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Voluntary Voting System Guidelines Version 2.0

Test Assertions Version 1.0

Introduction

This document contains detailed test assertions for select *Voluntary Voting System Guidelines 2.0 Requirements* (*VVSG 2.0*). Test assertions were not developed for all VVSG 2.0 requirements. The requirements identified for test assertion development were flagged in several different ways:

- Public comment period of the DRAFT VVSG 2.0,
- Public hearings on the state of the DRAFT VVSG 2.0, and
- Internal review by EAC staff.

Many of the VVSG requirements focus on design at a high level and may be open to interpretation. In order to thoroughly test these requirements, manufacturers and VSTLs need the ability to break down each VVSG requirement into unambiguous, specific, and testable conditions. Test assertions are a method to accomplish this. The test assertions contain granular conditions that must be tested to determine conformance to specific VVSG requirements. The overall goal of the assertions is to ensure that the VSTLs test each requirement in the VVSG correctly and comprehensively. EAC staff will regularly review and revise the test assertions with feedback from VSTLs, manufacturers, election officials, NIST, and other stakeholders and will make recommendations to the Executive Director for final approval. These test assertions help ensure uniformity and consistency among all the VSTL and ensure the same pass/fail result regardless of which VSTL is used to test a specific voting system.

Test assertions were only developed for a specific subset of VVSG 2.0 requirements. They were requirements identified as potentially ambiguous and/or difficult to test. Test assertions may ultimately be developed for more requirements in the VVSG. Upon using the test assertions during the EAC's Testing & Certification Program, additional problems may be identified that necessitate updates or completely new test assertions to be developed. Therefore, this effort is intended to be a living document that will be updated as needed.

Organization and Structure of Test Assertions

The VVSG 2.0 test assertions are organized and numbered according to the principles and guidelines to which they are most applicable. Each assertion has the following fields:

- Number and title of each requirement
- Number of each test assertion
- Text of each test assertion and sub-assertion

Test assertions are indicated by the presence of the letters "TA" and followed by the original requirement number to which the test assertion applies. When a requirement contains a numbered list, then the hash sign is placed within the TA designation to specifically map that assertion back to that numbered item within the requirement. Blue and italicized text helps to differentiate key terms or phrases from one test assertion to another when the assertions under a single requirement are largely similar.

Technical terms used in the requirements

Unless otherwise specified, the intended sense of any technical terms is that which is commonly used by the information technology industry. In some cases, terminology is specific to elections or voting systems. Requirements that use words with special meanings are linked to their definitions in the VVSG 2.0 Glossary of Terms. Technical standards (e.g., ISO, ANSI) incorporated into the test assertions are fully cited in the VVSG 2.0, alongside other technical documents and references useful for understanding the information.

Conformance Language

The text of a requirement is referred to as *normative*, meaning that the text constitutes the requirement and must be satisfied when implementing and testing the voting device or system. Text in this document that is not part of a requirement, such as the discussion field, is referred to as *informative*, meaning that it is for informational purposes only and does not contain requirements.

Test assertions are derived from the requirements and may also include additional information from the discussion fields. Assertions contain normative text and are designed to contain at least one keyword. Keywords are words that have a specific meaning within this document and are always capitalized. The following is list of keywords used within this document:

- *MUST:* indicates a mandatory requirement. Synonymous with "is required to."
- *MUST NOT:* also indicates a mandatory requirement, but the requirement is to *not* do something.
- *MAY:* indicates an optional, permissible action and often suggests one possible way of conforming to a more general requirement.
- *SHOULD:* indicates an optional action that is recommended, one that is particularly suitable, without mentioning or excluding others. When a requirement's discussion field indicates a preference for a particular action, that is an indicator that the "SHOULD" keyword is appropriate in the test assertions. Synonymous with "is permitted and

recommended."

- *IF / THEN:* indicates a requirement contingent upon the existence of a feature or other condition.
- *EITHER*: indicates that there are alternate ways to fulfill a requirement.
- *ONLY:* indicates that an action can be performed solely in a single manner.

Principle 1

1.1.3-A – Opening the polls

TA113A-1: Scanners and ballot marking devices MUST provide designated functions for entering voting mode:

> **TA113A-1-1:** Access control MUST be present to prevent the inadvertent OR unauthorized activation of the poll-opening function.
> **TA113A-1-2:** Instructions for opening the polls MUST be provided *on-screen.*
> **TA113A-1-3:** Instructions for opening the polls MUST be provided *in the TDP.*
> **TA113A-1-4:** A means of verifying that the polls have been opened MUST be provided.

1.1.7-G – Scan to manufacturer specifications

TA117G-1: The voting system MUST be capable of providing a report to show the mark detection thresholds used to scan ballots.

> **TA117G-1-1:** These reports MUST be available on an ad hoc basis to election officials.

1.1.7-H – Accurately detect imperfect marks

TA117H-1: Voting systems MUST be able to detect a 1 MM thick line made with the following pencils on the HB scale: HB, B, 2B, 3B, 4B, 5B, 6B, 7B, 8B, and 9B.

1.1.7-I – Ignore extraneous marks inside voting targets

TA 117I-1: The voting system MUST NOT interpret imperfections in the ballot stock as valid marks as defined in the manufacturer's documentation.

TA 117I-2: The voting system MUST NOT interpret folds in the ballot stock as valid marks as defined in the manufacturer's documentation.

TA 117I-3: The voting system MUST NOT interpret insignificant marks identified within the voting target as valid marks as defined in the manufacturer's documentation.

1.1.7-J – Marginal marks, no bias

TA 117J-1: The voting system MUST NOT evaluate identical ambiguous marks as valid votes in one target area and as invalid votes in other target areas on the same ballot.

TA 117J-2: The voting system MUST evaluate identical valid marks made in identical marking positions on identical ballot pages as valid marks.
TA 117J-3: The voting system MUST evaluate identical invalid marks made in identical marking positions on identical ballot pages as invalid marks.

1.1.9-B – Partisan primary elections

TA119B-1: The voting system MUST be able to separately report the number of ballots *read* for all political parties in open primary elections.

TA119B-2: The voting system MUST be able to separately report the number of ballots *read* for all political parties in closed primary elections.

TA119B-3: The voting system MUST be able to separately report the number of ballots *counted* for all political parties in open primary elections.

TA119B-4: The voting system MUST be able to separately report the number of ballots *counted* for all political parties in closed primary elections.

1.2-A – Assessment of accuracy

TA12A-1: Voting systems interpreting human made marks MUST interpret valid marks created in accordance with the manufacturer's published specifications as valid marks.

TA12A-2: Voting systems interpreting human made marks MUST NOT interpret invalid marks that do NOT meet the manufacturer's published specifications as valid marks.

1.2-C – Minimum ballot positions

TA12C-1: IF a voting system uses optical scan technology, THEN the system MUST accurately interpret at least 10,000,000 ballot positions in accordance with the manufacturer's valid mark specifications.

Principle 2

2.1-C – Acceptable coding conventions

TA21C-1: The voting system manufacturer MUST *declare* a publicly available set of coding conventions.

>**TA21C-1-1:** The coding convention MUST appear in a publicly available book, magazine, journal, or on the Internet.

TA21C-2: The voting system manufacturer MUST *utilize* a publicly available set of coding conventions for voting system software.

TA21C-3: The coding convention MUST be credible.

>**TA21C-3-1:** The coding convention MUST be used by at least two organizations who are not voting system manufacturers.

2.1.1-A – General build quality

TA211A-1: Voting system manufacturers MUST document the quality assurance procedures used to ensure their products are free from damage or defect.

TA211A-2: IF components from third-party suppliers are used for their intended purpose within the voting system, THEN the voting system manufacturer MUST ensure that third-party suppliers document the quality assurance procedures used to ensure components supplied from third parties are free from damage or defect.

2.1.1-C – Durability of paper

TA211C-1: The paper specified for use in the voting system MUST conform to the applicable specifications contained within the Government Paper Specification Standards, February 1999 No. 11, OR the government standards that have superseded them.

>**TA211C-1-1**: The manufacturer MUST document the type of paper used by the voting system.

2.1.2-A – Electronic device maintainability

TA212A-1: IF a voting system component is electronic THEN it MUST have test points labeled.

>**TA212A-1-1:** Examples of labels MAY include affixed, adhered, or engraved labels.

TA212A-2: IF a voting system component is electronic THEN the voting system manufacturer MUST identify all test points in the voting system documentation.

TA212A-3: IF a voting system component is electronic AND IF a failure in the device occurs THEN physical or audible indicators related to that failure MUST *be present*.

TA212A-4: IF a voting system component is electronic AND IF a failure in the device occurs THEN physical or audible indicators related to that failure MUST *be properly labeled*.

      TA212A-4-1: Examples of labels MAY include affixed, adhered, or engraved labels.

TA212A-5: IF a voting system component is electronic THEN the voting system manufacturer MUST identify the meaning of all physical or audible indicators related to failures in the voting system documentation.

2.1.2-B – System maintainability

TA212B-1: Voting system documentation intended for election workers MUST specify methods that trained election workers, lacking a technical background, can use to detect routine and common voting system equipment failures.

TA212B-2: *Alarms* MUST be sufficient to enable detection, diagnosis, and accessibility of components that require maintenance.

TA212B-3: *Indicators* MUST be sufficient to enable detection, diagnosis, and accessibility of components that require maintenance.

2.3-C – Separation of code and data

TA23C-1: The voting system software MUST NOT *compile* instructions OR logic from *configuration files.*

TA23C-2: The voting system software MUST NOT *interpret* instructions OR logic from *configuration files.*

TA23C-3: The voting system software MUST NOT *compile* instructions OR logic from *any other source of data.*

TA23C-4: The voting system software MUST NOT *interpret* instructions OR logic from *any other source of data.*

2.4-A – Modularity

TA24A-1: The voting system software MUST have a singular purpose per module.

TA24A-2: The voting system documentation MUST describe the design patterns used to achieve modularity in the application.

2.4-B – Module testability

TA24B-1: The voting system software modules MUST contain one, and only one, function.

TA24B-2: The voting system software modules MUST be designed *so that their functions can be tested independently.*

TA24B-3: The voting system software MUST be designed *to be testable through the application of a test harness.*

2.4-C – Module size and identification

TA24C-1: The voting system software modules SHOULD NOT exceed 180 lines in length.

> **TA34C-1-1:** Lines MUST be executable statements OR flow control statements with suitable formatting.

TA24C-2: The manufacturers declared coding conventions MUST specify a naming convention in order to ensure modules are *easily identifiable.*

2.5.2-A - Input validation and error defense

TA252A-1: The voting system MUST provide the capability to monitor peripherals interfacing with the voting application.

TA252A-2: IF the voting system expects *the presence of a value* THEN it MUST allow for *a null or absent value* without unexpected results.
> **TA252A-2-1:** IF necessary, THEN appropriate action MUST be taken.

TA252A-3: IF the voting system expects a value *within a range* THEN it MUST allow for *the presence of data outside of that range* without unexpected results
> **TA252A-3-1:** IF necessary, THEN appropriate action MUST be taken.

TA252A-4: IF the voting system expects *a value with a particular length* THEN it MUST allow for the presence of *values outside the length* without unexpected results.
> **TA252A-4-1:** IF necessary THEN appropriate action MUST be taken.

TA252A-5: IF the voting system expects a value *with a particular data type* THEN it MUST allow for the presence of *other data types* without unexpected results.
> **TA252A-5-1:** IF necessary THEN appropriate action MUST be taken.

TA252A-6: IF the voting system expects a value *with a particular format* THEN it MUST allow for the presence of *other formats* without unexpected results.
> **TA252A-6-1:** IF necessary, THEN appropriate action MUST be taken.

TA252A-7: IF the voting system expects a value *within a specific set of specified values* THEN it MUST allow for the presence of *other values outside that set* without unexpected results.
> **TA252A-7-1:** IF necessary, THEN appropriate action MUST be taken.

TA252-A-8: Voting system errors MUST be included in the event log.

TA252-A-9: The voting system event log MUST contain how errors were corrected.

TA252A-10: *Invalid* inputs MUST NOT prevent a voting system from recovering from an error.
> **TA252A-10-1:** Recovery MAY be initiated by a *system reboot.*
> **TA252A-10-2:** Recovery MAY be initiated by an *election worker.*

TA252A-11: *Incomplete* inputs MUST NOT prevent a voting system from recovering from an error.
> **TA252A-11-1:** Recovery MAY be initiated by a *system reboot.*
> **TA252A-11-2:** Recovery MAY be initiated by an *election worker.*

2.5.4-J – Memory mismanagement

TA254J-1: IF dynamic memory allocation is performed outside of a COTS library THEN the dynamic memory allocation functionality must allow analysis or instrumentation using a COTS tool that can detect memory management errors.

2.5.4-M – Election integrity monitoring

TA254M-1: The voting system MUST detect OR MUST prevent *modifications to storage locations in memory* that contain aggregated vote totals.

TA254M-2: The voting system MUST detect OR MUST prevent *modifications to local storage* that contain aggregated vote totals.

