

CRT-DWF Draft 20060317

Chapter 2 Conformance Clause

2.1 Scope and applicability

The Voluntary Voting System Guidelines are intended primarily for use by:

- Designers and manufacturers of voting systems;
- Test labs performing the analysis and testing of voting systems in support of the EAC national certification process;
- Software repositories designated by the EAC or by a state; and
- Test labs and consultants performing the state certification of voting systems.

The Guidelines may also be of use to election officials in setting requirements for voting systems in requests for proposals.

The Guidelines include:

- A product standard ([Volume III](#)) defining requirements that apply to voting systems that vendors produce;
- Standards on data to be provided ([Volume IV](#)) defining requirements that apply to documentation, [reports](#), and other information that vendors and test labs deliver;
- A testing standard ([Volume V](#)) defining test methods and protocols that test labs implement; and
- A terminology standard ([Volume II](#)) defining terms used in the foregoing.

2.2 Structure of requirements

Each voting system requirement is identified according to a hierarchical scheme in which higher-level, "parent" requirements (such as "provide accessibility for visually impaired voters") are supported by lower-level subrequirements (e.g., "provide an audio-tactile interface"). Thus, requirements are nested.

Some requirements are directly testable and some are not. The latter tend to be higher-level and are included because (1) they are testable indirectly insofar as their lower-level requirements are testable, and (2) they often provide the structure and rationale for the lower-level requirements.

The applicability of a requirement is specified with the *Applies to:* field, which indicates the class(es) of voting systems or devices to which the requirement applies. Classes are defined in [Volume III](#)

[Section 2.6.](#)

A requirement having N different classes separated by commas in its *Applies to:* field is equivalent to N different requirements that apply to each listed class individually.

The scope of a parent requirement is inherited by its subrequirements unless they explicitly specify a narrower scope. The scope may be narrowed through a generic relation (e.g., *DRE* is a subclass of *Vote-capture device*) or a partitive relation (e.g., a *DRE* is part of a *Voting system*).

2.3 Normative language

The following keywords are used to convey conformance requirements:

- **Shall** indicates a mandatory requirement to do something. Synonymous with "is required to."
- **Is prohibited** indicates a mandatory requirement *not* to do something. Synonymous with "shall not."
- **Should, Is encouraged** indicate an optional recommended action, one that is particularly suitable, without mentioning or excluding others. Synonymous with "is permitted and recommended."
- **May** indicates an optional, permissible action. Synonymous with "is permitted."

Text using these keywords is directly applicable to achieving conformance to the Guidelines. Informative parts of this document include discussion, examples, extended explanations, and other matter that is necessary for proper understanding of the Guidelines and conformance to them.

2.4 Conformance designations

A [voting system](#) conforms to the product standard if all stated requirements that apply to the [voting system](#) and its constituent [devices](#) are fulfilled. The [implementation statement](#) (see [Volume III Section 2.5](#)) declares the capabilities, features and optional functions that have been implemented and are subject to conformance and certification testing.

There is no concept of partial conformance—neither that a [voting system](#) is x % conforming, nor that a [device](#) that is not a complete [voting system](#) by itself is conforming. Individual devices of [voting systems](#) are not tested or certified except as parts of complete systems.⁵

2.5 Implementation statement

An implementation statement documents the requirements that have been implemented by the voting system, the optional features and capabilities supported by the voting system, and any extensions (i.e., additional functionality beyond what is defined in the Guidelines) that it implements.

An implementation statement may take the form of a checklist to be completed for each voting system submitted for certification. It is used by test labs to identify the [conformity assessment](#) activities that are applicable.

R 2.5-1 Implementation statement

An implementation statement shall include:

- a. Full product identification of the [voting system](#), including version number or timestamp;
- b. Separate identification of each [device](#) (see below) that is part of the [voting system](#);
- c. Version of VVSG to which certification is desired;
- d. [Classes implemented](#) (see [Volume III Section 2.6.3](#));
- e. [Device capacities and limits](#) (especially those appearing in [Volume III Section 5.3.1](#)); and
- f. List of languages supported.

