Organizing Requirements by Principles
Appendix: Requirements Text

This document is an appendix to the document:

> **Organizing Requirements by Principles:**
> **Exploring a revised structure for VVSG Chapter 3**
> (Principles-Structure for VVSG-Chap3.docx)

The contains the full text of the VVSG usability and accessibility requirements organized into principles, guidelines and requirements as outlined in the main document.

After doing the analysis and creating the structural tables, we felt that they would be useful for one kind of discussion, but that the full text would be more useful in seeing whether the new organization is sensible and whether all of the requirements are in a logical place.

Undoubtedly, we will have made some errors in the organization, and we hope that this will make it easier to find and fix them.

Although our goal was to include all of the text from the VVSG, we left out introductory and explanatory text that was not part of a requirement. And in a few cases, we have omitted the full text of some long detailed requirements, such as the "reach and touch" dimensions. These omissions are listed in full at the end of this document.

Principles and Guidelines (Overview)

PRINCIPLE 1: EQUIVALENT AND CONSISTENT

All voters have access to mark and cast their ballot as intended, regardless of their abilities, without discrimination.

1.1: Provide voters with a consistent experience of the voting process in all modes of voting

1.2: Provide voters with equivalent information and options in all modes of voting.

PRINCIPLE 2: CAST AS MARKED

Ballots are cast as marked, both secretly and privately.

2.1: The voting process shall preserve the secrecy of the ballot.

2.2: The voting system must ensure that ballot selections, interface options, voter identity and information about voters are kept private.

2.3: The voting system supports the voter in marking the ballot accurately

2.4: The voting process helps voters avoid errors that invalidate their ballot, including blank ballots, undervotes, overvotes, and marginal marks.

PRINCIPLE 3: MARKED AS INTENDED

Ballots are presented in a clear, understandable way, and is operable by all voters.

3.1: Perceivable - The default system settings for displaying the ballot work for the widest range of voters, and voters can adjust settings and preferences to meet their needs.

3.2: Operable - Voters and poll workers must be able to use all controls accurately, and all ballot changes are made with the direct control of the voter.

3.3: Understandable – Voters can understand all information as it is presented.

3.4: Robust - The voting system's hardware and accessories support usability and accessibility requirements while protecting voters from harmful conditions.

PRINCIPLE 4: TESTED FOR USABILITY

Meets performance standards for usability and accessibility.

4.1 – Conduct summative usability tests using a wide range of voters and poll workers, including those with and without disabilities.

PRINCIPLE 5: MEETS WEB ACCESSIBILITY STANDARDS

Browser-based systems meet web accessibility standards in addition to voting standards.

5.1: When a voting system uses standard web software platforms (HTML or native apps), the voting system meets all requirements in VVSG 2.0 Level AA in addition to those in the VVSG.

PRINCIPLE 1: EQUIVALENT AND CONSISTENT
All voters have access to mark and cast their ballot as intended, regardless of their abilities, without discrimination.

3. All eligible voters shall have access to the voting process without discrimination.

   Source : VVSG 3.1.1.a
   Accessibility: [voting specific]

4. The voting process shall be accessible to individuals with disabilities. The voting process includes access to the polling place, instructions on how to vote, initiating the voting session, making ballot selections, review of the ballot, final submission of the ballot, and getting help when needed.

   Source: 3.1.1.a.i
   Accessibility: [voting specific]

GUIDELINE 1.1: Provide voters with a consistent experience of the voting process in all modes of voting.

1. The voting system **shall** be capable of presenting the ballot, contest choices, review screens, vote verification records, and voting instructions in any language declared by the manufacturer to be supported by the system.

   > Discussion: For example, if the manufacturer claims that a given system is capable of supporting Spanish and Chinese, then it must do so. Presentation of the ballot includes both visual and audio formats. Both written and unwritten languages are within the scope of this requirement

   Source: 3.2.7.a
   Accessibility: [voting specific]

2. Any records, including paper ballots and paper verification records, **shall** have the information required to support auditing by poll workers and others who can read only English.

> Discussion: Even though the system must be easily available to voters without a command of English, any persistent records of the vote must also be fully available to English-only readers for auditing purposes. In the case of paper, this does not imply a fully bi-lingual ballot. For instance, the full text of a referendum question might appear only in the alternative language, but the content of the vote (e.g., "yes" on ballot question 106) needs to be readable by English-only readers.

Source: 3.2.7.a.iii
Accessibility: [voting specific]

5. The Acc-VS **shall** be integrated into the manufacturer's complete voting system so as to support accessibility for disabled voters throughout the voting session.

> Discussion: This requirement ensures accessibility to the voter throughout the entire session. Not only must individual system components (such as ballot markers, paper records, and optical scanners) be accessible, but also they must work together to support this result.

Source: 3.3.1.a
Accessibility: [voting specific]

6. If the Acc-VS generates a paper record (or some other durable, human-readable record) that can be the official ballot or determinative vote record then the voting system **shall** allow the voter to verify that record using the same access features used by the voter to cast the ballot.

> Discussion: While paper records generally provide a simple and effective means for technology-independent vote verification, their use can present difficulties for voters with certain types of disabilities. The purpose of this requirement is to ensure that all voters have a similar opportunity for vote verification.[7]Note that this requirement addresses the special difficulties that may arise with the use of paper. Verification is part of the voting process, and all the other general requirements apply to verification, in particular those dealing with dexterity (e.g. 3.3.4 c), blindness (e.g. 3.3.3 e) and low vision issues (e.g. 3.2.5 g). This requirement allows the voter to use the same access features throughout the entire voting session. It also does not preclude the voter from choosing a different access feature to verify the record. See also requirement 3.2.2.1.g.

Source: 3.3.1.e
Accessibility: [voting specific]

7. The ATI **shall** provide the same capabilities to vote and cast a ballot as are provided by its visual interface.

> Discussion: For example, if a visual ballot supports voting a straight party ticket and then changing the vote for a single contest, so must the ATI.

Source: 3.3.3.b.i
Accessibility: Related to 508: 1194.31 (Functional Performance Criteria)

8. If the Acc-VS supports ballot activation for non-blind voters, then it **shall** also provide features that enable voters who are blind to perform this activation.

> Discussion: For example, smart cards might provide tactile cues so as to allow correct insertion.

Source: 3.3.3.d
Accessibility: Related to 508: 1194.31 (Functional Performance Criteria)

9. If the Acc-VS supports ballot submission or vote verification for non-blind voters, then it **shall** also provide features that enable voters who are blind to perform these actions.

> Discussion: For example, if voters using this station normally perform paper-based verification, or if they feed their own optical scan ballots into a reader, blind voters must also be able to do so.

Source: 3.3.3.e
Accessibility: Related to 508: 1194.31 (Functional Performance Criteria)

10. The Acc-VS **shall** provide features that enable voters who lack fine motor control or the use of their hands to submit their ballots privately and independently without manually handling the ballot.

> Discussion: For example, if voters using this station normally perform paper-based verification, or if they feed their own optical scan ballots into a reader, voters with dexterity disabilities must also be able to do so. Note that the general requirement for privacy when voting (Requirement part 1:3.2.3.1 a.) still applies.

Source: 3.3.4.b
Accessibility: Related to 508: 1194.31 (Functional Performance Criteria)

11. The manufacturer **shall** supply documentation describing 1) recommended procedures that fully implement accessibility for voters with disabilities and 2) how the Acc-VS supports those procedures.

Discussion: The purpose of this requirement is for the manufacturer not simply to deliver system components, but also to describe the accessibility scenarios they are intended to support.

Source: 3.3.1.a.i
Accessibility: [voting specific]

12. The voting equipment shall display, print and store the paper record in any of the written alternative languages chosen for the ballot.
    i. To assist with manual auditing, candidate names on the paper record shall be presented in the same language as used on the DRE summary screen.
    ii. Information on the paper record not needed by the voter to perform verification shall be in English

Discussion: In addition to the voter ballot selections, the marking of the paper record as accepted or void, and the indication of the ballot page number need to be printed in the alternative language. Other information, such as precinct and election identifiers, **shall** be in English to facilitate use of the paper record for auditing.

Source: 7.8.6.c, ci, cii
Accessibility: [voting specific]

13. All accessibility requirements from Subsection 3.3 **shall** apply to voting machines with VVPAT.

Source: 7.8.7.a
Accessibility: [voting specific]

PRINCIPLE 1: EQUIVALENT AND CONSISTENT
(continued)

GUIDELINE 1.2: Provide voters with equivalent information and options in all modes of voting.