TA254M-3: IF any of the following violations occur THEN the voting system MUST alert an election official OR an election administrator.

    TA254M-3-1: The voting system MUST detect OR MUST prevent *ballot box stuffing*.

    TA254M-3-2: The voting system MUST detect OR MUST prevent *accumulating negative votes*.

2.6-A – Surviving device failure

TA26A-1: If a voting system failure was corrected THEN:

    TA26A-1-1: All *devices* MUST resume normal operation.

    TA26A-1-2: All *components* MUST resume normal operation.

    TA26A-1-3: The *voting system* MUST resume normal operation in a controlled fashion.

        TA26A-1-3-1: Normal operations MUST resume at the initial state before the error occurred.

2.6-B – No compromising voting or audit data

TA26B-1: IF a recovery condition occurs due to an exception THEN the voting system software MUST cryptographically validate the *vote* data following recovery from the exception.

TA26B-2: IF a recovery condition occurs due to an exception THEN the voting system software MUST cryptographically validate the *audit* data following recovery from the exception.

Principle 3

3.1.1-B – System overview, functional diagram

TA311B-1: The system overview MUST include a functional diagram of the voting system.

TA311B-2: The functional diagram MUST be at a system level.

TA311B-3: The functional diagram MUST depict all of the hardware platforms AND software components developed by the vendor.

TA311B-4: The functional diagram MUST show how the components relate to each other, to include at a minimum *data interchange.*

TA311B-5: The functional diagram MUST show how the components interact, to include at a minimum *all network communications.*

3.1.2-B – Maximum tabulation rate

TA312B-1: IF the voting system utilizes a bulk-fed scanner THEN the manufacturer documentation MUST specify the maximum tabulation rate for that scanner.

TA312B-2: IF any individual *component* impacts the overall maximum tabulation rate THEN the documentation MUST specify the tabulation rate for all such *components*.

TA312B-3: IF any individual *factor, such as paper size*, impacts the overall maximum tabulation rate THEN the documentation MUST specify the tabulation rate for all such *factors*.

3.1.2-C – Reliably detectable marks

TA312C-1: The voting system manufacturers MUST document what constitutes a valid mark.
    TA312C-1-1: Any system configurations or other settings that influence mark detection within that voting system (e.g., threshold settings) MUST be included in the documentation.

TA312C-2: The voting system manufacturers MUST document marks that the voting system identifies as ambiguous.
    TA312C-2-1: These ambiguous marks MAY require manual adjudication.

TA312C-3: The voting system manufacturers MUST document marks that do not constitute a valid mark.

> **TA312C-3-1:** Any system configurations or other settings that influence mark detection within that voting system (e.g., threshold settings) MUST be included in the documentation.

3.1.3-A – System security documentation

TA313A-1: The voting system documentation MUST include a description of *the security architecture of the voting system.*

> **TA313A-1-1:** The voting system documentation MUST include a description of *the security functions of the voting system.*

TA313A-2: The voting system documentation MUST include a description of *how election staff and election workers can leverage the security features provided by the voting system.*

3.1.3-C – Physical security

TA313C-1: For each voting device the documentation MUST describe all physical security controls for that device.

> **TA313C-1-1:** Security controls MUST include procedural steps for election staff and workers to keep the voting system physically secure.

> **TA313C-1-2:** The voting system documentation MUST describe the correct way to implement the physical security controls.

TA313C-2: The voting system documentation MUST include procedures that serve as a model of how to use the physical security countermeasures.

3.1.4-M – Trusted storage media

TA314M-1: The voting system documentation MUST specify memory storage devices used to install voting system software OR firmware onto the voting system.

TA314M-2: The trusted storage media MUST be trusted.

> **TA314M-2-1:** Trusted storage media devices *SHOULD be read-only storage devices*.

> **TA314M-2-2:** Trusted storage media devices *MUST be zeroed-out before first use.*

TA314M-2-2-1: Methods for zeroization MAY include the latest version of NIST SP 800-88: Guidelines for Media Sanitization.

3.1.6-K – Marking devices

TA316K-1: The voting system documentation MUST identify specific writing utensils necessary for the system to *interpret a voter mark.*

TA316K-2: The voting system documentation MUST identify specific writing utensils necessary for the system to *meet all performance requirements for accuracy including those defined by the manufacturers.*

3.1.7-B – Personnel

TA317B-1: The voting system documentation MUST specify at least two skill levels (e.g. election worker, election official, IT administrator) AND detail the knowledge required to perform the duties of each of the following:

TA317B-1-1: The voting system documentation MUST define the skill levels required to *perform pre-election or election preparation functions.*

TA317B-1-2: The voting system documentation MUST define the skill levels required to perform *operations for voting system functions performed at the polling place.*

TA317B-1-3: The voting system documentation MUST define the skill levels required to *perform operations for voting system functions performed at the central count facility.*

TA317B-1-4: The voting system documentation MUST define the skill levels required to *perform preventive maintenance tasks.*

TA317B-1-5: The voting system documentation MUST define the skill levels required to *diagnose faulty hardware, firmware, or software.*

TA317B-1-6: The voting system documentation MUST define the skill levels required to *perform corrective maintenance tasks.*

TA317B-1-7: The voting system documentation MUST define the skill levels required to *perform testing to verify the correction of problems.*

3.2-B – Minimum properties included in the setup inspection process

TA32B-1: The voting system documentation MUST include the process *to verify that ONLY certified software is installed on the voting system.*

> **TA32B-1-1:** *A cryptographic hash MUST be used.*

TA32B-2: The voting system documentation MUST include the process *for checking storage locations.*

> **TA32B-2-1:** The voting system documentation MUST include the process for checking *electronic storage locations that hold election information that changes during an election.*
>
> > **TA32B-2-1-1:** IF there is an expected value, then that value MUST be documented.
>
> **TA32B-2-2:** The voting system documentation MUST include the process *for checking physical storage locations (e.g., ballots, parts of an audit trail).*
>
> > **TA32B-2-2-1:** IF physical storage locations are not intended to be empty before the polls open THEN the status and expected state of the physical storage locations MUST be specified.

TA32B-3: The voting system documentation MUST describe procedures for *inspecting consumable items (e.g., ink, paper).*

TA317B-4: The voting system documentation MUST describe procedures for *performing logic and accuracy testing.*

3.3-A – System security, system event logging

TA33A-1: The manufacturer MUST supply documentation that is free of proprietary information or markings containing:

> **TA33A-1-1:** *A description of event logging capabilities.*
>
> **TA33A-1-2:** *The purpose of the log (e.g., security, audit trail, I/O).*

TA33A-2: The manufacturer MUST supply documentation that is free of proprietary information or markings containing *details of the format of the log file.*

3.3-B – Specification of common data format usage

TA33B-1: For each voting system *component,* the manufacturer MUST supply documentation describing how the manufacturer has implemented the NIST CDF.

TA33B-2: For each voting system *function*, the manufacturer MUST supply documentation describing how the manufacturer has implemented the NIST CDF.

TA33B-4: The manufacturer MUST supply documentation that describes how *elements* are used.

TA33B-5: The manufacturer MUST supply documentation that describes how *attributes* are used.

TA33B-6: The manufacturer MUST supply documentation that describes any *constraints on data elements.*

TA33B-7: The manufacturer MUST supply documentation that describes any *extensions made to the CDF specification*.

Principle 4

4.1-D – Exchange of voting device election event logs

TA41D-1: The voting system MUST be capable of *importing* election event log data conforming to Election event logging common data format specification: *Wack et al, Special Publication 1500-101: Election Event Logging Common Data Format Specification, National Institute of Standards and Technology (NIST), April 2020*.

TA41D-2: The voting system MUST be capable of *exporting* election event log data in a NIST SP 1500-101 compliant format.

4.2-B – Public documented manufacturer formats

TA42B-1: IF the voting system uses *methods of compression* outside the scope of the CDF, THEN these *methods of compression* MUST be publicly documented.

TA42B-2: IF the voting system uses *methods of encoding* outside the scope of the CDF, THEN these *methods of encoding* MUST be publicly documented.

TA42B-3: IF the voting system uses *data formats* outside the scope of the CDF, THEN these *data formats* MUST be publicly documented.

TA42B-4: IF the voting system uses *protocols* outside the scope of the CDF, THEN these *protocols* MUST be publicly documented.

4.3-A – Standard device interfaces

TA43A-1: IF the voting system uses peripherals, THEN the peripherals that connect to the voting system MUST use standardized hardware interfaces.

> **TA43A-1-1:** Standardized hardware interfaces MUST NOT require *proprietary hardware.*

> **TA43A-1-2:** Standardized hardware interfaces MUST NOT require *the user to obtain licenses.*

Principle 5

5.1-A – Voting methods and interaction modes

TA51A-1: IF a voting system uses paper ballots, THEN the voting system MUST provide features that assist in the reading of such ballots by voters with poor reading vision.

TA51A-2: IF a voting system uses paper verification, THEN the voting system MUST provide features that assist in the reading of such records by voters with poor reading vision.

TA51A-3: IF a voting system uses paper ballots, THEN the voting machine MAY provide *paper ballots in at least two font size ranges, 3.0mm to 4.0mm inclusive and 6.3mm to 9.0 mm inclusive, to allow voters with poor reading vision to read these ballots.*

TA51A-4: IF a voting system uses paper ballots, THEN the voting system MAY provide *magnification of those records to allow voters with poor vision a means to read these ballots.*

> **TA51A-4-1:** This magnification MAY be done EITHER by 1) optical devices OR 2) electronic devices.

> **TA51A-4-2:** This magnification MUST be compatible with the paper records' configuration.

> **TA51A-4-3:** The magnifier MUST provide legibility for the paper as actually presented on the system.

> **TA51A-4-4:** The manufacturer MAY provide the magnifier itself as part of the system.

> **TA51A-4-5:** The manufacturer MAY provide the make and model number of readily available magnifiers that are compatible with the system.

TA51A-5: The audio-tactile interface of the voting system MUST provide the same capabilities to *vote* as are provided by its visual interface.

TA51A-6: The audio-tactile interface of the voting system MUST provide the same capabilities to *cast a ballot* as are provided by its visual interface.

TA51A-7: IF a visual ballot supports voting a straight party ticket and then changing the choice in a single contest, THEN the voting system audio-tactile interface MUST support voting a straight party ticket and then changing the choice in a single contest.

TA51A-8: IF the voting system supports ballot activation for non-blind voters, THEN the voting system MUST provide features that enable voters who are blind to perform this activation.

TA51A-8-1: One such feature MAY be smart cards providing *tactile* cues so as to allow correct insertion.

TA51A-8-2: One such feature MAY be smart cards providing *audio* cues so as to allow correct insertion.

TA51A-9: The voting system MUST provide features that enable voters who are blind to independently *submit* their *ballot*.

TA51A-10: The voting system MUST provide features that enable voters who are blind to independently *cast* their *ballot*.

TA51A-11: The voting system MUST provide features that enable voters who are blind to independently *verify* their vote.

TA51A-12: The voting system MUST provide features that enable voters who lack fine motor control OR the use of their hands to submit their ballots *independently* without manually handling the ballot.

TA51A-13: The voting system MUST provide features that enable voters who lack fine motor control OR the use of their hands to submit their ballots *privately* without manually handling the ballot.

5.1-C – Vote records

TA51C-1: *Paper ballots* MUST contain all the information required to support auditing by *election workers and others* who can read ONLY English.

TA51C-2: *Paper verification records* MUST contain all the information required to support auditing by *election workers and others* who can read ONLY English.

5.2-A – No bias

TA52A-1: FOR all *contest choices* on an *audio* ballot, there MUST be no discernible differences in *audio* presentation to the voter.

TA52A-1-1: FOR all contest choices on an audio ballot, there MUST be no discernible differences in the audio presentation of the *human speaker or synthetic voice.*

TA52A-1-2: FOR all contest choices on an audio ballot, there MUST be no discernible differences in the audio presentation of the *voice characteristics including, but not limited to, speech rate, volume, and pitch.*

TA52A-2: FOR all *ballot selections within a review screen* on an *audio* ballot, there MUST be no discernible differences in *audio* presentation to the voter.

> **TA52A-2-1:** FOR all ballot selections within a review screen on an audio ballot, there MUST be no discernible differences in the audio presentation of the *human speaker or synthetic voice.*

> **TA52A-2-2:** FOR all ballot selections within a review screen on an audio ballot, there MUST be no discernible differences in the audio presentation of the *voice characteristics including, but not limited to, speech rate, volume, and pitch.*

TA52A-3: FOR all *undervotes* within *a review screen on an audio ballot*, there MUST be no discernible differences in audio presentation to the voter.

TA52A-4: FOR all *overvotes within a review screen on an audio ballot*, there MUST be no discernible differences in audio presentation to the voter.

TA52A-5: FOR *all audio voter verifiable audit records*, presented separately from the review screen (e.g., readback of a VVPAT), there MUST be no discernible differences in audio presentation to the voter.

