made on the surface of a paper ballot.

party-specific contest: **Contest** such that eligibility to vote in that **contest** is restricted based on political party **affiliation** or lack thereof. Discussion: The **affiliation** might be the registered **affiliation** of the voter or it might be an **affiliation** declared at the time of voting. See **closed primary**, **open primary**.

PCOS: **Precinct-count optical scanner**.

**Perfect Ballot Index:** Ratio of the number of cast ballots containing no voting errors (e.g., a vote for an unintended choice or a missing vote) over the number of cast ballots containing one or more voting errors. Discussion: This metric is used in the **VPP**.

poll worker: Role defined in Part 1 Section 5.4.

precinct: Administrative division in which voters cast ballots [nominally] at the same polling place. Discussion: In jurisdictions that use vote centers, the assignment of a polling place no longer plays a meaningful role in determining precinct boundaries. In other jurisdictions, it is still possible for two or more precincts to cast ballots at a given polling place (see **combined precinct**).

precinct-count optical scanner: **Optical scanner** used to count ballots at the polling place. Discussion: A **PCOS** is a special purpose scanner designed to enable the voter to feed his or her own paper ballot—one ballot at a time.

precinct reporting device: **Reporting device** that consolidates and reports votes from multiple **vote-capture devices** at the polling place. Discussion: For **DREs** and some paper-based systems, these devices provide electronic storage of the vote count, print the results after the close of polls, and may transmit results to a central location over public telecommunication networks.

primary election: Election held to determine which candidate(s) will represent a political party for particular offices in the general election and/or to narrow the field of candidates in **non-party-specific contests** prior to the general election. Discussion: From the functional viewpoint of the voting system, the defining features of a primary election are the presence of **party-specific contests** and a requirement to report separate totals for the different political parties.

privacy enclosure: Equipment, such as a booth or partition, provided in conjunction with a **vote-capture device** to make it difficult for anyone other than the voter to determine through visual observation how the voter voted.

programmed device: **Electronic device** that includes **application logic**. Discussion: Most electronic voting devices include application logic and are therefore programmed devices. A
A standalone printer is an example of an electronic device that might not contain any application logic (it could run entirely on COTS firmware).

**provisional ballot:** Ballot cast by a voter whose eligibility to vote is disputed by an election official. See also challenged ballot.

**ranked order:** Voting variation in which voters express their intent by ordering contest choices from strongest to weakest preference. Discussion: Implementations of ranked order voting differ in whether voters are required to rank every choice and in the algorithm used to determine a winner or winners.

**read ballot:** Cast ballot that has been interpreted by a tabulator to determine what votes it contains. A read ballot may or may not be counted. For example, an optical scan cast ballot that has been scanned successfully is a read ballot. See also cast ballot and counted ballot.

**record:** (n) Preserved evidence of activities performed or results achieved (e.g., forms, reports, test results). (v) To create a record.

**relevant contest:** Contest appearing in a ballot style or ballot associated with a given reporting context. Discussion: If a contest is included in a ballot style associated with a given reporting context, that contest is relevant even if no ballots of that style were counted.

**report:** Self-contained, time stamped, archival record, such as a printout or analogous electronic file that is produced at a specific time and subsequently protected from modification.

**reporting context:** Scope within which reported totals or counts are calculated (e.g., precinct or election district). Discussion: Reporting contexts may overlap in complex ways; for example, in the case of split precincts, there is not a simple containment relationship between election districts and precincts.

**reporting device:** Tabulator that generates post-election reports. Discussion: This covers the post-election portion of Election Management System functionality.

**report total error rate:** Ratio of the report total error to the report total volume (see Requirement part3:5.3.4-B).

**review-required ballot:** Ballot that is flagged or separated for some form of manual processing.

**software independence:** Quality of a voting system or voting device such that a previously undetected change or fault in software cannot cause an undetectable change or error in election outcome.

**split precinct:** Precinct serving voters from two or more administrative divisions, such as election districts, that may require different ballot configurations.