Source: New requirement.

DISCUSSION

A keyboard, mouse or printer connected to a programmed vote-capture device, as well as any optical drive, hard drive or similar component installed within it, are considered components of the vote-capture device, not separate [devices](#). The [vote-capture device](#) is "responsible" for these components—e.g., a [DRE](#) must prevent unauthorized flashing of the [firmware](#) in its optical drive or other components that could be subverted to manipulate vote outcomes.

Vendors may wish to contact their intended testing labs in advance to determine if those labs can supply them with an implementation statement *pro forma* to facilitate meeting this requirement.

2.6 Classes

2.6.1 Voting device terminology

Voting device	Device that is part of the voting system . <i>Voting device</i> subsumes <i>Vote-capture device</i> , <i>Paper-based device</i> , <i>Electronic device</i> , <i>Tabulator</i> , <i>VVPAT</i> , and all device voting variations (<i>In-person voting device</i> , etc.).
Vote-capture device	Device that is used directly by a voter to vote a ballot. <i>Vote-capture device</i> subsumes <i>ALVS</i> , <i>Acc-VS</i> , <i>Card puncher</i> , <i>MMPB</i> , <i>EBM</i> , and <i>DRE</i> .
Paper-based device	Device that records votes, counts votes, and/or produces a report of the vote count from votes cast on paper cards or sheets. <i>Paper-based device</i> subsumes <i>Card puncher</i> , <i>MMPB</i> , <i>EBM</i> , <i>Punchcard reader</i> , and <i>Optical scanner</i> .
Electronic device	Device that uses electricity. <i>Electronic device</i> subsumes <i>Programmed device</i> and <i>Punchcard reader</i> .
Programmed device	Electronic device that includes software or firmware installed or commissioned by the voting system vendor. <i>Programmed device</i> subsumes <i>EBM</i> , <i>DRE</i> , <i>Optical scanner</i> , and <i>EMS</i> .
Tabulator	Device that counts votes. <i>Tabulator</i> subsumes <i>DRE</i> , <i>Punchcard reader</i> , <i>Optical scanner</i> , <i>EMS</i> , <i>Precinct tabulator</i> and <i>Central tabulator</i> .
Precinct tabulator	Tabulator that counts votes at the polling place. Note: These devices typically tabulate ballots as they are cast and print the results after the close of polls. For DREs and some paper-based systems, these devices provide electronic storage of the vote count and may transmit results to a central location over public telecommunication networks. A tabulator that may be configured for use either in the precinct or in the central location may satisfy the requirements for both <i>Precinct tabulator</i> and <i>Central tabulator</i> . <i>Precinct tabulator</i> subsumes <i>PCOS</i> .
Central tabulator	Tabulator that counts votes from multiple precincts at a central location. Note: Voted ballots are typically placed into secure storage at the polling place and then transported or transmitted to a central tabulator. A tabulator that may be configured for use either in the precinct or in the central location may satisfy the requirements for both <i>Precinct tabulator</i> and <i>Central tabulator</i> .
Card puncher	Vote-capture device that allows a voter to record votes by means of holes punched in designated voting response locations.
MMPB	(Manually-Marked Paper Ballot) Vote-capture device consisting of a paper ballot and a writing utensil.
EBM	(Electronically-assisted Ballot Marker) Vote-capture device that gathers votes via an electronic voter interface and produces an executed paper ballot as a result. Note: The

	ballot output by an EBM may or may not include a bar code. An EBM may mark ballot positions on a pre-printed ballot or it may print an entire ballot. The latter kind are called EBPs . <i>EBM</i> subsumes <i>EBP</i> .
EBP	(Electronic Ballot Printer) EBM that prints an entire ballot.
VVPAT	(Voter-Verified Paper Audit Trail) Voting device that supports voter verification using a paper audit trail.
DRE	(Direct Record Electronic) Combination vote-capture device 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.
Punchcard reader	Tabulator that counts votes that were recorded by means of holes punched through a paper ballot.
Optical scanner	Tabulator that counts votes that were recorded by means of marks made on the surface of a paper ballot. <i>Optical scanner</i> subsumes <i>PCOS</i> .
EMS	(Election Management System) Tabulator used to prepare ballots and programs for use in casting and counting votes and to consolidate, report, and display election results. Note: The EMS produces a printed report of the vote count and may produce a report stored on electronic media.
PCOS	(Precinct Count Optical Scanner) Optical scanner used as a precinct tabulator .
ALVS	(Alternative Language Voting Station) Voting station that provides alternative language accessibility pursuant to 42 USC 1973aa-1a.
Acc-VS	(Accessible Voting Station) Voting station equipped for individuals with disabilities referred to in 42 USC 15481 (a)(3)(B).