> **TA52A-5-1:** FOR all audio voter verifiable audit records, there MUST be no discernible differences in the audio presentation of the *human speaker or synthetic voice.*

> **TA52A-5-2:** FOR all audio voter verifiable audit records, there MUST be no discernible differences in the audio presentation of the *voice characteristics including, but not limited to, speech rate, volume, and pitch.*

TA52A-6: FOR all *undervotes within an audio voter verifiable audit record*, there MUST be no discernible differences in audio presentation to the voter.

TA52A-7: FOR all *overvotes within an audio voter verifiable audit record*, there MUST be no discernible differences in audio presentation to the voter.

TA52A-8: FOR all *contest choices* within the *enhanced visual* ballot mode (e.g., high contrast ballots), there MUST be no discernible differences in *visual* presentation to the voter.

> **TA52A-8-1:** FOR all *contest choices* on an enhanced visual ballot mode, there MUST be no discernible differences in the visual presentation of *font* properties including, but not limited to, *family, style (bold, italic, underline), and size*.

TA52A-8-2: FOR all *contest choices* on an enhanced visual ballot mode, there MUST be no discernible differences in the visual presentation of *text* properties including, but not limited to, *word and letter spacing, vertical and horizontal alignment, indentation, line height, and white space handling*.

TA52A-8-3: FOR all *contest choices* on an enhanced visual ballot mode, there MUST be no discernible differences in the visual presentation of *color*.

TA52A-8-4: FOR all *contest choices* on an enhanced visual ballot mode, there MUST be no discernible differences in the visual presentation of *background*.

TA52A-8-5: FOR all *contest choices* on an enhanced visual ballot mode, there MUST be no discernible differences in the visual presentation of *margins, borders, padding, and spacing.*

TA52A-9: FOR all *ballot selections within a review screen* on an enhanced visual ballot, there MUST be no discernible differences in visual presentation to the voter.

TA52A-9-1: FOR all *ballot selections within a review screen* on an enhanced visual ballot, there MUST be no discernible differences in the visual presentation of *font* properties including, but not limited to, *family, style (bold, italic, underline), and size.*

TA52A-9-2: FOR all *ballot selections within a review screen* on an enhanced visual ballot, there MUST be no discernible differences in the visual presentation of *text* properties including, but not limited to, *word and letter spacing, vertical and horizontal alignment, indentation, line height, and white space handling*.

TA52A-9-3: FOR all *ballot selections within a review screen* on an enhanced visual ballot, there MUST be no discernible differences in the visual presentation of *color*.

TA52A-9-4: FOR all *ballot selections within a review screen* on an enhanced visual ballot, there MUST be no discernible differences in the visual presentation of *background*.

TA52A-9-5: FOR all *ballot selections within a review screen* on an enhanced visual ballot, there MUST be no discernible differences in the visual presentation of *margins, borders, padding, and spacing*.

TA52A-10: FOR all *undervotes within a review screen on an enhanced visual ballot*, there MUST be no discernible differences in visual presentation to the voter.

TA52A-11: FOR all *ballot selections within an enhanced visual voter verifiable audit record* presented separately from the review screen (e.g., readback of a VVPAT), there MUST be no discernible differences in visual presentation to the voter.

> **TA52A-11-1:** FOR all *ballot selections within an enhanced visual voter verifiable audit record*, there MUST be no discernible differences in the visual presentation of *font* properties including, but not limited to, *family, style (bold, italic, underline), and size.*

> **TA52A-11-2:** FOR all *ballot selections within an enhanced visual voter verifiable audit record*, there MUST be no discernible differences in the visual presentation of *text* properties including, but not limited to, *word and letter spacing, vertical and horizontal alignment, indentation, line height, and white space handling.*

> **TA52A-11-3:** FOR all *ballot selections within an enhanced visual voter verifiable audit record*, there MUST be no discernible differences in the visual presentation of *color.*

> **TA52A-11-4:** FOR all *ballot selections within an enhanced visual voter verifiable audit record*, there SHALL be no discernible differences in the visual presentation of *background (e.g., pattern, image).*

> **TA52A-11-5:** FOR all *ballot selections within an enhanced visual voter verifiable audit record*, there MUST be no discernible differences in the visual presentation of *margins, borders, padding, and spacing.*

TA52A-12: FOR all *undervotes within an enhanced visual voter verifiable audit record*, there MUST be no discernible differences in visual presentation to the voter.

TA52A-13: FOR all contest choices on a *tactile* ballot, there MUST be no discernible differences in *tactile* presentation to the voter.

TA52A-14: FOR all *ballot selections within a review screen* on a *tactile* ballot, there MUST be no discernible differences in *tactile* presentation to the voter.

TA52A-15: FOR all *undervotes* within *a review screen on a tactile ballot*, there MUST be no discernible differences in *tactile* presentation to the voter.

TA52A-16: FOR all *overvotes within a review screen on a tactile ballot*, there MUST be no discernible differences in *tactile* presentation to the voter.

TA52A-17: FOR *all audio voter verifiable audit records*, there MUST be no discernible differences in *tactile* presentation to the voter.

TA52A-18: FOR all *undervotes within an audio voter verifiable audit record*, there MUST be no discernible differences in *tactile* presentation to the voter.

TA52A-19: FOR all *overvotes within an audio voter verifiable audit record*, there MUST be no discernible differences in *tactile* presentation to the voter.

TA52A-20: FOR all contest choices on a *limited dexterity mode* ballot (e.g., mouth stick, "sip and puff"), there MUST be no discernible differences in *limited dexterity mode* presentation to the voter.

TA52A-21: FOR all *ballot selections within a review screen* on a *limited dexterity mode* ballot, there MUST be no discernible differences in *limited dexterity mode* presentation to the voter.

TA52A-22: FOR all *undervotes* within *a review screen on a limited dexterity mode ballot,* there MUST be no discernible differences in *limited dexterity mode* presentation to the voter.

TA52A-23: FOR all *overvotes within a review screen on a limited dexterity mode ballot,* there MUST be no discernible differences in *limited dexterity mode* presentation to the voter.

TA52A-24: FOR *all audio voter verifiable audit records*, there MUST be no discernible differences in *limited dexterity mode* presentation to the voter.

TA52A-25: FOR all *undervotes within a limited dexterity mode voter verifiable audit record*, there MUST be no discernible differences in *limited dexterity mode* presentation to the voter.

TA52A-26: FOR all *overvotes within a limited dexterity mode audio voter verifiable audit record*, there MUST be no discernible differences in *limited dexterity mode* presentation to the voter.

5.2-C – Information in all modes

TA52C-1: IF the voting system equipment used an interaction mode in accordance with *5.1-A - Voting methods and interaction modes*, THEN *instructions* to the voter MUST be presented in that same mode.

TA52C-2: IF the voting system equipment used an interaction mode in accordance with *5.1-A - Voting methods and interaction modes*, THEN *warnings* to the voter MUST be presented in that same mode.

TA52C-3: IF the voting system equipment used an interaction mode in accordance with *5.1-A - Voting methods and interaction modes*, THEN *messages* to the voter MUST be presented in that same mode.

TA52C-4: IF the voting system equipment used an interaction mode in accordance with *5.1-A - Voting methods and interaction modes*, THEN *notifications of undervotes or overvotes* MUST be presented in that same mode.

TA52C-5: IF the voting system equipment used an interaction mode in accordance with *5.1-A - Voting methods and interaction modes*, THEN *contest options* MUST be presented in that same mode.

5.2-E – Sound cues

TA52E-1: IF the voting system provides sound cues as a method to alert the voter AND the voting system is *NOT in* audio-only mode THEN the tone MUST *be* accompanied by a visual cue.

TA52E-2: IF the voting system provides sound cues as a method to alert the voter AND the voting system is *in* audio-only mode THEN the tone MUST *NOT be* accompanied by a visual cue.

TA52E-3: IF the voting system provides visual cues as a method to alert the voter AND the voting system is *NOT in* visual-only mode THEN the visual cue MUST *be* accompanied by a sound cue.

TA52E-4: IF the voting system provides visual cues as a method to alert the voter AND the voting system is *in* visual-only mode THEN the visual cue MUST *NOT be* accompanied by a sound cue.

TA52E-5: IF the voting system beeps when the voter attempts to overvote THEN there MUST be an equivalent visual cue.

> **TA52E-5-1:** The equivalent visual cue MAY be the appearance of *an icon*.

> **TA52E-5-2:** The equivalent visual cue MAY be the appearance of *a blinking element*.

Principle 6

6.1-C – Enabling or disabling output

TA61C-1: The voting system MUST allow the voter to *disable* the *audio* output resulting in a *video*-only presentation.

> **TA61C-1-1:** The voting system MUST allow the voter to do this without requiring assistance.

TA61C-2: The voting system MUST allow the voter to *disable* the *visual* output resulting in an *audio*-only presentation.

> **TA61C-2-1:** The voting system MUST allow the voter to do this without requiring assistance.

TA61C-3: The voting system MUST allow the voter to *enable* the *audio* output resulting in an *audio*-only presentation.

> **TA61C-3-1:** The voting system MUST allow the voter to do this without requiring assistance.

TA61C-4: The voting system MUST allow the voter to *enable* the *visual* output resulting in a *video*-only presentation.

> **TA61C-4-1:** The voting system MUST allow the voter to do this without requiring assistance.

TA61C-5: IF the voter enables or disables the video or audio output THEN the voting system MUST notify the voter of the change.

6.1-D – Audio privacy

TA61D-1: IF the *voting session* is performed using an audio interface THEN the *auditory content and associated audio cues* MUST NOT be discernible to any other individual in the polling place without the voter's consent.

TA61D-2: IF *headphones* are used with an audio interface THEN t*he headphones* MUST have low sound leakage such that the auditory content and associated audio cues are not discernible to any other individual in the polling place without the voter's consent.

TA61D-3: IF *ballot submission* is performed using an audio interface THEN the voting system MUST prevent any individual in the polling place (without the voter's consent) from perceiving any *content on the ballot submitted* by the voter during the *voting session*.

TA61D-4: IF *ballot submission* is performed using an audio interface THEN the voting system MUST prevent any individual in the polling place (without the voter's consent) from perceiving any *input controls (and any interaction with these input controls) on the visual interface used* by the voter during the *ballot submission process.*

> **TA61D-4-1**: Input controls MAY include buttons, touchscreen input, "sip and puff", and other forms of interaction with the voting system.

TA61D-5: Voters MAY share audio interfaces with their designated assistants.

6.2-A - Voter Independence

TA62A-1: The voting system MUST allow voters to independently *mark* their ballots.

TA62A-2: The voting system MUST allow voters to independently *verify* their ballots.

TA62A-3: The voting system MUST allow voters to independently *cast* their ballots.

> **TA62A-3-1:** Ballot casting MAY be accomplished through a combination of procedural and technical means.

TA62A-4: In order to be accessible to individuals with disabilities the voting system MUST ensure that these individuals have the same opportunity for *access* as for other voters.

TA62A-5: In order to be accessible to individuals with disabilities the voting system MUST ensure that these individuals have the same opportunity for *participation* as for other voters.

TA 62A-6: IF the voting system *allows voters to access features after their ballot is cast* THEN these features MUST be accessible to individuals with disabilities.

TA62A-7: IF the voting system *utilizes an end-to-end (E2E) architecture with receipts* THEN *E2E receipts* MUST be accessible to individuals with disabilities.

Principle 7

7.1-A – Reset to default settings

TA71A-1: There MUST be no discernible differences in all *voter* configurable aspects at the beginning of all voting sessions.

TA71A-2: There MUST be no discernible differences in all *poll worker* configurable aspects that are presented to the voter at the beginning of all voting sessions.

TA71A-3: IF a *voter* changes any adjustable setting of the voter interface, during the voting session, THEN at the beginning of the next voting session, that setting MUST have the original default value.

TA71A-4: IF a *poll worker* changes any adjustable setting of the voter interface, during the voting session, THEN at the beginning of the next voting session, that setting MUST have the original default value.

TA71A-5: IF a *voter* changes *font size* during the voting session, THEN at the beginning of the next voting session, the font size MUST have the original default value.

TA71A-6: IF a *poll worker* changes *font size* during the voting session, THEN at the beginning of the next voting session, the font size MUST have the original default value.

TA71A-7: IF a *voter* changes *color* during a voting session, THEN at the beginning of the next voting session, the color MUST have the original default value.

TA71A-8: IF a *poll worker* changes *color* during a voting session, THEN at the beginning of the next voting session, the color MUST have the original default value.

TA71A-9 IF a *voter* changes *contrast* during a voting session, THEN at the beginning of the next voting session, the contrast MUST have the original default value.

TA71A-10: IF a *poll worker* changes *contrast* during a voting session, THEN at the beginning of the next voting session, the contrast MUST have the original default value.

TA71A-11: IF a *voter* changes *audio volume* during a voting session, THEN at the beginning of the next voting session, the audio volume MUST have the original default value.

