



Directive on Logic & Accuracy Testing

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Directive 1 of 2024

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The following directive is issued March 7, 2024, by the Secretary of the Commonwealth of Pennsylvania pursuant to authority contained in Sections 201 and 1105- A of the Election Code, 25 P.S. §§ 2621, 3031.5.

Background

All counties in Pennsylvania must conduct pre-election logic and accuracy testing (L&A testing) prior to every election (primary, general, special, or municipal) that is conducted in their jurisdiction.

L&A testing is a series of pre-election steps intended to ensure that ballots, scanners, ballot-marking devices, and all components of a county's certified voting system are properly configured and in good working order prior to being used in an election. These steps must include every procedure that counties will use in the actual election.

L&A testing promotes election integrity by:

- 1) Providing election officials an opportunity to identify and redress errors in election definition, ballot format, and layout, including, but not limited to, appropriate locations for folds on absentee/mail-in ballots, missing races, missing party identification, misspellings of candidate names, incorrectly worded ballot questions, and incorrect tabulation.
- 2) Exposing inadequate, incorrect, or faulty election supplies, such as incorrect paper stock and memory cards that have not been properly wiped of data and reformatted.
- 3) Demonstrating to political parties, candidates, the media, and voters that the county is prepared for the upcoming election and the voting equipment has been adequately tested, which promotes confidence in the integrity of Pennsylvania elections.

Following completion of L&A testing, each county election board shall certify to the Secretary when they have completed their L&A testing and shall identify the system configuration for the election. The certification shall be on a form prescribed and furnished by the Secretary, a copy of which is attached as Appendix A. County election boards must complete the certification at least **fifteen (15) days prior to every election** held in their jurisdiction and must submit the certification electronically to the Department of State as prescribed by the Bureau of Elections.

Summary of L&A Testing Goals

- Verify that all ballots are accurately defined, including:
 - All necessary contests (races) are properly programmed, including special elections, retention elections, and ballot questions.
 - Ballot styles are properly mapped to their respective precincts. A “ballot style” is a ballot’s particular array of election contests and candidates, specific to each election precinct.
 - Candidate names are correctly spelled.
 - Contests and candidates are displayed in the required order.
 - The parties or political bodies of candidates are properly identified.
 - Names of all parties/independent political bodies are correctly spelled.
 - Audio files are present and properly configured for all candidates and ballot questions.
- Verify that all votes are aggregated and tabulated correctly, and that all accompanying hardware is in working order.
- Verify that all voting system component configurations meet federal and state certification standards and conditions.
- Verify that the voting system software/firmware works as expected.

Testing of Absentee and Mail-in Ballots

Prior to beginning the structured L&A testing, test the printed ballots that will be issued to voters to confirm that the ballots are accurate and can be read by the tabulating equipment once they are returned for counting. Test these ballots on the equipment that will be used to centrally count mail ballots. If using a ballot-on-demand (BOD) printer to print mail ballots, test the functionality of the printer for all ballot styles.

- 1) Prepare the BOD printer following the manufacturer’s procedures and load the required ballot definition files on the BOD printer. Print ballots of all ballot styles and sets that will be printed for election use.
- 2) If using pre-printed ballots or a mailing house, gather from the print vendor test ballots for all ballot styles to be used in the election.

- 3) Mark ballots of each ballot style and set type (absentee/mail-in) following the “tabulation test voting pattern” and scan them using both a central scanner and a precinct scanner.
- 4) A good way to test all of the ballots is to create an “all poll” media device for the scanners, which will permit all ballot styles for the election to be scanned.
- 5) Fold some ballots comparable to the manner in which absentee and mail-in ballots are received.
- 6) Scan the ballots on the central scanner following the exact same process that you will follow on Election Day.
- 7) Scan the ballots four (4) times on the precinct scanner, each time changing the direction in which the ballot is inserted into the scanner. The goal of this test is to ensure that all printed ballots can be read by the tabulator in all orientations.
- 8) Once ballots are tested for absentee and mail-in voting, changes should not be made to a county’s election definition. If the election definition is changed after testing is completed, ballots must be retested. If the election definition is changed after the county has distributed any absentee or mail-in ballots, when these ballots are returned the ballots will either need to be hand-counted or a ballot duplication team will need to transfer the voter’s votes to a ballot that can be tabulated by the voting equipment. Follow the procedure outlined in section 1114-A of the Election Code, 25 P.S. § 3031.14, for creating a true duplicate copy of a damaged or defective ballot. When a ballot is duplicated, the county must maintain both the original and duplicate ballot and record an identical serial number on each.