1. If the electronic ballot interface generates a paper record (or some other durable, human-readable record) that can be the official ballot or determinative vote record, then the voting system shall allow the voter to verify that record using the same access features used by the voter to vote the ballot.

   > Discussion: While paper records generally provide a simple and effective means for technology-independent vote verification, their use can present difficulties for voters who use large font, high contrast, alternative languages, and other settings described in Section 3.2. The purpose of this requirement is to ensure that all voters have a similar opportunity for vote verification. Note that this requirement addresses the special difficulties that may arise with the use of paper. Verification is part of the voting process, and all the other general requirements apply to verification, in particular those dealing with dexterity (e.g. 3.3.4 c), blindness (e.g. 3.3.3 e) and poor vision issues (e.g. 3.2.5 g). This requirement allows the voter to use the same access features throughout the entire voting session. It also does not preclude the voter from choosing a different access feature to verify the record. See also requirement 3.3.1.e.

   Source : VVSG 3.2.2.1.g
   Accessibility: [voting specific]

14. Voting systems using paper ballots or paper verification records **shall** provide features that assist in the reading of such ballots and records by voters with poor reading vision.

   > Discussion: While this requirement may be satisfied by one of its sub-requirements, other innovative solutions are not precluded.

   Source: 3.2.5.g
   Accessibility: [voting specific]

11. Information presented to the voter in the typical case of English-literate voters (including instructions, warnings, messages, contest choices, and vote verification information) shall also be presented when an alternative language is being used, whether the language is written or an unwritten language presented aurally.

> Discussion: Therefore, it may not be sufficient simply to present the ballot per se in the alternative language, especially in the case of electronic ballot interface systems. All the supporting information must also be available in the alternative language.

Source: VVSG 3.2.7.a.ii
Accessibility: [voting specific]

12. When the provision of accessibility for the Acc-VS involves an alternative format for ballot presentation, then all information presented to non-disabled voters, including instructions, warnings, error and other messages, and contest choices, shall be presented in that alternative format.

Source: VVSG 3.3.1.b
Accessibility: Related to 508: 1194.31 (Functional Performance Criteria)

13. If the Acc-VS has an electronic image display, the Acc-VS **shall** provide synchronized audio output to convey the same information as that which is displayed on the screen

Source: 3.3.2.c
Accessibility: Related to 508: 1194.31 (Functional Performance Criteria)

14. The system **shall** allow the voter to switch among the three modes (synchronized audio/video, video-only, or audio-only) throughout the voting session while preserving the current votes.

Source: VVVSG: 3.3.2.c.ii
Accessibility: Related to 508: 1194.31 (Functional Performance Criteria)

15. If the Acc-VS provides sound cues as a method to alert the voter, the tone **shall** be accompanied by a visual cue, unless the station is in audio-only mode.

> Discussion: For instance, the voting equipment might beep if the voter attempts to overvote. If so, there would have to be an equivalent visual cue, such as the appearance of an icon, or a blinking element. If the Acc-VS has been set to audio-only mode, there would be no visual cue.

Source: VVSG: 3.3.6.b
Accessibility: 508: 1194.31.c ((Functional Performance Criteria: Hearing)

16. All usability requirements from Subsection 3.1 **shall** apply to voting machines with VVPAT.

> Discussion: The requirements in this section are in addition to those in Subsection 3.1.

Source: VVSG: 7.8.6
Accessibility: [voting specific]

17. If the normal voting procedure includes VVPAT, the accessible voting equipment should provide features that enable voters who are visually impaired and voters with an unwritten language to perform this verification. If state statute designates the paper record produced by the VVPAT to be the official ballot or the determinative record on a recount, the accessible voting equipment shall provide features that enable visually impaired voters and voters with an unwritten language to review the paper record.

> Discussion: For example, the accessible voting equipment might provide an automated reader that converts the paper record contents into audio output. Subsection 3.3.1.e also applies

Source: VVSG: 7.8.7.b
Accessibility: [voting specific]

PRINCIPLE 2: CAST AS MARKED
Ballots are cast as marked, both secretly and privately.

GUIDELINE 2.1: The voting process shall preserve the secrecy of the ballot.

Source: 3.1.1.c
Accessibility: [voting specific]

1. The voting process must preclude anyone else from determining the content of a voter's ballot without the voter's cooperation. Privacy ensures that the voter can cast votes based solely on his or her own preferences without intimidation or inhibition.

Source: 3.2.3
Accessibility: [voting specific]

18. The voting system **shall** not issue a receipt to the voter that would provide proof to another of how the voter voted.

Source: 3.2..e
Accessibility: [voting specific]

19. No information **shall** be kept within an electronic cast voter record that identifies any alternative language feature(s) used by a voter.

Source: 3.2.3.2.a
Accessibility: [voting specific]

20. No information **shall** be kept within an electronic cast voter record that identifies any accessibility feature(s) used by a voter.

Source: 3.2.3.2.b
Accessibility: [voting specific]

> Discussion: When voters use non-typical ballot interfaces, such as large print or alternative languages, their anonymity may be vulnerable. To the extent possible, only the logical contents of their ballots should be recorded, not the special formats in which they were rendered. However, in the case of paper ballots, where the interface is the record, some format information is unavoidably preserved.

21. When a VVPAT with a spool-to-spool continuous paper record is used, a means **shall** be provided to preserve the secrecy of the paper record of voter selections.

   Source: 7.8.5.b
   Accessibility: [voting specific]

22. When a VVPAT with a spool-to-spool continuous paper record is used, no record **shall** be maintained of which voters used which voting machine or the order in which they voted.

   Source: 7.8.5.c
   Accessibility: [voting specific]

23. Unique identifiers **shall** not be displayed in a way that is easily memorable by the voter.

   > Discussion: Unique identifiers on the paper record are displayed or formatted in such a way that they are not memorable to voters, such as by obscuring them in other characters.

   Source: 7.8.5.f
   Accessibility: [voting specific]

24. Both paper rolls and paper record secure receptacles **shall** be controlled, protected, and preserved with the same security as a ballot box.

   Source: 7.8.5.g
   Accessibility: [voting specific]

PRINCIPLE 2: CAST AS MARKED
(continued)

GUIDELINE 2.2: The voting system must ensure that ballot selections, interface options, voter identity and information about voters are kept private.

1. The voting process **shall** preclude anyone else from determining the content of a voter's ballot without the voter's cooperation. If such a determination is made against the wishes of the voter, then his or her privacy has been violated.

   Source: 3.1.1.c.i
   Accessibility: [voting specific]

25. The voting system **shall** prevent others from determining the contents of a ballot.

   > Discussion: The voting system itself provides no means by which others can "determine" how one has voted. Of course voters could simply tell someone else for whom they voted, but the system provides no evidence for such statements, and therefore voters cannot be coerced into providing such evidence. It is assumed that the system is deployed according to the installation instructions provided by the manufacturer. Whether the configuration of the voting system protects privacy may well depend on proper setup.

   Source: 3.2.3.1.a
   Accessibility: [voting specific]

26. The voting system **shall** support ballot privacy during the voting session and ballot submission.

   > Discussion: This requirement may involve different approaches for electronic and paper interfaces. In both cases, appropriate shielding of the voting station is important. When a paper record with ballot information needs to be transported by the voter, devices such as privacy sleeves may be necessary. This requirement applies to all records with information on votes (such as a vote verification record) even if that record is not itself a ballot.

   Source: 3.2.3.1.b
   Accessibility: [voting specific]

27. During the voting session, the audio interface of the voting system **shall** be audible only to the voter.

> Discussion: Voters who are hard of hearing but need to use an audio interface may also need to increase the volume of the audio. Such situations require headphones with low sound leakage.

Source: 3.2.3.1.c
Accessibility: [voting specific]

28. The voting system **shall** issue all warnings in a way that preserves the privacy of the voter and the confidentiality of the ballot.

> Discussion: HAVA 301 (a)(1)(C) mandates that the voting system must notify the voter of an attempted overvote in a way that preserves the privacy of the voter and the confidentiality of the ballot. This requirement generalizes that mandate.

Source: 3.2.3.1.d
Accessibility: [voting specific]

29. There **shall** be a means by which the voter can disable either the audio or the video output, resulting in a video-only or audio-only presentation, respectively.