TA71A-12: IF a *poll worker* changes *audio volume* during a voting session, THEN at the beginning of the next voting session, the audio volume MUST have the original default value.

TA71A-13: IF a *voter* changes *rate of speech* during a voting session, THEN at the beginning of the next voting session, the audio volume MUST have the original default value.

TA71A-14: IF a *poll worker* changes *rate of speech* during a voting session, THEN at the beginning of the next voting session, the audio volume MUST have the original default value.

TA71A-15: IF a *voter* changes *audio/video mode* during a voting session, THEN at the beginning of the next voting session, the audio/video mode MUST have the original default value.

TA71A-16: IF a *poll worker* changes *audio/video* mode during a voting session, THEN at the beginning of the next voting session, the audio/video mode MUST have the original default value.

TA71A-17: IF a *voter enables alternative devices* during a voting session, THEN at the beginning of the next voting session, the alternative device setting MUST have the original default value.

TA71A-18: IF a *poll worker enables alternative devices* during a voting session, THEN at the beginning of the next voting session, the alternative device setting MUST have the original default value.

7.1-E – Color conventions

TA71E-1: The voting system MUST present all *general information* to the voter in EITHER *green, blue or white* colors.

TA71E-2: The voting system MUST present all *normal status indicators* to the voter in EITHER *green, blue or white* colors.

TA71E-3: The voting system MUST present all *warnings* to the voter in EITHER *amber or yellow* colors.

TA71E-4: The voting system MUST present all *marginal status information* to the voter in EITHER *amber or yellow* colors.

TA71E-5: The voting system MUST present all *error conditions* to the voter in a *red* color.

TA71E-6: The voting system MUST present all *problems requiring immediate attention* to the voter in a *red* color.

7.1-G – Text size (electronic display)

TA71G-1: The voting system MUST be capable of showing information in a range of text sizes that are selectable by the voter.

TA71G-2: The voting system MUST allow voters to *increase* text size.

TA71G-3: The voting system MUST allow voters to *decrease* text size.

TA71G-4: The default text size MUST be at least 4.8 mm, based on the height of uppercase I.

TA71G-5: The voting system MUST EITHER:

> **TA71G-5-1:** Allow the text to scale to increase or decrease in regular increments of at least 0.5 mm covering the full range of acceptable text sizes, OR

> **TA71G-5-2:** Provide at least four discrete text sizes falling within the following ranges:

>> **TA71G-5-2-1:** 3.5-4.2 mm (10-12 points).

>> **TA71G-5-2-2:** 4.8-5.6 mm (14-16 points).

>> **TA71G-5-2-3:** 6.4-7.1 mm (18-20 points).

>> **TA71G-5-2-4:** 8.5-9.0 mm (24-25 points).

7.1-H – Scaling and zooming (electronic display)

TA71H-1: IF the text size, on the screen, is changed, THEN *all other information* in the interface MUST change size.

> **TA71H-1-1:** The relationship of the new size of all *the information* MUST be consistent to the size of the text.

TA71H-2: IF the text size, on the screen, is changed, THEN all *informational icons* in the interface MUST change size.

> **TA71H-2-1:** The relationship of the new size of the *informational icons* MUST be consistent to the size of the text.

TA71H-3: IF the text size, on the screen, is changed, THEN all *screen titles* in the interface MUST change size.

> **TA71H-3-1:** The relationship of the new size of the *screen titles* MUST be consistent to the size of the text.

TA71H-4: IF the text size, on the screen, is changed, THEN all *buttons* in the interface MUST change size.

> **TA71H-4-1:** The relationship of the new size of the *buttons* MUST be consistent to the size of the text.

TA71H-5: IF the text size, on the screen, is changed, THEN all *ballot marking target areas* in the interface MUST change size.

> **TA71H-5-1:** The relationship of the new size of the *ballot marking target areas* MUST be consistent to the size of the text.

TA71H-6: IF the text size is enlarged 200% OR less THEN the screen layouts MUST NOT require horizontal *scrolling*.

TA71H-7: IF the text size is enlarged 200% OR less THEN the screen layouts MUST NOT require horizontal *panning*.

TA71H-8: IF the text size is enlarged to 7.1 mm OR less THEN the screen layouts MUST NOT require horizontal *scrolling*.

TA71H-9: IF the text size is enlarged to 7.1mm OR less THEN the screen layouts MUST NOT require horizontal *panning*.

TA71H-10: IF the text size is enlarged greater than 200% THEN the voting system MUST maintain a consistent relationship between the ballot option and the marking targets.

> **TA71H-10-1:** This consistent relationship MAY be achieved by horizontal *scrolling*.

> **TA71H-10-2:** This consistent relationship MAY be achieved by horizontal *panning*.

7.1-M – Audio comprehension

TA71M-1: For both recorded and synthetic speech the audio presentation of verbal information MUST be readily comprehensible by voters who *have hearing loss no greater than 25 dB*.

TA71M-2: For both recorded and synthetic speech, the audio presentation of verbal information MUST be readily comprehensible by voters who are proficient in the language implemented and under test.

TA71M-3: Characteristics that MUST be taken into consideration in the audio presentation of verbal information include, but are not limited to, proper enunciation, normal intonation, and appropriate rate of speech.

TA71M-4: For both recorded and synthetic speech, candidate names MUST be capable of being pronounced as the candidate intends.

TA71M-5: Characteristics that MUST be taken into consideration in the audio presentation of verbal information include, but are not limited to background noise.

TA71M-6: Characteristics that MUST be taken into consideration in the audio presentation of verbal information include, but are not limited to recording OR reproduction in dual-mono, with the same audio information in both ears.

7.1-N – Tactile keys

TA71N-1: All mechanically operated *controls* on the voting system MUST be recognizable solely by touch without activating those *controls*.

TA71N-1-1-: IF these controls include a text label THEN these *controls* MUST also include a United English Braille label.

TA71N-1-2: IF a full keyboard is NOT used THEN these *controls* MUST NOT require *sequential presses OR operations.*

TA71N-1-3: IF a full keyboard is NOT used THEN these *controls* MUST NOT require *timed presses OR operations.*

TA71N-1-4: IF a full keyboard is NOT used THEN these *controls* MUST NOT require *simultaneous presses OR operations.*

TA71N-2: All mechanically operated *buttons* on the voting system MUST be recognizable solely by touch without activating those *buttons*.

TA71N-2-1: IF these *buttons* include a text label THEN these *buttons* MUST also include a United English Braille label.

TA71N-2-2: IF a full keyboard is NOT used THEN these *buttons* MUST NOT require *sequential presses OR operations.*

TA71N-2-4: IF a full keyboard is NOT used THEN these *buttons* MUST NOT require *timed presses OR operations.*

TA71N-2-5: IF a full keyboard is NOT used THEN these *buttons* MUST NOT require *simultaneous presses OR operations.*

TA71N-3: All mechanically operated *keys* on the voting system MUST be recognizable solely by touch without activating those *keys*.

TA71N-3-1: IF these *keys* include a text label THEN these *keys* MUST also include a United English Braille label.

TA71N-3-2: IF a full keyboard is NOT used THEN these keys MUST NOT require sequential presses OR operations.

TA71N-3-3: IF a full keyboard is NOT used THEN these *keys* MUST NOT require *timed presses OR operations.*

TA71N-3-4: IF a full keyboard is NOT used THEN these keys MUST NOT require *simultaneous presses OR operations.*

TA71N-4: *Any other hardware interface* on the voting system MUST be recognizable solely by touch without activating *that interface.*

    TA71N-4-1: IF this *hardware interface* includes a text label THEN this *hardware interface* MUST also include a United English Braille label.

    TA71N-4-2: IF a full keyboard is NOT used THEN this *hardware interface* MUST NOT require *sequential presses OR operations.*

    TA71N-4-3: IF a full keyboard is NOT used THEN this *hardware interface* MUST NOT require *timed presses OR operations.*

    TA71N-4-4: IF a full keyboard is NOT used THEN this *hardware interface* MUST NOT require *simultaneous presses OR operations.*

    TA71N-4-5: Dual switches on the voting station MUST be recognizable solely by touch without activating those *dual switches.*

        TA71N-4-5-1: IF these *dual switches* include a text label THEN these *dual switches* MUST also include a United English Braille label.

        TA71N-4-5-2: IF a full keyboard is NOT used THEN these *dual switches* MUST NOT require *sequential presses OR operations.*

        TTA71N-4-5-3: IF a full keyboard is NOT used THEN these *dual switches* MUST NOT require *timed presses OR operations.*

        TA71N-4-5-4: IF a full keyboard is NOT used THEN these *dual switches* MUST NOT require *simultaneous presses OR operations.*

    TA71N-4-6: *Sip-and-puff devices* MUST be recognizable solely by touch without activating those *sip-and-puff devices.*

        TA71N-4-6-1: IF these *sip-and-puff devices* include a text label THEN these *sip-and-puff devices* MUST include a United English Braille label.

        TA71N-4-6-2: IF a full keyboard is NOT used THEN these *sip-and-puff devices* MUST NOT require *sequential presses OR operations.*

        TA71N-4-6-3: IF a full keyboard is NOT used THEN these *sip-and-puff devices* MUST NOT require *timed presses OR operations.*

> **TA71N-4-6-4:** IF a full keyboard is NOT used THEN these *sip-and-puff device*s MUST NOT require *simultaneous presses OR operations.*

7.2-A – Display and interaction options

TA72A-1: The voting system MUST provide a *visual f*ormat that supports *the full functionality of the visual ballot interface.*

TA72A-2: The voting system MUST provide a *visual* format that supports *instructions and feedback for this initial activation of the ballot (such as an insertion of a smart card).*

TA72A-3: The voting system MUST provide a *visual* format that supports *instructions and feedback to the voter on how to operate the accessible voting station, including settings and options (e.g., volume control, repetition).*

TA72A-4: The voting system MUST provide a *visual* format that supports *instructions and feedback to the voter on a change in the display format options.*

TA72A-5: The voting system MUST provide a *visual* format that supports *instructions and feedback to the voter on a change in the control options.*

TA72A-6: The voting system MUST provide a *visual* format that supports *instructions and feedback for navigation of the ballot.*

TA72A-7: The voting system MUST provide a *visual* format that supports *instructions and feedback for contest choices, including write-in candidates.*

TA72A-8: The voting system MUST provide a *visual* format that supports *instructions and feedback on confirming and changing selections.*

TA72A-9: The voting system MUST provide a *visual* format that supports *instructions and feedback on final submission of ballot.*

TA72A-10: The voting system MUST provide an *enhanced visual format* (e.g., high contrast setting) that supports *the full functionality of the visual ballot interface.*

TA72A-11: The voting system MUST provide an *enhanced visual format* (e.g., high contrast setting) that supports *instructions and feedback for this initial activation of the ballot (such as an insertion of a smart card).*

TA72A-12: The voting system MUST provide an *enhanced visual format* (e.g., high contrast setting) that supports *instructions and feedback to the voter on how to operate the accessible voting station, including settings and options (e.g., volume control, repetition).*

TA72A-13: The voting system MUST provide an *enhanced visual format* (e.g., high contrast setting) that supports *instructions and feedback to the voter on a change in the display format options.*

TA72A-14: The voting system MUST provide an *enhanced visual format* (e.g., high contrast setting) that supports *instructions and feedback to the voter on a change in the control options.*

TA72A-15: The voting system MUST provide an *enhanced visual format* (e.g., high contrast setting) that supports *instructions and feedback for navigation of the ballot.*

TA72A-16: The voting system MUST provide an *enhanced visual format* (e.g., high contrast setting) that supports *instructions and feedback for contest choices, including write-in candidates.*

TA72A-17: The voting system MUST provide an *enhanced visual format* (e.g., high contrast setting) that supports *instructions and feedback on confirming and changing selections.*

TA72A-18: The voting system MUST provide an *enhanced visual format* (e.g., high contrast setting) that supports *instructions and feedback on final submission of ballot.*

TA72A-19: The voting system MUST provide an *audio* format that supports *the full functionality of the visual ballot interface.*

TA72A-20: IF initial activation of the ballot (such as insertion of a smart card) is normally performed by the voter on a visual ballot interface THEN the voting system MUST provide *an audio format* that supports instructions and feedback for this initial activation

TA72A-21: The voting system MUST provide an *audio* format that supports *instructions and feedback to the voter on how to operate the accessible voting station, including settings and options (e.g., volume control, repetition).*

TA72A-22: The voting system MUST provide an *audio* format that supports *instructions and feedback to the voter on a change in the display format options.*

TA72A-23: The voting system MUST provide an *audio* format that supports *instructions and feedback to the voter on a change in the control options.*

TA72A-24: The voting system MUST provide an *audio* format that supports *instructions and feedback for navigation of the ballot.*

TA72A-25: The voting system MUST provide an *audio* format that supports i*nstructions and feedback for contest choices, including write-in candidates.*

TA72A-26: The voting system MUST provide an *audio* format that supports *instructions and feedback on confirming and changing selections.*

TA72A-27: The voting system MUST provide an *audio* format that supports *instructions and feedback on final submission of ballot.*