Preparing for Full L&A Testing

Notice and Public Observation

Under Section 1110-A(d) of the Election Code, 25 P.S. § 3031.10(d), no later than forty (40) days before an election, the county election board must mail a written notice stating the date, time, and location when L&A testing will begin to:

- the chairman of each political party recognized to participate in a primary election within the county; and
- the chair or presiding officer of any citizens’ organization which has registered its name and address at least fifty (50) days before such election.

Further, county boards should provide at least forty-eight (48) hours' notice to the public of the time and place of the test to provide the public an opportunity to attend. The public notice:

- may be placed in a newspaper or legal publication that has a countywide distribution;
- should outline the starting time and location of the testing; and
- need not include an ending time for the testing.

The preparation and testing of voting equipment must be open to the public to observe; however, such members of the public shall not in any manner interfere with the preparation and testing of the voting equipment units. To prevent any interference by the public when observing, the county may make reasonable rules and regulations concerning the conduct of those members of the public who wish to observe. These rules shall not prevent members of the public from fairly observing and should be published after public approval by the elections board subject to 25 P.S. § 2642(f).

Preparing for Testing

In addition to issuing notice, counties should do the following when preparing for L&A testing:

- 1) Review the Secretary's certification report for the county's voting system to ensure that the voting system components are being prepared to meet all conditions of the report that apply in the county's upcoming election.
- 2) Proofread all balloting materials. The Department recommends using more than one proofreader and proofreading at multiple stages. Proofread ALL ballot types, including Election Day ballots, absentee ballots, mail-in ballots, provisional ballots, bilingual or alternative language ballots, accessible (audio) ballots, federal ballots, partisan and non-partisan ballots, and emergency ballots.
- 3) Ensure that there are enough multi-partisan teams to conduct the testing. If the county needs to employ additional staff, the Department recommends employing precinct officials and not third-party vendor personnel.
- 4) Ensure a county election official is present to independently verify and attest to the testing results if a vendor will be participating in L&A testing.
- 5) Ensure the designated location has adequate space to conduct testing.

- 6) Complete an inventory, or manifest, of all devices to be used on Election Day, including backup equipment not directly assigned to a specific polling place. All component devices of the voting system must be tested during L&A testing.
- 7) Prepare a task list detailing every action to be taken during the testing, following the instructions in this directive. Testing scenarios should mimic election activities as much as possible.

Preparation of Test Decks and Testing Scenarios

Create a test deck for each ballot style and voting system component. These test ballots will be used to simulate Election Day activities during the testing process.

Test decks should consist of ballots voted with a pre-determined number of valid votes for each candidate, retention election, ballot question, and write-in position that appears on every ballot style that will be used in the upcoming election. Counties should consider the many types of scenarios that can occur during an election and replicate them using the test decks to ensure voting system logic and accuracy.

The Department strongly discourages relying solely on automated L&A testing or using only preprinted ballots provided by vendors. Manual entry of votes, using pre-audited ballots prepared by election officials, is the most effective way to identify potential errors and anomalies.

When preparing test decks, counties should ensure the following:

- 1) Test decks should include ballots printed via all printing options — including by the ballot printing or mail house vendor, from a BOD printer, and ballots generated from a ballot-marking device (BMD). The goal is to ensure that test deck ballots are printed under the exact same conditions as live ballots that will be provided to and voted by the voters.
- 2) The same paper stock should be used for testing that will be used for the election.
- 3) Test decks should include all ballot sets and styles to be used in the election (including, for example, Election Day ballots, absentee ballots, mail-in ballots, emergency ballots, provisional ballots, ballot on demand, ballot-marking devices, accessible ballots, non-partisan ballots, bilingual ballots, and federal ballots).
- 4) Test decks should encompass scenarios that include votes for all candidates, write-ins, retention elections, ballot questions, and candidates for special elections that are held concurrent with regularly scheduled elections.

- 5) Test decks should include ballots in all languages.
- 6) Test decks should encompass scenarios including votes for all ballot positions.

Additionally, test decks must include ballots that are intended to fail or trigger equipment warnings. The goal is to ensure that the voting system components will adequately flag or reject improperly marked ballots and that such ballots will not affect tabulation.