Source: 3.3.2.c.i
Accessibility: Related to WCAG 1.1

30. Voter privacy **shall** be preserved during the process of recording, verifying and auditing his or her ballot selections.

> Discussion: The privacy requirements from Section 3 also apply to voting equipment with VVPAT.

Source: 7.8.5.a
Accessibility: [voting specific]

31. The electronic and paper records **shall** be created and stored in ways that preserve the privacy of the voter.

> Discussion: For VVPAT systems that use separate pieces of paper for the record, this can be accomplished in various ways including shuffling the order of the records or other methods to separate the order of stored records.

Source: 7.8.5.d
Accessibility: [voting specific]

32. The privacy of voters whose paper records contain an alternative language **shall** be maintained

Source: 7.8.5.d
Accessibility: [voting specific]

PRINCIPLE 2: CAST AS MARKED
(continued)

GUIDELINE 2.3: The voting system supports the voter in marking the ballot accurately

1. Each ballot shall accurately capture selections made by the voter

   Source: 3.1.1.b
   Accessibility: [voting specific]

33. The voting system **shall** support voters in the task of effectively completing their ballots.

    Source: 3.2.1.a
    Accessibility: [voting specific]

34. The features of the voting system shall not contribute to the commission of voter error within the voting session.

    Source: 3.2.1.b
    Accessibility: [voting specific]

35. The voting system **shall** provide the capability to design a ballot with a high level of clarity and comprehensibility.

    Source: 3.2.4.e
    Accessibility: [voting specific]

36. The voting system should not visually present a single contest spread over two pages or two columns.

    Discussion: Such a visual separation poses the risk that the voter may perceive one contest as two, or fail to see additional choices. If a contest has a large number of candidates, it may be infeasible to observe this guideline.

    Source: 3.2.4.e.i
    Accessibility: [voting specific]

37. The ballot **shall** clearly indicate the maximum number of candidates for which one can vote within a single contest.

Source: 3.2.4.e.ii
Accessibility: [voting specific]

38. The relationship between the name of a candidate and the mechanism used to vote for that candidate **shall** be consistent throughout the ballot.

> Discussion: For example, the response field where voters indicate their votes must not be located to the left of some candidates' names, and to the right of others'.

Source: 3.2.4.e.iii
Accessibility: [voting specific]

39. The voting system **shall** provide unambiguous feedback regarding the voter's selection, such as displaying a checkmark beside the selected option or conspicuously changing its appearance.

Source: 3.2.6.b
Accessibility: [voting specific]

40. The electronic ballot interface shall prevent voters from selecting more than the allowable number of choices for each contest.

> Discussion: This requirement does not specify exactly how the system must respond when a voter attempts to select an "extra" candidate. For instance, the system may prevent the selection and issue a warning, or, in the case of a single-choice contest, simply change the vote.

Source: 3.2.2.1.a
Accessibility:

PRINCIPLE 2: CAST AS MARKED
(continued)

GUIDELINE 2.4: The voting process helps voters avoid errors that invalidate their ballot, including blank ballots, undervotes, overvotes, and marginal marks.

Requirements for Notification and Warnings

1. If and only if the voter successfully casts or prints the ballot, then the electronic ballot interface or PCOS system **shall** so notify the voter.

> Discussion: The purpose of this requirement is to provide feedback to voters to assure them that the voting session has been completed. Note that either a false notification of success or a missing confirmation of actual success violates this requirement.

Source: 3.2.2.d
Accessibility: WCAG 3.3.1, 3.3.3-4

41. If the voter takes the appropriate action to cast a ballot, but the DRE does not accept and record it successfully, including failure to store the ballot image, then the DRE **shall** so notify the voter and provide clear instruction as to the steps the voter should take to cast the ballot.

> Discussion: If a DRE fails at the point of casting a ballot, it must clearly indicate to the voter and to election officials responding to the failure whether or not the ballot was cast. Otherwise, election officials may be unable to provide substantial confirmation that the vote was or was not counted, possibly resulting in disenfranchisement or the casting of more than one ballot by a single voter. A device that "freezes" when the voter attempts to cast the ballot, providing no evidence one way or the other whether the ballot was cast would violate this requirement.

Source: 3.2.2.1.f
Accessibility: WCAG 3.3.1, 3.3.3-4

42. If the voter takes the appropriate action to cast a ballot, but the PCOS system does not accept and record it successfully, including failure to read the ballot or to transport it into the ballot box, the PCOS **shall** so notify the voter.

> Discussion: This requirement means that PCOS systems must detect and report electrical and mechanical failures within the system itself. It does not require the detection of errors on the part of the voter.

Source: 3.2.2.2.g
Accessibility: WCAG 3.3.1, 3.3.3-4

43. The PCOS system **shall** be capable of notifying the voter that he or she has submitted a paper ballot that is blank on one or both sides. The system **shall** provide a means for an authorized election official to deactivate this capability.

> Discussion: One purpose of this feature is to detect situations in which the voter might be unaware that the ballot is two-sided. This feature is distinct from the ability to detect and warn about undervoting.

Source: 3.2.2.2.c
Accessibility: WCAG 3.3.1, 3.3.3-4

44. If the voter selects more than the allowable number of choices within a contest, the voting system **shall** notify the voter of the effect of this action before the ballot is cast and counted.

> Discussion: In the case of manual systems, this may be achieved through appropriately placed instructions. This requirement has no force for electronic ballot interfaces, since they prevent overvoting in the first place.

Source: 3.2.2.a
Accessibility: WCAG 3.3.1, 3.3.3-4

45. The PCOS system shall be capable of providing feedback to the voter that identifies specific contests for which the voter has made more than the allowable number of votes (i.e., overvotes).

Source: 3.2.2.2.a
Accessibility: WCAG 3.3.1, 3.3.3-4

46. The PCOS system **shall** be capable of providing feedback to the voter that identifies specific contests for which the voter has made fewer than the allowable number of votes (i.e., undervotes). The system **shall** provide a means for an authorized election official to deactivate this capability entirely and by contest. However, if a ballot is submitted with all the contests on one side left blank, notification to the voter is performed as described in requirement 3.2.2.2 c

   Source: 3.2.2.2.b
   Accessibility: WCAG 3.3.1, 3.3.3-4

47. The electronic ballot interface **shall** provide feedback to the voter, before final casting or printing of the ballot, that identifies specific contests for which the voter has selected fewer than the allowable number of choices (i.e., undervotes).

   > Discussion: For electronic ballot interface systems, no allowance is made for disabling this feature. Also, see the plain language requirement below on clarity of warnings 3.2.4c.i

   Source: 3.2.2.1.b
   Accessibility: WCAG 3.3.1, 3.3.3-4

Requirements for Error Correction

1. The voting system **shall** allow the voter, at the voter's choice, to submit an undervoted ballot without correction.

   Source: 3.2.2.b
   Accessibility: WCAG 3.3.1, 3.3.3-4

48. The voting system **shall** provide the voter the opportunity to correct the ballot for either an undervote or overvote before the ballot is cast and counted.

   > Discussion: In the case of manual systems, this may be achieved through appropriately placed written instructions. Some corrections may require the voter to obtain a new paper ballot from a poll worker. Also, note the requirements on precinct-count optical scanners in Section 3.2.2.2 below.

   Source: 3.2.2.c
   Accessibility: WCAG 3.3.1, 3.3.3-4

49. The electronic ballot interface shall provide the voter the opportunity to correct the ballot before it is cast or printed. The electronic ballot interface shall allow the voter to make these corrections without assistance. The corrections to be supported.

   Source: 3.2.2.1.c
   Accessibility: WCAG 3.3.1, 3.3.3-4

50. The electronic ballot interface shall allow the voter to change a vote within a contest before advancing to the next contest.

   > Discussion: The point here is that voters using an editable interface should not have to wait for a final ballot review screen in order to change a vote.

   Source: 3.2.2.1.d
   Accessibility: WCAG 3.3.1, 3.3.3-4

51. If the PCOS system has notified the voter that a potential error condition (such as an overvote, undervote, or blank ballot) exists, the system shall then allow the voter to correct the ballot or to submit it as is.

   > Discussion: This requirement mandates that the system be capable of allowing either correction or immediate submission. For instance, a questionable paper ballot might be physically ejected for possible correction. This requirement does not constrain the procedures that jurisdictions might adopt for handling such situations (e.g., whether poll worker intervention is required).

