

Human Factors Test Approach for VVSG 2.0

Test cases for VVSG 2.0 human factors requirements
in Principle 2.2 and Principles 5 – 8

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Interaction Modes: Part 1. Accessible Ballot Activation

Covers requirements

- **5.1.A – Interaction modes**
- **5.1-D – Accessibility features**
- **6.1-A – Preserving privacy for voters**
- **6.1-C – Enabling or disabling output**
- **6.2-A – Voter independence**
- **8.1-C – Personal assistive technology**
- **8.1-D – Secondary ID and biometrics**
- **8.1-F – Discernable audio jacks**
- **8.1-I – Standard PAT jacks**

Method

This method is repeated for each of the five interaction modes.

Preparation

Determine what actions voters have to take to begin a voting session and activate their ballot, including setting the voting system into each of the interaction modes in 5.1-A

- The default visual mode
- Visual mode with alternative text sizes and contrast
- Visual mode with the tactile interface
- Audio mode and tactile interface with no visual mode
- Non-manual mode

This test requires two testers:

- Tester A completes any actions performed by election workers for all testers for each mode.
- Tester B, with knowledge of capabilities of voters with disabilities (including low vision, blindness, low dexterity, and no use of their hands) completes the voter actions.

For all systems

Review the documentation and follow the procedures for election workers and voters to authenticate to use the voting systems.

Pass/Fail Conditions for 8.1-D

- The system passes if there are no biometric measures for identification or authentication.
- The system fails if there are biometric measures with no alternatives.

- Otherwise the system passes.

For electronic ballot interfaces

The test is repeated for each mode.

For each interaction mode, Tester B completes the steps required to initiate the voting session and reach the first contest, including:

- Receiving any device or blank ballot and traveling with it to the voting station
- Any steps (pressing a button, entering an activation key, inserting a smartcard, inserting a ballot) needed to initiate the voting session
- Identifying and positioning any headphones, tactile keypad, or other devices, including plugging them in, if necessary
- Making any adjustments needed to activate the interaction mode or adjust settings

If an election worker is required to take an action for all voters in any interaction mode, Tester A completes them, following instructions in the system documentation.

This test ends when the voter reaches the first contest in the desired interaction mode, with all adjustments made to the system.

Pass/Fail Conditions

- The system fails 5.1-A and 6.2-A if a voter would be unable to complete ballot activation at all.
- The system fails 5.1-D, 6.1-C and 6.2-A if a voter would be unable to activate the accessibility features.
- The system fails 6.1-A if any assistance affects voter privacy or requires assistance beyond verbal instructions to activate the ballot beyond what any voter would receive.
- The system fails 8.1-F and 8.1-I if a voter would be unable to plug in the audio headsets with more assistance than verbal instructions.
- The system fails 8.1-C if personal assistive technology other than personal headsets, hearing aids, eyeglasses, or personal pointing devices such as a hand splint or mouthstick are required.
- Otherwise, the system passes.

Interaction Modes: Part 2. Ballot Marking

Covers requirements

- **5.1.A – Interaction modes**
- **5.1-D – Accessibility features**
- **5.2-C – All information in all modes**
- **5.2-D – Audio synchronizes**
- **6.2-A – Voter independence**
- **7.3-C – System-related errors**
- **7.2-K – Key operability**
- **8.1-C – Personal assistive technology (PAT)**

Method

Preparation

This test continues the voting session begun in Accessible Ballot Activation continuing the test of interaction during a voting session in all interaction modes.

For a hand-marked paper ballot:

- Begin when the ballot is ready to be marked
- End when the ballot is completely marked

For an electronic interface:

- Begin at the first contest, after activating the system and completing any setup needed for each interaction mode
- End at the final screen or view of the review function

Determine what actions voters have to take to mark their ballot, in each of the 5 modes. The test is repeated for each mode.

- The default visual mode with touch or other default interaction device
- Visual mode with audio and the tactile interface
- Audio mode and tactile interface with no visual mode
- Visual mode with alternative text sizes and contrast
- Non-manual mode

For all electronic ballot interfaces

This test requires two systems.

- System A set up for using the default visual mode with touch or other default interaction device
- System B set up for using the interaction mode being tested

This test requires two testers:

- Tester A completes any actions performed by election workers for all testers for each mode
- Tester B, with knowledge of capabilities of voters with disabilities (including low vision, blindness, low dexterity, and no use of their hands) completes the voter actions

Proceed through an entire voting session, using the default ballot choices except as noted below.

- While voting Contest #2 (US Senate), first mark a vote for Dennis Weiford and then change it to Lloyd Garriss. This change must be possible before advancing to the next contest.
- Just before voting in contest #8 (State Assemblyman), navigate sequentially backward to contest #5 (Lieutenant-Governor), and then forward to contest #8 again. It should be possible to see and modify the votes cast in contests #5, #6, and #7, (Lieutenant-Governor, Registrar of Deeds, and State Senator).
- No votes are to be indicated in contest #11 (Mayor).

Pass/Fail Conditions

- The system passes if the editing within contest #2 can be performed.
- The system passes if the navigation among contests #5, 6, 7, and 8 can be performed.
- The system fails 8.1-C if personal assistive technology other than personal headsets, hearing aids, eyeglasses, or personal pointing devices such as a hand splint or mouthstick are required.
- Otherwise, the system fails.

After initial completion of the ballot following the voting instructions in Appendix A, attempt to add a selection for Sylvia Wentworth-Farthington in contest #2 (US Senate). This must be done without "clearing" the prior selection for Lloyd Garriss.

The system may either refuse to accept the new vote or may change the selection from Garriss to Wentworth-Farthington, but may not indicate a vote for both.

Attempt to add a selection for Harvey Eagle in contest #12 (City Council). Again, the system may either refuse the new selection or change an old one, but it may not indicate the addition of a 5th vote.

Pass/Fail Conditions

- The system fails the system at any point indicates more votes within a contest than allowed.
- Otherwise, the system passes.

Attempt to select candidate Orville White in contest #11 (Mayor) and then proceed to a point just prior to final casting of the ballot.

Fail Condition

- The system fails if it has not given a warning about under-voting in contest #11 by this point in the test procedure.

If there has been a warning, return to contest #11 and add a selection for Gregory Seldon, so that the contest is no longer under-voted.

Then remove the selection Charlene Hennessey in contest #9 (County Commissioner) and again proceed to the point just prior to final casting of the ballot.

Attempt to change the vote in contest #7 (State Senate) from Marty Talirico to Edward Shiplett.

Fail Condition

- The system fails 5.1-A, 5.1-D, and 6.2-A if any of the changes cannot be done independently.
- The system fails 5.1-A, 5.1-D, and 6.2-A if the system A provides any functionality that is absent in system B.
- The system 7.3-A if the system actions or messages fail to provide clear feedback or information to voters.

For testing the audio-tactile interface

Check that the audio-tactile interface in System B contains the same instructions, functionality and navigation as the visual-touch interface in System A.

In contest #11 (Mayor), test the ability to move back and forth between contests at any time:

- As the first candidate for contest #11 (Mayor), is being announced, skip ahead immediately to the next contest #12 (City Council).
- As the second candidate for contest #12 (City Council), is being announced, return to contest #11 (Mayor), and then return to the already-voted contest #10 (Registrar of Wills).
- Finally, as contest #10 (Registrar of Wills) is being re-announced, skip ahead to contest #11 (Mayor).

At the first ballot question, test the ability to skip reading the full text of the question:

- As soon as the ballot question reading begins, skip to the voting selections, and choose Yes, then go ahead to the second ballot question.
- While that ballot question is being read, skip ahead to the third ballot question.

Fail Condition

- The system fails 5.1-A, 5.1-D, and 6.2-A if the system A provides any functionality that is absent in system B.
- The system fails 5.1-A and 5.1-D and 5.2-C if the ATI does not provide full instructions and feedback as described.
- The system fails 5.1-A, 5.1-D and 5.2-D if the navigation of moving back and forth between contests described here cannot be performed.
- The system fails 5.1-A, 5.1-D, and 5.2-D if the navigation of skipping the full reading of a ballot testing described here cannot be performed.

For testing non-manual ballot marking

Do not at any time make use of your hands to operate the system. As you proceed through the voting session, verify that it is possible to complete marking actions without use of your hands. This includes operations such as:

- selecting candidates
- changing a vote
- writing in a candidate
- navigating the ballot

It is not required that this operation be "just as easy" as manual operation, but it should be reasonably accessible. If the system provides several such mechanisms, evaluate each of them.

Fail Condition

- The system fails 7.2-K if the mechanism for non-manual operation of the system causes significant difficulty.
- The system fails 5.1-A if non-manual use of the system is not functionally equivalent to manual use.
- The system fails 8.1-C if personal assistive technology other than personal headsets, hearing aids, eyeglasses, or personal pointing devices such as a hand splint or mouthstick are required.

Interaction Modes: Part 3. Accessible Ballot Verification and Casting

Covers requirements:

- **5.1.A – Interaction modes**
- **5.1-D – Accessibility features**
- **5.1-E – Reading paper ballots**
- **6.1-A – Preserving privacy for voters**
- **6.2-A – Voter independence**
- **7.1-I – Text size (paper)**
- **7.1-J – Sans serif font**
- **8.1-C – Personal assistive technology (PAT)**

Method

This test completes the voting session continued in Accessible Ballot Marking. It begins:

- For a hand-marked paper ballot when all contests are marked and the ballot is complete
- For an electronic interface, begin at the final screen or view of the review function

Preparation

Determine what actions voters have to take to complete the voting session, including verification and casting, in each of the 5 modes:

- The default visual mode
- Visual mode with alternative text sizes and contrast
- Visual mode with the tactile interface
- Audio mode and tactile interface with no visual mode
- Non-manual mode

The test is repeated for each mode.

This test requires two testers:

- Tester A completes any actions performed by election workers for all testers for each mode
- Tester B, with knowledge of capabilities of voters with disabilities (including low vision, blindness, low dexterity, and no use of their hands) completes the voter actions

For electronic ballot interfaces

For each interaction mode, Tester B continues the voting session until a printed ballot or other record is produced.

Verify that a mechanism is provided that can read that record and generate an audio representation of its contents.

Pass/Fail Conditions

- The system passes 5.1-E if there is no paper-based record for vote verification.
- The system passes 5.1-A, 5.1-D and 6.2-A if it provides audio read-back for paper verification records.
- Otherwise, it fails.

For all systems

For each interaction mode, Tester B continues the voting session until the ballot is cast.

Verify that the paper record is legible and visible. For example, the record must be in large enough text, fully visible, and positioned so that it can be read by a voter in a wheelchair.

Pass/Fail Conditions

- The system passes 7.1-I if the system's paper verification records are printed in at least 3.5mm (10 point) type.
- The system passes 5.1-E if the verification record is positioned so it is fully visible to all voters without handling the ballot.
- The system passes 7.1-J if the text is in a sans-serif font.
- Otherwise, it fails.

Proceed through the process of ballot submission and verify that these features constitute a viable mechanism in each mode.

If an election worker is required to take an action for all voter in any interaction mode, Tester A completes that action, following instructions in the system documentation.

This test ends when the ballot is successfully cast.

Pass/Fail Conditions

- The system fails 5.1-A, 5.1-D and 6.2-A if a voter would be unable to cast their ballot independently using any accessibility features required for the interaction mode.
- The system fails 6.1-A if any assistance affects voter privacy or requires assistance beyond verbal instructions to activate the ballot beyond what any voter would receive.
- The system fails 8.1-C if personal assistive technology other than personal headsets, hearing aids, eyeglasses, or personal pointing devices such as a hand splint or mouthstick are required.

- Otherwise, the system passes.

Alternative Languages

Covers requirements:

- **5.1-B – Languages**
- **5.1-C – Vote records**
- **5.2-B – Presenting content in all languages**
- **5.2-D – Audio synchronized**
- **5.2-F – Preserving votes**
- **7.3-M – Identifying languages**

Method

Preparation

Determine the set of alternative languages for which the manufacturer claims support in the TDP. This test is repeated for each language supported.

For each language, if the primary tester is not fluent in that language, there must be a second tester who is fluent.

This test requires two systems, one to serve as the "base" English system (A), and the other to serve as the alternative language system (B). Systems A and B are run "in parallel" to allow for comparison of the English and alternative presentation.

- Electronic interfaces are tested in video and audio mode, using the editable ballot session
- Audio-only systems, such as a vote-by-phone system are tested in audio mode
- Non-editable paper interfaces are tested using the non-editable ballot session, with overvote and undervote warnings turned on.

For all systems

Throughout the session, verify that no knowledge of English is necessary to successfully operate system B in the alternative language. This includes ballot activation, making selections in both candidates and ballot questions contests, review, verification, and ballot casting. Candidate names, however, may be presented in English, in the alternative language, or both.

Fail Condition for 5.1-B - Languages

- The system fails if any operation of system B requires knowledge of English.

Verify that all instructions, warnings, contest information, voting records, and other text intended for the voter produced by the English system A are also produced correctly by the alternative language system B. Examples include instructions and feedback for:

- Initial activation of the ballot
- How to operate the voting interface, including settings and options (such as font size, volume control)
- Navigation of the ballot
- Making contest choices, including maximum number to vote for and how to write-in candidates
- Confirming and changing ballot choices
- Verification and casting of the ballot
- End-to-end cryptography receipts

Pass/Fail Conditions for 5.2-B – Presenting content in all languages

- The system passes if system B provides all the information in the alternative language as provided in English by system A.
- Otherwise it fails.

After completion of the session, examine the records intended for use in an audit, including paper and electronic, as appropriate. This may require going through poll closing procedures so as to gain access to the audit records or paper ballots. Verify that these records are intelligible using only English. This does not require a fully-bilingual ballot, only that it is possible to audit the ballot selections in English.

Pass/Fail Conditions for 5.1-C – Vote records

- The system fails if it is not possible to determine the vote selections using only English.
- Otherwise, it passes.

For electronic ballot interfaces

At the beginning of the session, select the alternative language being tested, observing how the name of the language is presented.

Fail Condition for 7.3-M – Identifying languages

- The system fails if the language is not presented in its native name.

After completing the selection of a candidate for contest #4 (Governor), switch the system B back to English. Review all the ballot choices made in the first four contests on system B to verify that ballot choices have been preserved.

Fail Condition for 5.2-F – Preserving votes

- The system fails if system B cannot be switched to English.

- The system fails if any of the choices already made have been altered.

Pass/Fail Conditions for 7.3-M – Identifying languages

- The system passes if the control to change languages is visible on the screen.
- Otherwise it fails.

After completing the selection of a candidate for contest #7 (State Senator) switch languages again, changing system B back to the alternative language. Review the first seven contests to verify that ballot choices have been preserved.

Fail Condition for 5.2-F – Preserving votes

- The system fails if system B cannot be switched back to the alternative language.
- The system fails if any of the choices already made have been altered.

Complete the selection of candidates in contests #8 – #12, listening to the audio while observing the visual display to verify that the two modes are synchronized so that the information in the audio is visible on the screen, including positioning a long list of candidates on the screen and moving between contests.

Pass/Fail Conditions for 5.2-D – Audio synchronized

- The system passes if the audio and visual displays are synchronized.
- Otherwise it fails.