Table 2 Voting device terminology

2.6.2 [Classes overview](#)

A [class](#) simultaneously identifies a set of requirements and a set of [voting systems](#) or [devices](#) to which those requirements apply. The purpose of [classes](#) is to categorize requirements into related groups of functionality that apply to different types of voting systems and devices.

[Classes](#) may subsume other [classes](#). For example, *Paper-based device* subsumes *Card puncher*, *Punchcard reader*, and *Optical scanner*. The subsuming class is called the superclass while the subsumed classes are called subclasses. A group of related [classes](#) forms a classification hierarchy or lattice.

Subclasses "inherit" the requirements of their superclasses. Additionally, a subclass may further constrain a [class](#) by adding new requirements. However, a subclass may not relax or remove requirements inherited from a superclass.

Classes may be declared to be *disjoint* (mutually exclusive), or not, as appropriate.

A [voting system](#) conforms to a [class](#) if all stated requirements identified by that [class](#) are fulfilled. Since subclasses may not relax or remove requirements inherited from a superclass, it is true in all cases that a [voting system](#) conforming to a subclass also conforms to all of its superclasses. For example, a [voting system](#) conforming to any subclass of *Voting system* fulfills the general requirements that apply to all voting systems.

The classification mechanism is useful in many different contexts when there is a need to identify specific portions of the VVSG. [Table 3](#) provides several examples.

Context	Use
VVSG	Requirements applicable to a given class
Implementation statement	This system conforms to a specified class
Conformity assessment	Tests and reviews applicable to the specified class
Certification	Scope of certification is the specified class
Declaration of conformity	This product is certified to that class
Request for proposals	Seeking to procure a system conforming to a specified class

Table 3 Use of classes in different contexts

[Figure 2](#) and [Figure 3](#) repeat in pictorial form the classification hierarchies that are defined in the next section to illustrate their high-level structure. A class is represented by an oval containing the name of the class. When two classes are connected by a line, this indicates that the higher class subsumes the lower one.