   Source: 3.2.2.2.d
   Accessibility: WCAG 3.3.1, 3.3.3-4

52. Paper-based precinct tabulators **shall** be able to identify a ballot containing marginal marks. When such a ballot is detected, the tabulator **shall**:
   i.   Return the ballot to the voter;
   ii. Provide feedback to the voter that identifies the specific contests for which a marginal mark was detected; and
   iii. Allow the voter either to correct the ballot or to submit the ballot "as is" without correction, at the voter's choice.

   > Discussion: Basically, a marginal mark is one that, according to the manufacturer specifications, is neither clearly countable as a vote nor clearly countable as a non-vote.

The purpose of this requirement is to provide more certainty about the handling of poorly-marked ballots. If a given candidate or option is clearly marked as chosen, or left completely unmarked, then there is no ambiguity to resolve. However, each manufacturer should define a "gray area" (with respect to location, darkness, etc.) in which marks will be actively flagged as ambiguous.

Source: 3.2.2.2.e, i-iii
Accessibility: WCAG 3.3.1, 3.3.3-4

PRINCIPLE 3: MARKED AS INTENDED
Ballots are presented in a clear, understandable way, and is operable by all voters.

GUIDELINE 3.1: Perceivable - The default system settings for displaying the ballot work for the widest range of voters, and voters can adjust settings and preferences to meet their needs.

1. The ballot **shall** be presented to the voter in a manner that is clear and usable. Voters should encounter no difficulty or confusion regarding the process for recording their selections.

   Source: 3.1.1.b.i
   Accessibility: WCAG 1

Requirements for Custom Settings

53. Any aspect of the voting system voter interface that is adjustable by either the voter or poll worker, including font size, color, contrast, audio volume, or rate of speech, shall automatically reset to a standard default value upon completion of that voter's session. For the Acc-VS with an electronic image display, the aspects include synchronized audio/video mode and non-manual input mode.

    Discussion: This ensures that the voting system presents the same initial appearance to every voter.

    Source: 3.2.5.b
    Accessibility: [voting specific]. Related to 1194.25.f (Reset volume)

54. If any aspect of a voting system is adjustable by either the voter or poll worker, there **shall** be a mechanism to allow the voter to reset all such aspects to their default values while preserving the current votes.

    Discussion: The purpose is to allow a voter or poll worker who has adjusted the system into an undesirable state to reset all the aspects and begin again.

    Source: 3.2.5.c
    Accessibility: [voting specific]. Related to 1194.25.f (Reset volume)

15. The electronic ballot interface should allow the voter to select among the available languages throughout the voting session while preserving the current votes. When presenting a choice of languages to the voter, the electronic ballot interface **shall** use the native name of each language.

> Discussion: For instance, a voter may initially choose an English version of the ballot, but then wish to switch to another language in order to read a referendum question.

Source: 3.2.7.a.i
Accessibility: [voting specific]

Requirements for All Visual Interfaces

55. The default visual display for voters and poll workers of a voting station with an electronic display **shall** have a luminosity contrast ratio between the foreground text and background color of at least 10:1 for all elements that visually convey information such as text, controls, and infographics or icons. For paper ballots, the contrast ratio **shall** be at least 10:1 as measured based on ambient lighting of at least 300 lx.

> Discussion: A 10:1 luminosity contrast ratio provides enough difference between the text and background to enable people with most color vision deficiencies to read the ballot. Note that this is higher than the general web requirements of 4.5:1 in WCAG 2.0 Checkpoint 1.4.6 (Level AAA) to accommodate a wider range of visual disabilities. There are several free tools available to test color luminosity contrast, including http://juicystudio.com/services/luminositycontrastratio.php

The contrast ratio between the target area boundaries and the surrounding space **shall** be no less than 10:1. (printed ballots). 3.c

> Discussion: For example, this applies to the oval or box outline delineating the target area, as well as the broken arrow designating the target area.

Source: 3.2.5.h.i and 3.2.2.2.f.ii
Accessibility: Exceeds WCAG 1.4.3 and 1.4.3 (Contrast Minimum/Enhanced)

56. The use of color by the voting system **shall** agree with common conventions: (a) green, blue or white is used for general information or as a normal status indicator; (b) amber or yellow is used to indicate warnings or a marginal status; (c) red is used to indicate error conditions or a problem requiring immediate attention.

Source: 3.2.4.f
Accessibility: WCAG 1.4.1 (Use of Color)

57. Color coding **shall** not be used as the sole means of conveying information, indicating an action, prompting a response, or distinguishing a visual element.

> Discussion: While color can be used for emphasis, some other non-color mode must also be used. This could include shape, lines, words, text, or text style. For example, an icon for "stop" can be red enclosed in an octagon shape. Or, a background color can be combined with a bounding rule and a label to group elements on the ballot.

Source: 3.2.5.i
Accessibility: WCAG 1.4.1 (Use of Color)

58. For all text intended for voters or poll workers, the voting system **shall** provide a font with the following characteristics
   i. Height of capital letters at least: 3.0 mm
   ii. ii. x-height of at least: 70% of cap height
   iii. iii. Stroke width at least: 0.35 mm.

Source: 3.2.5.d
Accessibility: WCAG 1.4.8 (AAA) (Visual presentation)

59. Text intended for the voter should be presented in a sans serif font.

> Discussion: In general, sans serif fonts are easier to read on-screen, they look reasonably good when their size is reduced, and they tend to retain their visual appeal across different platforms.

Source: 3.2.5.f
Accessibility: N/A, Based on guidelines for dyslexia and other reading disabilities

Requirements for Electronic Visual Interfaces

1. A voting system that uses an electronic image display shall be capable of showing all information in at least two font sizes:

   i. 3.0-4.0 mm cap height, with a corresponding x-height at least 70% of the cap height and a minimum stroke width of 0.35 mm;

   ii. 6.3-9.0 mm cap height, with a corresponding x-height at least 70% of the cap height and a minimum stroke width of 0.7 mm; under control of the voter. The system shall allow the voter to adjust font size throughout the voting session while preserving the current votes.

> Discussion: While larger font sizes may assist most voters with poor vision, certain disabilities such as tunnel vision are best addressed by smaller font sizes. Larger font sizes may also assist voters with cognitive disabilities. This requirement mandates the availability of at least two font sizes, but additional choices (including continuous variability) are allowed.

Source: 3.2.5.e
Accessibility: WCAG 1.4.4

2. A voting station with an electronic display screen shall have a high contrast mode either as an initial setting or under the control of the voter. If the system allows the voter to adjust contrast during the voting session it shall preserve the current votes. High contrast is a luminosity contrast ratio between the foreground text and background color of at least 20:1. The high contrast mode shall use at least one of the following color combinations:

   - Black text on a white background
   - White text on a black background
   - Yellow text on a black background
   - Light cyan text on a black background

> Discussion: A high contrast mode ensures that there is an option for the visual presentation for people with color vision deficiencies or whose vision requires high contrast.

Source: 3.2.5.h.ii
Accessibility: WCAG 1.4.3 and 1.4.6

3. An Acc-VS with a color electronic image display **shall** allow the voter to adjust the color saturation throughout the voting session while preserving the current votes.

Source: 3.3.2.a
Accessibility: WCAG 1.4.8

4. At a minimum, two alternative display options listed **shall** be available: 1) black text on white background,2) white text on black background, 3) yellow text on a black background, or 4) light cyan text on a black background.

Source: 3.3.2.a.i
Accessibility: WCAG 1.4.3 and 1.4.6

Requirements for Print Interfaces

1. The voting system may achieve legibility of paper records by supporting the printing of those records in at least two font sizes, 3.0-4.0mm and 6.3-9.0mm.

   > Discussion: Although the system may be capable of printing in several font sizes, the use of various font sizes in an actual election may be governed by local or state laws and regulations.

   Source: 3.2.5.g.i
   Accessibility: WCAG 1.4.4, 1.4.8 (AAA)

2. The system may achieve legibility of paper records by supporting magnification of those records. This magnification may be done by optical or electronic devices. The manufacturer may either: 1) provide the magnifier itself as part of the system, or 2) provide the make and model number of readily available magnifiers that are compatible with the system.

   > Discussion: The magnifier(s) either provided or cited must, of course, provide legibility for the paper as actually presented on the system. For instance, if the paper record is under a transparent cover to prevent the voter from touching it, the means of magnification must be compatible with this configuration. "Straight edge" magnifiers, which allow the user to read an entire line, may be especially suitable for the voting task.