On contest #15 Ballot Question #1 Proposed Constitutional Amendment C, switch languages back to English

Pass/Fail Conditions for 7.3-M – Identifying languages

- The system passes if the control to change languages is visible on the screen.
- Otherwise it fails.

Continue to the review screen switch languages back to the alternative language

Pass/Fail Conditions for 7.3-M – Identifying languages

- The system passes if the control to change languages is visible on the screen.
- Otherwise it fails.

Audio – Intelligibility

Covers requirement

- **7.1-M – Audio comprehension**

Method

Preparation

Set up the voting system in audio-tactile mode with the headphones supplied by the system. If there is more than one tester, install an audio splitter, so that both testers can listen to the audio.

The headphones used must be stereo headsets to allow testing for information in each channel.

The International Telecommunications Union (ITU) provides a set of freely available test signals for testing audio quality [in Rec. ITU-T P.50 Appendix](#)

For all systems

Complete an entire voting session in audio-tactile mode using the speaker for audio output. Use the tactile keypad for:

- Contest #2 (US Senate): Change the rate of speech to each of the options offered by the system, comparing the audio at each speed. At the end of the contest, return to the default rate of speech.
- Contest #4 (Governor): Attempt to overvote, listening to any messages the system produces.
- Contest #4 (Governor): Use the tactile keypad to skip to the first candidate while the contest introduction is being read, listening for whether the audio also skips to reading the candidate information.
- Contest # 7 (State Senator): Go back to the previous contest, listening for how the system voices information about the status of the contest and each candidate.
- Contest # 13 (Retention Question 1): Listen to the first few seconds of the ballot question, then skip to the marking options.

During the session, evaluate the intelligibility of the audio information presented, including:

- the pronunciation of candidate names, instructions, and warnings
- the use of normal intonation
- appropriate rate of speech for all types of information
- similar volume levels for all types of information
- no clipping of the beginning or end of each piece of information
- acceptably low background noise

- any loss of critical information due to audio quality
- the same information is played in both ears.

Fail/Pass Conditions

- The system fails if the tester judges that the same information is not played in both ears.
- The system fails if the tester judges that words in the text or candidate names are not pronounced as intended in Standard English.
- The system fails if the tester judges that there is high background noise interfering with intelligibility.
- The system fails if the tester judges that critical information would be unintelligible to the voter.
- The system fails if the audio does not skip ahead when interrupted.
- Otherwise, the system passes.

Audio – No Interference with Hearing Aids

Covers requirements

- **8.1-G – Telephone style handset**
- **8.1-J – Hearing aids**

Method

The test methods to be used are fully documented in the American National Standard Institute (ANSI) for Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids, ANSI C63.19. The system is measured under this standard as if it is a wireless device.

For all systems

Pass/Fail Condition

- The system fails 8.1-J if it causes magnetic interference with a hearing aid.
- Otherwise it passes.

Fail Condition

- The system fails 8.1-J and 8.1-G if it does not achieve a category T4 rating under ANSI C63.19.

For systems with a telephone-style handset

Pass/Fail Condition

- The system fails 8.1-G if a wireless T-Coil coupling is not provided.
- Otherwise if passes.

Audio - Range of Frequency

Covers requirement

- **7.1-L – Speech frequencies**

Method

FCC regulations for hearing aids, 47 CFR Parts 20 and 68: Hearing Aid Standard, includes useful information about how to test audio volume and quality.

Preparation

For this test, the input signal to the audio equipment is controlled, rather than using the normal audio signal generated by the test ballot.

The tester for this method must be familiar with audio equipment and able to follow the method in IEEE 269. This standard specifies the required test equipment, test setup, and test procedures.

Frequency range is measured in one of two ways, depending on whether the audio information is presented through open air or through headphones or a handset.

For both test modes

The input test signal is “pink noise” (a signal with noise distributed evenly across the spectrum) with a flatness of at least ± 0.5 dB for all third octave bands from 100Hz to 10KHz. The output level should be 80 dB SPL ± 5 dB as measured with a broadband instrument using an A-weighting filter. This output level should ensure that the audio circuit’s peak capacity isn’t reached and therefore won’t influence the frequencies of interest.

Measure the frequency spectrum as described in IEEE 269 for all third octave bands from 100Hz through 10KHz and the measured spectrum must comply within the tolerances of the floating mask requirement.

Open-Air Frequency Measurement

The test for measuring the audio frequency spectrum is described in IEEE 269. Open air sound levels should be measured in anechoic conditions to prevent reflections from affecting the measurement accuracy.

Headphone/Handset Frequency Measurement

Follow the test methodology that is relevant to receiving audio through a private audio output device applicable to the voting system under test. "Headphones" equates to the term "headsets" used in Clause 9 of the referenced standard.

For a HATS (Head and Torso Simulator), use Type 3.3 ears as defined in Clause 5 of the referenced standard.

If the ERP (Ear Reference Point) is not specified by the manufacturer of the private audio output device, then use the defaults in the referenced standard.

Fail Condition

- The If the audio output falls below 60dB SPL for any frequency between 315Hz and 10KHz, "Range of Frequency" fails.

Audio - Sanitized Headphone or Handset

Covers requirement

- **8.1-H – Sanitized headphones**

Method

For all systems

Inspect the method used by the system to provide a headphone or handset to the voter.

Review the documentation and materials provided with the system for the recommended method of providing a sanitized headphone or handset for each voter.

Sanitation can be achieved in various ways, including the use of "throw-away" headphones, or of sanitary coverings.

Fail Condition

- The system fails if no audio mode is provided.

Pass/Fail Conditions

- The system passes if there are adequate provisions for sanitization, using the headphones or handset provided with the system.
- Otherwise, the system fails.

Audio – Settings for Rate of Speech

Covers requirement

- **7.1-K – Audio setting**

Method

FCC regulations for hearing aids, 47 CFR Parts 20 and 68: Hearing Aid Standard, includes useful information about how to test audio volume and quality.

Preparation

This method can be completed using an external speaker instead of headphones, to allow two testers to work together, one operating the system and the other taking the timings.

For all electronic interfaces

Open the settings control and determine how many different speech rates are available in the system.

Fail Condition

- The system fails if there is no mechanism for adjusting speech rate.

Proceed through the voting session to contest #5 (Lieutenant-Governor). Count the number of words to read the entire screen in audio mode. This number will be used to calculate the speech rate.

Measure the amount of time taken to announce all the candidates, using the default speech rate. Calculate the words per minute.

Pass/Fail Conditions

- The system passes if the speech rate is between 120 and 125 wpm.
- Otherwise, the system fails.

Set the speech rate to the minimum setting and repeat the measurement of the amount of time taken to announce all the candidates for contest #5 (Lt-Governor). Calculate the words per minute.

While timing, listen for any distortion or change in pitch that affects intelligibility.

Pass/Fail Conditions

- The system passes if the speech rate is between 60 and 70 wpm or 50% of the default speech rate.
- Otherwise, the system fails.

Set the speech rate to the maximum setting and repeat the measurement of the amount of time taken to announce all the candidates for contest #5 (Lieutenant-Governor). Calculate the words per minute.

While timing, listen for any distortion or change in pitch that affects intelligibility.

Pass/Fail Conditions

- The system passes if the speech rate is between 240 and 250 wpm or 200% of the default speech rate.
- Otherwise, the system fails.

Fail Condition

- The system fails if either the maximum or minimum speech rates change the pitch of the voice enough to distort intelligibility.

Audio – Settings for Volume

Covers requirements:

- **7.1-K – Audio settings**

Method

FCC regulations for hearing aids, 47 CFR Parts 20 and 68: Hearing Aid Standard, includes useful information about how to test audio volume and quality.

Preparation

This method can be completed using an external speaker instead of headphones, to allow two testers to work together, one operating the system and the other taking measurements.

For all systems

Open the settings control and determine how many different volume settings are available in the system.

Fail Condition

- The system fails if there is no mechanism for adjusting volume.

Using the default volume setting, proceed through the voting session to contest #1 (President and Vice-President) and measure this volume using one of the methods below

Pass/Fail Conditions

- The system passes if the speech rate is between 60 and 70 dB SPL.
- Otherwise, the system fails.

Next, adjust the volume to the minimum setting and measure the announcement of candidates in contest #2 (US Senate) as the minimum volume.

Fail Condition

- The system fails if the minimum volume is not approximately 20dB SPL ($\pm 10\%$).

Increase the volume gradually, up to the maximum allowed and measure the announcement of successive candidates in the contests presented. If the volume control has discrete increments, increase the volume by one increment for each step. If the volume control has a continuous adjustment, attempt to increase the volume by an amount no greater than 10dB SPL for each step. The audio-tactile interface's "pause and resume" feature may be useful in performing these steps.

Fail Condition

- The system fails if the measured difference in volume between any two successive steps is greater than 10dB SPL.

Fail Condition

- The system fails if the final (maximum volume is not approximately 100dB SPL ($\pm 10\%$)).

Measuring Sound Volume

Volume is measured in one of two ways, depending on whether the audio information is presented through open air or through headphones or a handset. For both modes:

Speech must be continuous for the entire measurement period (at least 15 seconds) and averaged over that period, because it is used as the test signal.

The measuring equipment must have an accuracy of at least ± 0.5 dB-SPL, an A-weighting filter, and a range from 15 dB SPL to 120 dB SPL.

Open Air Volume

General setup and test methods are as described in IEEE 1329. The volume is measured as the dB SPL level of the audio information with a sound meter at the conventional head position(s) of a voter operating the voting system. Open air sound levels are to be measured in anechoic conditions to prevent reflections from affecting the measurement accuracy.

If the voting system is designed for operation when both sitting and standing, then take measurements for both operating positions.

Headphone/Handset Volume

The test is described in IEEE 269. The referenced standard specifies the required test equipment, test setup, and test procedures.

Follow the test methodology that is relevant to receiving audio through the through a private audio output device applicable to the VSUT. "Headphones" equates to the term "headsets" used in Clause 9 of the referenced standard.

For a HATS (Head and Torso Simulator), use Type 3.3 ears as defined in Clause 5 of the referenced standard.

If the ERP (Ear Reference Point) is not specified by the manufacturer of the private audio output device, then use the defaults in the referenced standard.

Audio - Standard Audio Connector

Covers requirement

- **8.1-E – Standard audio connectors**
- **8.1-F – Discernable audio jacks**
- **7.1-N – Tactile keys**
- **7.3-L – Icon labels**

Method

Connect a headphone that has a 3.5mm stereo plug and verify that the audio presentation of the ballot is clearly audible through the headphones.

Observe whether the location of the jack can be easily discovered by a user without use of sight, while standing or sitting in front of the unit. Make note if:

- The jack is in a hidden location, not on a front or side surface of the voting system case.
- There are sharp edges near the jack that might be touched while looking for it.
- There is no Braille label corresponding to a text label.
- There is an icon label that is not discernable by touch nor has a Braille label corresponding to it.

Fail Conditions

- The system fails 8.1-E if no 3.5 mm stereo headphone jack available.
- The system fails 8.1-E if there is not a clear audio signal through the headphones.
- The system fails 8.1-F if the location of the jack cannot be discovered by feel, without the use of sight.
- The system fails 7.1-N if there is a text label without a Braille or icon label.
- The system files 7.3-L if there is an icon label that is not discernable by touch.

Audio – Voter Control of Audio

Covers requirements:

- **7.2-G—Voter control of audio**

Method

In contest #4 (Governor), allow the system to read the first 5 candidates, then pause the audio and cause the system to repeat the information in the contest header.

Fail Condition

- The system fails if the system cannot be made to repeat the contest information.

In contest #5 (Lieutenant-Governor), attempt to cause the ATI to repeat the candidates' names for Lieutenant-Governor.

Fail Condition

- The system fails if the system cannot be made to repeat the candidate names.

In contest #9 (County Commissioners), attempt to cause the audio tactile interface to pause and then resume as it announces the name of the 2nd candidate for county commissioner, and again for the 4th candidate.

Fail Condition

- The system fails if the system cannot be made to pause and resume while announcing a name.

As contest #16 (Referendum #2: PROPOSED CONSTITUTIONAL AMENDMENT D) is being read, skip the reading of the full text of the amendment and go directly to the voting options.

Fail Condition

- The system fails if the system cannot be made to skip immediately to the voting choice while reading a referendum.

Audio – Voter Speech Not Required

Covers requirements:

- **6.1-A –Preserving Voter Privacy**
- **7.2-F– Voter Speech**

Method

For all systems

Proceed through an entire voting session. The tester need not complete a vote for every contest, but must at least proceed through ballot initiation, vote at least one conventional contest, and vote for at least one write-in candidate, and perform final vote casting.

Confirm that:

- Speech is never required to perform any of the functions of the system
- If speech is allowed, there is a way to perform the function without speech
- If speech is allowed, the voter speech could not reveal any ballot selections to a bystander.

Pass/Fail Conditions

- The system fails 7.2-F if speech is required to perform any voting function without an alternative.
- The system fails 6.1-A if any voter speech could violate voter privacy.
- Otherwise, the system passes.

Audio - Visual Redundancy for Sound Cues

Covers requirements

- **5.2-C – All information in all modes**
- **5.2-E – Sound cues**

Method

Proceed through an entire voting session with the voting station in audio/visual mode.

While voting for contest #2 (US Senate), refrain from any interaction with the system to cause the system to issue an inactivity alert.

While voting for contest #3 (US Representative), attempt to overvote to cause the system to notify the voter of the error.

If at any time, an audio cue is used as a warning or alert, there must also be a corresponding visual cue. Any visual cues must have a corresponding cue in audio.

Pass/Fail Conditions

- The system passes 5.2-C if any visual information is also presented in audio.
- The system passes 5.2-E if aural cues are accompanied by visual cues and all visual cues are accompanied by an audio cue.
- Otherwise, the system fails

Ballot Design

Covers requirements:

- **7.1-E – Color conventions**
- **7.1-F – Using color**
- **7.3-B – No split contests**
- **7.3-C – Contest information**
- **7.3-D – Consistent relationship**
- **7.3-E – Feedback**
- **7.3-L – Icon labels**

Method

Preparation

This method tests the design of the ballot marking interface or paper ballots produced by the system, following the manufacturer best practices. Because ballots for an actual election are produced by election offices, this is a test of the capabilities of the system to produce a ballot that meets the VVSG 2.0 requirements.

Prepare (or select) an electronic and a sample paper ballot laid out following the best practices in the documentation and the NIST standard test ballot specification (Appendix 1), which includes contests that test the full design capabilities of the system.

For a paper ballot, this test is repeated once.

For an electronic interface, this test is twice, for the:

- Visual interface with touch or the default input method
- Audio interface (with the screen turned off) and the tactile controller

For each test, two experts in the ballot design proceed through an entire voting session. General principles and best practices known to the experts are used as criteria, in addition to the specific requirements.

For all systems

After proceeding through the voting session in each of the interaction mode, the experts determine the kind and severity of ballot design problems exhibited by the system.

Fail Condition

- The system fails if there are ballot design problems serious enough that voters have difficulty understanding and executing the ballot.