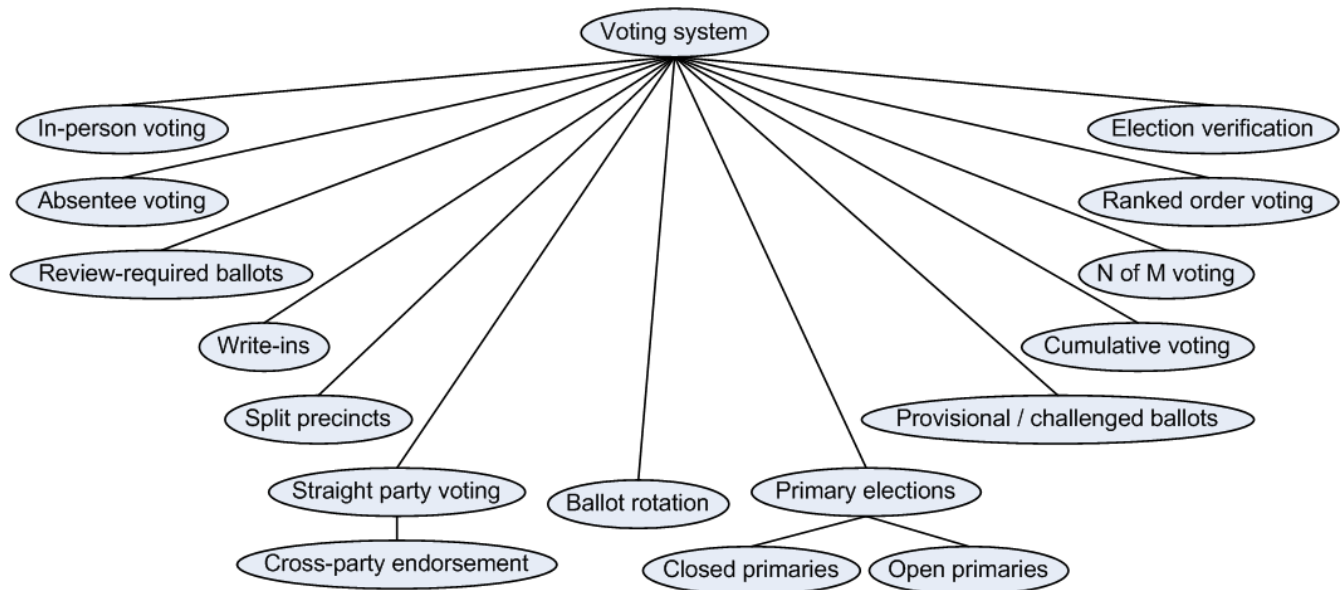


Figure 2 Voting system classes

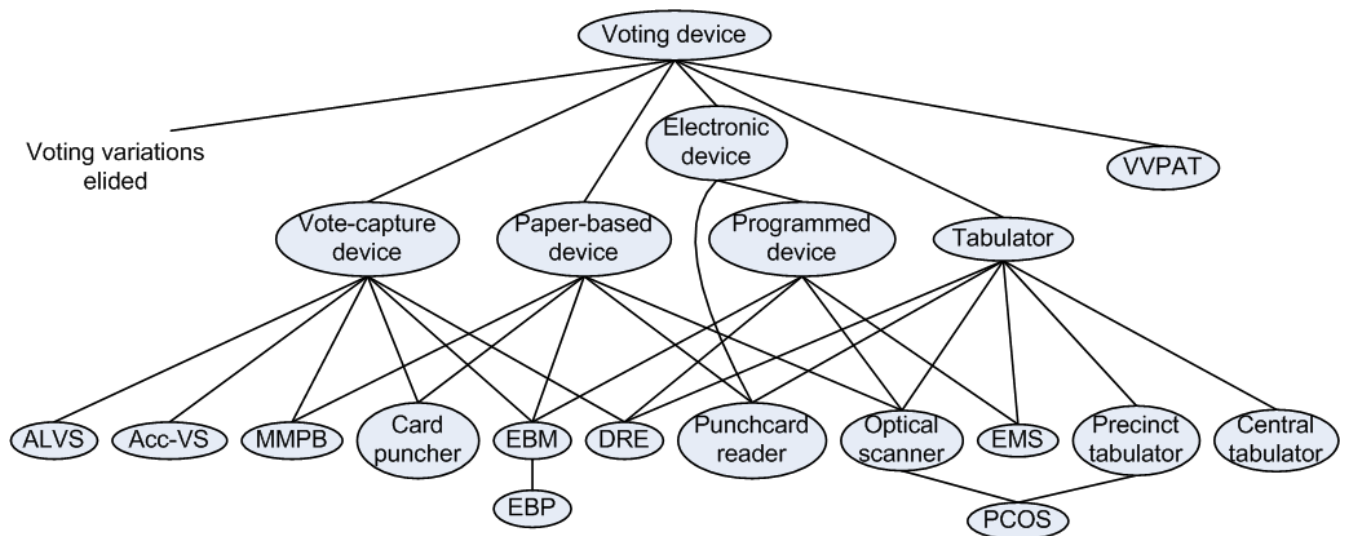


Figure 3 Voting device classes

2.6.3 Classes identified in implementation statement

R 2.6-1 Implementation statement, system classes

An implementation statement for a voting system shall identify all applicable classes from Volume III Section 2.6.3.1.

Source: New requirement.