TA72A-28: The voting system MUST provide *tactile controls* that support *the full functionality of the visual ballot interface.*

TA72A-29: IF initial activation of the ballot (such as insertion of a smart card) is normally performed by the voter on a visual ballot interface THEN the voting system MUST provide *tactile controls* that supports instructions and feedback for this initial activation

TA72A-30: The voting system MUST provide *tactile controls* that support *instructions and feedback to the voter on how to operate the accessible voting station, including settings and options (e.g., volume control, repetition).*

TA72A-31: The voting system MUST provide *tactile controls* that support *instructions and feedback to the voter on a change in the display format options.*

TA72A-32: The voting system MUST provide *tactile controls* that support *instructions and feedback to the voter on a change in the control options.*

TA72A-33: The voting system MUST provide *tactile controls* that support i*nstructions and feedback for navigation of the ballot.*

TA72A-34: The voting system MUST provide *tactile controls* that support *instructions and feedback for contest choices, including write-in candidates.*

TA72A-35: The voting system MUST provide *tactile controls* that support *instructions and feedback on confirming and changing selections.*

TA72A-36: The voting system MUST provide *tactile controls* that support *instructions and feedback on final submission of ballot.*

TA72A-37: The voting system MUST provide *limited dexterity controls* that support *the full functionality of the visual ballot interface.*

TA72A-38: IF initial activation of the ballot (such as insertion of a smart card) is normally performed by the voter on a visual ballot interface THEN the voting system MUST provide limited dexterity controls that supports instructions and feedback for this initial activation

TA72A-39: The voting system MUST provide *limited dexterity controls* that support *instructions and feedback to the voter on how to operate the accessible voting station, including settings and options (e.g., volume control, repetition).*

TA72A-40: The voting system MUST provide *limited dexterity controls* that support *instructions and feedback to the voter on a change in the display format options.*

TA72A-41: The voting system MUST provide *limited dexterity controls* that support *instructions and feedback to the voter on a change in the control options.*

TA72A-42: The voting system MUST provide *limited dexterity controls* that support *instructions and feedback for navigation of the ballot.*

TA72A-43: The voting system MUST provide *limited dexterity controls* that support *instructions and feedback for contest choices, including write-in candidates.*

TA72A-44: The voting system MUST provide *limited dexterity controls* that support *instructions and feedback on confirming and changing selections.*

TA72A-45: The voting system MUST provide *limited dexterity controls* that support *instructions and feedback on final submission of ballot.*

7.2-B – Navigation between contests

TA72B-1: IF the voting system uses an electronic ballot interface AND IF a next contest exists, THEN the voting system MUST allow navigation to the *next* contest, without making a selection for the currently displayed contest.

> **TA72B-1-1:** This MUST be allowed across all categories of interaction, including audio and visual.

TA72B-2: IF the voting system uses an electronic ballot interface AND IF a previous contest exists, THEN the voting system MUST allow navigation to the *previous* contest, without making a selection for the currently displayed contest.

TA72B-2-1: This MUST be allowed across all categories of interaction, including audio and visual.

7.2-E – Touch screen gestures

TA72E-1: IF the voting system provides a touch-screen interface AND allows gestures THEN the voting system MUST meet the following conditions:

TA72E-1-1: There MUST be at least one other way of interacting with the touch screen besides gestures.

TA72E-1-2: Gestures MUST be an optional alternative.

TA72E-1-3: Gestures MUST work the same way everywhere within the entire voting interaction.

TA72E-1-4: The voting system MUST NOT allow navigation off of the current contest using gestures.

TA72E-1-5: Unintended gestures MUST NOT result in accidental activation of an action.

TA72E-1-6: Complicated gestures MUST NOT be allowed.

TA72E-1-7: The allowable gestures MUST be limited to ones that are well-known.

TA72E-1-8: Allowable gestures MUST NOT include *sequential actions*.

TA72E-1-9: Allowable gestures MUST NOT include *timed actions*.

TA72E-1-10: Allowable gestures MUST NOT include *simultaneous actions*.

7.2-H – Accidental activation

TA72H-1: Voting system *on-screen* controls MUST prevent accidental activation.

TA72H-1-1: Detecting accidental activation to a voter's touch MUST be included in the manufacturer's usability testing report per *8.3-A – Usability tests with voters*.

TA72H-1-2: Controls MUST NOT be placed in areas where users touch the device for support (e.g., device chassis, frame, screen bezel).

TA72H-1-3: An on-screen navigational touch and lift motion MUST NOT result in the selection OR deselection of any on-screen option (e.g., touch vote target scroll up and releasing should not activate any on-screen item).

TA72H-1-4: An active, selectable area for a button MUST NOT extend outside the visual bounds of the button OR control.

TA72H-1-5: An active, selectable area for any touch area MUST NOT extend outside the visual bounds of the touch area OR control.

TA72H-2: Voting system *physical controls* MUST prevent accidental activation.

TA72H-2-1: Detecting accidental activation to a voter's touch MUST be included in the manufacturer's usability testing report per *8.3-A – Usability tests with voters.*

TA72H-2-2: Controls MUST NOT be placed in areas where users touch the device for support (e.g., device chassis, frame, screen bezel).

7.2-P – Floor space

TA72P-1: For the floor area, intended for use by the voter, the voting system MUST be designed to be operable, when set up according to the documentation supplied by the manufacturer, *within a clear floor space of at least a 30 inch (760 mm) wide by 48 inch (1220 mm) deep rectangle, to allow for a wheelchair.*

TA72P-2: For the floor area, intended for use by the voter, the voting system MUST be operable, when set up according to the documentation supplied by the manufacturer, *on a floor space positioned for a forward approach OR positioned for a parallel approach.*

TA72P-3: The voting system MUST conform to requirement *3.1.5-G - Operational environment*.

TA 72P-3-1: The manufacturer MUST document the amount of room necessary for a voter's assistant, including clearance for entry into the voting system AND clearance for exit from the voting system.

TA72P-4: The voting system MUST allow adequate room for an assistant to the voter, when deployed according to the installation instructions.

TA72P-4-1: Adequate room for the assistant SHALL include clearance for *entry to* the voting station.

TA72P-4-2: Adequate room for the assistant SHALL include clearance for *exit from* the voting station.

7.2-R – Control labels visible

TA72R-1: Labels on the voting system, used for control, necessary for the voter to operate the voting system, MUST be placed on a surface of the voting system where they are visible AND legible to voters with normal eyesight (no worse than 20/40 corrected) from a *seated* posture.

TA72R-2: Labels on the voting system, used for control, necessary for the voter to operate the voting system, MUST be placed on a surface of the voting system where they are visible AND

legible to voters with normal eyesight (no worse than 20/40 corrected) from a *standing* posture.

TA72R-3: Labels on the voting system, used for control, necessary for the voter to operate the voting system, MUST be placed within the dimensions required by requirement 7.2-Q - Physical dimensions.

7.3-A – System-related errors

TA73A-1: The voting system MUST help voters to complete their ballots and achieve their desired result.

TA73A-2: Voting system features MUST NOT contribute to the possibility of voter error within the voting session.

7.3-C – Contest information

TA73C-1: FOR all contests within a ballot, each contest MUST indicate, in a manner explicitly associated with that contest, the *title of the office OR the title of the question* for that contest.

TA73C-2: FOR all contests within a ballot, each contest MUST indicate, in a manner explicitly associated with that contest, the *maximum number of choices allowed* for that contest.

TA73C-3: If the voting interface is an electronic ballot interface THEN the information for each contest MUST be in a consistent order.

TA73C-4: If the voting interface is an electronic ballot interface THEN the information for each contest MUST include *the title of the office OR the title of the question.*

    TA73C-4-1: This MUST include any distinguishing information if applicable.

        TA73C-4-1-1: Distinguishing information MAY include the *length of the term.*

        TA73C-4-1-2: Distinguishing information MAY include the *jurisdiction.*

TA73C-5: If the voting interface is an electronic ballot interface THEN the information for each contest MUST include *the maximum number of selections allowed in the contest.*

TA73C-6: If the voting interface is an electronic ballot interface AND IF the format is audio THEN the information for each contest MUST include the number of options OR the number of candidates.

TA73C-7: If the voting interface is an electronic ballot interface AND IF any selections have been made THEN the information for each contest MUST include the number of selections remaining.

TA73C-8: If the voting interface is an electronic ballot interface AND IF the format is audio AND IF any selections have been made THEN the information for each contest MUST include the currently selected candidates OR the currently selected options.

TA73C-9: If the voting interface is an electronic ballot interface THEN the information for each contest MUST include any instructions OR any reminders detailing how to find marking instructions.

> **TA73C-9-1:** This must be placed *visually* after the contest information.

> **TA73C-9-2:** This must be placed *in audio* after the contest information

7.3-E – Feedback

TA73E-1: After making a selection, a voting system MUST provide, to the voter, an unambiguous visual difference between selected choice(s) and the non-selected choices within a given contest.

> **TA73E-1-1:** IF the voting system uses a visual interface THEN the voting system MAY indicate the selection of candidates and choices by the voter by *displaying a checkmark beside the selected option.*

> **TA73E-1-2:** IF the voting system uses a visual interface THEN then the voting system MAY indicate the selection of candidates and choices by the voter by *displaying an "X" beside the selected option.*

> **TA73E-1-3:** IF the voting system uses a visual interface THEN then the voting system MAY indicate the selection of candidates and choices by the voter by *conspicuously changing its appearance.*

> **TA73E-1-4:** IF the voting system uses a visual interface THEN then the voting system MAY indicate the selection of candidates and choices by the voter *by the use of highlighting around the chosen option.*

TA73E-2: IF a voting system implements an audio interface, THEN after making a selection, a voting system MUST provide, to the voter, an audio confirmation of the selected contest choice(s) within a given contest.

> **TA73E-2-1:** IF the voting system uses an audio interface THEN then the voting system MAY provide a spoken confirmation after making a selection.

7.3-K – Warnings, alerts, and instructions

TA73K-1: All *warning*s issued by the voting system MUST be distinguishable from other information.

TA73K-2: All *alerts* issued by the voting system MUST be distinguishable from other information.

TA73K-3: All *instructions* issued by the voting system MUST be distinguishable from other information.

TA73K-4-: All *warnings* issued by the voting system MUST clearly state the nature of the problem.

> **TA73K-4-1:** These MUST be in plain language.

TA73K-5: All *warning*s issued by the voting system MUST clearly state whether the voter has performed an invalid operation OR whether the voter has attempted an invalid operation OR whether the voting system has malfunctioned.

> **TA73K-5-1:** This *MUST be in plain language.*

TA73K-6: All *warnings* issued by the voting system MUST clearly state the responses available to the voter.

> **TA73K-6-1:** This MUST be in plain language.

TA73K-7: All *alerts* issued by the voting system MUST clearly state the nature of the problem.

> **TA73K-7-1:** This MUST be in plain language.

TA73K-8: All *alerts* issued by the voting system MUST clearly state whether the voter has performed an invalid operation OR whether the voter has attempted an invalid operation OR whether the voting system has malfunctioned.

> **TA73K-8-1:** This MUST be in plain language.

TA73K-9: All *alerts* issued by the voting system MUST clearly state the responses available to the voter.

> **TA73K-9-1:** This MUST be in plain language.

TA73K-10: IF the voting equipment malfunctions, THEN a warning issued by the voting system related to this malfunction MUST include information pertaining to this malfunction.

TA73K-11: IF the voter *attempts* an invalid operation, THEN a warning issued by the voting system related to this attempt MUST include information pertaining to this *attempt.*

TA73K-12: IF the voter *performs* an invalid operation, THEN a warning issued by the voting system related to this performance MUST include information pertaining to this *performance.*

TA73K-13: Each distinct instruction MUST be separated from all other instructions.

> **TA73K-13-1:** Several unrelated instructions MUST NOT be "buried" in a long paragraph.

TA73K-14: IF the interface is a *visual* interface THEN each distinct instruction MUST be separated *spatially from other instructions.*

TA73K-15: IF the interface is an *audio* interface THEN each distinct instruction MUST be separated *from other instructions by a noticeable pause.*

TA73K-16: IF an alert is intended to confirm visual changes to the voter using an audio format THEN the voting system MAY communicate this with a short text OR sound.

7.3-M – Identifying languages

TA73M-1: The controls to *identify* a language MUST appear on the screen in a prominent location.

> **TA73M-1-1:** The controls MUST NOT be hidden in a *Help* or *Settings* menu.

TA73M-2: The controls to *change* a language MUST appear on the screen in a prominent location.

> **TA73M-2-1:** The controls MUST NOT be hidden in a *Help* or *Settings* menu.

TA73M-3: IF the electronic ballot interface presents a choice of languages to the voter, THEN the electronic ballot interface MUST use the native name of each language.