Improperly marked ballots include ballots:

- with more votes than allowed for all contests;
- with more votes than allowed for randomly selected contests;
- with no votes for any contest;
- voted with ambiguous marks in the target area for all candidates (if applicable); and
- from an incorrect ballot set for the same precinct.

Tabulation Test Voting Variation

Preparing the test decks includes voting a pre-determined number of valid votes for each candidate, write-in position, and option on every ballot question and retention election to verify the voting system accurately tabulates votes. The county should use Microsoft Excel or other software to document the pre-determined votes, calculate the anticipated results, and compare them to the results produced by the voting system during testing.

The Department ***strongly recommends*** preparing test decks such that ***each choice in each election contest is given a unique number of votes***. Write-in options should count as a choice, and for ballot questions and retention elections, “Yes” and “No” should count as different choices. For example, in an election contest involving three candidates and a write-in option, one choice should receive one vote, and the other choices should receive two votes, three votes, and four votes, respectively.

The county also should vary vote patterns across election contests. For example, where a ballot contains two ballot questions, each with “Yes” and “No” choices, the county should prepare the test deck such that one ballot question receives two “Yes” votes and one “No” vote, and the other ballot question receives one “Yes” vote and two “No” votes.

This is the best tabulating testing pattern that will make it easiest to identify errors or issues. Alternatively, counties may employ one of the following patterns:

- Incremental/decremental pattern: For each election contest, the county sets the highest vote total any choice may receive and then assigns votes to the remaining choices in that contest in an increasing or decreasing pattern. For example, in an election contest involving five candidates and a write-in option, the county could set the highest vote total at three and give the first choice three votes, and the other choices two votes, one vote, three votes, two votes, and one vote, respectively. This pattern should then be varied across election contests, so that results for contests with similar choices can easily be distinguished.
- Alternating pattern: For each election contest, the county sets the highest vote total any choice may receive and then assigns votes to the remaining choices in that contest in an alternating pattern. For example, in an election contest involving five candidates and a write-in option, the county could set the highest vote total at two and give the first choice two votes, and the other choices one vote, two votes, one vote, two votes, and one vote, respectively. This pattern should then be varied across election contests, so that results for contests with similar choices can easily be distinguished.

The county **must not** prepare test decks such that each choice in an election contest receives only a single vote, or all choices are not voted for at least once. ***If the anticipated result is the same for each choice in an election contest, or for each election contest with similar choices, the county may be unable to confirm that the voting system is accurately tabulating votes.***

The county must repeat the same pattern when preparing test decks for each ballot set, as applicable.

Preparation of Media Device

Before data for an election can be placed on any memory card for an optical scan tabulator, central count scanner, or ballot-marking device, the data contained on the memory card from any previous election must be removed under the guidelines of the relevant voting system. Ensure that the media device has been fully formatted before using it for L&A testing.

- 1) Inspect all media devices and ensure that they are formatted, labeled, and numbered appropriately.
- 2) Label the media device with the name of the poll (e.g., precinct name, absentee, mail-in, provisional). It is a best practice to make the marking and labelling as evident as possible. For example, write the precinct name/number and device

name clearly. As a best practice, use different colored labels for primary and redundant (back-up) media devices.

- 3) Download the election information to the media devices according to the voting system manufacturer's instructions.
- 4) Create a media device for each precinct scanner or central scanner that will be used in the election.

Preparation of Voting Equipment

L&A testing must include testing every hardware component of the voting system, regardless of whether it will be deployed to a precinct or retained at the warehouse as a backup. Below is a list of items to be tested or verified during L&A testing for an election:

- 1) Ballot-marking devices
- 2) Precinct scanners
- 3) Central count scanners
- 4) Connected printers
- 5) Connected peripherals for ADA voting equipment

Prior to the testing, perform the following checks:

- 1) Inspect the physical condition of the equipment and locks and sealing mechanisms to ensure they are intact.
- 2) Power on the devices and validate that the certified software/firmware is installed.
- 3) Check the batteries in voting systems that use batteries as either the primary power source, or as backup to the primary power source.
- 4) Implement a process to ensure that all batteries are fully charged for Election Day.
- 5) Check the scanner heads on all precinct scanners.
- 6) Check the calibration of scanners.
- 7) Verify the calibration of any ballot-marking device screens and replace or repair as needed.