R 2.6-2 Implementation statement, device classes

For each distinct device included in the system, an implementation statement for a voting system shall identify:

- a. All applicable classes from Volume III Section 2.6.3.2; and
- b. All applicable classes from Volume III Section 2.6.3.3.

Source: New requirement.

In the following subsections, references following the names of classes indicate the origin of those classes.

2.6.3.1 Supported voting variations (system-level)

The classes enumerated in this section identify voting variations supported by the voting system. Although the intent of most is apparent from the applicable requirements, the following may require additional explanation.

Conformance to the *Write-ins* class indicates that the [voting system](#) is capable of end-to-end processing of [write-in](#) votes. If the [voting system](#) requires that [write-in](#) votes be counted manually, then it does not satisfy [Requirement III.4.8-1](#) and therefore does not conform to the *Write-ins* class. However, it may conform to the *Review-required ballots* class (see below).

The same principle applies to the *Absentee voting* class and the *Provisional / challenged ballots* class. If the counting of these ballots is external to the [voting system](#), then the system does not satisfy [Requirement III.4.8-2](#) or [Requirement III.4.8-3](#) and therefore does not conform to the *Absentee voting* or *Provisional / challenged ballots* class, respectively.

Conformance to the *Review-required ballots* class indicates that the [voting system](#) is capable of flagging or separating ballots for later processing and including the results of that processing in the reported totals. If the consolidation of counts from review-required ballots with counts from other ballots is external to the [voting system](#), then the system does not satisfy [Requirement III.4.9-27](#) and therefore does not conform to the *Review-required ballots* class.

In some systems, [write-in](#) votes are counted as a single ballot position representing all [write-ins](#), and these votes are assigned to candidates through manual post-processing if and only if the election is close enough to warrant the effort. Although this approach does not conform to the *Write-ins* class, the system's handling of [write-in](#) votes is identical to its handling of other ballot positions, so the behavior is verifiable.

Choose all that apply.

- In-person voting ([\[2\]](#) I.2.5.2)
- Absentee voting ([\[2\]](#) I.2.5.2)
- Provisional / challenged ballots ([\[2\]](#) I.2.5.2, I.2.2.8.2o)
- Review-required ballots ([\[2\]](#) I.2.5.2)
- Primary elections
 - Closed primaries ([\[2\]](#) I.2.2.8.2a)
 - Open primaries ([\[2\]](#) I.2.2.8.2b)
- Write-ins ([\[2\]](#) I.2.2.8.2e)
- Ballot rotation ([\[2\]](#) I.2.2.8.2g)
- Straight party voting ([\[2\]](#) I.2.2.8.2h)
 - Cross-party endorsement ([\[2\]](#) I.2.2.8.2i)
- Split precincts ([\[2\]](#) I.2.2.8.2j)
- N of M voting ([\[2\]](#) I.2.2.8.2k)
- Cumulative voting ([\[2\]](#) I.2.2.8.2m)
- Ranked order voting ([\[2\]](#) I.2.2.8.2n)
- Election verification ([\[5\]](#) I.C.1.2.2)

The following subclasses are tentatively deleted until it becomes more clear that they are needed and/or whether they go on the system or the voting device. See [PREFACE](#).

- Remote configuration (incoming data) ([2] I.5)
 - Public network remote configuration
 - Wireless network remote configuration
- Remote data delivery (outgoing data) ([2] I.5)
 - Public network data delivery ([2] I.1.5.4, I.5)
 - Wireless network data delivery

The class *Remote data delivery* identifies all systems in which data are transmitted from individual voting machines to some other machine, regardless of whether or not the target machine is located within the same polling place.

2.6.3.2 Supported voting variations (device-level)

It is necessary to specify voting variations at the device level as well as the system level because a system may support a given voting variation without having that support in every device. For example, a system may support [absentee voting](#) by having [absentee ballot](#) support in one special [tabulator](#) and in the central [EMS](#). However, for the most part, these should agree with the variations claimed at the system level.

Choose all that apply.