Observe whether the selection of candidates and choices is conspicuously and unmistakably indicated by the system. Examples of acceptable feedback for a visual system would be an "X" or checkmark next to the chosen option or the use of highlighting around the chosen option.

Fail Condition

- The system fails 7.2-E if the visual feedback mechanism does not clearly indicate voter choices.

Observe which contests fit on a single screen, and how any contests that cannot fit all candidates on a single screen enable navigation.

Pass/Fail Conditions

- The system passes if all the contests except for contest #4 (Governor) are presented on a single page or screen.
- The system passes 7.3-B.1 if the paper ballot format can present all contests in a way that does not divide the options across two columns or pages.
- The system passes 7.3-B-2 if the electronic interface for any contest that does not fit on a single screen has an easily visible, unambiguous method of moving through the contest to see all ballot choices.
- Otherwise, the system fails.

Observe the layout of the contests, the placement of instructions, and the use of icons, color and other typographical features on the ballot.

Pass/Fail Conditions

- The system passes 7.3-C if every contest clearly indicates the title of the contest and the maximum number of choices for which one can vote.
- The system passes 7.3-D if all contests maintain the same relationship between the name of a candidate and the mechanism used to vote for that candidate.
- The system passes if ballot instructions are placed near to where they are needed by the voter.
- The system passes 7.1-E and 7.1-F if all uses of color within the ballot conform to common conventions.
- The system passes 7.3-L if every ballot icon is accompanied by a corresponding linguistic label.
- Otherwise, the system fails.

For the audio interface with tactile key inputs

Set up the voting system with:

- Audio output
- The screen turned off
- Set up for input with the tactile keypad

Complete a voting session, adding observations of the audio feedback and whether the selection of candidates and choices is conspicuously and unmistakably indicated by the system; e.g., as by a spoken confirmation, such as, "You have selected John Smith" would be acceptable.

Fail Conditions

- The system fails 7.3-E if the audio feedback mechanism does not clearly indicate voter choices.

Ballot Design – Color Contrast

Covers Requirements

- **7.1-C—Default Contrast**
- **7.1-D—Contrast Options**

Method

Preparation

Review the system documentation to identify the options available for setting the contrast and determine the color specifications for foreground and background colors in each setting.

Select a color contrast evaluation tool that uses the Web Content Authoring Guidelines (WCAG 2.0) formula for relative luminance. There is a list of suitable tools available from the W3C Web Accessibility Initiative [resources section for understanding contrast](#). Note, however that the contrast requirements for voting systems is higher than the general contrast checkpoints in the Web Content Authoring Guidelines (WCAG 2.0)

Select samples for contrast testing, including at least one example from each available type of material. Since the purpose of the test is to assure adequate contrast, the tester should look for examples of potentially low contrast, such as light-colored icons or text on a white background, or dark icons or text on a deeply colored background. The examples chosen for inspection, both the lighter and darker area must be at least 1/2 inch in height and width.

Material intended for voters includes:

- Instructions (built-in or external) on the use of the system for voting
- The actual ballot or ballot interface
- Verification records

Material intended for poll workers includes:

- Instructions on the operation of the system
- Any labels or instructions affixed to the system itself

For an electronic marking interface

Open the settings function for changing the color contrast on the screen and review the settings available.

Using the color specifications from the documentation calculate the color contrast ratio between the text and background colors for:

- Contest title, contest voting instructions and candidate names on a contrast screen

- Vote selection marking targets
- Contest information on the review screen
- Navigation buttons
- Help and instructional text

Fail Condition

- The system fails 7.1-C.1 if the default color contrast is not at least 10:1 for all elements.
- The system fails 7.1-D.1 if there is not a high-contrast option with a color contrast of at least 20:1.
- The system fails 7.1-D.2 if there is not a high-contrast option with at least one of the settings with a black background and yellow, cyan or white text as specified in 7.1-D-2.
- The system fails 7.1-D.3 if there is not a low contrast option with a color contrast between 4.5:1 and 8:1.

For printed samples on paper or system labels

Measure the luminance of the foreground item and of the adjacent background, using a spot photometer. Set the sensitivity of the photometer to simulate an environment with a diffuse ambient light level of 300 lx.

Fail Condition

- The system fails 7.1-C.2 if the higher luminance of these two measurements is less than 10:1 (ten times the lower luminance).

Ballot Design – Fonts Used

Covers requirements:

- **7.1-J – Sans-serif font**

Method

For electronic ballot interfaces

Examine a selection of information types in the ballot interface to determine whether the text is presented in a sans-serif font.

Include at least one page representing:

- Contest screen: Contest title, contest voting instructions and candidate names on a contrast screen
- Ballot question screen: Title, question text, question voting instructions
- Review screen: Title, instructions, contests and candidate listings
- Help and instructional text
- Navigation buttons

Pass/Fail Conditions

- The system passes if all the text intended for the voter is presented in a sans serif font.
- Otherwise, the system fails.

Ballot Design – Text Size

Covers requirements:

- **7.1-G – Text size (electronic display)**
- **7.1-H – Scaling and zooming (electronic display)**
- **7.1-I – Text size (paper)**

Method

Preparation

Prepare (or select) an electronic and a sample paper ballot laid out following the best practices in the documentation.

Gather samples of all signage or instructional material intended for use by voters.

Gather samples of any printed records intended for voters produced by the voting system.

For all systems

Determine if the voting system documentation includes recommended notices, instructions, or other information to be posted in the voting booth.

If so, examine the sample information and identify the smallest text

Measure the text height of the names of the candidates and the smallest text size on the ballot, using a capitol letter I.

Fail Condition for 7.1-I and 7.1-G

- The system fails if the smallest text size is not at least 3.5 mm (10 points, or 0.14 inch).

For paper ballots or other records

Examine the paper ballot to identify the smallest text.

Measure the text height of the names of the candidates and the smallest text size on the ballot, using a capitol letter I.

Fail Condition for 7.1-I

- The system fails if the smallest text size is not at least 3.5 mm (10 points).

Examine any paper record produced by the voting system to identify the smallest text.

Measure the text height of the names of the candidates and the smallest text size on the ballot, using a capitol letter I.

Fail Condition for 7.1-I

- The system fails if the smallest text size is not at least 3.5 mm (10 points, or 0.14 inch).

For electronic ballot interfaces

Set the voting system to use the default text size. Proceed through a voting session, measuring the size of each type of text, including:

- Instructions
- Contest titles
- Contest voting instructions (such as “vote for 1”)
- Candidate names
- Additional information about a candidate (such as party name)

Using a 15x magnifier for accuracy, measure the height of the text, using a capitol letter I.

Fail Condition for 7.1-G

- The system fails if the default text intended for the voter is less than 4.8mm.

Open the system settings options for text size.

If the system allows continuous scrolling:

- Measure the size of the candidate names at the smallest and largest size, using a capitol letter I.
- Measure the size of the text at a middle setting and then increment the text by the smallest possible step.

Fail Condition for 7.1-G.1

- The system fails if the smallest text size is not at least 3.5mm.
- The system fails if the largest text size is not at least 9.0mm.
- The system fails if the increment between two adjacent text sizes is greater than 0.5mm.

If the system uses defined text sizes:

Measure the size of the candidate names at each of the text sizes using a capitol letter I.

Determine if the text size options include at least:

- 3.5-4.2 mm (10-12 points)
- 4.8-5.6 mm (14-16 points)
- 6.4-7.1 mm (18-20 points)
- 8.5-9.0 mm (24-25 points)

Fail Condition for 7.1-G.2

- The system fails if the text size options do not include at least the required text sizes ranges.

For all electronic interfaces

Set the text size options to as close to 200% of the default size, or so that the candidate name text height is as close as possible to 7.1mm.

Examine all of the screen types looking for how the ballot layout adjusts at larger sizes. Screen types might include:

- Instructional or navigational screens
- Candidate contest screens
- Ballot question screens
- Review screens

Fail Condition for 7.1-H.1

- The system fails if the any of the screen layouts required horizontal scrolling or panning at 200% of the default text size.

Examine the screen layouts for all candidate and ballot questions at all text sizes larger than the 200% text size. Look at the relationship between the ballot options and associated marking targets.

Fail Condition for 7.1-H.2

- The system fails if the any of the screen layouts do not maintain a consistent relationship between the ballot option and marking targets.

Ballot Design - No Bias Among Choices

Covers requirement

- **5.2-A – No bias**
- **7.3-D – Consistent relationship**

Method

Inspect the ballot and confirm that all candidates and other ballot choices are presented in an equivalent manner.

For electronic ballot interfaces and printed ballots

Inspect all candidates and ballot questions in the sample ballot. Ensure that the presentation is identical, including:

- Font, text size, text color, and other characteristics
- Layout of the candidate name or voting choice including placement within the visual area for each candidate
- The size of the visual area for each candidate

For audio interfaces

In the sample ballot inspect the following contests:

- context #5 (Lieutenant-Governor)
- contest #6 (Secretary of State)
- contest #7 (State Senator)
- Contest #17 - Ballot question 3 PROPOSED CONSTITUTIONAL AMENDMENT H, and
- Contest #18 - Ballot question 4 PROPOSED CONSTITUTIONAL AMENDMENT K .

Ensure that audio presentation is identical and does not introduce bias, including:

- Volume and speed of the audio
- Voice used for all voting choices
- Placement and timing of additional information about the voting choice status or other instructions.

Pass/Fail Conditions for 5.2-A and 7.3-D

- The system passes if all choices are presented in a consistent manner.
- Otherwise, the system fails.

Ballot Design - Use of Color

Covers requirements:

- 7.1-E – Color conventions
- 7.1-F – Using color

Method

For all systems

Review all voter and poll worker interfaces and documentation, looking for any information or presentations in which color is the exclusive means of conveying information.

- Multiple colors for text is acceptable, since the text itself conveys information.
- Colored icons are acceptable as long as they are otherwise distinguishable by shape or accompanying text.

Pass/Fail Conditions

- The system passes if no presentations are found that rely solely on color.
- Otherwise, the system fails.

For electronic ballot interfaces

Review all of the types of information presented to voters during a voting session or to election workers in any maintenance tasks, looking for any use of color in status indicators and the use of common conventions for the use of color:

- Green, blue, or white for general information or as a normal status indicator
- Amber or yellow to indicate warnings or a marginal status
- Red to indicate error conditions or a problem requiring immediate attention

Pass/Fail Conditions

- The system passes warnings or other indicators use common color conventions.
- Otherwise, the system fails.

Clear Floor Space

Covers requirement:

- **7.2-P.1 – Floor space**

Method

Preparation

Set up the system for use by voters according to the manufacturer's documentation, including any table or voting booth it sits on.

Determine whether the floor area is an integral part of the voting system, or whether this area is part of the polling place infrastructure.

Refer to United States Access Board [Chapter 3 – Operable Parts](#) diagram for clear floor space for how to measure.

For all systems

The tester measures (using a conventional tape measure) the floor area intended for occupation by the voter, using a conventional tape measure. The area to be measured must be clear of all obstructions and overhanging elements.

Fail Condition

- The system fails if the measured area cannot contain a 30 wide x 48 deep inch area for forward approach.
- The system fails if the measured area cannot contain a 48 wide x 30 deep inch area for side approach.

For systems with integral floor space

If the floor area is integral to the system, measure the slope:

- Use a 24 inch level and a block of material exactly half an inch thick.
- Place the level on the floor and rotate it around the center of the area to determine the direction of slope if any.
- If there is a significant slope, place the block at the lowest point approximately 12 inches from the center of the area.
- Then place one end of the level on the block and the other end across the center from it (so that the level is along the diameter of a centered circle).

Fail Condition

- The system fails if the level is sloped downwards towards the block.

Clear Space for Assistant

Covers requirement

- **7.2-P.2 – Floor space**

Method

Preparation

Set up the system according to the manufacturer’s documentation.

Use a motorized wheelchair or a large chair with markings to occupy similar space to a wheelchair, including footrests.

This test requires two testers:

- Tester A with knowledge of capabilities of voters with disabilities (including low vision, blindness, low dexterity, no use of their hands, and cognitive disabilities) acts as the voter.
- Tester B acts as the assistant

For all systems

Tester A, in a wheelchair, approaches the system and positions themselves to vote, oriented and located as intended by the manufacturer.

Tester B attempts to accompany Tester A in the voting area, standing or seated, as appropriate for the system, so they can see the ballot marking interface.

Fail Condition

- The system fails if there is inadequate room for the assistant to enter or leave the area.
- The system fails if there is inadequate room for the assistant to accompany the tester into the area.

They then proceed through the entire voting session (including ballot initiation, verification, and submission, as appropriate) using the default ballot choices.

Test for assisting a sighted voter with dexterity disabilities

Through contest #9 (County Commissioners), the voter (Tester A) views the ballot and then give oral instructions to the assistant (Tester B) who carries them out.

Test for assisting a blind or low vision voter, or voter with cognitive disabilities

In the remaining contests, the assistant (Tester B) provides support and oral instructions to the voter (Tester A) who marks the ballot with this assistance.

Fail Condition

- The system fails if the tester or assistant has significant difficulty viewing the ballot or other relevant material.

Assess, based on the voting session, whether or not there are significant difficulties in executing physical tasks to assist the voter, including ballot initiation, verification, and submission, as well as selection of candidates.

Fail Condition

- The system fails if the tester or assistant has significant difficulty executing physical tasks.

Controls – Discernible by Touch and Vision

Covers requirements:

- **7.1-N—Tactile Keys**
- **7.1-O—Toggle Keys**
- **7.1-P—Identifying controls**

Method

Inspect each device a voter or election worker will use. Examine all of the system's physical buttons, controls, and keys intended for use by the voter and verify that they are distinguishable by shape or texture.

During this inspection, pay particular attention to the keys on a tactile keypad that voters will use to navigate an electronic marking interface. Verify that no two have an identical shape, nor do any two have identical colors.

It is acceptable for a group of keys, such as a set of 4 arrow keys, a conventional 4x3 telephone keypad or a full alphabetic keyboard to have the same shape and color if they are distinguishable by their relative location.

In a keypad with multiple keys such as a number pad, it is sufficient if certain "home" keys (such as the "5" in the middle of the keypad) are tactilely distinctive. This allows the user to navigate to nearby keys via their position.

Fail/Pass Conditions

- The system fails 7.1-P if there are controls or keys which cannot be distinguished by shape or texture.
- The system fails 7.1-N if there are controls or keys that do not have a Braille or icon label for any text label.
- Otherwise, the system passes.

Attempt to use each control verify that it is possible to touch them lightly to identify the control by touch, without activating it.

Fail/Pass Conditions

- The system fails 7.1-N if the tester has significant difficulty in tactilely discerning a key or control without also activating it.
- Otherwise, the system passes.

Complete a voting session using the default ballot choices. During the session, examine the system for the presence of locking or toggle controls or keys intended for use by the voter. These are keys (such as "shift") that modify the effect of all subsequent input until explicitly reversed.

Pass Condition for 7.1-O

- The system there are no locking or toggle controls or keys intended for use by the voter.

If there are such locking or toggle keys are found, verify that the status of each is visually discernible. For instance, on many keyboards, there is a small LED, either directly on the "caps lock" key or elsewhere on the keyboard, that is lit if and only if "caps lock" is activated.