   Source: 3.2.5.g.ii
   Accessibility: WCAG 1.4.8 (AAA)

3. The voting equipment shall be capable of showing the information on the paper in a font size of at least 3.0 mm and should be capable of showing the information in at least two font ranges; 3.0-4.0 mm and 6.3-9.0 mm, under the control of the poll worker

   > Discussion: In keeping with requirements in Subsection 3.1, the paper record should use the same font sizes as displayed by the voting machine, but at least be capable of 3.0 mm. While larger font sizes may assist voters with poor vision, certain disabilities such as tunnel vision are best addressed by smaller font sizes.

   Source: 7.8.6.b
   Accessibility: WCAG 1.4.4, 1.4.8 (AAA)

Requirements for Audio Interfaces

1. The audio system **shall** set the initial volume for each voting session between 60 and 70 dB SPL.

   > Discussion: A voter does not "inherit" the volume as set by the previous user of the voting station. See requirement 3.2.5.b.

   Source: 3.3.3.c.iv
   Accessibility: Related to 508: 1194.25.e and f

4. The audio system **shall** allow the voter to control the volume throughout the voting session while preserving the current votes. The volume **shall** be adjustable from a minimum of 20dB SPL up to a maximum of 100 dB SPL, in increments no greater than 10 dB.

   Source: 3.3.3.c.v
   Accessibility: WCAG 1.4.2, 508: 1194.25.f

5. The audio system **shall** be able to reproduce frequencies over the audible speech range of 315 Hz to 10 KHz.

   > Discussion: The required frequencies include the range of normal human speech. This allows the reproduced speech to sound natural.

   Source: 3.3.3.c.vi
   Accessibility: WCAG 1.4.2

6. The audio presentation of verbal information should be readily comprehensible by voters who have normal hearing and are proficient in the language. This includes such characteristics as proper enunciation, normal intonation, appropriate rate of speech, and low background noise. Candidate names should be pronounced as the candidate intends.

   > Discussion: This requirement covers both recorded and synthetic speech. It applies to those aspects of the audio content that are inherent to the voting system or that are generated by default. To the extent that the audio presentation is determined by election officials designing the ballot, it is beyond of the scope of this requirement.

   Source: 3.3.3.c.vii
   Accessibility: Related to 508: 1194.25.f

7. The audio system **shall** allow the voter to control the rate of speech throughout the voting session while preserving the current votes. The range of speeds supported **shall** include 75% to 200% of the nominal rate. Adjusting the rate of speech **shall** not affect the pitch of the voice.

   Source: 3.3.3.c.viii
   Accessibility: n/a

8. The Acc-VS **shall** incorporate the features listed under Requirement 3.3.3 c for voting systems that provide audio presentation of the ballot.

   > Discussion: Note especially the requirements for volume initialization and control.

   Source: 3.3.6.a
   Accessibility: [voting specific]

9. For voters with low reading proficiency in English, use audio interface requirement 3.3.3 b

   Source: 3.3.8.a
   Accessibility: [voting specific]

Requirements for Mechanical or Tactile Controls

1. Groups of buttons and controls which perform different functions on the Acc-VS **shall** be distinguishable by both shape and color. This applies to buttons and controls implemented either "on-screen" or in hardware. This requirement does not apply to sizeable groups of keys in wide use by individuals with disabilities, such as a full alphabetic keyboard when used for purposes other than basic navigation and selection (e.g. entering a write-in candidate name).

   > Discussion: The redundant cues assist those with low vision. They also help individuals who may have difficulty reading the text on the screen, those who are blind but have some residual vision, and those who use the controls on an Acc-VS because of limited dexterity. While this requirement is primarily focused on those with low vision, a feature intended primarily to address one kind of disability may very well assist voters with other kinds. The TRACE Center's EZ Access design is an example of button functions distinguishable by both shape and color: http://trace.wisc.edu/ez/

   Source: 3.3.2.b   Accessibility: WCAG 1.3.3

10. Mechanically operated controls or keys, or any other hardware interface on the Acc-VS available to the voter **shall** be tactilely discernible without activating those controls or keys.

> Discussion: A blind voter should be able to operate the Acc-VS by "feel" alone. This means that vision should not be necessary for such operations as inserting a smart card or plugging into a headphone jack. Note also the more general Requirement 3.2.6 c. against accidental activation of controls.

Source: 3.3.3.f   Accessibility: 508: 1194.23.k(1)

11. The status of all locking or toggle controls or keys (such as the "shift" key) for the Acc-VS **shall** be visually discernible, and also discernible through either touch or sound.

Source: 3.3.3.g   Accessibility: 508: 1194.23.k(4)

PRINCIPLE 3: MARKED AS INTENDED
(continued)

GUIDELINE 3.2: Operable - Voters and poll workers must be able to use all controls accurately, and all ballot changes made with the direct control the voter.

Requirements for All Interface Controls

1. The electronic ballot interface shall provide navigation controls that allow the voter to advance to the next contest or go back to the previous contest before completing a vote on the contest(s) currently being presented (whether visually or aurally).

   > Discussion: For example, voters should not be forced to proceed sequentially through all the contests before going back to check their votes within a previous contest.

   Source: 3.2.2.1.e
   Accessibility: [voting specific]Related to WCAG 2.4.5

12. The voting system **shall** not require voter speech for its operation.

   > Discussion: This does not preclude voting systems from offering speech input as an option, but speech must not be the only means of input.

   Source: 3.3.9.a
   Accessibility: 508: 1194.31.e

13. Voting system input mechanisms **shall** be designed to prevent accidental activation.

   > Discussion: There are at least two kinds of accidental activation. One is when a control is activated as it is being "explored" by the voter because the control is overly sensitive to the touch. A second issue is the problem of having a control in a location where it can easily be activated unintentionally. An example would be a button in the very bottom left corner of the screen where a voter might hold the unit for support.

   Source: 3.2.6.c
   Accessibility: Related to 508: 1194.31.f and 508: 1194.23.k(1)

Controls within reach

1. The Acc-VS **shall** provide a clear floor space of 30 inches minimum by 48 inches minimum for a stationary mobility aid. The clear floor space **shall** be designed for a forward approach or a parallel approach.

   Source: 3.3.5.a
   Accessibility: ADAAG1

2. When deployed according to the installation instructions provided by the manufacturer, the Acc-VS **shall** allow adequate room for an assistant to the voter. This includes clearance for entry to and exit from the area of the voting station.

   > Discussion: Disabled voters sometimes prefer to have an assistant help them vote. The setup of the Acc-VS should not preclude this.

   Source: 3.3.5.b
   Accessibility: ADAAG

3. Labels, displays, controls, keys, audio jacks, and any other part of the Acc-VS necessary for the voter to operate the voting system **shall** be legible and visible to a voter in a wheelchair with normal eyesight (no worse than 20/40, corrected) who is in an appropriate position and orientation with respect to the Acc-VS.

   > Discussion: There are a number of factors that could make relevant parts of the Acc-VS difficult to see, such as: small lettering; controls and labels tilted at an awkward angle from the voter's viewpoint; and glare from overhead lighting.

   Source: 3.3.5.c
   Accessibility: ADAAG

4. If the Acc-VS has a forward approach with no forward reach obstruction then the high reach shall be 48 inches maximum and the low reach shall be 15 inches minimum. See Figure 1.

   Source: 3.3.5.1.a
   Accessibility: ADAAG

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[1] ADA Accessibility Guidelines (ADAAG) contains requirements for accessibility to buildings and facilities by individuals with disabilities under the Americans with Disabilities Act (ADA) of 1990. https://www.access-board.gov/guidelines-and-standards/buildings-and-sites/about-the-ada-standards/background/adaag

5. If the Acc-VS has a forward approach with a forward reach obstruction, the following sub-requirements **shall** apply. (See Figure 2).

   [i – iv]

   Source: 3.3.5.1.b
   Accessibility: ADAAG

6. If the Acc-VS has a parallel approach with no side reach obstruction then the maximum high reach shall be 48 inches and the minimum low reach shall be 15 inches. See Figure 3.

   [i – ii]

   Source: 3.3.5.1.c
   Accessibility: ADAAG

7. If the Acc-VS has a parallel approach with a side reach obstruction, the following sub-requirements shall apply. See Figure 4.

   Discussion: Since this is a parallel approach, no clearance under the obstruction is required.