7.3-O – Instructions for election workers

TA73O-1: The voting system MUST include *clear* instructions for *setup.*

TA73O-2: The voting system MUST include *complete* instructions for *setup.*

TA73O-3: The voting system MUST include *detailed* instructions for *setup.*

TA73O-4: The voting system MUST include *clear* instructions for *polling.*

TA73O-5: The voting system MUST include *complete* instructions for *polling.*

TA73O-6: The voting system MUST include *detailed* instructions for *polling.*

TA73O-7: The voting system MUST include *clear* instructions for *shutdown.*

TA73O-8: The voting system MUST include *complete* instructions for *shutdown.*

TA73O-9: The voting system MUST include *detailed* instructions for *shutdown.*

TA73O-10: The voting system MUST include *clear* instructions for *how to use accessibility features.*

TA73O-11: The voting system MUST include *complete* instructions for *how to use accessibility features.*

TA73O-12: The voting system MUST include *detailed* instructions for *how to use accessibility features.*

TA73O-13: The voting system MUST include *clear* messages for *setup.*

TA73O-14: The voting system MUST include *complete* messages for *setup.*

TA73O-15: The voting system MUST include *detailed* messages for *setup.*

TA73O-16: The voting system MUST include *clear* messages for *polling.*

TA73O-17: The voting system MUST include *complete* messages for *polling.*

TA73O-18: The voting system MUST include *detailed* messages for *polling.*

TA73O-19: The voting system MUST include *clear* messages for *shutdown.*

TA73O-20: The voting system MUST include *complete* messages for *shutdown.*

TA73O-21: The voting system MUST include *detailed* messages for *shutdown.*

TA73O-22: The voting system MUST include *clear* messages for *how to use accessibility features.*

TA73O-23: The voting system MUST include *complete* messages for *how to use accessibility features.*

TA73O-24: The voting system MUST include *detailed* messages for *how to use accessibility features.*

TA73O-25: In order to make *instructions clear* the *instructions* MUST conform to best practices for plain language.

TA73O-26: In order to make *messages clear* the *messages* MUST conform to best practices for plain language.

TA73O-27: In order to make *instructions complete* the *instructions* MUST cover all necessary steps in order to perform the necessary action.

TA73O-28: In order to make *messages complete* the *messages* MUST cover all necessary steps in order to perform the necessary action.

TA73O-29: In order to make *instructions detailed* the *instructions* MUST include sufficiently granular instructions for how to perform the necessary action.

TA73O-30: In order to make *messages detailed* the *messages* MUST include sufficiently granular instructions for how to perform the necessary action.

TA73O-31: The documentation required for normal voting system operation MUST be presented at a level appropriate for poll workers who are not experts in voting system and computer technology.

TA73O-32: The documentation MUST be in a format suitable for use in the polling place.

TA73O-33: The *instructions* MUST enable the poll worker to verify that the voting system *has been set up correctly (setup).*

TA73O-34: The *instructions* MUST enable the poll worker to verify that the voting system *is in correct working order to record votes (polling).*

TA73O-35: The *instructions* MUST enable the poll worker to verify that the voting system *has been shut down correctly (shutdown).*

TA73O-36: The *messages* MUST enable the poll worker to verify that the voting system *has been set up correctly (setup).*

TA73O-37: The *messages* MUST enable the poll worker to verify that the voting system *is in correct working order to record votes (polling).*

TA73O-38: The *messages* MUST enable the poll worker to verify that the voting *has been shut down correctly (shutdown).*

7.3-P – Plain language

TA73P-1: Instructional material for the voter that is inherent to the voting system MUST conform to best practices for plain language.

> **TA73P-1-1:** Best practices for plain language MAY include Guidelines for Writing Clear Instructions and Messages for Voters and Poll Workers (Redish, Laskowski, NIST Interagency Report 7596, *Guidelines for Writing Clear Instructions and Messages for Voters and Poll Workers*, 2009).

> **TA73P-1-2:** Best practices for plain language MAY include https://www.plainlanguage.gov/

TA73P-2: Instructional material for the voter that is generated by default MUST conform to best practices for plain language.

> **TA73P-2-1:** Best practices for plain language MAY include Guidelines for Writing Clear Instructions and Messages for Voters and Poll Workers (Redish, Laskowski, NIST

Interagency Report 7596, *Guidelines for Writing Clear Instructions and Messages for Voters and Poll Workers*, 2009).

TA73P-2-2: Best practices for plain language MAY include https://www.plainlanguage.gov/

TA73P-3: Instructional material for the election worker that is inherent to the voting system MUST conform to best practices for plain language.

TA73P-4: Instructional material for the election worker that is generated by default MUST conform to best practices for plain language.

TA73P-4-1: Best practices for plain language MAY include Guidelines for Writing Clear Instructions and Messages for Voters and Poll Workers (Redish, Laskowski, NIST Interagency Report 7596, *Guidelines for Writing Clear Instructions and Messages for Voters and Poll Workers*, 2009).

TA73P-4-2: Best *p*ractices for plain language MAY include https://www.plainlanguage.gov/

TA73P-5: IF an instruction is based on a limiting condition, THEN the condition SHOULD be stated first, AND then the action to be performed SHOULD be stated after that.

TA73P-6: The voting system SHOULD use familiar words.

TA73P-7: The voting system SHOULD use common words.

TA73P-8: The voting system SHOULD avoid technical or specialized words that voters are not likely to understand.

TA73P-9: The voting system SHOULD issue instructions on the correct way to perform actions, rather than telling voters what not to do.

TA73P-10: The system's instructions SHOULD address the voter directly rather than use passive voice constructions.

TA73P-11: The voting system SHOULD avoid the use of gender-based pronouns.

TA73P-12: Messages generated by the voting system for election workers in support of the operation of the system MUST use plain language.

TA73P-13: Messages generated by the voting system for election workers in support of the maintenance of the system MUST use plain language.

TA73P-14: Messages generated by the voting system for election workers in support of the safety of the system MUST use plain language.

Principle 8

8.1-H – Sanitized headphones

TA81H-1: Headphones OR handsets that can be sanitized MUST be provided as part of the voting system.

TA81H-2: The voting system manufacturer MUST provide instructions *on-screen* on how to sanitize headphones OR sanitize handsets.

TA81H-3: The voting system manufacturer MUST provide instructions *in the TDP* on how to sanitize headphones OR sanitize handsets.

TA81H-4: The voting system manufacturer MUST provide *a means to* sanitize headphones OR sanitize headsets.

> **TA81H-4-1:** The requirement for sanitized headphones or handsets MAY be achieved by providing *single-use headphones.*

> **TA81H-4-2:** The requirement for sanitized headphones or handsets MAY be achieved by providing *sanitary coverings.*

8.3-A – Usability tests with voters

TA83A-1: The manufacturer MUST conduct realistic usability tests on the voting system.

> **TA83A-1-1:** The tests MUST include all voter activities in a voter session.

> > **TA83A-1-1-1:** Voter activities MUST *start with ballot activation.*

> > **TA83A-1-1-2:** Voter activities MUST *end with verification and casting.*

TA83A-2: The usability tests MUST be performed upon a completely functioning product.

TA83A-3: Test participants MUST be representative of the general population.

TA83A-4: The visual interface MUST be used.

> **TA83A-4-1:** The population under test MUST consist of a mix of voters including, but not limited to, users of different ages, genders, ethnicities, levels of education, voting experience.

TA838A-5: Each language supported by the voting system MUST have a test participant who speaks that language.

> **TA838A-5-1:** This test participant must speak the non-English language they are assigned to test as their primary language.

TA83A-6: Test participants MUST include blind voters using *the audio format.*

> **TA83A-6-1:** The visual acuity of these test participants MUST be less than 20/200 OR these participants MUST NOT be able to use the low-vision interface.

TA83A-7: Test participants MUST include blind voters *using tactile controls.*

> **TA83A-7-1:** The visual acuity of these test participants MUST be less than 20/200 OR these participants MUST NOT be able to use the low-vision interface.

TA83A-8: Test participants MUST include voters with low vision who use the enhanced visual interface with OR without audio.

> **TA83A-8-1:** The usability tests MUST use individuals whose visual acuity is less than 20/70 but greater than or equal to 20/200.
>
> **TA83A-8-2:** The usability tests MUST use individuals who can only read large-print, high contrast text.
>
> **TA83A-8-3:** The summative usability tests MUST NOT use individuals who can read normal-sized text, even when wearing glasses or contacts, unless held very close to their face.
>
> **TA83A-8-4:** The manufacturer MUST ensure that at least eight individuals with low vision are able to complete the testing session, without assistance.
>
> **TA83A-8-5:** The manufacturer SHOULD initially target at least 10 - 12 individuals with low vision, in order to ensure that at least 8 individuals with low vision individuals are able to complete the testing sessions.

TA83A-9: Test participants MUST include voters with limited dexterity (e.g., inability to grip a pencil) who use the visual tactile interface.

> **TA83A-9-1:** The manufacturer MUST ensure that at least eight test participants with limited dexterity are able to complete the testing session, without assistance.
>
> **TA83A-9-2:** The manufacturer SHOULD initially target at least 10 - 12 participants with limited dexterity, in order to ensure that at least 8 individuals with limited dexterity are able to complete the testing sessions.

TA83A-10: The population under test MUST consist of voters who are eligible to vote in the U.S.

TA83A-11: The population under test MUST NOT consist of voters who are, or have been, a poll worker, a voting machine manufacturer, a voting machine developer, in the marketing or sales of voting systems, or involved in any other position that is part of the voting process.

TA83A-12: The population under test MUST NOT consist of voters who are involved with a usability or market research business/company.

TA83A-13: The population under test SHOULD NOT consist of voters who have previously participated in a voting system usability test.

TA83A-14: The manufacturer MUST report the total number of participants tested and demographics of the participants.

TA83A-15: Manufacturers SHOULD describe their recruiting strategy.

TA83A-16: The manufacturer SHOULD detail any compensation given to participants.

TA83A-17: The manufacturer MUST describe how the voters were screened and selected.

TA83A-18: The manufacturer SHOULD note any differences between the users profiled as recruits and the users who participated in the actual study.

TA83A-19: The manufacturer MUST ensure that at least eight blind test participants are able to complete the testing session, without assistance.
>   **TA83A-19-1:** The manufacturer SHOULD initially target at least 10 - 12 blind participants, in order to ensure that at least 8 blind individuals are able to complete the testing sessions.

TA83A-20: The manufacturer SHOULD ensure that at least 30 test participants are able to complete the testing session.

TA83A-21: The manufacturer SHOULD include detailed tables of all participant demographics, whether or not they completed the test, as an appendix to the test report.

TA83A-22: The manufacturer MUST report the test results for all participants, whether or not they completed the test, using the Common Industry Format modified for voting systems (CIF-for-Voting Systems).

TA83A-22-1: The manufacturer SHOULD use the Modified CIF Template for manufacturers as a template and guidance for the semantics, content and testing.

TA83A-22-2: The manufacturer MUST ensure that the usability test report conforms to the *formatting* requirements of the Common Industry Format (CIF).

TA83A-22-3: The manufacturer MUST ensure that the usability test report conforms to the *content* requirements of the Common Industry Format (CIF).

TA83A-22-4: The usability test report MUST be submitted to the EAC as part of the documentation manufacturers are required to file with the application to test a voting system.

TA83A-23: Manufacturers MAY define their own testing protocols for the usability tests.

TA83A-24: The Technical Data Package submitted to the EAC for national certification MUST contain the Usability Test Report.

TA83A-25-1: The usability tests MUST *measure* metrics for efficiency, effectiveness, and satisfaction as defined in the ISO/CIF standard (ISO/IEC 25062:2006).

TA83A-25-1: The usability tests MUST *report* metrics for efficiency, effectiveness, and satisfaction as defined in the ISO/CIF standard (ISO/IEC 25062:2006).

TA83A-25: The test ballot used in the usability tests, conducted by the manufacturer, MUST be realistic.

TA83A-26: The test ballot used in the usability tests SHOULD look like a real ballot, such as the NIST test ballot.

TA83A-27: The test ballot used in the usability tests SHOULD have *at least 12 contests.*

TA83A-28: The test ballot used in the usability tests SHOULD have *at least 2 ballot questions.*

TA83A-29: The test ballot used in the usability tests SHOULD have *at least 5 propositions.*

TA83A-30: The test ballot used in the usability tests SHOULD have *at least one multiple-vote contest.*

TA83A-31: The test ballot used in the usability tests SHOULD have *at least one write-in contest.*

TA83A-32: The test script used in the usability tests, conducted by the manufacturer, MUST be realistic.

TA83A-33: The test script MUST enable testing of all valid operations for the voter interface under test.

TA83A-34: The testing environment for the usability tests, conducted by the manufacturer, MUST be realistic.

TA83A-35: The testing environment SHOULD be set up as it would be in a polling place.

TA83A-36: The usability tests conducted by the manufacturer MAY use the NIST medium complexity test ballot.

8.4-A – Usability tests with election workers

TA84A-1: The documentation required for normal voting system operation MUST be presented at a level appropriate for election workers who are not experts in voting system and computer technology.

> **TA84A-1-1:** The documentation SHOULD NOT presuppose familiarity with personal computers.