Activate the locking or toggle function of each key and verify that the state of the key is discernible either through touch (e.g. a key in a depressed or raised position, or a toggle switch positioned to the left or right) or through some audible feedback (e.g., verbal feedback such as "shift"/"un-shift" or via a distinctive tone).

Deactivate the locking or toggle function and verify that the state of the key returns to its initial appearance.

Fail Conditions for 7.1-O

- The system fails if the status of locking or toggle controls or keys intended for use by the voter is not visually discernable.
- The system fails if status of locking or toggle controls or keys intended for use by the voter is not tactilely discernable.
- The system fails if the current appearance of any characteristic does not match its initial appearance as noted in the first session.
- Otherwise, the system passes.

Controls - No Dependence on Direct Bodily Contact

Covers requirement

- **7.2-L – Bodily contact**

Method

For touch-screen interfaces

Avoiding contact between body and the screen by wearing non-conductive gloves attempt to use the touch interface to activate controls in the interface using:

- a soft rubber-pointed stylus
- a hard rubber-pointed stylus such as the eraser of a pencil or a mouth-stick
- a finger, while wearing non-conductive gloves

Pass/Fail Conditions

- The system passes if all of the controls respond properly.
- Otherwise, the system fails.

Controls - Operable

Covers requirement

- **7.2-K – Key operability**

Method

Preparation

This test method requires a linear force gauge with

- a peak indicator
- accuracy of at least $\pm 0.1\text{N}$ (0.02 lbs)
- range from zero to at least 27 N (6 lbs)
- capability to measure both push and pull forces

For all systems

Examine all of the physical controls that are part of the system and attempt to use them for the tasks indicated in the documentation. Verify that no control requires an operation that involves holding the control tightly, pinching with two fingers, or twisting the wrist.

Fail Condition

- The system fails if any operation in the session requires tight grasping, pinching, or twisting of the wrist.

Use a linear force gauge with a peak indicator (manual or electronic) on the actual controls to measure the activation force required by the controls

Pass/Fail Conditions

- The system fails if the activation force for any control exceeds 5 lbs.
- Otherwise, the system passes.

Controls - Personal Technology Input Device Use

Covers requirement

- **8.1-I – Standard PAT Jacks**

Method

Preparation

This test uses a personal assistive technology device, such as a dual switch for general use. It cannot be the same device supplied with the voting system. It must use a 3.5 mm (1/8 inch) industry standard jack.

For a vote capture device or other vote station device

Attach a personal dual switch to the device to be tested and attempt to use it to interact with the voting system.

Pass/Fail Conditions

- The system fails if there is no 3.5 mm (1/8 inch) industry standard jack for personal assistive technology.
- The system fails if the personal assistive technology.
- Otherwise, the system passes.

Attempt to complete a voting session using the personal technology.

Pass/Fail Conditions

- The system fails if all voting functions cannot be completed.
- Otherwise, the system passes.

Controls – Reach and touch

Covers requirement

- 7.2-Q – Physical dimensions

Method

Preparation

Download the United States Access Board documentation for the position of operable parts from the [ADA Standards for Section 407 Operable Parts](#) and [Chapter 3 – Operable Parts](#) from the explanation of the requirements and how to meet them.

For this test, only the operable parts of the voting system device itself that are to be used by voters are relevant. The position of electrical outlets or controls intended only for use by election workers are excluded.

Set up the system as instructed in the documentation, including placing the device on a table or portable voting booth.

Examine the voting system device to determine the location of all controls to be used by voters, including all parts of the touch screen, physical buttons, audio or assistive technology jacks, activation devices, and pathways for a paper ballot.

For all systems

Using the list of controls to be used by voters, measure the reach and touch distance as documented in [Chapter 3 – Operable Parts](#) for all possible postures:

- Standing at the system
- Sitting in a chair
- Sitting upright in a manual wheelchair with a forward approach
- Sitting in approximately 45 degrees in a motorized wheelchair at a typical height with a side approach

Pass/Fail Conditions

- The system passes if both high and low reach points meet the specifications for forward approach.
- The system passes if both high and low reach points meet the specifications for side approach.
- The system passes if it meets the requirements for knee and toe space.
- The system passes if it meets the requirements for either unobstructed or obstructed reach.

- Otherwise, the system fails.

Controls – Size and placement

Covers requirements:

- **7.2-H – Accidental activation**
- **7.2-I – Touch area size**
- **7.2-J – Paper ballot target areas**
- **7.2-M – No repetitive activation**

Method

This test method must be enacted for both the touch and tactile controls (those designed for voters with dexterity disabilities).

A tester with usability and accessibility expertise proceeds through an entire voting session using the default ballot choices.

For touch-screen controls

Inspect the overall screen layout and note whether any controls or touch areas on the screen are unusually sensitive or are located so as to be susceptible to unintentional contact (e.g., some voters tend to grip a screen at its lower corners).

Fail Condition for 7.2.H

- The system fails if it presents significant vulnerabilities for accidental activation.

Inspect touch controls for using the system, including:

- Buttons or controls used to open help or settings functions or navigate around the ballot
- Buttons or controls used to respond to messages, activate menus, or similar functions
- Touch areas to make vote selections for candidates and ballot questions
- Keys in an on-screen alphabetic keyboard, if included in the system
- Buttons or controls in administrative functions

Using a ruler, measure the size of the sensitive touch area and the space to the nearest adjacent touch area.

Fail Conditions for 7.2.I

- The system fails if the space between any two touch areas is less than 0.1 inches.
- The system fails if the size of any touch area for write-ins is less than 0.5 inches in height or width.

For tactile keypad controls

Using the tactile keypad in a voting session, observe the effect of holding any tactile control in place, including letter keys on a keyboard, "next page" or "previous page" control buttons, or joysticks and verify that none of them have a repetitive effect (e.g. holding down a "next page" control should not cause the system to advance through several pages). Particular attention should be paid to these controls intended for use by voters with dexterity disabilities.

Pass/Fail Conditions for 7.2-M

- The system fails if a control with a repetitive effect is found.
- Otherwise it passes.

For paper ballots

Using a ruler, measure the size of the area used to mark a selection.

Fail Conditions for 7.2.J

- The system fails if the size of the marking target is less than 0.12 inches in either height or width.

Controls - Visibility of Displays and Controls

Covers requirement:

- **7.2-R--Controls visible**

Method

Preparation

Set up the voting station according to the instructions of the manufacturer (including lighting).

This test also requires

- A tester with vision no worse than 20/40 corrected.
- A manual wheelchair or a chair that can simulate the position of a voter sitting upright in a wheelchair with foot rests.
- A motorized wheelchair with the seat set in a 45 degree tilted position, or a way to simulate the posture of a voter in this position.

For all systems

This test is repeated for three different postures:

- Standing at the system
- Sitting upright in a manual wheelchair
- Sitting in approximately 45 degrees in a motorized wheelchair at a typical height

This test does not include all possible positions for voters as they approach the system. In each of the positions, the tester should observe carefully for whether any controls might not be visible from a range of head positions. The ability of the voter to reach the controls is covered in *Controls – Reach and Touch*

Determine if there is significant difficulty in seeing and identifying any of the controls, keys, or audio jacks, or in reading any of the labels, displays, or other elements of the voting station intended for the voter. Potential problems include the angle of surface or a control hidden from view depending on the height and posture of the voter.

Fail/Pass Conditions

- The system fails if there is significant difficulty in the visibility of elements intended for the voter.
- Otherwise, the system passes.

Instructions - Accessibility Documentation

Covers requirements

- **5.1.A – Interaction modes**
- **5.1-F – Accessibility documentation**
- **7.3-O – Instructions for election workers**
- **7.3-P – Plain language**

Method

Preparation

Determine what accessibility features are included in the system listed in the TDP.

This test is repeated for each feature supported, using them as needed to test each interaction mode in 5.1-A

For all systems

Review the documentation provided by the manufacturer and confirm that it describes voting procedures covering each feature and all interaction mode, and that it is written in a manner that makes the information understandable by election workers, who may have to explain to voters how to use the system.

The documentation should explain:

- Any special factors for operating the system in a polling place environment such placement of system or necessary floor space clearances.
- Session startup procedures for all modes, such as plugging in a personal headphone or initiating use of non-manual input.
- How to tell when a feature is working correctly.
- Whether the voter or election worker is expected to perform a procedure.
- Recommended procedures for assisting voters.

Fail Condition for 5.1-F

- The system fails if the documentation does not include procedures for accessibility features.

Fail Condition for 7.3-O and 7.3-P

- The system fails if the documentation is not written in plain language and in a format suitable for use in the polling place.

Instructions – Assistance from System

Covers requirements:

- **5.2-C – All information in all modes**
- **5.2-D – Audio synchronized**
- **7.3-N – Instructions for voters**

Method

For electronic ballot interfaces

Set up the system so that both the audio and visual interface are turned on.

Proceed through an entire voting session, using the editable ballot session. Confirm that help is available from the system at these points within the session and that the same information is communicated in both audio and visual modes:

- prior to voting for any of the candidate
- immediately after voting for the 2nd candidate
- while writing in a candidate
- when viewing the session review screen
- through the process of printing (if part of the system) and the final casting of the ballot

Pass/Fail Conditions for 7.3-N

- The system passes if assistance is available at the points designated above.
- Otherwise, the system fails.

Pass/Fail Conditions for 5.2-C and 5.2-D

- The system passes if assistance is available in both in both visual and audio displays.
- Otherwise, the system fails.

For paper based systems

Confirm that written instructions or some other built-in mechanism would be readily available to the voter throughout the voting session. Possibilities for presenting assistance include information on the ballot itself, a poster in the voting booth, or an independent electronic "help" system.

Pass/Fail Conditions

- The system passes if assistance is readily available to the voter at any time during the voting session.

- Otherwise, the system fails.

Instructions – Completeness of Instructions

Covers requirements:

- **5.2-C – All information in all modes**
- **7.3-N – Instructions for voters**
- **7.3-O – Instructions for election workers**

Method

For all systems

For electronic interfaces, set up the system so that both the audio and visual interface are turned on.

Proceed through an entire voting session. During the session, attempt to discover and exercise all functions provided by the system

Confirm that help is available from the system at these points within the session and that the same information is communicated in both audio and visual modes.

Examples of functions for voters are listed below. They are not all required, but, if present, must have instructions for their use. The system must provide instructions for all its operations, even if some of those are beyond what is mandated by the VVSG.

- Session initiation (e.g., use of an activation card, ballot insertion, or code)
- Setup of assistive technology
- Adjustment of visual display characteristics (e.g., font size, color, contrast)
- Adjustment of audio characteristics (e.g. volume, speed)
- Use of other auxiliary devices, such as a magnifier for paper records.
- Navigating back and forth through multiple pages
- Changing a vote
- Writing in a candidate for office
- Review of the ballot
- Final casting of the ballot

Instructions for election workers include confirming that

- The system has been set up correctly
- The system is ready for voting sessions
- The system has been shut down properly

Pass/Fail Conditions

- The system passes 5.2-C if all instructions are available in both audio and visual modes.

- The system passes 7.3-N if adequate instructions are available for all voter operations.
- The system passes 7.3-O if adequate instructions are available for all voter operations.
- Otherwise, the system fails.

Instructions - Language Clarity

Covers requirements:

- **7.3-K—Warnings, alerts and instructions**
- **7.3-L — Icons**
- **7.3-N – Instructions for voters**
- **7.3-O – Instructions for election workers**
- **7.3-P – Plain language**

Method

Preparation

The testers must be experts in usability and plain language

In elections, some of the messages intended for the voter originate with the voting system and some are mandated by election law. The VVSG requirements apply only to the default messages from the system. However, the presentation of legally required messages can also be considered, if they are included in the test setup, so wording for instructions and warnings are included in the test.

Set up the system with warnings enabled for over-votes and under-votes and any other optional messages, so that all system default messages are reviewed.

This test must be completed for both the audio and visual interfaces. This can be done simultaneously, with two testers, each focusing on one of the presentation modes.

For all voting systems

Review all text intended for voters or election worker using the Guidelines for Writing Clear Instructions and Messages for Voters and Poll Workers provide a basis for determining whether a given system's documentation is written at a professionally-recognized level of quality. General principles and best practices known to the expert testers, or listed in 7.3-P may also be used as criterial.

Note that any guidelines are not to be treated as absolutes. As an example, one instance of the use of passive voice does not necessarily ensure failure for the requirement.

Pass/Fail Conditions

- The system passes 7.3-P if system instructions, warnings, alerts, and labels meet the guidelines for plain language.

- The system fails 7.3-P if the system instructions are unclear enough that voters would have significant difficulty understanding warnings, notices, or instructions.

Warnings and alerts issued by the voting system should state:

- the nature of the problem
- whether the voter has made a mistake or whether the voting system itself has malfunctioned
- the options for responses available to the voter.

Pass/Fail Conditions for 7.1-K

- The system passes if all warnings or alerts clearly address the nature of the problem, whether the voter made a mistake or if the system malfunctioned, and the set of responses available to the voter.
- The system passes if each instruction or warning is distinct from other information spatially in a visual presentation.
- The system passes if each instruction or warning is distinct from other information with a pause or other audible indicator in an audio presentation.
- Otherwise, the system fails.

Labels and visual presentation for icon labels are accompanied by text.

Pass/Fail Conditions for 7.1-L

- The system passes the labels for all icons are understandable.
- Otherwise the system fails.

Navigation – Between contests

Covers requirement

- **7.2-B – Navigation between contests**
- **7.2-E – Touch gestures**

Method

For electronic ballot interfaces

This test must be completed, using the touch interface and the tactile keypad.

Proceed through a voting session using the default ballot choices for the first five contests.

- At contest #5 (Lieutenant-Governor), attempt to go back to contest #3 (US Representative).
- Attempt to continue to contest #4 (Governor).
- Continue through the contests to contest #16 Ballot Question #2 - PROPOSED CONSTITUTIONAL AMENDMENT D.
- Go back to contest #15 Ballot Question #1 - PROPOSED CONSTITUTIONAL AMENDMENT C.

Pass/Fail Conditions

- The system passes if it is possible to navigate forward and backward between the contests.
- Otherwise the system fails.

Using the touch interface, attempt to use gestures on the screen, including:

- Swiping up and down
- Swiping diagonally
- Swiping left or right

Fail Conditions

- The system fails if any gesture can be used to navigate between contests.

Navigation – Scrolling or Paging Within a Contest

Covers requirement

- **7.2-D – Scrolling**
- **7.2-E – Touch gestures**
- **7.2-H – Accidental activation**

Method

For an electronic ballot interface

This test is conducted on Contest #9 (County Commissioners), a contest with a long list of 15 candidates.

Pass Conditions

- The system passes if all candidates are displayed in a single view with no scrolling or other navigation required.

Using the touch interface, attempt to navigate within the contest to reach the last voting option (name the candidate) or write-in, observing the screen display while navigating the list of candidates.