   Source: 3.3.5.1.d
   Accessibility: ADAAG

8. The paper and electronic records **shall** be presented to allow the voter to read and compare the records without the voter having to shift his or her position

   Source: 7.8.6.d
   Accessibility: [voting specific]

Requirements for Print Interfaces

1. The target shall be no less than 3 mm across in any direction.

   Source: 3.2.2.2.f.i
   Accessibility: 508: 1194.31.f

2. If the paper record cannot be displayed in its entirety on a single page, a means shall be provided to allow the voter to view the entire record.

> Discussion: Possible solutions include scrolling the paper or printing a new sheet of paper. The voter should be notified if it is not possible to scroll in reverse, so they will know to complete verification in one pass.

3. If the paper record cannot be displayed in its entirety on a single page, each page of the record shall be numbered and shall include the total count of pages for the record.

> Discussion: Possible numbering schemes include "Page X of Y"

Requirements for Electronic Interface Controls

1. The electronic ballot interface shall not require page scrolling by the voter.

> Discussion: That is, the page of displayed information must fit completely within the physical screen presenting it. Scrolling is not an intuitive operation for those unfamiliar with the use of computers. Even those experienced with computers often do not notice a scroll bar and miss information at the bottom of the "page." Voting systems may require voters to move to the next or previous "page."

9. On touch screens, the sensitive touch areas **shall** have a minimum height of 0.5 inches and minimum width of 0.7 inches. The vertical distance between the centers of adjacent areas **shall** be at least 0.6 inches, and the horizontal distance at least 0.8 inches. Touch areas **shall** not overlap.

Requirements for Controls

1. The Acc-VS **shall** provide an audio-tactile interface (ATI) that supports the full functionality of the visual ballot interface.

> Discussion: Note the necessity of both audio output and tactilely discernible controls for voter input. Full functionality includes at least:

> • Instructions and feedback on initial activation of the ballot (such as insertion of a smart card), if applicable;
>
> • Instructions and feedback to the voter on how to operate the accessible voting station, including settings and options (e.g., volume control, repetition);
>
> • Instructions and feedback for navigation of the ballot;
>
> • Instructions and feedback for contest choices, including write-in candidates;
>
> • Instructions and feedback on confirming and changing votes; and
>
> • Instructions and feedback on final submission of ballot.

Source: 3.3.3.b
Accessibility: [voting specific] Related to 508: 1194.25 and 508:1194.23.k.1-4

10. Keys, controls, and other manual operations on the Acc-VS shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist. The force required to activate controls and keys shall be no greater 5 lbs. (22.2 N).

> Discussion: Controls are to be operable without excessive force. This includes operations such as inserting an activation card, and inserting and removing ballots.

Source: 3.3.4.c
Accessibility: 508: 1194.23.k.1

11. The Acc-VS controls shall not require direct bodily contact or for the body to be part of any electrical circuit.

> Discussion: This requirement ensures that controls are operable by individuals using prosthetic devices.

Source: 3.3.4.d
Accessibility: Related to 508: 1194.24.d

12. No key or control on a voting system shall have a repetitive effect as a result of being held in its active position.

> Discussion: This is to preclude accidental activation. For instance, if a voter is typing in the name of a write-in candidate, depressing and holding the "e" key results in only a single "e" added to the name.

Source: 3.2.6.c.ii

Accessibility: 508: 1194.23.k(3)

Requirements for Audio Controls

1. The ATI shall allow the voter to have any information provided by the voting system repeated.

   > Discussion: This feature may also be useful to voters with cognitive disabilities.

   Source: 3.3.3.b.ii
   Accessibility: WCAG 1.4.2

2. The ATI shall allow the voter to pause and resume the audio presentation.

   > Discussion: This feature may also be useful to voters with cognitive disabilities.

   Source: 3.3.3.b.iii
   Accessibility: WCAG 1.4.2

3. The ATI shall allow the voter to skip to the next contest or return to previous contests.

   > Discussion: This is analogous to the ability of sighted voters to move on to the next contest once they have made a selection or to abstain from voting on a contest altogether.

   Source: 3.3.3.b.iv
   Accessibility: WCAG 1.4.2

4. The ATI shall allow the voter to skip over the reading of a referendum so as to be able to vote on it immediately.

   > Discussion: This is analogous to the ability of sighted voters to skip over the wording of a referendum on which they have already made a decision prior to the voting session (e.g., "Vote yes on proposition #123").

   Source: 3.3.3.b.v
   Accessibility: WCAG 1.4.2

Requirements for System Response to Voter Actions

1. The initial system response time of the electronic ballot interface shall be no greater than 0.5 seconds.

   > Discussion: This is so the voter can very quickly perceive that an action has been detected by the system and is being processed. The voter never gets the sense of dealing with an

unresponsive or "dead" system. Note that this requirement applies to auditory and visual voting system responses.

2. When the voter performs an action to record a single vote, the completed system response time of the electronic ballot interface shall be no greater than one second in the case of a visual response, and no greater than five seconds in the case of an audio response.

   Discussion: For example, if the voter touches a button to indicate a vote for a candidate, a visual system might display an "X" next to the candidate's name, and an audio system might announce, "You have voted for John Smith for Governor".

3. The completed system response time during a voter interaction with the visual display of the electronic ballot interface shall be no greater than 10 seconds.

   Discussion: Even for "large" operations such as initializing the ballot or painting a new screen, the system must never take more than 10 seconds. In the case of audio systems, no upper limit is specified, since certain operations may take longer, depending on the length of the text being read (e.g., reading out a long list of candidates running in a contest).

4. If the electronic ballot interface has not completed its visual response within one second, it shall present to the voter, within 0.5 seconds of the voter's action, some indication that it is preparing its response.

   Discussion: For instance, the system might present a progress bar indicating that it is "busy" processing the voter's request. This requirement is intended to preclude the "frozen screen" effect, in which no detectible activity is taking place for several seconds. There need not be a specific "activity" icon, as long as some visual change is apparent (such as progressively "painting" a new screen).

5. The electronic ballot interface shall detect and warn about lengthy voter inactivity during a voting session. Each electronic ballot interface shall have a defined and documented voter inactivity time, and that time shall be between two and five minutes.

> Discussion: Each type of system must have a given inactivity time that is consistent among and within all voting sessions. This ensures that all voters are treated equitably.

Source: 3.2.6.1.e
Accessibility: WCAG 2.2.1

6. Upon expiration of the voter inactivity time, the electronic ballot interface **shall** issue an alert and provide a means by which the voter may receive additional time. The alert time **shall** be between 20 and 45 seconds. If the voter does not respond to the alert within the alert time, the electronic ballot interface **shall** go into an inactive state requiring poll worker intervention.

Source: 3.2.6.1.f
Accessibility: WCAG 2.2.1

PRINCIPLE 3: MARKED AS INTENDED (continued)

GUIDELINE 3.3: Understandable – Voters can understand all information as it is presented.

Requirements for all Instructions, alerts and warnings

1. Warnings and alerts issued by the voting system shall be distinguishable from other information and should clearly state:
   - The nature of the problem;
   - Whether the voter has performed or attempted an invalid operation or whether the voting system itself has malfunctioned in some way; and
   - The set of responses available to the voter.

   > Discussion: For instance, "Do you need more time? Select 'Yes' or 'No'." rather than "System detects imminent timeout condition." In case of an equipment failure, the only action available to the voter might be to get assistance from a poll worker.

   Source: 3.2.4.c.i
   Accessibility: WCAG 3.3.1, 3.3.3-4

2. Each distinct instruction should be separated spatially from other instructions for visual or tactile interfaces, and temporally for auditory interfaces.

   > Discussion: This implies not "burying" several unrelated instructions in a single long paragraph.

   Source: 3.2.4.c.iv
   Accessibility: WCAG 3.3.1, 3.3.3-4

3. Consistent with election law, the voting system shall support a process that does not introduce bias for or against any of the contest choices to be presented to the voter. In both visual and aural formats, the choices shall be presented in an equivalent manner.

   > Discussion: Certain differences in presentation are mandated by state law, such as the order in which candidates are listed and provisions for voting for write-in candidates.

However, comparable characteristics such as font size or voice volume and speed must be the same for all choices.

Source: 3.2.4.d
Accessibility: [voting specific]

4. The voting system should present instructions near to where they are needed.

Discussion: For instance, only general instructions should be grouped at the beginning of the ballot; those pertaining to specific situations should be presented where and when needed.