TA84A-2: The *instructions* MUST enable the election worker to verify that the voting system *has been set up correctly (setup).*

TA84A-3: The *instructions* MUST enable the election worker to verify that the voting system *is in correct working order to record votes (polling).*

TA84A-4: The *instructions* MUST enable the election worker to verify that the voting system *has been shut down correctly (shutdown).*

TA84A-5: Voting system *setup*, as documented by the manufacturer, MUST be reasonably easy for the typical election worker to *learn.*

TA84A-6: Voting system *setup*, as documented by the manufacturer, MUST be reasonably easy for the typical election worker to *understand.*

TA84A-7: Voting system *setup*, as documented by the manufacturer, MUST be reasonably easy for the typical election worker to *perform.*

TA84A-8: Voting system *polling*, as documented by the manufacturer, MUST be reasonably easy for the typical election worker to *learn.*

TA84A-9: Voting system *polling*, as documented by the manufacturer, MUST be reasonably easy for the typical election worker to *understand.*

TA84A-10: Voting system *polling,* as documented by the manufacturer, MUST be reasonably easy for the typical election worker to *perform.*

TA84A-11: Voting system *shutdown,* as documented by the manufacturer, MUST be reasonably easy for the typical election worker to *learn.*

TA84A-12: Voting system *shutdown*, as documented by the manufacturer, MUST be reasonably easy for the typical election worker to *understand.*

TA84A-13: Voting system *shutdown,* as documented by the manufacturer, MUST be reasonably easy for the typical election worker to *perform.*

TA84A-14: The manufacturer MUST conduct realistic usability tests on the voting system with representative election workers.

TA84A-15: The test participants MUST include typical election workers and consist of a mix of workers including, but not limited to, workers of different ages, genders, ethnicities, levels of education, and voting experience.

TA84A-16: The usability tests MUST include voting system *setup.*
> **TA84A-16-1**: The usability tests MUST include opening the voting system.
>
> **TA84A-16-2**: The usability tests MUST include providing ballots in different languages.
>
> **TA84A-16-3**: The usability tests MUST include selecting the correct ballot type (e.g., for vote centers).
> **TA84A-16-4**: The usability tests MUST include setting up the voting system to use different interaction modes.

TA84A-17: The usability tests MUST include voting system *polling.*

    TA84A-17-1: The usability tests MUST include operation during voting

    TA84A-17-2: IF they are part of the voting system THEN the usability tests MUST include use of assistive technology AND/OR language options.

TA84A-18: The usability tests MUST include voting system *shutdown.*

    TA84A-18-1: IF it is supported by the voting system THEN the usability tests MUST include shutdown at the end of a voting day during a multi-day early voting period.

    TA84A-18-2: The usability tests MUST include shutdown at the end of voting including any reports.

TA84A-19: The manufacturer MUST ensure that the election workers usability documentation/report is included in the TDP.

TA84A-20: The election workers usability test report MUST be submitted to the EAC in the Common Industry Format modified for voting systems (CIF-for-Voting Systems).

    TA84A-20-1: The manufacturer MUST ensure that the usability test report conforms to the *formatting* requirements of the Common Industry Format (CIF).

    TA84A-20-2: The manufacturer MUST ensure that the usability test report conforms to the *content* requirements of the Common Industry Format.

    TA84A-20-3: The usability test report MUST be submitted to the EAC as part of the documentation manufacturers are required to file with the application to test a voting system.

Principle 9

9.1.1-A – Software independent

TA911A-1: A undetected fault or error in software or hardware MUST NOT lead to an undetectable change in an election result.

> **TA911A-1-1:** IF a voting system is a paper-based system THEN it MUST generate a paper record of votes cast.

> **TA911A-1-2:** IF a voting system is an E2E system THEN it MUST produce cryptographic proof of the validity of cast votes as defined in section 9.1.6.

TA911A-2: The voting system documentation must include a detailed description of how the voting system achieves software independence.

9.1.2-A – Tamper evident records

TA912A-1: Voting systems MUST generate tamper-evident records.

TA912A-2: Tamper-evident records produced by voting systems MUST enable detection of incorrect election outcomes.

> **TA912A-2-1:** Paper records MAY be used as tamper evidence records.

> **TA912A-2-1:** Cryptographic proof of the validity of votes cast via an E2E protocol MAY be used as tamper evidence records.

TA912A3-3: For each vote cast by the voter the voting system MUST capture the contents of that vote at the time the ballot is cast.

TA912A3-4: For each vote cast by the voter the voting system MUST EITHER generate paper records for that vote at the time the vote is cast OR the voting system MUST generate E2E artifacts for that vote at the time the vote is cast.

TA912A4-5: All detected errors MUST be recorded in a manner that provides evidence of any attempted unauthorized modification or access to the record.

9.1.4-A – Auditor verification

TA914A-1: IF an external auditor is given voting system records THEN the auditor MUST be able to validate that all cast ballots were correctly tabulated.

TA914A-2: The voting system MUST generate records that are easily accessible to an election official without *the use of additional software outside the scope of the certified voting system.*

TA914A-3: The voting system MUST generate records that are easily accessible to an election official without *the assistance from the voting system manufacturer.*

9.1.5-C – Paper record intelligibility

TA915C-1: All recorded ballot selections MUST be presented *in a human-readable format.*

    TA915C-1-2: If the voting system presents *non-human-readable* ballot selections THEN they MUST be accompanied by ballot selections presented in a human-readable format.

TA915C-2: All human-readable text accompanying recorded ballot selections MUST be presented *using plain language.*

9.1.6-G – Evidence export

TA916G-1: Cryptographic E2E voting systems MUST be capable of exporting cryptographic evidence supporting the verification of ballot tabulation.

    TA916G-1-1: Cryptographic evidence MUST NOT violate ballot secrecy.

TA916G-2: Cryptographic E2E voting systems MUST provide the cryptographic evidence in a non-proprietary available format.

TA916G-3: Cryptographic E2E voting systems MUST provide the cryptographic evidence in a publicly available format.

9.1.6-E – Ballot receipt

TA916E-1: The voting system MUST provide voters with a receipt that allows them to verify that their ballot selections were included in the reported election outcome.

    TA916E-1-1: Ballot receipts generated by the voting system MUST NOT contain any ballot selections.

    TA916E-1-2: Ballot receipts generated by the voting system MUST NOT contain information that allows a voter to show their ballot selections to other individuals.

TA916E-1-3: Ballot receipts generated by the voting system MUST conform to a publicly available format.

TA916E-1-4: Ballot receipts generated by the voting system MAY contain unique identifiers.

TA916E-1-5: Ballot receipts AND their verification MUST conform to all applicable accessibility requirements in the VVSG.

TA916E-1-6: Ballot receipts MUST conform to all applicable voter-privacy requirements in the VVSG.

9.1.6-K – Privacy preserving, universally verifiable ballot tabulation

TA916K-1: The voting system MUST provide voting system records for public verification.
> **TA916K-1-1:** The voting system records MUST NOT be in a proprietary format in order for auditors or observers to perform verification.

TA916K-2: The voting system MUST NOT store records sequentially, with date stamps, or other information such as language or accessible method used that could violate voter privacy.

9.4-A – Risk-limiting audit

TA94A-1: IF a voting system uses a paper-based architecture, THEN the system MUST allow election officials to conduct a risk limiting audit.
> **TA94A-1-1:** A voting system MAY be considered "efficient" IF it meets requirements 4.1-D - Exchange of cast vote records (CVRs), 9.4-C - Unique ballot identifiers, and 9.4-D - Multipage ballots.

9.4-C – Unique ballot identifiers

TA94C-1: The voting system MUST EITHER preserve ballot scanning order OR MUST be capable of affixing a unique ballot identifier.
> **TA94C-1-2:** IF the voting system uses ballot identifiers, they MUST be unique within a counting group such as a batch or tabulator.

9.4-D – Multipage ballots

TA94D-1: IF a voting system is being used to conduct a risk limiting audit THEN:

TA94D-1-1: FOR multipage ballot cards, the voting system MUST ensure EITHER page numbers OR some other ballot card identifiers used to keep ballot cards together, are affixed to multipage ballots.

TA94D-1-2: The voting system MUST EITHER preserve scan order OR MUST be capable of affixing a unique ballot identifier to each page of a multipage ballot card as per 9.4-C - Unique ballot identifiers.

TA94D-1-3: The voting system MUST specify the page number OR card identifier for each record in the CVR report.

Principle 10

10.1-A – System use of voter information

TA101A-1: The voting system MUST NOT have the capability to *accept* any identifying information about any voter.

TA101A-1-1: The voting system MUST NOT have the capability to *accept the first name* of any voter.

TA101A-1-2: The voting system MUST NOT have the capability to *accept the last name* *o*f any voter.

TA101A-1-3: The voting system MUST NOT have the capability to *accept the address* of any voter.

TA101A-1-4: The voting system MUST NOT have the capability to *accept information about the driver's license* of any voter.

TA101A-1-5: The voting system MUST NOT have the capability to *accept the voter registration number* of any voter.

TA101A-2: The voting system MUST NOT have the capability to *process* any identifying information about any voter.

TA101A-2-1: The voting system MUST NOT have the capability to *process the first name* of any voter.

TA101A-2-2: The voting system MUST NOT have the capability to *process the last name* of any voter.

TA101A-2-3: The voting system MUST NOT have the capability to *process the address* of any voter.

TA101A-2-4: The voting system MUST NOT have the capability to *process information about the driver's license* of any voter.

TA101A-2-5: The voting system MUST NOT have the capability to *process the voter registration number* of any voter.

TA101A-3: The voting system MUST NOT have the ability to *store* any identifying information about any voter.

> **TA101A-3-1:** The voting system MUST NOT have the capability to *store the first name* of any voter.

> **TA101A-3-2:** The voting system MUST NOT have the capability to *store the last name* of any voter.

> **TA101A-3-3:** The voting system MUST NOT have the capability to *store the address* of any voter.

> **TA101A-3-4:** The voting system MUST NOT have the capability to *store information about the driver's license* of any voter.

> **TA101A-3-5:** The voting system MUST NOT have the capability to *store the voter registration number* of any voter.

TA101A-4: The voting system MUST NOT have the ability to *report* any identifying information about any voter.

> **TA101A-4-1:** The voting system MUST NOT have the capability to *report the first name* of any voter.

> **TA101A-4-2:** The voting system MUST NOT have the capability to *report the last name* of any voter.

> **TA101A-4-3**: The voting system MUST NOT have the capability to *report the address* of any voter.

> **TA101A-4-4:** The voting system MUST NOT have the capability to *report information about the driver's license* of any voter.

> **TA101A-4-5:** The voting system MUST NOT have the capability to *report the voter registration number* of any voter.

10.2.1-D – Isolated storage location

TA1021D-1: IF a ballot contains an indirect association, that ballot MUST NOT be stored in the same storage location as cast ballots.

TA1021D-1-1: The voting system MAY store ballots containing indirect associations in a separate directory within the voting system.

10.2.3-A – Restrict access to records of voter intent

TA1023A-1: The voting system must require administrator-level authorization in order to access any *directories* containing *CVRs.*

TA1023A-2: The voting system must require administrator-level authorization in order to access any *storage locations* containing *CVRs.*

TA1023A-3: The voting system must require administrator-level authorization in order to access any *directories* containing *ballot images.*

TA1023A-4: The voting system must require administrator-level authorization in order to access any *storage locations* containing *ballot images*.

TA1023A-5: The voting system must require administrator-level authorization in order to access any *directories* containing *ballot selections.*

TA1023A-6: The voting system must require administrator-level authorization in order to access any *storage locations* of *ballot selections*.

10.2.4-C – Activation device records

TA1024C-1: The voting system MUST NOT *create* any information that can be used to identify a specific voter's ballot*.*
>   **TA1024C-1-1:** This MUST NOT include the *order* in which voters use the voting system.
>
>   **TA1024C-1-2:** This MUST NOT include the *time* at which voters use the voting system.

TA1024C-2: The voting system MUST NOT *retain* any information that can be used to identify a specific voter's ballot*.*
>   **TA1024C-2-1:** This MUST NOT include the *order* in which voters use the voting system.
>
>   **TA1024C-2-2:** This MUST NOT include the *time* at which voters use the voting system.

Principle 11

11.1-B – Voter information in log files

TA11B-1: The voting system MUST NOT log any identifying information about any voter.

> **TA11B-1-1:** The voting system MUST NOT log *the first name* of any voter.
>
> **TA11B-1-2:** The voting system MUST NOT log *the last name o*f any voter.
>
> **TA11B-1-3:** The voting system MUST NOT log *the address* of any voter.
>
> **TA11B-1-4:** The voting system MUST NOT log *information about the driver's license* of any voter.
>
> **TA11B-1-5:** The voting system MUST NOT log *the voter registration number* of any voter.

Principle 12

12.1-A – Unauthorized physical access

TA121A-1: The voting system MUST prevent access by chance OR access without intention.