Fail/Pass Conditions

- The system passes if it does not use touch controls.
- The system fails if there is no way to navigate within the contest using on-screen touch controls.
- The system fails if the method of navigating relies solely on conventional platform scroll bars.
- The system fails if the contest header information including the name of the contest and voting rules disappears at any time.
- The system fails if there is no visible cue on every screen that there are additional candidates that are not currently displayed on the screen.
- The system fails if there is no visible cue when there are no more candidates above or below the ones currently displayed.
- Otherwise, the system passes.

Select three candidates: Camille Argent, Mary Tawa, Martin Schreiner. Review the selections on the contest screen by navigating through the list.

Go to the review screen and confirm that all three candidates are listed, with a notification that the contest is undervoted.

Fail/Pass Conditions

- The system fails if it is not possible to review the selections without leaving the contest screen.
- The system fails if the review screen does not accurately list the selections and undervotes.
- Otherwise, the system passes.

Return to the contest screen, and attempt to mark one more candidate than allowed.

Fail/Pass Conditions

- The system fails if it does not display an accurate overvote notification that is the same as on other contests.
- Otherwise, the system passes.

Using the audio and tactile keypad, attempt to navigate within the contest to reach the last voting option (name the candidate) or write-in, observing the screen display while navigating the list of candidates. Select three candidates: Amanda Marracini, Valarie Altman, Joe Smith.

Fail/Pass Conditions

- The system fails if there is no way to navigate within the contest using the tactile keys.
- The system fails if the visual display does not synchronize with the audio while moving through the list of candidates.
- The system fails if it does not accurately communicate when the beginning and end of the list of candidates is reached.
- Otherwise, the system passes.

Using the touch interface, attempt to navigate within the contest to reach the last voting option (Martin Schreiner) or write-in, while using a gesture of swiping up and down.

Fail/Pass Conditions

- The system fails if it does not support gestures, but accidentally activates a candidate while attempting to swipe.

- The system fails if using gestures to navigate within the contest changes the basic interaction from the touch or keypad interaction, including managing the selections made and displaying information about the contest and marking status.
- Otherwise, the system passes.

Navigation – Touch gestures

Covers requirements:

- **7.2-E – Touch gestures**
- **7.2-B – Navigation within contests**
- **7.2-D – Scrolling**
- **7.2-H – Accidental activation**

Method

Consult the system documentation for the gestures supported.

Fail/Pass Conditions for 7.2-E

- The system passes if it does not use touch gestures.
- The system fails if there is any function that can be completed only by using gestures (other than tapping).
- The system passes if the gestures include only simple, common gestures such as swiping (with any number of fingers).
- The system fails if any gestures require sequential, times, or simultaneous actions.
- Otherwise the system passes.

Complete a default voting session, including marking all choices, while using gestures whenever appropriate.

Fail/Pass Conditions

- The system fails 7.2-D, 7.2-E, and 7.2-H, if it is possible to accidentally activate a marking selection or on-screen control while using gestures.
- The system fails 7.2-B if it is possible to navigate between contests using gestures.
- The system fails 7.2-E if the gestures do not work consistently across the entire voting interaction.
- Otherwise, the system passes.

Marking and Casting - Correcting a Ballot

Covers requirement:

- **7.3-F—Correcting the ballot**
- **7.2-C – Voter control**

Method

For electronic ballot interfaces

Verify that the interface allows the voter to make a change while making initial choices in a contest, and can return to the contest to make a change before printing or casting the ballot.

Making a change includes:

- Adding or removing a selection
- Removing all selections
- Any other change possible within the contest rules (for example, changing the ranking of a candidate in a ranked-choice voting contest)

Fail/Pass Conditions for 7.3-F

- The system fails if it does not allow voters to change their selections in a contest on the contest screen.
- The system fails if it does not allow voters to return to a contest by navigating to that contest from any other contest or from the review screen and make a change.
- The system fails if it does not allow voters to remove selections from a contest and skip voting in that contest.
- The system fails if making a change before printing a ballot on a ballot marking system cannot be done without assistance from an election worker.
- Otherwise the system passes.

Verify that the system does not make any changes to vote selections and deselections except in response to a voter action or after informing the voter of the change to be made.

In a vote-for-1 contest, select a candidate, then attempt to select a second candidates.

Pass/Fail Conditions for 7.3-C.1

- The system passes if it notifies the voter and requires the first candidate to be deselected before choosing another.

- The system passes if it deselects the first candidate and selects the second one, announcing this in both audio and visual modes.
- Otherwise the system passes.

In a vote-for-N of M contest, select as many candidates as allowed, then try to select one more.

Pass/Fail Conditions

- The system fails 7.3-C.2 if it deselects any candidate without notifying the voter.
- The system passes 7.3-C.3 if it informs the voter that they have selected too many candidates and provides a way to change the selections.
- The system passes 7.3-C.1, 2, and 3 if it prevents the voter from making more choices than allowed.

If the system supports straight party voting or other group selection, make a selection of a group under those voting rules.

Then, continue through the ballot observing how the group selection is reflected in the contest displays.

On a contest in which a group selection has been made, attempt to change a single selection, following the voting rules.

Pass/Fail Conditions for 7.3-C.4

- The system passes if it does not support group selection.
- The system passes if the candidates chosen through the group selection are displayed as selected in their contests, either in the same manner as other candidates, or in a manner that indicates their membership in the group selection.
- The system passes if attempting to deselect one member of the group is done with clear feedback of the result of the action.
- Otherwise the system fails.

If the system supports ranked choice voting or other preferential methods, rank a contest, following the voting rules and ensuring that the rankings are not the same order as the initial list.

Attempt to change the ranking following the instructions in the voting system.

Proceed to the next contest and then return to the contest being ranked.

Proceed to the review screen, and then return to the contest being ranked.

Pass/Fail Conditions for 7.3-C.5

- The system passes if it does not support preferential methods.
- The system passes if it allows the ranking to be changed.
- The system passes if the system does not re-order candidates except in response to an explicit voter command, or on returning to the contest.
- Otherwise the system fails.

For paper-based systems

Verify that instructions on how to correct a ballot are readily available to the voter. For example, this may be achieved by posting the instructions within a voting booth or stall, or by including the instructions directly on the ballot.

Review the documentation for election workers for a general procedure for correcting a ballot. Note that the specific procedure will be defined under local laws by the elections office.

Pass/Fail Conditions for 7.30F

- The system passes if instructions or directions for posting instructions for correcting the ballot are readily available to the voter.
- The system passes if the poll worker documentation includes a procedure for correcting a ballot.
- Otherwise, the system fails.

Marking and Casting - Reviewing a Ballot

Covers requirement:

- **7.3-G—Full ballot selections review**

Method

For electronic ballot interfaces

Complete a voting session including leaving contest #7 (State Senator), contest #8 (State Assemblyman) and contest #9 (County Commissioners) blank and voting for fewer than allowed in contest #12 (City Council).

Verify that the system includes a function that allows voters to review their selections before printing and/or casting their ballot.

Pass/Fail Conditions

- The system passes if the review function displays all contests on the ballot with the voter selections.
- The system passes if the review function displays a notification for the contests that are left blank.
- The system passes if the review function displays a notification for the undervoted contests, stating the number of missed voting opportunities.
- The system passes if there is a way for voters to return to any contest from the review function to make a change.
- The system passes if any changes made are updated on return to the review function.
- Otherwise, the system fails.

Return to the review function, making any changes necessary to ensure that there is at least one blank contest and one undervoted contest.

Attempt to proceed to print or cast the ballot.

Pass/Fail Conditions

- The system passes if it allows the voter to print or cast the ballot with undervotes.
- Otherwise, the system fails.

For paper ballot scanners

Prepare a hand-marked paper ballot leaving contest #7 (State Senator), contest #8 (State Assemblyman) and contest #9 (County Commissioners) blank and voting for fewer than allowed in contest #12 (City Council).

Attempt to cast the ballot.

Pass/Fail Conditions

- The system passes if the review function displays all contests on the ballot with the voter selections.
- The system passes if the review function displays a notification for the contests that are left blank.
- The system passes if the review function displays a notification for the undervoted contests, stating the number of missed voting opportunities.
- Otherwise, the system fails.

Without casting the ballot, add a vote selection in contests #4 (Governor) and contest #5 (Lieutenant-Governor). Attempt to cast the ballot.

Pass/Fail Conditions

- The system passes if it allows the voter to print or cast the ballot with undervotes.
- Otherwise, the system fails.

Marking and Casting – Notification of Ballot Casting Failure

Covers requirement

- **7.3-J – Notification of casting**

Method

For all paper ballot scanners

Consult with the manufacturer to determine what elements on a paper ballot are read when the ballot is scanned. Prepare ballots that has been damaged by folding, tearing or creasing it along the marking lines, or adding marks that deface any timing marks or codes used to read the selections.

Attempt to cast a ballot by inserting it into the scanner in the wrong orientation or crooked.

Attempt to cast a ballot inserting it into the scanner with excessive force to cause a jam.

Attempt to cast a ballot that has been deliberately damaged.

In addition to deliberately setting up the precondition, if during any of the other testing, equipment failure for ballot casting is detected, determine

- Whether or not the current ballot was recorded, and
- Whether an adequate notification to the voter was issued.

For ballot marking devices that print a paper ballot

If during any of the other testing, equipment failure for ballot printing is detected, determine

- Whether or not the current ballot was recorded, and
- Whether an adequate notification to the voter was issued.

For electronic ballot interfaces that cast and record the ballot directly

If during any of the other testing, equipment failure for ballot casting is detected, determine

- Whether or not the current ballot was recorded, and
- Whether an adequate notification to the voter was issued.

Pass/Fail Conditions

- The system passes if a correct and adequate notification is issued in all attempts to cast a ballot.
- Otherwise, the system fails.

Marking and Casting – Notification of Blank Ballot

Covers requirement

- **7.3-J – Notification of casting**

Method

Preparation

Ensure that the system has a warning for blank ballots enabled.

For paper ballot scanners

Attempt to cast paper ballots with the following characteristics. If the system does not accept two-sided ballots, then skip those cases.

Ballot Condition	Correct Result
One-sided ballot, blank	Warning
One-sided ballot, with a single vote	No Warning
Two-sided ballot, completely blank	Warning
Two-sided ballot, with a single vote on each side	No Warning
Two-sided ballot, blank front side, single vote on back	Warning
Two-sided ballot, single vote on front, blank back side	Warning

Fail Condition

- The system fails if the result in any of the cases does not produce the correct result.

Disable the system for warning about blank ballots and re-submit the test ballots, as above.

Pass/Fail Conditions

- The system passes if it accepts all the ballots without warning.
- Otherwise, the system fails.

Marking and Casting - Notifications of Effect of Over-Voting

Covers requirement

- 7.3-H – Overvotes

Method

For electronic ballot interfaces

During a voting session, attempt to overvote and inspect the actions taken by the system and any messages.

Contest type	Correct Results
Vote-for-one contest	Current choice replaced with new choice with no notification OR Current choice replaced with new choice with notification including the name of the candidate removed OR Notification that too many selections have been made and how to change the selection
Vote-for-N contest	Notification of any actions the system has taken OR Notification that too many selections have been made and how to change the selection

Pass/Fail Conditions

- The system passes if it prevents the voter from leaving the contest with an overvote.
- The system passes if adequate notification on the effect of over-voting is readily available to the voter.
- Otherwise, the system fails.

For a paper ballot scanner

Set up the system to have warnings about overvotes enabled.

Fail Conditions

- The system passes if it cannot be set up to warn about overvotes.

Prepare a ballot or go through an electronic session to create a ballot that has been marked in the standard way, except as follows:

- In contest #2 (US Senate), select both Dennis Weiford and Lloyd Garriss (over-vote).
- In contest #8 (State Assemblyman), do not select any candidate (under-vote).
- In contest #11 (Mayor), write in a vote for Bob Johnson, as well as selecting both Orville White and Gregory Seldon (over-vote).
- In contest #12 (City Council), select only for Donald Davis, Hugh Smith, and Beverly Barker (under-vote).
- In contest #13 Retention Question #1 (Retain Robert Demergue as Chief Justice) mark neither the "yes" nor "no" boxes (under-vote).
- In contest #16 Ballot Question #2 (PROPOSED CONSTITUTIONAL AMENDMENT D) mark both the "yes" and "no" boxes (over-vote).
- In contest #18 Ballot Question #4 (PROPOSED CONSTITUTIONAL AMENDMENT K) mark neither the "yes" nor "no" boxes (under-vote).

For each of the overvote tests, the system must issue the appropriate warnings. It must always warn about over-voting in exactly these contests:

- Contest #2 (US Senate),
- Contest #11 (Mayor),
- Contest #16 Ballot Question #2 (PROPOSED CONSTITUTIONAL AMENDMENT D)

Fail Condition

- The system fails if it does not consistently warn about: Contest #2 (US Senate), Contest #11 (Mayor), and contest #16 Ballot Question #2 (PROPOSED CONSTITUTIONAL AMENDMENT D).

For hand-marked paper ballots

Inspect the ballot for a sample of voter instructions that provide information about the effect of overvoting.

Inspect the system documentation for samples of notifications that can be posted within a voting booth that provide information about overvotes and the effect of overvoting.

Pass/Fail Conditions

- The system passes if adequate notification on the effect of over-voting is readily available to the voter.
- Otherwise, the system fails.

Marking and Casting - Under Voting to be Permitted

Covers requirement

- **7.3-1 – Undervotes**

Method

Set up the system to have warnings about overvotes and undervotes enabled.

Prepare a ballot or go through an electronic session to create a ballot that has been marked in the standard way, except as follows:

- In contest #2 (US Senate), select both Dennis Weiford and Lloyd Garriss (over-vote).
- In contest #8 (State Assemblyman), do not select any candidate (under-vote).
- In contest #11 (Mayor), write in a vote for Bob Johnson, as well as selecting both Orville White and Gregory Seldon (over-vote).
- In contest #12 (City Council), select only for Donald Davis, Hugh Smith, and Carroll Shry (under-vote).
- In contest #13 Retention Question #1 (Retain Robert Demergue as Chief Justice) mark neither the "yes" nor "no" boxes (under-vote).
- In contest #16 Ballot Question #2 (PROPOSED CONSTITUTIONAL AMENDMENT D) mark both the "yes" and "no" boxes (over-vote).
- In contest #18 Ballot Question #4 (PROPOSED CONSTITUTIONAL AMENDMENT K) mark neither the "yes" nor "no" boxes (under-vote).

Attempt to cast the ballot. The system must always warn about over-voting in exactly these contests:

- contest #2 (US Senate)
- contest #11 (Mayor)
- contest #16 Ballot Question #2 (PROPOSED CONSTITUTIONAL AMENDMENT D)

It must also warn about under-voting in exactly these contests:

- contest #8 (State Assemblyman)
- contest #12 (City Council)
- contest #13 Retention Question #1 (Retain Robert Demergue as Chief Justice)
- contest #18 Ballot Question #4 (PROPOSED CONSTITUTIONAL AMENDMENT K)

Fail Condition

- The system fails if the system does not issue all three overvote warnings and under-vote warnings for exactly the four contests listed above.

Change the system settings to have an under-vote warning for just contest #12 (City Council) and attempt to cast the ballot.

Fail Condition

- The system fails if it does not issue all three overvote warnings and an under-vote warning for exactly contest 12 (City Council).