- 8) Verify the date and time settings on all voting systems.
- 9) Verify that all media devices are “zeroed out.”
- 10) Verify that each device is labelled with its assigned precinct or polling place where it will be deployed and is accurately listed on your county’s inventory or manifest list.

Conducting L&A Testing

All components being used for the election, including all ballot styles, precinct scanners, central count scanners, accessible devices, and any backup equipment being used, must be part of the L&A testing.

Administrative Steps

As described above in section 3.1, the county board of elections may establish reasonable rules and regulations for public observation of L&A testing. The board must also be available during the first day of preparation, at the beginning of the day or for the first hour of public observation, to explain the process and respond to questions. The following practices must be observed:

- 1) Administer an oath to those persons conducting the L&A tests who are not permanent elections staff.
- 2) Establish an area where the public can observe the process.
- 3) Allow only election officials and those conducting tests into the testing area.
- 4) Prohibit the photocopying of any testing reports or other materials.
- 5) Prohibit photographic and audio equipment, including cellphone cameras, from being used to record security seals or serial numbers. While the news media may report on the testing process, counties must ensure that security seals, serial numbers, locks, and other details concerning security measures are not recorded or displayed.

Ballot-Marking Device Testing

The functionality and accuracy of ballot-marking devices (BMDs) must be included in any pre-election testing protocols. A test deck must be created using a BMD based on the guidelines outlined in the "Preparation of Test Decks and Testing Scenarios" in this document. Once the BMD test deck is created, the ballots must be tested on a related scanner. It is also necessary to test the various devices available to voters with disabilities for use on Election Day, including audio voting features, tactile discernible

controls, and pneumatic switch attachments which can be operated orally or by vacuum pressure (AKA sip-and-puff devices).

Ballot-Marking Device Setup and Preparation

- 1) Set each voting system to be tested to “election mode” rather than “test mode.”
- 2) Review and confirm that the prepared test decks contain all the applicable test cases suggested in the “Tabulation Test Voting Variation” section of this document. Print any “open polls” or zero tape report that can be printed from the BMD, and confirm that the expected contest order on the zero tape matches the contest order on the test ballots.
- 3) Perform all the actions that would take place on Election Day. The goal is to test all actions as they would occur on Election Day.
- 4) For each ballot style, mark and print ballots following the tabulation test voting variation on at least one BMD.
 - a. Use touchscreen, audio ballot, Audio Tactile Interface (ATI) controller and any other assistive devices provided by the manufacturer.
 - b. Use ballots in all languages used on Election Day.
 - c. Use all the accessible features provided for the ballot: font, contrast, audio-only mode, etc.
 - d. After printing each ballot, review the ballots produced by the BMD to ensure the printed ballots match the choices that were made on the BMD screen. Review the printed ballot to ensure that the contests are listed in the correct order; all the races, including retentions, show the candidate names; and ballot questions are identifiable. The printed ballot must allow the confirmation of each choice that was made on the BMD screen.
- 5) County election boards must test and prepare any BMDs intended to be used as backup devices. Since it is hard to predict where the device might be used, the best approach is to test at least two random ballot styles.

Test Closing Procedures

- 1) Perform end-of-day polling place activities as would be performed on Election Day.
- 2) Perform a review of marked and printed ballots to ensure that ballots are marked accurately as required by the test voting variations.

- 3) Gather prepared ballots for scanning.
- 4) After confirming that the marked ballots scan and generate expected results, prepare the machines for Election Day:
 - a. Clear the data generated during testing.
 - b. Ensure that the device has all supplies for printing ballots on Election Day.
 - c. Lock and seal the devices.
 - d. Shut the machines down.
- 5) Review the seals and locks once again and document the validation. The best practice is to have one person prepare the machine and then have one or two reviewers review the seals and locks.
- 6) Any discrepancies noted during the L&A testing must be evaluated in detail to identify the root cause of the problem.
- 7) If the problem is isolated to a specific machine, that machine must be marked and must not be used on Election Day.
- 8) Explain clearly to observers if any discrepancies are noted to ensure that everyone present completely understands the process and conclusions.