TA121A-2: The voting system MUST prevent opportunistic access. I.e. unauthorized access.

TA121A-3: All unauthorized physical access attempts on the voting system SHOULD leave physical evidence.

TA121A-4: All unauthorized access events that are successful MUST leave physical evidence.
> **TA121A-4-1:** IF unauthorized access occurs THEN the physical evidence MUST indicate the point of access

TA121A-5: All physical access points on the voting system MUST be capable of being secured by *tamper prevention methods (e.g., locks).*

TA121A-6: All physical access points on the voting system MUST be capable of being secured by *tamper detection methods (e.g., seals, tape)*.

TA121A-7: The voting system documentation MUST describe how to properly implement procedural and physical methods for detecting unauthorized access.

12.1-B – Unauthorized physical access alert

TA121B-1: IF the *voter-facing* system component is in an activated stage AND IF the *voter-facing* system component is accessed in an unauthorized manner THEN the *voter-facing* system component MUST produce an alert.

TA121B-2: Alerts produced by the voting system MUST be EITHER audible OR visual in nature.
> **TA121B-2-1:** Audible alerts produced by the voting system SHOULD be greater than 60 dB.

TA121B-3: Alerts MUST comply with requirements set forth in *7.3-K – Warnings, alerts, and instructions*.

12.1-C – Disconnecting a physical device

TA121C-1: IF a *voter-facing* system component is in an activated stage AND IF a component of a *voter-facing* system component is physically disconnected THEN the *voter-facing* system component MUST produce an alert.

TA121C-2: Alerts produced by the voting system MUST be EITHER audible AND/OR visual in nature.

> **TA121C-2-1:** Audible alerts produced by the voting system SHOULD be greater than 40 dB.

TA121C-3: Alerts MUST comply with requirements set forth in *7.3-K – Warnings, alerts, and instructions*.

12.1-D – Logging of physical connections and disconnections

TA121D-1: IF a *voter-facing* system component is in an activated stage AND IF *voter-facing* system component is physically *connected* THEN the *voter-facing* system component MUST log the *connection*.

TA121D-2: IF a *voter-facing* system component is in an activated stage AND IF *voter-facing* system component is physically *disconnected* THEN the *voter-facing* system component MUST log the *disconnection*.

12.1-E – Secure containers

TA121E-1: The manufacturer's documentation MUST specify tamper evident seals to be used for containers that *store* voting system records (e.g., ballots).

TA121E-2: The manufacturer's documentation MUST specify tamper evident seals to be used for containers that *transport* voting system records (e.g., ballots).

TA121E-3: The manufacturer's documentation MUST specify methods for properly applying seals on containers that *store* voting system records (e.g., ballots).

TA121E-4: The manufacturer's documentation MUST specify methods for properly applying seals on containers that *transport* voting system records (e.g., ballots).

TA121E-5: IF unauthorized physical access to a container *storing* voting system records occurs THEN the tamper evident seals MUST leave evidence of tampering when installed as documented.

TA121E-6: IF unauthorized physical access to a container *transporting* voting system records occurs THEN the tamper evident seals MUST leave evidence of tampering when installed as documented.

12.1-F – Secure locking systems

TA121F-1: IF the voting system uses locks THEN the voting system MUST be capable of supporting at a minimum, the following keying schemes:

> **TA121F-1-1:** The voting system MUST support *an end user using a single key to access every voting device.*

> **TA121F-1-2:** The voting system MUST support *unique keys assigned to each voting system.*

TA121F-2: Documentation MUST be provided by the manufacturer for each key scheme supported.

12.1-G – Backup power for power-reliant countermeasures

TA121G-1: IF the voting system employs a physical security mechanism that requires power to operate, THEN that physical countermeasure MUST continue to operate using backup power if the power fails.

TA121G-2: IF a voting system employs a powered physical security countermeasure, switching from primary power to backup power supply MUST produce an alert.

> **TA121G-2-1:** Alerts produced by MUST be EITHER audible AND/OR visual in nature.

> > **TA121G-2-1-1:** Audible alerts SHOULD be greater than 40 dB.

> > **TA121G-2-1-2:** Alerts MUST comply with requirements set forth in *7.3-K – Warnings, alerts, and instructions*.

TA121G-3: IF a power failure occurs for a physical security mechanism, THEN that physical countermeasure MUST automatically switch over to the backup power source.

TA121G-4: IF the voting system employs a physical security mechanism that requires power to operate, THEN that physical countermeasure MUST generate an event log entry when the power fails.

12.2-A – Physical port and access least functionality

TA122A-1: Any *physical port* that is exposed MUST be essential to voting operations OR MUST be essential to testing the voting system OR MUST be essential to auditing the voting machine.

TA122A-2: Any *access point* (e.g., panel, door) that is exposed MUST be essential to voting operations OR MUST be essential to testing the voting system OR MUST be essential to auditing the voting machine.

12.2-B – Physical port auto-disable

TA122B-1: IF the voting system is in an *activated* stage, THEN the voting system MUST automatically disable any digital communication *port* that is disconnected*.

TA122B-2: IF the voting system is in a *suspended* stage, THEN the voting system MUST automatically disable any digital communication *port* that is disconnected*.

Principle 13

13.1.2-A – Integrity protection for election records

TA1312A-1: The voting system MUST EITHER cryptographically hash *CVRs* OR digitally sign *CVRs* when a ballot is cast.

TA1312A-2: The voting system MUST EITHER cryptographically hash *a ballot image file* OR digitally sign *a ballot image file* when they are generated.

13.1.2-A – Verification of election records

TA132A-1: IF a voting system is receiving data THEN it MUST validate the digital signature of all election data received.

TA132A-2: IF a voting system is receiving data THEN it MUST log any verification error of received election results, as they occur.

TA132A-3: IF a voting system is receiving data THEN it MUST present on-screen any verification errors of the received election results, as they occur.

TA132A-4: IF a voting system is receiving data AND IF the received election data fails verification THEN it MUST NOT aggregate any received election data.

TA132A-5: IF a voting system is receiving data AND IF the received election data fails verification THEN it MUST NOT tabulate any received election data.

13.4-A – Confidentiality and integrity protection of transmitted data

TA134A-1: The *receiving* device MUST be cryptographically authenticated before a voting system device transmits information to another voting system device.

TA134A-2: The *originating* device MUST be cryptographically authenticated before a voting system device transfers information to another voting system device.

TA134A-3: The voting system must encrypt all data sent over a network.

TA134A-4: IF a voting system is transmitting data THEN it MUST verify EITHER the hash of all election data received via a network connection OR the digital signature of all election data received via a network connection before it is acted upon.

TA134A-5: IF a voting system is transmitting data THEN it MUST use ONLY FIPS-validated protocols for integrity protection over a network.

Principle 14

14.1-B – Addressing and accepting risk

TA141B-1: For each documented risk in the voting system manufacturer's risk assessment, the manufacturer MUST describe EITHER a technical control to mitigate the risk OR note that the risk is accepted.

> **TA141B-1-1:** For accepted risks, voting system manufacturers MUST provide the reason that the risk is acceptable for voting system integrity.

TA141B-2: Voting system manufacturers SHOULD use the formats outlined in *NIST SP 800-31-1: Guide for Conducting Risk Assessments* OR *ISO/IEC 27005:2011 Information technology -- Security techniques -- Information security risk management*.

14.2-A – Non-essential networking interfaces

TA142A-1: The voting system manufacturer MUST document all essential features of the voting system.

TA142A-2: The voting system manufacturer MUST disable all non-essential networking services as part of initial system configuration.

> **TA142A-2-2:** All other non-essential features MUST also be disabled.

14.2-C – Wireless communication restrictions

TA142C-1: The voting system MUST NOT establish wireless connections.

TA142C-2: The voting system MUST NOT broadcast or advertise a wireless network.

TA142C-3: The voting system MUST NOT accept connection requests.

TA142C-4: The voting system MUST disable any wireless functionality by default.

> **TA142C-4-1:** Wireless device drivers MUST NOT be installed.

> **TA142C-4-2:** This MAY be accomplished via *removing wireless hardware*.

> **TA142C-4-3:** This MAY be accomplished via *administrator-controlled device configurations*.

TA142C-4-4: This MAY be accomplished via *disconnecting/unplugging wireless device antennas*.

14.2-D – Wireless network status indicator

TA142D-1: IF a voting system contains wireless functionality, THEN there MUST always be a status indicator confirming that wireless networking functionality is disabled.

14.2-E – External network restrictions

TA142E-1: IF a voting system can establish a connection to an external network THEN the voting system MUST NOT allow any wireless OR any wired connection to a network.

TA142E-2: All voting system components MUST utilize non-routable IP addresses.

TA142E-3: IF a voting system can establish a connection to an external network THEN the voting system MUST NOT allow any device external to the voting system to connect to that network.

14.2-G – Unused code

TA142G-1: The compiled voting system application MUST NOT contain *unused* code.

TA142G-2: The compiled voting system application MUST NOT contain *dead* code.

14.2-H – Use of exploit mitigation technologies

TA142H-1: The voting system platform MUST implement Data Execution Prevention (DEP) AND Address Space Layout Randomization (ASLR) OR implement equivalent exploit mitigation technologies.

14.2-J – Importing software libraries

TA142J-1: The voting system MUST NOT bulk import OR include libraries that the voting application does not need to function.

14.2-L – Known vulnerabilities

TA142L-1: The voting system manufacturer must specify a process for identifying vulnerabilities within the vulnerability management plan.

TA142L-2: The voting system MUST NOT contain vulnerabilities within its platform that are contained within the National Vulnerability Database (www.nvd.nist.gov).

14.3-B – Criticality analysis

TA143B-1: The voting system manufacturer MUST provide a written criticality analysis.

    TA143B-1-1: The criticality analysis MUST provide a model for identifying impact to security, privacy, and performance for failure OR compromise.

    TA143B-1-2: The criticality analysis MUST identify critical components.

        TA143B-1-2-1: NISTIR 8179 AND NISTIR 8272 MAY be used.

    TA143B-1-3: The criticality analysis MUST describe the process used to identify components as critical.

        TA143B-1-3-1: NISTIR 8179 AND NISTIR 8272 MAY be used.

    TA143B-1-4: The criticality analysis MUST prioritize critical components.

        TA143B-1-4-1: The prioritization MAY be listed as low, medium, and high criticality.

    TA143B-1-5: The criticality analysis MUST NOT label all components with equal priority.

TA143B-2: The voting system manufacturer MUST provide a written supplier impact analysis.

    TA143B-2-1: The voting system documentation MUST identify critical suppliers.

Principle 15

15.1-E – Configuration file access log

TA151E-1: The voting system MUST log identifying information of EITHER the group accessing configuration files OR identifying information of the role of users accessing configuration files.

> **TA151E-1-1:** Identifying Information MAY include the username.

TA151E-1-2: Identifying Information MAY include the name of the user.

> **TA151E-1-3:** The voting system log must contain time of access for a configuration file.

15.2-A – Presentation of voting application errors

TA152A-1: IF an error occurs THEN the voting system application MUST provide a notification on-screen describing the application error in time for the user to react to it before performing other actions.

15.3-A – Malware protection mechanisms

TA153A-1: IF a COTS device provides EMS functionality THEN the voting system MUST utilize application allowlisting OR MUST use digital signatures on the COTS EMS devices in order to protect against malware.

TA153A-2: IF malware protection is an included feature of the system THEN the voting system MUST launch applications providing malware protection before the voting application is loaded.

15.3-B – Updatable malware protection mechanisms

TA153B-1: IF new malware signatures are received for COTS devices providing EMS functionality THEN malware protection mechanisms MUST be capable of being updated with the new signatures.

TA153B-2: COTS devices providing EMS functionality MUST launch applications providing malware protection before the voting application is loaded.

15.3-D – Notification of malware detection

TA153D-1: COTS workstations providing EMS functionality MUST immediately notify a user when malware is detected on COTS EMS devices.

TA153D-1-1: COTS workstations providing EMS functionality MUST make malware detection notifications on-screen.

15.3-E – Logging malware detection

TA153E-1: IF malware is detected THEN the voting system MUST log every instance of detection.

15.4-B – Secure network configuration documentation

TA154B-1: The voting system documentation MUST include *operating system* configurations.

TA154B-2: The voting system documentation MUST include *database* configurations.

TA154B-3: The voting system documentation MUST include configurations for any other security relevant *application* important to security.

TA154B-4: The voting system documentation MUST include configurations for any other security relevant *system* important to security.

TA154B-5: IF a voting system provides networking connectivity THEN it MUST provide best practices for *system administrators*.

TA154B-6: IF a voting system provides network connectivity THEN it MUST provide best practices for *election workers.*

15.4-C – Documentation for disabled wireless

TA154C-1: The voting system documentation MUST include instructions for physically removing power from any embedded wireless chipsets.

15.4-D – Rule and policy updates

TA154D-1: The voting system MUST be capable of *updating* rules and policies to *network appliances*.

TA154D-2: The voting system MUST be capable of *utilizing* updated rules and policies for *network appliances.*