- In-person voting device ([2] I.2.5.2)
- Absentee voting device ([2] I.2.5.2)
- Provisional / challenged ballots device ([2] I.2.5.2, I.2.2.8.2o)
- Review-required ballots device ([2] I.2.5.2)
- Primary elections device
 - Closed primaries device ([2] I.2.2.8.2a)
 - Open primaries device ([2] I.2.2.8.2b)
- Write-ins device ([2] I.2.2.8.2e)
- Ballot rotation device ([2] I.2.2.8.2g)
- Straight party voting device ([2] I.2.2.8.2h)
 - Cross-party endorsement device ([2] I.2.2.8.2i)
- Split precincts device ([2] I.2.2.8.2j)
- N of M voting device ([2] I.2.2.8.2k)
- Cumulative voting device ([2] I.2.2.8.2m)
- Ranked order voting device ([2] I.2.2.8.2n)
- Election verification device ([5] I.C.1.2.2)

2.6.3.3 Voting [device](#) classes

The classes enumerated in this section identify different types of voting devices. Choose all that apply.

- Vote-capture device
- Paper-based device ([2] I.1.5.2)
- Electronic device
 - Programmed device
- Tabulator
 - Precinct tabulator ([2] I.1.5.5)
 - Central tabulator ([2] I.1.5.6)

- VVPAT (voter-verified paper audit trail) ([5] I.7.9)
- ALVS (alternative language voting station) ([4] I.2.2.7.2)
- Acc-VS (accessible voting station) ([5] I.3.2)

- Card puncher ([2] I.1.5.2, "punchcard")
- MMPB (Manually-Marked Paper Ballot)
- EBM (Electronically-assisted Ballot Marker)
 - EBP (Electronic Ballot Printer)
- DRE (Direct Record Electronic) ([2] I.1.5.3)
- Punchcard reader ([2] I.1.5.2, "punchcard")
- Optical scanner ([2] I.1.5.2, "marksense")
- EMS (Election Management System) ([2] I.2.2.6)

PCOS is implied if *Precinct tabulator* and *Optical scanner* are identified.

2.6.4 Semantics of **classes**

A **class** simultaneously identifies a set of requirements and a set of **voting systems** or **devices** to which those requirements apply.

For a **class** C , let $S(C)$ represent the set of **voting systems** or **devices** identified by C and let $R(C)$ represent the set of requirements applicable to those **voting systems** or **devices**.

A subclass identifies a superset of the requirements and a subset of the **voting systems** or **devices** identified by its superclass. A **voting system** that conforms to a subclass necessarily conforms to its superclass. The superclass is said to *subsume* the subclass.

If **class** C_1 subsumes C_2 , then

$$R(C_2) \supseteq R(C_1)$$

$$S(C_2) \subseteq S(C_1)$$

A **class** may have multiple superclasses. Let $P(C)$ represent the set of superclasses of C . Then

$$R(C) \supseteq \bigcup_{x \in P(C)} R(x)$$

$$S(C) \subseteq \bigcap_{x \in P(C)} S(x)$$

Given [classes](#) C_3 and C_4 , one may derive a new subclass by combining C_3 and C_4 . By default, this new [class](#) identifies the union of the requirements and the intersection of the [voting systems](#) or [devices](#) identified by C_3 and C_4 . However, additional requirements that applied to neither superclass may apply specifically to the new subclass. The combining operation on [classes](#) is represented with a wedge (^).

$$R(C_3 \wedge C_4) \supseteq R(C_3) \cup R(C_4)$$

$$S(C_3 \wedge C_4) = S(C_3) \cap S(C_4)$$

A [class](#) that is derived by combining [classes](#) that are disjoint is said to be *incoherent* and identifies no [voting systems](#) or [devices](#). The set of requirements identified by an incoherent [class](#) is likely to be self-contradictory.

2.7 Extensions

Extensions are additional functions, features, and/or capabilities included in a voting system that are not defined in the Guidelines. To accommodate the needs of states that may impose additional requirements and to accommodate changes in technology, these Guidelines allow extensions. However, as extensions are essentially subclasses of one or more classes defined in these Guidelines, they are subject to the integrity constraint that applies to all subclasses: an extension may not contradict nor relax requirements that would otherwise apply to the system and its constituent devices.