Change the system settings to have under-vote warnings turned off and attempt to cast the ballot.

Fail Condition

- The system fails if it does not issue all three overvote warnings and no under-vote warnings.

Change the system again to have all overvote and undervote warnings turned on.

Attempt final casting of the ballot. The system must then provide an opportunity to correct his/her ballot. Typically, an optical scanner would return the paper ballot for correction, although other mechanisms may be possible.

Fail Condition

- The system fails if it does not give the tester the opportunity to correct the ballot at the conclusion of each sub-test.

If allowed to correct, mark the "yes" box for contest #18 Ballot Question #4 (PROPOSED CONSTITUTIONAL AMENDMENT K), so as to correct that one under-vote, and then re-submit the ballot.

Fail Condition

- The system fails if it does not consistently warn about all overvoted and undervoted contests.

Attempt to submit his/her ballot without further correction (for all sub-tests, there is only one attempt to correct).

Fail Condition

- The system fails if it refuses to accept final casting of the ballot.

Pass/Fail Conditions

- The system passes if it notifies the voter that the ballot has been cast successfully.
- Otherwise, the system fails.

Privacy of Voting Session

Covers requirements:

- **6.1-A – Preserving privacy for voters**
- **6.1-B – Warnings**
- **6.1.D – Audio privacy**

Method

Preparation

Set up the system following the manufacturer's instructions for layout in the polling place. The layout includes:

- The arrangement of the components of the voting booth, including signs or notices and any devices for activation, marking, printing or casting a ballot.
- The arrangement of any equipment to cast a marked ballot, if not in the voting booth.
- The position and orientation of the equipment in relation to other polling place activity, such as a check-in desk, location of poll workers and judges, and of waiting voters.

Any ballot scanner that is part of the system should be set up with warnings enable for both overvotes and undervotes.

This test requires two testers, a "voter" and a "bystander".

For all systems

The "voter" proceeds through an entire voting session from activation to casting, following the instructions for voting as given by the system, including procedures for changing a ballot or for the use of a privacy sleeve. The point is to see whether privacy is violated even if the voter acts conscientiously.

The "bystander" approaches the voting station as closely as another voter would typically be allowed in a polling place environment. The "bystander" attempts to determine any of the "voter's" choices through either visual or auditory cues. This attempt continues throughout the entire voting session, including ballot verification and casting.

For electronic ballot interfaces

Use the instructions for the standard session in Appendix A, including making changes and casting a ballot with undervotes and overvotes.

The session must be enacted three times, using:

- the conventional visual-tactile interface
- the audio interface
- the synchronized audio/visual interface with wheelchair access and the non-manual controls provided for voters with dexterity disabilities.

A tester performs any assistance or actions poll workers provide for all voters.

For hand-marked paper ballots

Use the instructions for the standard session in Appendix A, including making changes and casting a ballot with undervotes and overvotes. Note that this includes submitting a ballot to a scanner and then correcting it and re-submitting.

Fail/Pass Conditions

- The system fails 6.1-A if the "bystander" can discover any voter choices via visual cues.
- The system fails 6.1-C if the "bystander" can discover any voter choices via auditory cues.
- The system fails 6.1-B if the "bystander" can discover any voter choices via warnings.
- The system fails if the "bystander" can discover any voter choices via any other plausible means, including needing assistance from an election worker.
- Otherwise, the system passes.

Response – System Response Time

Covers requirements:

- **7.2-N – System response time**

Method

Preparation

This test requires the use of a video system with an accurate on-screen timer to record the voting session. The timer must have a precision of at least 0.1 seconds.

- Position the camera so there is a clear view of the screen.
- Connect an external speaker to the audio jack so the audio can be recorded.

The test team should familiarize themselves with the response of the screens and tactile controls, so they can be as consistent as possible in how controls are activated to avoid variation in the timings.

Repeat the test method using both the visual/touch and audio/tactile interaction modes.

For electronic ballot interfaces

Proceed through the voting session using the editable ballot session described above, as the interaction with the system is recorded. Measure the initial and completed response times at least the following events:

- Initial activation of the ballot
- Selecting a candidate
- Changing a candidate selection
- Transition to the next page
- Transition to a previous page
- Typing in the letters for a write-in candidate
- Completion of typing in a write-in candidate

Fail Conditions

- The system fails if its initial response time for any of the events is greater than 0.1 seconds for a visual change.
- The system fails if its initial response time for any of the events is greater than 0.5 seconds for an audio response.

- The system fails if the system's visual and audio initial response time to selecting or de-selecting a candidate exceeds 1.0 seconds.
- The system fails if its completed response time for selection of a candidate exceeds 1.0 seconds, and no system activity indicator appears.

Response - Inactivity Time

Covers requirements:

- **7.2-N – Inactivity alerts**

Method

Preparation

This test can be conducted using the video setup from Response – System Response time, or with a conventional stop watch.

For all systems with an electronic interface

Review the documentation for a definition of “inactivity time.”

Fail Conditions

- The system fails if voter inactivity time is not documented.
- The system fails if voter inactivity time is documented as less than 2 minutes or greater than 5 minutes.

The next actions are completed in a sequence, testing the time before an inactivity alert is displayed and the time between that alert and when the system goes into an inactive state.

Proceed through the voting session up to contest #3 (US Representative). At that point, cease interaction with the system and begin timing the duration until the system issues an inactivity alert.

Fail Condition

- The system fails if the measured inactivity time is not within 5% of the documented inactivity time.

Within five seconds after the alert, select a candidate in contest #3 and verify that the system is now active again, without the need for intervention by a poll worker.

Fail Condition

- The system fails if the system cannot be re-started by the voter.

After proceeding to contest #5 (Lieutenant-Governor), stop interaction with the system again and verifies that the inactivity alert is given after the appropriate interval.

Fail Condition

- The system fails if the measured inactivity time is not within 5% of the documented inactivity time.

Continue to wait without interacting with the system. Measure the time from when the inactivity alert was given until the system goes into an inactive state, displaying a message or other warning.

Fail Condition

- The system fails if the alert time is less than 20 seconds or greater than 45 seconds.

Observe the state of the system after it goes into an inactive state and what actions are required to re-activate the system or terminate the voting session.

Fail Condition

- The system fails if it is possible to re-activate the system without intervention from an election worker.

Safety Certification

Covers requirement

- **8.1-K – Eliminating hazards**

Method

Verify that the system has been certified in accordance with the requirements of UL 60950, Safety of Information Technology Equipment, by a duly authorized safety testing laboratory.

This test does not include performing the safety checks directly, but rather to verify that the system has been certified by a safety lab.

Fail/Pass Conditions

- The system fails if certification for UL 60950, Safety of Information Technology Equipment, by a duly authorized safety testing laboratory cannot be verified.

Screen Characteristics

Covers requirements

- 8.1-A – Electronic display screens

Method

For all electronic display screens

Consult the documentation for the screen to determine:

- The minimum diffuse ambient contrast ratio for 500 lx illuminance

Examine the voting system to determine how it can be shielded from reflections through:

- Adjustment of the vertical angle by voters
- Placement of an enclosure that is part of equipment that comes with the voting system
- An anti-glare screen surface

Pass/Fail Conditions

- The system fails if minimum contrast ration is less than 10:1.
- The system fails if there is no way to shield the screen from reflections.
- Otherwise, the system passes.

For primary displays for voting selections

Consult the documentation for the screen to determine:

- The minimum diagonal measurement of the screen size
- The display resolution used in the voting system setup

Pass/Fail Conditions

- The system fails if diagonal measurement is less than 12 inches.
- The system fails if the display resolution is less than 1920 x 1080 pixels.
- Otherwise, the system passes.

For displays for messages to voters or poll workers

Consult the documentation for the screen to determine:

- The minimum diagonal measurement of the screen size
- The display resolution used in the voting system setup

Pass/Fail Conditions

- The system fails if diagonal measurement is less than 9.5 inches.
- The system fails if the display resolution is less than 1280 x 800 pixels.
- Otherwise, the system passes.

Screen Flashes

Covers requirements

- **8.1-B – Flashing**

Method

For all electronic display screens

Proceed through a voting session or use the device as it is intended, looking for any flashing elements.

If a flashing element is found, use a stop watch to time the display for 5 seconds, counting the number of flashes in this time. Divide the number of flashes by 5 to determine the flashes per second.

Pass/Fail Conditions

- The system passes if there are no flashing elements.
- The system fails if any element flashes more than three times in a second.
- Otherwise, the system passes.

Settings – Audio and Visual Mode

Covers requirements:

- **6.1-C – Enabling of disabling output**

Method

Preparation

This test can be completed during the voting session in Settings – Default Settings

For electronic ballot interfaces

Begin a voting session with the audio enabled.

Confirm that the audio and visual display are both turned on.

In the settings function, turn off the visual display.

Pass/Fail Conditions

- The system fails if there is no setting to allow the voter to turn off the visual display.
- The system fails if the visual display does not turn off.
- Otherwise, the system passes.

Continue through at least one contest, and confirm that the audio and a tactile keypad function correctly.

Attempt to turn the visual display on again. Continue through one more contest to confirm that the system continues to function correctly.

Pass/Fail Conditions

- The system fails if there is no way to turn on the visual display.
- The system fails if a voter cannot turn the display on again.
- Otherwise, the system passes

Settings - Default Settings

Covers requirements:

- **6.1-C – Enabling of disabling output**
- **7.1-A – Reset to default settings**
- **7.1-B – Reset by voter**

Method

This test involves as many as five display characteristics.

Characteristic	Type of Interface
Font size	Visual interface
Contrast	Visual interface
Audio volume	Audio interface
Rate of speech	Audio Interface
Visual display on or off	Visual interface

Proceed through a voting session using the default ballot choices.

- Vote in the first three contests, and note the initial appearance (audio as well as visual) of each of the applicable characteristics listed above.
- Set the system to full audio/video mode if available.
- Before voting in contest #4 (Governor), change all visual and audio display options to a different setting, noting the settings chosen.
- Vote in contest #4 (Governor) and move on to contest #5 (Lieutenant-Governor).
- Activate the mechanism provided to reset all the adjustable characteristics.

Compare the appearance of all the applicable characteristics after the reset to the default settings when starting the voting session.

This test can also be run by making changes in first the visual and then the audio settings to make it easier to compare the adjusted setting to the default.

Fail Condition

- The system fails 7.1-B if the current appearance of any characteristic does not match its initial appearance after a reset during the voting session.

Before completing the voting session, change all visual and audio settings.

- Complete the voting session.
- Then initiate new voting session, and proceed to the first contest.

Compare the appearance of all settings to the ones observed when starting the voting session.

Pass/Fail Conditions for 6.1-C, 7.1-A, 7.1-B

- The system fails if the current appearance of any characteristic does not match its initial appearance as noted in the first voting session.
- Otherwise, the system passes.

Testing for Federal Accessibility Standards

Covers requirements:

- **8.2-A – Federal standards for accessibility**

Method

Preparation

Select an evaluation tool for the Web Content Authoring Guidelines (WCAG 2.0) checkpoints. There is a list of suitable tools available from the W3C Web Accessibility Initiative.

For all voting system devices

Review the voting system against the federal standards under Section 508 of the Rehabilitation Act as of January 18, 2018, and the WCAG 2.0 Level AA checkpoints included in that standard.

Note that several requirements for voting systems exceed checkpoints in the Web Content Authoring Guidelines (WCAG 2.0) Level AA.

Pass/Fail Conditions

- The system fails if it does not meet any applicable requirements in the standard.
- Otherwise, the system passes.

Usability Testing Reports

Covers requirements:

- **8.3-A – Usability testing with voters**
- **8.4-A – Usability testing with poll workers**
- **2.2-A – User centered design**

Method

Preparation

- 8.3-A Usability testing with voters: Guidance for usability testing by the manufacturer is covered in a separate document – How to test for voter usability – and associated forms, including guidance and forms for using the Common Industry Format (CIF) for Voting Systems.
- 8.4-A Usability testing with poll workers: Guidance for usability testing by the manufacturer is covered in a separate document – Testing for poll worker usability – and associated forms.
- 2.2-A – User centered design: Guidance for reporting user-centered design activities is covered in a separate document

For all usability tests

A usability expert who is familiar with the Common Industry Format (CIF) examines the TDP to ensure the existence and adequacy of the test report submitted by the manufacturer and verify that the report conforms to the formatting and content requirements of the CIF. The expert verifies that the demographic characteristics of the subject pool meet the specifications of the particular requirement. Note that there are no requirements pertaining to the quantitative results of the test.

In the usability tests oriented towards voters, the tasks within the test must encompass an entire voting session, from activation to casting.

The usability tests for poll workers must encompass setup, operation, and shutdown of the system.

Fail Conditions for 8.3-A and 8.4-A

- The system fails if the report does not follow the CIF template.
- The system fails if the subject pool does not conform to the required demographic characteristics.

- The system fails if the tasks do not cover the appropriate voting activity.

Fail Conditions for 8.4-A (Expert review)

- The system fails if the poll worker documentation is not written at a level readily understandable by non-experts.
- The system fails if the poll worker documentation is not organized for easy use in a polling place situation.
- The system fails if the poll worker documentation does not clearly explain how to verify that the system is in a correct state for setup, operation, and shutdown.
- The system fails if the expert review of the poll worker documentation reveals any other serious problems for poll worker usability.
- The system fails if the documentation contains significant inaccuracies or omissions with respect to the actual procedures.
- The system fails if the procedures are judged to be excessively difficult, complex, or error-prone.
- The system fails if all the messages encountered are not deemed clear and usable.

Fail Conditions for 8.4-A

- The system fails if there was any task that a majority of the participant teams did not complete, because system messages were difficult to understand or follow.
- The system fails if there was any task that a majority of the participant teams did not complete, because the documentation was too technically complex.
- The system fails if there was any task that a majority of the participant teams did not complete, because the documentation is not presented in a format suitable for the polling place.

Pass/Fail Conditions for 8.3-A and 8.4-A

- The system passes if for each of the tasks, at least half the participant teams completed the task and then confirmed that completion to the tester. Otherwise, the system fails.
- The system fails if there was any task that a majority of the participant teams did not complete, because the system (instructions and documentation) failed to provide clear and sufficient guidance. Otherwise, the system passes.

- The system fails if there was any task that a majority of the participant teams did not complete, because the overall system operation is excessively difficult, complex, or error-prone. Otherwise, the system passes.

For the user-centered design report

A usability expert who is familiar with user centered design examines the TDP to ensure the existence and adequacy of the test report submitted by the manufacturer.

Pass/Fail Conditions for 2.2-A

- The system passes if the report substantially follows the recommended format for reporting user-centered design activities.
- The system passes if the activities represent a reasonable user-centered design process.
- The system passes if the participants in the user-centered design activities reflect the required demographic characteristics.
- Otherwise the system fails.

Test methods outside of HFP

Hardware - Personal Technology Jacks

Covers requirement

- **8.1-I – Standard PAT Jacks**

Method

We need a test method for #1 that examines the hardware – this is a security as well as a usability issue.

Secrecy of Cast Vote Record (CVR)

Covers requirements in

- **Principle 10: Ballot Secrecy**

Method

This test should be run after the voting sessions that test for alternative languages and for access by blind voters.