Source: 3.2.4.e.iv
Accessibility: WCAG 3.3.2

5. When an icon is used to convey information, indicate an action, or prompt a response, it shall be accompanied by a corresponding linguistic label.

Discussion: While icons can be used for emphasis when communicating with the voter, they must not be the sole means by which information is conveyed, since there is no widely accepted "iconic" language and therefore not all voters may understand a given icon.

Source: 3.2.4.g
Accessibility: WCAG 1.1, 2.4.6

6. The voting system shall include clear, complete, and detailed instructions and messages for setup, polling, and shutdown.

Discussion: This requirement covers documentation for those aspects of system operation normally performed by poll workers and other "non-expert" operators. It does not address inherently complex operations such as ballot definition. The instructions would usually be in the form of a written manual, but could also be presented on other media, such as a DVD or videotape. In the context of this requirement, "message" means information delivered by the system to the poll worker as he or she attempts to perform a setup, polling, or shutdown operation. For specific guidance on how to implement this requirement, please see: "NISTIR 7519: Style Guide for Voting System Documentation" at http://www.nist.gov/itl/vote/upload/NISTIR-7519.pdf.

Source: 3.2.8.1.c.i - iii
Accessibility: [voting specific] Related to 508:1194.41

7. The instructions for performing the verification process **shall** be made available to the voter in a location on the voting machine.

> Discussion: All instructions must meet the usability requirements contained in Subsection 3.1.

Source: 7.8.6.g
Accessibility: [voting specific]

Requirements for Plain Language

1. The voting system shall provide instructions for all its valid operations.

> Discussion: If an operation is available to the voter, it must be documented. Examples include how to change a vote, how to navigate among contests, how to cast a straight party vote, how to cast a write-in vote, and how to adjust display and audio characteristics.

Source: 3.2.4.a
Accessibility: WCAG 3.3.2

2. The voting system shall provide a means for the voter to get help directly from the system at any time during the voting session.

> Discussion: The voter should always be able to get context-sensitive help from the system when needed. The purpose is to minimize the need for assistance from the poll worker. Electronic ballot interface systems may provide this with a distinctive "help" button. In addition to context-sensitive help, any voting system may provide written instructions that are separate from the ballot.

Source: 3.2.4.b
Accessibility: WCAG 3.3.5 (AAA)

3. Instructional material for the voter shall conform to norms and best practices for plain language.

> Discussion: Although part of general usability, the use of plain language is also expected to assist voters with cognitive disabilities. The plain language requirements apply to instructions that are inherent to the voting system or that are generated by default. To the extent that instructions are determined by election officials designing the ballot, they are beyond of the scope of this requirement. For specific guidance on how to implement this requirement, see: "Guidelines for Writing Clear Instructions and Messages for Voters and Poll Workers" at http://vote.nist.gov/032906PlainLanguageRpt.pdf.

Source: 3.2.4.c
Accessibility: WCAG 3.1.3-5 - 3.1.6 (AAA)

4. When an instruction is based on a condition, the condition should be stated first, and then the action to be performed.

> Discussion: For instance, use "In order to change your vote, do X", rather than "Do X, in order to change your vote."

Source: 3.2.4.c.ii
Accessibility: n/a

5. The voting system should use familiar, common words and avoid technical or specialized words that voters are not likely to understand.

> Discussion: For instance, "... there are more contests on the other side ..." rather than "...additional contests are presented on the reverse ..."

Source: 3.2.4.c.iii
Accessibility: WCAG 3.1.3-4, 3.1.5-6 (AAA)

6. The voting system should issue instructions on the correct way to perform actions, rather than telling voters what not to do.

> Discussion: For example, "Fill in the oval for your write-in vote to count" rather than "If the oval is not marked, your write-in vote cannot be counted."

Source: 3.2.4.c.v
Accessibility: n/a

7. The system's instructions should address the voter directly rather than use passive voice constructions.

> Discussion: For example, "remove and retain this ballot stub" rather than "this ballot stub must be removed and retained by the voter."

Source: 3.2.4.c.vi
Accessibility: n/a

8. The voting system should avoid the use of gender-based pronouns.

> Discussion: For example, "...write in your choice directly on the ballot..." rather than "... write in his name directly on the ballot..."

Source: 3.2.4.c.vii
Accessibility: n/a

9. Messages generated by the voting system for poll workers in support of the operation, maintenance, or safety of the system **shall** adhere to the requirements for clarity in Section 3.2.4 "Voter instructions, plain language and information presentation."

Source: 3.2.8.a
Accessibility: n/a

PRINCIPLE 3: MARKED AS INTENDED (continued)

GUIDELINE 3.4: Robust - The voting system's hardware and accessories support usability and accessibility requirements while protecting voters from harmful conditions.

Requirements for Electronic Displays

1. If the voting system uses an electronic display screen as the primary visual interface for the voter, the display shall have the following characteristics:

ii. Minimum display brightness: 130 cd/m2

iii. Minimum display darkroom 7×7 checkerboard contrast: 150:1

iv. Minimum display pixel pitch: 85 pixels/inch (0.3 mm/pixel)

v. Minimum display area 700 cm2

vi. Antiglare screen surface that shows no distinct virtual image of a light source

vii. Minimum uniform diffuse ambient contrast ratio for 500 lx illuminance: 10:1

> Discussion: Aside from usability concerns, this requirement protects voters from having visually-induced seizures.

Source: 3.2.5.a, 3.2.5.a.ii-vii
Accessibility: n/a

2. Flicker frequency NOT between 2 Hz and 55 Hz.

Source: 3.2.5.a.i
Accessibility: 508: 1194.25.i

Requirements for Personal Assistive Technology (PAT)

1. The support provided to voters with disabilities shall be intrinsic to the Acc-VS. Personal assistive devices of the voter shall not be necessary to operate the Acc-VS correctly. This does not apply to personal assistive technology required to comply with 3.3.4 b.

> Discussion: This requirement does not preclude the Acc-VS from providing interfaces to assistive technology. (See definition of "personal assistive devices" in Appendix A.) Its purpose is to assure that disabled voters are not required to bring special devices with them in order to vote successfully. The requirement does not assert that the Acc-VS will eliminate the need for a voter's ordinary non-interfacing devices, such as eyeglasses or canes.

Source: 3.3.1.c
Accessibility: 508: 1194.25

2. If a voting system provides for voter identification or authentication by using biometric measures that require a voter to possess particular biological characteristics, then the Acc-VS **shall** provide a secondary means that does not depend on those characteristics.

> Discussion: For example, if fingerprints are used for voter identification, another mechanism must be provided for voters without usable fingerprints.

Source: 3.3.1.d
Accessibility: 508: 1194.25d

3. The ATI shall provide its audio signal through an industry standard connector for private listening using a 3.5mm stereo headphone jack to allow voters to use their own audio assistive devices.

Source: 3.3.3.c.i
Accessibility: 508: 1194.25.e

4. If the ATI utilizes a telephone style handset or headphone to provide audio information, it shall provide a wireless T-CoilANSI01] American National Standard for Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids, ANSI C63.19. 9coupling for assistive hearing devices so as to provide access to that information for voters with partial hearing. That coupling shall achieve at least a category T4 rating as defined by [ANSIO1] American National Standard for Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids, ANSI C63.19.

> Discussion: Note that Requirement 3.3.6 c protects the use of hearing devices.

Source: 3.3.3.c.ii

5. The Acc-VS shall provide a 3.5 mm industry standard jack used to connect a personal assistive technology switch to the Acc-VS. This jack shall allow only switch data to be transmitted to the voting system. The voting system shall accept switch input that is functionally equivalent to tactile input. All the functionality of the Acc-VS (e.g., straight party voting, write-in candidates) that is available through the conventional forms of input, such as tactile, shall also be available through this non-manual input mechanism.

> Discussion: This requirement ensures that the Acc-VS are operable by individuals who do not have the use of their hands. Examples of non-manual controls include "sip and puff" switches. While it is desirable that the voter be able to independently initiate use of the non-manual input mechanism, this requirement guarantees only that the voter can vote independently once the mechanism is enabled.

Source: 3.3.4.a
Accessibility: Related to 508: 1194.25.e

Safety Requirements

1. Devices associated with the voting system **shall** be certified in accordance with the requirements of UL 60950-1, Information Technology Equipment – Safety – Part 1 by a certification organization accredited by the Department of Labor, Occupational Safety and Health Administration's Nationally Recognized Testing Laboratory program. The certification organization's scope of accreditation **shall** include IEC/UL 60950-1.