**spoil:** (A ballot) To mark or otherwise alter a ballot so as to indicate, in a manner supported by the voting system, that the ballot is not to be cast.

**straight party override:** Explicit vote that conflicts with the vote(s) implied by a straight party vote.

**straight party voting:** Voting variation in which a vote in a designated, special contest (in which the choices are political parties) implies votes in accordance with the endorsements of
<table>
<thead>
<tr>
<th><strong>References</strong></th>
<th><strong>APPENDIX B: REFERENCES</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>the selected party in all other contests on the ballot in which straight party voting is allowed.</td>
<td></td>
</tr>
<tr>
<td><strong>summative usability testing:</strong></td>
<td><strong>Operational testing</strong> with representative users and tasks to measure the usability (defined as effectiveness, efficiency and satisfaction) of the complete product. Discussion: The purpose of a summative test is to evaluate a product through defined measures, rather than diagnosis and correction of specific design problems, as in formative testing.</td>
</tr>
<tr>
<td><strong>system extent:</strong></td>
<td><strong>Administrative unit that is the entire scope within which the voting system is used (e.g., a county). Discussion: The system extent corresponds to the top-level reporting context for which the system generates reports.</strong></td>
</tr>
<tr>
<td><strong>tabulator:</strong></td>
<td><strong>Programmed device</strong> that counts votes; e.g., a DRE, optical scanner, or reporting device. Discussion: Any distinction between processing individual votes and processing vote totals that resulted from a previous step is not relevant; both of these constitute &quot;counting votes.&quot;</td>
</tr>
<tr>
<td><strong>test:</strong></td>
<td><strong>Procedure used to determine one or more characteristics of an object of conformity assessment. Discussion: A test may be an operational test or a non-operating test (e.g., an inspection).</strong></td>
</tr>
<tr>
<td><strong>test engagement:</strong></td>
<td><strong>Association between a manufacturer and test lab that begins with an application for voting system testing and ends with a grant of certification, a denial of certification, or early termination of testing.</strong></td>
</tr>
<tr>
<td><strong>testing:</strong></td>
<td><strong>Determination of one or more characteristics of an object of conformity assessment, according to a procedure. Discussion: “Testing” typically applies to materials, products or processes. ([ISO04a])</strong></td>
</tr>
<tr>
<td><strong>test method:</strong></td>
<td><strong>Description of one or more tests, procedures by which tests are derived, or a combination of these.</strong></td>
</tr>
<tr>
<td><strong>test suite:</strong></td>
<td><strong>Implementation of a set of operational tests for a particular object (e.g., a specific voting system) or class of objects (e.g., all voting systems than can interpret the language in which the test data are expressed).</strong></td>
</tr>
<tr>
<td><strong>third-party logic:</strong></td>
<td><strong>Software, firmware, or hardwired logic that is neither application logic nor COTS; e.g., general-purpose software developed by a third party that is either customized (e.g., ported to a new platform, as is Windows CE) or not widely used, or source code generated by a COTS package.</strong></td>
</tr>
<tr>
<td><strong>token:</strong></td>
<td><strong>Device or digital representation that an authorized user of computer services is given to aid in authentication. Discussion: Also called authentication token or cryptographic token. The terms “hardware token” and “software token” are sometimes used to distinguish device tokens from digital representations. A hardware token such as a smartcard is sometimes used to activate the ballot; it contains the voter’s credentials, e.g., information needed to determine the correct ballot style. A smartcard token is sometimes used as an authentication mechanism for voting devices used in the polling place, e.g., a DRE, optical scanner, or electronic pollbook.</strong></td>
</tr>
</tbody>
</table>
| **Total Completion Score:**                                                   | **Proportion of voters who successfully cast a ballot. Discussion: Success is independent of whether or not the ballot contains voting errors (see Perfect Ballot Index). Failure to cast a ballot might involve problems such as a voter simply “giving up” during the voting session because of an inability to operate the system, or a**
mistaken belief that one has successfully operated the casting mechanism. This metric is used in the VPP.