For systems with an electronic Cast Vote Record (CVR)

The tester examines the TDP for the system and determine the format of the electronic CVR to ensure that no accessibility data or alternative language data is part of the CVR design.

Fail Conditions

- The system fails if the format of the CVR includes information on the language used by the voter.
- The system fails if the format of the CVR includes information on the accessibility features used by the voter.

Examine a representation of the CVR generated by other voting sessions that tested for alternative languages and for access by blind voters, in which such data was potentially generated, and verify that such data was not recorded.

Fail/Pass Conditions

- The system fails 10.1-B if alternative language data was preserved in the CVR. Otherwise, the system passes.
- The system fails 10.1-C if accessibility data was preserved in the CVR

Secrecy - No receipt with proof of ballot selections

Covers requirements:

- **10.1-A – Preserving privacy for voters**

Fail/Pass Conditions

For the requirement 3.2.3.1-e,

- The system fails if the system issues a receipt whereby a voter could prove to another party how he or she voted
- Otherwise, the system passes

Appendix A: Ballot and Default Voting Session

Default voting session instructions

Contest 1: For President and Vice President of the United States, vote for Adam Cramer and Greg Vuocolo

Contest 2: For Senator, vote for David Brown

Contest 3: For Congress, vote for Brad Schott

Contest 4: For Governor, vote for Cathy Steele

Contest 5: Do not cast a vote for Lieutenant Governor

Contest 6: For Registrar of Deeds, write in a vote for Christopher Christopher

Contest 7: For State Senator, vote for Edward Shiplett

Contest 8: For State Assemblyman, vote for Amos Keller

Contest 9: For County Commissioners, vote for the Orange Party candidates only

Contest 10: For Registrar of Wills, write in Michael Marchesani

Contest 11: For Mayor, vote for Orville White

Contest 12: For City Council, vote for the following candidates:
Randall Rupp
Carroll Shry
Donald Davis

Contest 12: For Chief Justice of the Supreme Court
Vote to keep Robert Demergue in office

Contest 14: For the question of retaining Justice of the Supreme Court Elmer Hull
Do not vote

Contest 15: For Proposed Constitutional Amendment C
Vote for this amendment

Contest 16: For Proposed Constitutional Amendment D
Vote for this amendment

Contest 17: For Proposed Constitutional Amendment H
Vote against this amendment

Contest 18: For Proposed Constitutional Amendment K
Vote against this amendment

Contest 19: For Ballot Measure 101: Open Primaries
Do not vote

Contest 20: For Ballot Measure 106: Limits on Private Enforcement of Unfair Business
Competition Laws
Vote for the measure

Review and corrections

Review your choices, and make the following changes:

(Contest 5) Vote for your choice for Lieutenant Governor

(Contest 10) Check the spelling of the write-in candidate Michael Marchesani for Registrar of Wills

(Contest 14) Vote against retaining Justice of the Supreme Court Elmer Hull

Standard ballot specification

This ballot has 20 contests, with 28 voting options. It can be adjusted for testing specific features of the voting system or different election methods, such as adding a straight party voting option.

Information applicable to whole ballot

Date and Time	November 6, 2018, 7:00 AM to 8:00 PM
State	Hamilton
County	Franklin
Contest terms	All are full terms
Voting Method	Simple vote for N candidate(s) The ballot instructions can be adjusted for ranked choice voting or other preferential voting methods

Contest #1:

Title of Office	President and Vice-President of the United States
District of Office	Federal: United States
Test features	Vote for a pair / electors in a presidential contest Choice near top of list
Partisanship	Partisan
Minimum Votes Allowed	0
Maximum Votes Allowed	1
Maximum Write-in Votes Allowed	0
<ul style="list-style-type: none"> • Candidate #1.1: Joseph Barchi and Joseph Hallaren / Blue • Candidate #1.2: Adam Cramer and Greg Vuocolo / Yellow • Candidate #1.3: Daniel Court and Amy Blumhardt / Purple • Candidate #1.4: Alvin Boone and James Lian / Orange • Candidate #1.5: Austin Hildebrand-MacDougall and James Garritty / Pink • Candidate #1.6: Martin Patterson and Clay Lariviere / Gold • Candidate #1.7: Elizabeth Harp and Antoine Jefferson / Gray • Candidate #1.8: Charles Layne and Andrew Kowalski / Aqua • Candidate #1.9: Marzena Pazgier and Welton Phelps / Brown 	

Contest #2:

Title of Office	US Senate
District of Office	Federal: Statewide
Test features	Names difficult to distinguish in audio (Brown/Pound) Choice at end of list
Partisanship	Partisan
Minimum Votes Allowed	0
Maximum Votes Allowed	1
Maximum Write-in Votes Allowed	1
<ul style="list-style-type: none"> • Candidate #2.1: Dennis Weiford / Blue • Candidate #2.2: Lloyd Garriss / Yellow • Candidate #2.3: Sylvia Wentworth-Farthington / Purple • Candidate #2.4: Heather Hewetson / Orange • Candidate #2.5: Victor Martinez / Pink • Candidate #2.6: David Brown / Gold • Candidate #2.7: David Pound / Gray 	

Contest #3:

Title of Office	US Representative
District of Office	Federal: 6th Congressional District
Test features	Medium number of candidates
Partisanship	Partisan
Minimum Votes Allowed	0
Maximum Votes Allowed	1
Maximum Write-in Votes Allowed	1
<ul style="list-style-type: none"> • Candidate #3.1: Brad Plunkard / Blue • Candidate #3.2: Bruce Reeder / Yellow • Candidate #3.3: Brad Schott / Purple • Candidate #3.4: Glen Tawney / Orange • Candidate #3.5: Carroll Forrest / Pink 	

Contest #4:

Title of Office	Governor
District of Office	State
Test features	Very long list of candidates
Partisanship	Partisan
Minimum Votes Allowed	0
Maximum Votes Allowed	1
Maximum Write-in Votes Allowed	1

- Candidate #4.1: Charlene Franz / Blue
- Candidate #4.2: Gerard Harris / Yellow
- Candidate #4.3: Linda Bargmann / Purple
- Candidate #4.4: Barbara Adcock / Orange
- Candidate #4.5: Carrie Steel-Loy / Pink
- Candidate #4.6: Frederick Sharp / Gold
- Candidate #4.7: Alex Wallace / Gray
- Candidate #4.8: Barbara Williams / Aqua
- Candidate #4.9: Althea Sharp / Brown
- Candidate #4.10: Douglas Alpern / Independent
- Candidate #4.11: Ann Windbeck / Independent
- Candidate #4.12: Mike Greher / Independent
- Candidate #4.13: Patricia Alexander / Independent
- Candidate #4.14: Kenneth Mitchell / Independent
- Candidate #4.15: Stan Lee / Independent
- Candidate #4.16: Henry Ash / Independent
- Candidate #4.17: Karen Kennedy / Independent
- Candidate #4.18: Van Jackson / Independent
- Candidate #4.19: Debbie Brown / Independent
- Candidate #4.20: Joseph Teller / Independent
- Candidate #4.21: Greg Ward / Independent
- Candidate #4.22: Lou Murphy / Independent
- Candidate #4.23: Jane Newman / Independent
- Candidate #4.24: Jack Callanann / Independent
- Candidate #4.25: Esther York / Independent
- Candidate #4.26: Glen Chandler / Independent
- Candidate #4.27: Marcia Colgate / Independent
- Candidate #4.28: Leslie Porter / Independent
- Candidate #4.29: Molly Dalton / Independent
- Candidate #4.30: David Davis / Independent
- Candidate #4.31: May Peterson / Independent
- Candidate #4.32: Patricia Dawkins / Independent
- Candidate #4.33: Suzanne Adams / Independent
- Candidate #4.34: Mary Miller / Independent
- Candidate #4.35: Rosalind Leigh / Independent
- Candidate #4.36: Elaine Henry / Independent
- Candidate #4.37: Gail Moses / Independent
- Candidate #4.38: Daniel Jones / Independent
- Candidate #4.39: Don Maybee / Independent
- Candidate #4.40: Lillian Cohen / Independent
- Candidate #4.41: Richard Mitchell / Independent
- Candidate #4.42: Pat York / Independent
- Candidate #4.43: Linda Rappaport / Independent
- Candidate #4.44: Mike Porter / Independent
- Candidate #4.45: Margaret Sharp / Independent
- Candidate #4.46: Cathy Steele / Independent
- Candidate #4.47: Lawrence Smith / Independent
- Candidate #4.48: Bill Kendrick / Independent
- Candidate #4.49: Fred Stein / Independent
- Candidate #4.50: Jerry Cole / Independent

Contest #5:

Title of Office	Lieutenant-Governor
District of Office	State
Test features	Medium list of candidate
Partisanship	Partisan
Minimum Votes Allowed	0
Maximum Votes Allowed	1
Maximum Write-in Votes Allowed	1
<ul style="list-style-type: none"> • Candidate #5.1: Chris Norberg / Blue • Candidate #5.2: Anthony Parks / Yellow • Candidate #5.3: Luis Garcia / Purple • Candidate #5.4: Charles Qualey / Orange • Candidate #5.5: George Hovis / Pink • Candidate #5.6: Burt Zirkle / Gold • Candidate #5.7: Brenda Davis / Gray • Candidate #5.8: Edward Freeman / Aqua • Candidate #5.9: Paul Swan / Brown 	

Contest #6:

Title of Office	Secretary of State
District of Office	State
Test features	Single candidate + write-in
Partisanship	Partisan
Minimum Votes Allowed	0
Maximum Votes Allowed	1
Maximum Write-in Votes Allowed	1
<ul style="list-style-type: none"> • Candidate #6.1: Laila Shamsi / Yellow 	

Contest #7:

Title of Office	State Senator
District of Office	State: 31st District
Test features	Short list of candidates

Partisanship	Partisan
Minimum Votes Allowed	0
Maximum Votes Allowed	1
Maximum Write-in Votes Allowed	1
<ul style="list-style-type: none"> • Candidate #7.1: Edward Shiplett / Blue • Candidate #7.2: Marty Talarico / Yellow 	

Contest #8:

Title of Office	State Assemblyman
District of Office	54th District
Test features	Short list of candidates
Partisanship	Partisan
Minimum Votes Allowed	0
Maximum Votes Allowed	1
Maximum Write-in Votes Allowed	1
<ul style="list-style-type: none"> • Candidate #8.1: Andrea Solis / Blue • Candidate #8.2: Amos Keller / Yellow 	

Contest #9:

Title of Office	County Commissioners
District of Office	County
Test features	Hard to distinguish names Vote for N of M
Partisanship	Partisan
Minimum Votes Allowed	0
Maximum Votes Allowed	5
Maximum Write-in Votes Allowed	5
<ul style="list-style-type: none"> • Candidate #9.1: Camille Argent / Blue • Candidate #9.2: Chloe Witherspoon / Blue • Candidate #9.3: Clayton Bainbridge / Blue • Candidate #9.4: Amanda Marracini / Yellow • Candidate #9.5: Charlene Hennessey / Yellow • Candidate #9.6: Eric Savoy / Yellow 	

- Candidate #9.7: Susan Tawa / Yellow
- Candidate #9.8: Mary Tawa / Yellow
- Candidate #9.9: Damian Rangel / Purple
- Candidate #9.10: Valarie Altman / Orange
- Candidate #9.11: Helen Moore / Orange
- Candidate #9.12: John White / Orange
- Candidate #9.13: Joe Schmidt / Pink
- Candidate #9.14: Joe Smith / Pink
- Candidate #9.15 Martin Schreiner / Gray

Contest #10:

Title of Office	Registrar of Wills
District of Office	County: 4th seat
Test features	No candidate running, must write in or skip
Partisanship	Non-partisan
Minimum Votes Allowed	0
Maximum Votes Allowed	1
Maximum Write-in Votes Allowed	1
<ul style="list-style-type: none"> • No candidates 	

Contest #11:

Title of Office	Mayor
District of Office	City of Springfield
Test features	Short list of candidates
Partisanship	Partisan
Minimum Votes Allowed	0
Maximum Votes Allowed	1
Maximum Write-in Votes Allowed	1
<ul style="list-style-type: none"> • Candidate #11.1: Orville White / Blue • Candidate #11.2: Gregory Seldon / Yellow 	

Contest #12:

Title of Office	City Council
District of Office	City of Springfield
Test features	Vote for N or M Exact number in each party
Partisanship	Partisan
Minimum Votes Allowed	0
Maximum Votes Allowed	3
Maximum Write-in Votes Allowed	3
Candidate #12.1: Harvey Eagle / Blue Candidate #12.2: Randall Rupp / Blue Candidate #12.3: Carroll Shry / Blue Candidate #12.4: Beverly Barker / Yellow Candidate #12.5: Donald Davis / Yellow Candidate #12.6: Hugh Smith / Yellow	

Contest #13 - Retention Question 1:

Wording of Question	Retain Robert Demergue as Chief Justice of the Supreme Court?
Options	Yes / No

Contest #14 - Retention Question 2:

Wording of Question	Retain Elmer Hull as Associate Justice of the Supreme Court?
Options	Yes / No

Contest #15 - Ballot Question 1:

Title of proposition	PROPOSED CONSTITUTIONAL AMENDMENT C
Test features	Long ballot question text
Wording of proposition	Shall there be amendments to the State constitution intended to have the collective effect of ensuring the separation of governmental power among the three branches of state government: the legislative branch, the executive branch and the judicial branch? a. Article III, Section 6 of the Constitution shall be amended to read as follows:

	<p>Section 6. Holding of offices under other governments. - Senators and representatives not to hold other appointed offices under state government. -- No person holding any office under the government of the United States, or of any other state or country, shall act as a general officer or as a member of the general assembly, unless at the time of taking such engagement that person shall have resigned the office under such government; and if any general officer, senator, representative, or judge shall, after election and engagement, accept any appointment under any other government, the office under this shall be immediately vacated; but this restriction shall not apply to any person appointed to take deposition or acknowledgement of deeds, or other legal instruments, by the authority of any other state or country.</p> <p>No senator or representative shall, during the time for which he or she was elected, be appointed to any state office, board, commission or other state or quasi-public entity exercising executive power under the laws of this state, and no person holding any executive office or serving as a member of any board, commission or other state or quasi-public entity exercising executive power under the laws of this state shall be a member of the senate or the house of representatives during his or her continuance in such office.</p> <p>b. Article V of the Constitution shall be amended to read as follows: The powers of the government shall be distributed into three (3) separate and distinct departments: the legislative, the executive and the judicial.</p> <p>c. Article VI, Section 10 of the Constitution shall be deleted in its entirety.</p> <p>d. Article IX, Section 5 of the Constitution shall be amended to read as follows:</p> <p>Section 5. Powers of appointment.- The governor shall, by and with the advice and consent of the senate, appoint all officers of the state whose appointment is not herein otherwise provided for and all members of any board, commission or other state or quasi-public entity which exercises executive power under the laws of this state; but the general assembly may by law vest the appointment of such inferior officers, as they deem proper, in the governor, or within their respective departments in the other general officers, the judiciary or in the heads of departments.</p>
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Contest #16 - Ballot question 2:

Title of proposition	PROPOSED CONSTITUTIONAL AMENDMENT D
Test features	Short text
Wording of proposition	Shall there be an amendment to the State constitution concerning recovery of damages relating to construction of real property improvements, and, in connection therewith, prohibiting laws that limit or impair a property owner's right to recover damages caused by a failure to construct an improvement in a good and workmanlike manner?