> Discussion: IEC/UL 60950 is a comprehensive standard for IT equipment and addresses all the hazards discussed above under Safety.

Source: 3.2.8.2.a-b
Accessibility: UL 60950

2. A sanitized headphone or handset shall be made available to each voter.

> Discussion: This requirement can be achieved in various ways, including the use of "throwaway" headphones, or of sanitary coverings.

Source: 3.3.3.c.iii
Accessibility: n/a

3. No voting device shall cause electromagnetic interference with assistive hearing devices that would substantially degrade the performance of those devices. The voting device, measured as if it were a wireless device, shall achieve at least a category T4 rating as defined by [ANSI01] American National Standard for Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids, ANSI C63.19.

> Discussion: "Hearing devices" include hearing aids and cochlear implants.

Source: 3.3.6.c
Accessibility: 508: 1194.23.h, 508: 1194.23.i

PRINCIPLE 4: TESTED FOR USABILITY
Meets performance standards for usability and accessibility.

GUIDELINE 4.1 – Conduct summative usability tests using a wide range of voters and poll workers, including those with and without disabilities.

Requirements for usability testing

1. The voting process shall provide a high level of usability for voters.

   Source: 3.2.a
   Accessibility: n/a

2. Accordingly, voters shall be able to negotiate the process effectively, efficiently, and comfortably. The goal is that the resulting ballot accurately reflects the intention of the voter. The mandatory voting system standards mandated in HAVA Section 301 relate to the interaction between the voter and the voting system.

   Source: 3.2.b
   Accessibility: n/a

3. The manufacturer shall conduct summative usability tests for each of the voting system's supported languages, using subjects who are fluent in those languages but not fluent in English and shall report the test results, using the Common Industry Format, as part of the TDP. In addition, the usability test report shall be submitted to the EAC as part of the documentation manufacturers are required to file with the application to test a voting system.

   Source: 3.2.7.a.iv
   Accessibility: n/a

4. Voting system setup, polling, and shutdown, as documented by the manufacturer, shall be reasonably easy for the typical poll worker to learn, understand, and perform.

> Discussion: This requirement covers procedures and operations for those aspects of system operation normally performed by poll workers and other "non-expert" operators. It does not address inherently complex operations such as ballot definition or system repair. While a certain amount of complexity is unavoidable, these "normal" procedures should not require any special expertise. The procedures may require a reasonable amount of training.

Source: 3.2.8.1.a
Accessibility: [voting specific]

8. The manufacturer **shall** conduct summative usability tests on the voting system using individuals who are representative of the general population and **shall** report the test results, using the Common Industry Format, as part of the TDP.
    i. The tasks to be covered in the test **shall** include setup, operation, and shutdown.
    ii. In addition, the usability test report shall be submitted to the EAC as part of the documentation manufacturers are required to file with the application to test a voting system.

Source: 3.2.8.1.a
Accessibility: [voting specific]

5. The manufacturer **shall** submit a report of their summative usability tests on the voting system using individuals who are representative of the general population.

Source: 3.3.10.a
Accessibility: n/a

6. The manufacturer shall conduct summative usability tests on the Acc-VS using individuals who are blind and shall report the test results, using the Common Industry Format, as part of the TDP. i. In addition, the usability test report shall be submitted to the EAC as part of the documentation manufacturers are required to file with the application to test a voting system.

Source: 3.2.7.a.iv
Accessibility: [voting specific]

7. The manufacturer shall conduct summative usability tests on the Acc-VS using individuals who are blind and shall report the test results, using the Common Industry Format, as part of the TDP.

   Source: 3.3.3.a
   Accessibility: n/a, Related to 508: 1194.31

8. The manufacturer **shall** conduct summative usability tests on the Acc-VS using individuals with low vision and **shall** report the test results, using the Common Industry Format, as part of the TDP.

   Source: 3.3.10.b
   Accessibility: n/a, Related to 508: 1194.31

9. The manufacturer shall conduct summative usability tests on the Acc-VS using individuals lacking fine motor control and shall report the test results, using the Common Industry Format, as part of the TDP.

   Source: 3.3.10.c
   Accessibility: n/a, Related to 508: 1194.31

10. The Acc-VS should provide support to voters with cognitive disabilities.

> Discussion: Because of the highly varied nature of disabilities falling within the "cognitive" category, there are no design features uniquely aimed at helping those with such disabilities. However, many of the features designed primarily for other disabilities and for general usability are also highly relevant to these voters:
>
> • The synchronization of audio with the displayed screen information (Requirement 3.3.2 d.);
>
> • Requirement 3.2.4 and, in particular, the use of plain language (Requirement 3.2.4 c.);
>
> • Large font sizes and legibility of paper (Requirement 3.2.5 e and 3.2.5 g.); and
>
> • The ability to control various aspects of the audio presentation (Requirement 3.3.3 b. and 3.3.3 c) such as pausing, repetition, and speed.

   Source: 3.3.7.a
   Accessibility: n/a, Related to 508: 1194.31

PRINCIPLE 5: MEETS WEB STANDARDS
Browser-based systems meet web accessibility standards in addition to voting standards.

GUIDELINE 5.1: When a voting system uses standard web software platforms (HTML or native apps), the voting system meets all requirements in VVSG 2.0 Level AA in addition to those in the VVSG.

The WCAG success criteria that do not appear in the VVSG are listed below. In most cases, the success criteria address web platform technologies, general HTML content requirements, or interactions with personal assistive technology such as screen readers, that do not match the types of presentation or interaction covered in the VVSG.

- 1.2 – Time Based Media
- 1.3.1 – Info and Relationships
- 1.3.2 – Meaningful Sequence
- 1.4.5 – Images of Text
- 2.1.2 – No Keyboard Trap
- 2.4 – Navigable
- 3.2 – Predictable
- 4.1 – Compatible

Appendix: Material from VVSG not included

We started this exercise trying to include all of the text from the VVSG. However, some words from VVSG 1.1 are not included here.

- A few requirements (see notes below)

- Introductory material

Requirements omitted and the reason

VVSG	Description	Why omitted
3.2.8.1 .c.i - .iii	Poll worker documentation	Detailed requirements omitted for brevity, but should be included under 3.2.8.1.c
3.3.3.c	ATI usability	This requirements is introductory; with the actual requirements in i-vii
3.3.5.1	Controls within reach	All lowest level requirements i-iv omitted for brevity Illustrations omitted for brevity
3.3.10	Summative test report	All lowest level requirements in a. b. and c. omitted for brevity, including general discussion

Text omitted and the reason

VVSG	Description	Why omitted
3.1	Overview	Explanatory. Not relevant to the structure.
3.1.1	Purpose intro	Introductory and final text. Explanatory. Not relevant to the structure. 3.1.1a-c have been incorporated into the new structure.
3.1.2	Special terminology	Explanatory. Not relevant to the structure.
3.1.3	Interaction of u+a requirements	This section will require revision if a new structure is adopted.
3.2	Citation from HAVA	Explanatory. Not relevant to the structure.
3.2.2	Functional capabilities intro	Explanatory. Will require revision for a new structure
3.2.2.1	Editable interfaces - intro	Explanatory. May require revision for a new structure
3.2.2.1	Non-editable - introduction	Explanatory. May require revision for a new structure
3.2.4	Instructions - intro	Explanatory, including explanation of the "should" requirements in the plain language sections.

VVSG	Description	Why omitted
3.2.5	Visual - intro	E Explanatory. May require revision for a new structure
3.2.6	Interaction - intro	Explanatory.
3.2.6.1	Timing - intro	Explanatory.
3.2.7	Languages - intro	Explanatory.
3.2.8	Poll workers – intro	Explanatory
3.2.8.1	Operation – intro	Explanatory, defines scope of functions
3.2.8.2	Safety– intro	Explanatory, defines scope of functions
3.3	Accessibility - Intro	Explanatory, explains structure
3.3.1	Accessibility - Intro	Explanatory
3.3.2	Enhanced visual - Intro	Explanatory
3.3.3	ATI - Intro	Explanatory
3.3.4	Input - intro	Explanatory
3.3.5	Mobility –intro	Explanatory
3.3.6	Auditory –intro	Explanatory
3.3.7	Cognitive-intro	Explanatory
3.3.8	English- intro	Explanatory
3.3.9	Speech – intro	Explanatory
7.8.5	VVPAT Privacy - Intro	Explanatory