**Volume Test:** Test conducted in compliance with Requirement part3:5.2.3-D. Discussion: A volume test involves a large number of "test voters" using voting devices in conditions approximating normal use in an election.

**Vote:** (n) Indication of support for a particular contest choice in a manner supported by the voting system.

**Vote-Capture Device:** Device that is used directly by a voter to vote a ballot.

**Voted Ballot:** Ballot that has been cast or spoiled.

**Voter:** Role defined in Part 1 Section 5.4.

**Voter-Editable Ballot Device:** Vote-capture device that gathers votes via an electronic voter interface and allows the voter to alter previously made votes without spoiling the ballot.

**Voter Inactivity Time:** Amount of time from when the voting device completes its response until there is detectible voter activity. Discussion: Audio prompts from the system may take several minutes to play out. This time does not count as voter inactivity, since the system is still in the process of responding.

**Voter Inclusion Index:** Measure of voting accuracy and variance based on the mean accuracy per voter and the associated standard deviation. Discussion: Each voter is given a certain number of “voting opportunities” within the ballot. The more of these that are successfully completed, the higher the resulting accuracy for that voter. This metric is used in the VPP.

**Voter-Verifiable Paper Audit Trail:** DRE attachment that supports voter-verification by producing voter-verifiable paper records. Discussion: VVPAT can be subdivided into (a) paper-roll approaches that record all VVPRs sequentially on a continuous paper roll, and (b) cut-sheet approaches, which produce separate cut-sheets of paper, each containing a VVPR.

**Voter-Verifiable Paper Record:** Paper IVVR produced by an IVVR vote-capture device supporting voter verification (e.g., DRE+VVPAT and EBM).

**Voter Verification:** Confirmation by the voter that all votes were recorded as the voter intended. See also election verification.

**Voting Credentials:** Items sufficient to enable a DRE or EBP to activate a ballot of the ballot configuration that is appropriate for a given voter.

**Voting Device:** Device that is part of the voting system; e.g., a DRE, EBM, optical scanner, activation device, election definition device, or reporting device. Discussion: Components and materials that are vital to the function of the voting device within the voting system, such as smart cards and ballot printers, are considered parts of the device for the purpose of conformity assessment.

**Voting Performance Protocol:** Test method that measures how well subjects perform various voting tasks.

**Voting Process:** Entire array of procedures, people, resources, equipment and locations associated with the conduct of elections. See also, voting system.

**Voting Session:** (1) Span of time beginning when a ballot is enabled or activated and ending when that ballot is printed (on an EBM), cast (on a DRE), or spoiled. See Part 1 Section
8.2. (2) Interaction between the voter and *vote-capture device* that occurs during that span of time.

**voting station:** Vote-capture device, together with its privacy enclosure if it is supposed to have one.

**voting system:** Equipment (including hardware, firmware, and software), materials, and documentation used to define elections and *ballot styles*, configure voting equipment, identify and validate voting equipment configurations, perform logic and accuracy tests, activate ballots, capture votes, count votes, reconcile ballots (e.g., provisional and challenged, write-ins, and review-required ballots), generate reports, transmit election data, archive election data, and audit elections. See also, *voting process*.

**voting variation:** Voting style, option, or feature such as in-person voting, absentee voting, provisional / challenged ballots, review-required ballots, closed primaries, open primaries, write-ins, ballot rotation, straight party voting, cross-party endorsement, split precincts, N-of-M voting, cumulative voting, or ranked order voting.

**VPP:** Voting Performance Protocol.

**VVPAT:** Voter-verifiable paper audit trail.

**VVPR:** Voter-verifiable paper record.

**write-in:** Vote for a candidate who is explicitly named by the voter in lieu of choosing a candidate who is already listed on the ballot. Discussion: This does not preclude writing in the name of a candidate who is already listed on the ballot.