Contest #17 - Ballot question 3:

Title of proposition	PROPOSED CONSTITUTIONAL AMENDMENT H
Test features	Medium text
Wording of proposition	<p>Shall there be an amendment to the State constitution allowing the State legislature to enact laws limiting the amount of damages for noneconomic loss that could be awarded for injury or death caused by a health care provider? "Noneconomic loss" generally includes, but is not limited to, losses such as pain and suffering, inconvenience, mental anguish, loss of capacity for enjoyment of life, loss of consortium, and other losses the claimant is entitled to recover as damages under general law.</p> <p>This amendment will not in any way affect the recovery of damages for economic loss under State law. "Economic loss" generally includes, but is not limited to, monetary losses such as past and future medical expenses, loss of past and future earnings, loss of use of property, costs of repair or replacement, the economic value of domestic services, loss of employment or business opportunities. This amendment will not in any way affect the recovery of any additional damages known under State law as exemplary or punitive damages, which are damages allowed by law to punish a defendant and to deter persons from engaging in similar conduct in the future.</p>

Contest #18 - Ballot question 4:

Title of proposition	PROPOSED CONSTITUTIONAL AMENDMENT K
Wording of proposition	<p>Shall there be an amendment to the State constitution authorizing Madison and Fromwit Counties to hold referenda on whether to authorize slot machines in existing, licensed pari-mutuel facilities (thoroughbred and harness racing, greyhound racing, and jai alai) that have conducted live racing or games in that county during each of the last two calendar years before effective date of this amendment? The Legislature may tax slot machine revenues, and any such taxes shall supplement public education funding statewide. Requires implementing legislation.</p> <p>This amendment alone has no fiscal impact on government. If slot machines are authorized in Madison or Fromwit counties, governmental costs associated with additional gambling will increase by an unknown amount and local sales tax-related revenues will be reduced by \$5 million to \$8 million annually. If the Legislature also chooses to tax slot machine revenues, state tax revenues from Madison and Fromwit counties combined would range from \$200 million to \$500 million annually.</p>

Contest #19 - Ballot question 5

Title of proposition	BALLOT MEASURE 101 Open Primaries
Wording of proposition	Requires primary elections where voters may vote for any state or federal candidate regardless of party registration of voter or candidate. The two primary-election candidates receiving most votes for an office, whether they are candidates with no party or members of same or different party, would be listed on general election ballot. Exempts presidential nominations. Fiscal Impact: No significant net fiscal effect on state and local governments.

Contest #20 - Ballot question 6:

Title of proposition	BALLOT MEASURE 106 Limits on Private Enforcement of Unfair Business Competition Laws
Wording of proposition	Allows individual or class action "unfair business" lawsuits only if actual loss suffered; only government officials may enforce these laws on public's behalf. Fiscal Impact: Unknown state fiscal impact depending on whether the measure increases or decreases court workload and the extent to which diverted funds are replaced. Unknown potential costs to local governments, depending on the extent to which diverted funds are replaced.

End of logical specification for Test Ballot Specification.

Appendix B: Test cases by requirement

#	Requirement	External	VVSG 2.0 Test Cases
5.1-A	Interaction modes	WCAG&508 EAC RFI 2009-01	<ul style="list-style-type: none"> Interaction Modes: Part 1. Ballot Activation Interaction Modes: Part 2: Ballot Marking Interaction Modes: Part 3: Ballot Verification and Casting Instructions - Accessibility Documentation
5.1-B	Languages	VRA RFI 2007-04	<ul style="list-style-type: none"> Alternative Languages
5.1-C	Vote records	None	<ul style="list-style-type: none"> Alternative Languages
5.1-D	Accessibility features	HAVA EAC RFI 2009-01	<ul style="list-style-type: none"> Interaction Modes: Part 1. Ballot Activation Interaction Modes: Part 2: Ballot Marking Interaction Modes: Part 3: Ballot Verification and Casting
5.1-E	Reading paper ballots	HAVA	<ul style="list-style-type: none"> Interaction Modes: Part 3: Ballot Verification and Casting
5.1-F	Accessibility documentation	WCAG&508	<ul style="list-style-type: none"> Instructions - Accessibility Documentation
5.2-A	No bias	None	<ul style="list-style-type: none"> No bias among choices
5.2-B	Presenting content in all languages	VRA	<ul style="list-style-type: none"> Alternative Languages
5.2-C	All information in all modes	WCAG&508	<ul style="list-style-type: none"> Interaction Modes: Part 2: Ballot Marking Audio - Visual Redundancy for Sound Cues Instructions – Assistance from System Instructions – Completeness of Instructions
5.2-D	Audio synchronized	WCAG&508	<ul style="list-style-type: none"> Interaction Modes: Part 1. Ballot Activation Interaction Modes: Part 2: Ballot Marking Interaction Modes: Part 3: Ballot Verification and Casting Alternative languages Instructions – Assistance from System
5.2-E	Sound cues	WCAG&508	<ul style="list-style-type: none"> Audio - Visual Redundancy for Sound Cues
5.2-F	Preserving votes	WCAG&508	<ul style="list-style-type: none"> Alternative Languages

#	Requirement	External	VVSG 2.0 Test Cases
6.1-A	Preserving privacy for voters	HAVA	<ul style="list-style-type: none"> • Interaction Modes: Part 1. Ballot Activation • Interaction Modes: Part 2: Ballot Marking • Interaction Modes: Part 3: Ballot Verification and Casting • Privacy of Voting Session • Privacy of Cast Vote Record
6.1-B	Warnings	HAVA	<ul style="list-style-type: none"> • Privacy of Voting Session
6.1-C	Enabling or disabling output	WCAG&508	<ul style="list-style-type: none"> • Interaction Modes: Part 1. Ballot Activation • Settings—Audio and Visual Mode • Settings – Default Settings
6.1-D	Audio privacy	WCAG&508	<ul style="list-style-type: none"> • Privacy of Voting Session
6.2-A	Voter independence	HAVA	<ul style="list-style-type: none"> • Interaction Modes: Part 1. Ballot Activation • Interaction Modes: Part 2: Ballot Marking • Interaction Modes: Part 3: Ballot Verification and Casting • Audio – Voter Speech Not Required
7.1-A	Reset to default settings	WCAG&508	<ul style="list-style-type: none"> • Settings - Default Settings
7.1-B	Reset by voter	WCAG&508	<ul style="list-style-type: none"> • Settings - Default Settings
7.1-C	Default contrast	WCAG&508	<ul style="list-style-type: none"> • Ballot Design – Color Contrast
7.1-D	Contrast options	WCAG&508	<ul style="list-style-type: none"> • Ballot Design – Color Contrast
7.1-E	Color conventions	WCAG&508	<ul style="list-style-type: none"> • Ballot design – Use of Color
7.1-F	Using color	WCAG&508	<ul style="list-style-type: none"> • Ballot design – Use of Color
7.1-G	Text size (electronic display)	WCAG&508	<ul style="list-style-type: none"> • Ballot Design – Text Size
7.1-H	Scaling and zooming (electronic display)	WCAG&508	<ul style="list-style-type: none"> • Ballot Design – Text Size
7.1-I	Text size (paper)	no	<ul style="list-style-type: none"> • Ballot Design – Text Size • Interaction Modes: Part 3: Ballot Verification and Casting
7.1-J	Sans-serif font	WCAG&508	<ul style="list-style-type: none"> • Ballot Design – Fonts used • Accessible Ballot Verification and Casting
7.1-K	Audio settings	WCAG&508 EAC RFI 2013-02	<ul style="list-style-type: none"> • Audio Settings - Volume • Audio Settings - Rate of Speech
7.1-L	Speech frequencies	WCAG&508	<ul style="list-style-type: none"> • Audio Range of Frequency

#	Requirement	External	VVSG 2.0 Test Cases
7.1-M	Audio comprehension	WCAG&508 ITU-T P.50 Appendix I	<ul style="list-style-type: none"> • Audio Intelligibility
7.1-N	Tactile keys	WCAG&508	<ul style="list-style-type: none"> • Audio – Standard Audio Connector • Controls – Discernible by Touch and Vision
7.1-O	Toggle keys	WCAG&508	<ul style="list-style-type: none"> • Controls – Discernible by Touch and Vision
7.1-P	Identifying controls	WCAG&508 EAC RFI 2007-05	<ul style="list-style-type: none"> • Controls – Discernible by Touch and Vision
7.2-A	Display and interaction options	WCAG&508	<ul style="list-style-type: none"> • Controls – Discernible by Touch and Vision
7.2-B	Navigation between contests	WCAG&508	<ul style="list-style-type: none"> • Navigation – Between contests • Navigation – Touch gestures
7.2-C	Voter control	no	<ul style="list-style-type: none"> • Marking and Casting – Correcting the ballot
7.2-D	Scrolling	no	<ul style="list-style-type: none"> • Navigation – Scrolling or paging within a contest
7.2-E	Touch gestures	no	<ul style="list-style-type: none"> • Navigation – Between contests • Navigation – Scrolling or paging within a contest • Navigation – Touch Gestures
7.2-F	Voter speech	WCAG&508	<ul style="list-style-type: none"> • Audio – Voter Speech Not Required
7.2-G	Voter control of audio	WCAG&508	<ul style="list-style-type: none"> • Audio – Voter control of audio
7.2-H	Accidental activation	WCAG&508	<ul style="list-style-type: none"> • Controls – Size and Placement • Scrolling or Paging Within a Contest
7.2-I	Touch area size	WCAG&508	<ul style="list-style-type: none"> • Controls – Size and Placement
7.2-J	Paper ballot target areas	no	<ul style="list-style-type: none"> • Controls – Size and Placement
7.2-K	Key operability	WCAG&508	<ul style="list-style-type: none"> • Controls - Operable
7.2-L	Bodily contact	WCAG&508 EAC RFI 2015-05	<ul style="list-style-type: none"> • Controls – No dependence on direct bodily contact
7.2-M	No repetitive activation	WCAG&508	<ul style="list-style-type: none"> • Controls – Size and Placement
7.2-N	System response time	WCAG&508	<ul style="list-style-type: none"> • Response – System response time
7.2-O	Inactivity alerts	WCAG&508	<ul style="list-style-type: none"> • Response - Inactivity Time
7.2-P	Floor space	WCAG&508	<ul style="list-style-type: none"> • Clear Floor Space
7.2-Q	Physical dimensions	WCAG&508	<ul style="list-style-type: none"> • Controls – Reach and Touch
7.2-R	Control labels visible	no	<ul style="list-style-type: none"> • Controls – Visibility of controls and displays

#	Requirement	External	VVSG 2.0 Test Cases
7.3-A	System-related errors	no	<ul style="list-style-type: none"> Interaction Modes: Part 2: Ballot Marking
7.3-B	No split contests	WCAG&508	<ul style="list-style-type: none"> Ballot design
7.3-C	Contest information	no	<ul style="list-style-type: none"> Ballot design
7.3-D	Consistent relationship	no	<ul style="list-style-type: none"> No bias among choices
7.3-E	Feedback	no	<ul style="list-style-type: none"> Ballot design
7.3-F	Correcting the ballot	HAVA	<ul style="list-style-type: none"> Marking and casting - Correcting a Ballot
7.3-G	Full ballot selections review	HAVA	<ul style="list-style-type: none"> Marking and casting - Reviewing a Ballot
7.3-H	Overvotes	HAVA	<ul style="list-style-type: none"> Marking and casting – Notification of Effect of Over-Voting
7.3-I	Undervotes	HAVA	<ul style="list-style-type: none"> Marking and casting – Under Voting to be Permitted
7.3-J	Notification of casting	WCAG&508	<ul style="list-style-type: none"> Marking and casting - Ballot Casting Failure Marking and casting - Blank Ballot Notification
7.3-K	Warnings, alerts, and instructions	WCAG&508	<ul style="list-style-type: none"> Instructions - Language clarity
7.3-L	Icons labels	WCAG&508	<ul style="list-style-type: none"> Audio – Standard Audio Connector Instructions - Language clarity
7.3-M	Identifying languages	VRA	<ul style="list-style-type: none"> Alternative languages
7.3-N	Instructions for voters	WCAG&508	<ul style="list-style-type: none"> Instructions – Completeness of instructions Instructions - Language clarity Instructions – Assistance from System
7.3-O	Instructions for election workers	WCAG&508	<ul style="list-style-type: none"> Instructions - Language clarity Instructions – Completeness of instructions Instructions - Accessibility Documentation
7.3-P	Plain language	WCAG&508	<ul style="list-style-type: none"> Instructions - Language clarity Instructions - Accessibility Documentation

#	Requirement	External	VVSG 2.0 Test Cases
8.1-A	Electronic display screens	EAC RFI 2015-04 EAC RFI 2016-01	<ul style="list-style-type: none"> Screen characteristics
8.1-B	Flashing	WCAG&508	<ul style="list-style-type: none"> Screen flashes
8.1-C	Personal assistive technology (PAT)	WCAG&508	<ul style="list-style-type: none"> Interaction Modes: Part 1. Ballot Activation Interaction Modes: Part 2: Ballot Marking Interaction Modes: Part 3: Ballot Verification and Casting
8.1-D	Secondary ID and biometrics	WCAG&508	<ul style="list-style-type: none"> Interaction Modes: Part 1. Ballot Activation
8.1-E	Standard audio connectors	WCAG&508	<ul style="list-style-type: none"> Audio - Standard audio connector
8.1-F	Discernable audio jacks	No	<ul style="list-style-type: none"> Interaction Modes: Part 1. Ballot Activation Audio – Standard Audio Connector
8.1-G	Telephone style handset	WCAG&508 ANSI C63.19	<ul style="list-style-type: none"> Audio – No interference with heading aids
8.1-H	Sanitized headphones	no	<ul style="list-style-type: none"> Audio - Sanitized Headphone or Handset
8.1-I	Standard PAT jacks	WCAG&508	<ul style="list-style-type: none"> Interaction Modes: Part 1. Accessible Ballot Activation Controls - Personal Technology Input Controls – Personal Technology Jacks
8.1-J	Hearing aids	WCAG&508 ANSI C63.19	<ul style="list-style-type: none"> Audio – No interference with heading aids
8.1-K	Eliminating hazards	IEC/UL 60950- 1	<ul style="list-style-type: none"> Safety Certification
8.2-A	Federal standards for accessibility	WCAG&508 ADA	<ul style="list-style-type: none"> Testing for Federal Accessibility Standards
8.3-A	Usability testing with voters	RFI 2007-03 RFI 2013-04	<ul style="list-style-type: none"> Usability testing reports
8.4-A	Usability testing with election workers	no	<ul style="list-style-type: none"> Usability testing reports
2.2-A	User-centered design process	ISO 9241-210:2010	<ul style="list-style-type: none"> Usability Testing Report (TBD) User Centered Design Report