Precinct Scanners

Once a test desk and expected results have been validated, test decks are scanned by a bipartisan team of election officials or voting system operators on each voting system for which the ballot style is used. This test is used to check the accuracy of the ballot coding, the ability of the tabulators to accurately record votes marked on the ballots, and the ability of tabulators to accurately tally votes from all scanned ballots. Every scanner that will be used in the election must be tested.

Precinct Scanner Setup and Preparation

- 1) Set each device to be tested to “election mode” rather than “test mode.”
- 2) Review and confirm that the prepared test decks contain all the applicable test cases suggested in the “tabulation test voting variation” section of this document.
- 3) Load each precinct scanner with the pre-labeled memory cards specific to each Election Day precinct.

- 4) Perform all the actions that would take place on Election Day. The goal is to test all actions as they would happen on Election Day.
- 5) Ensure that the precinct scanner is set for the correct election.
- 6) Open the polls and validate the accuracy of the information displayed on the screens and public counters.
- 7) Print zero reports and validate the reports. Check the date and time, precinct polling place details, election, and that contest totals are zero.
- 8) Once the polls are “open” and a zero tape is generated, the bipartisan team should sign the zero tape to identify the officials participating in the test for each precinct scanner.

Test Deck Scanning

- 1) The bipartisan team must then begin scanning the ballots on each voting system for which the given ballot style is valid.
- 2) The team should follow the ballot instructions while marking and processing ballots to ensure that the instructions are clear.
- 3) Scan ballots in all orientations, alternating between all four possible orientations.
- 4) The testing staff should scan at least one ballot using any feature intended to provide voting system access for persons with disabilities. They should also scan at least one ballot using each required language. While one team member scans ballots, the other team member should monitor the equipment to ensure that the scanner and ballot counter are functioning properly.
- 5) The team must review and confirm that all configured error messages display properly.
- 6) Once all ballots from the test deck have been scanned into an individual machine, the team must “close” the polls and run a totals report.
- 7) The team should compare the results reported by the voting system to the expected results, confirm the accuracy of or discrepancies in the results, and determine if the system has passed or failed the test. Any discrepancies indicating a failure must be investigated, resolved, and the system must then be re-tested.

- 8) If a test deck is run and the pre-determined vote count is different than the voting system's tabulated results, the test team should document the problem, and then compare the unique voting variation (test plan) with the test deck pattern to ensure that the test deck was made correctly and that all ballots were scanned.
- 9) Any corrections to the test deck itself, or to the casting of the test deck, should be made, and the test deck should be re-run until two error-free test results are produced. If the tested voting system fails to produce two error-free results, the system should not be used in any election until the problem is resolved and a new round of pre-election testing is successfully completed.
- 10) The pre-election test results reports should be signed by the test team and placed in secure storage for any record retention periods the jurisdiction may require. After all voting systems for which each ballot style is valid have been tested, the test deck should be similarly stored with all corresponding reports, audit trails and log sheets.
- 11) The test should be documented by the testing team on a log created specifically for this purpose. The log shall include:
 - a. The date the test was executed,
 - b. The names of the persons who performed the test and recorded the results,
 - c. The serial number of the machine on which the test was executed,
 - d. The machine's protective counter number as it appeared both at the beginning and conclusion of testing,
 - e. The name or description of the test performed,
 - f. The version number of the software tested,
 - g. The test result – either "pass" if the results match the expected results exactly, or "fail" if there is even one discrepancy.
- 12) Jurisdictions must test and prepare any scanning devices intended to be used as backup devices. Since it is hard to predict where the device could be used, the best approach is to test two random ballot styles.

Test Closing Procedures

- 1) Perform end-of-day polling place activities as would be performed on Election Day.

- 2) Gather media including redundant (back-up) media if applicable, with results, upload to the election management system, and generate the consolidated result reports. It is a good practice to use redundant media on Election Day whenever possible. Ensure that the redundant media is also included in testing.
- 3) Document testing results as you would the official results.
- 4) Retain and seal all pre-election testing materials.
- 5) Prepare machines for Election Day use:
 - a. Clear totals.
 - b. Clear the results on the tabulator.
 - c. Insert new printing tapes.
 - d. Lock and seal the devices.
 - e. Shut the machine down.
- 6) Review the seals and locks once again and document the validation. The best practice is to have one person prepare the machine and then have one or two reviewers review the seals and locks.

Any discrepancies noted during the L&A testing must be evaluated in detail to identify the root cause of the problem.

- 1) If the problem is isolated to a specific machine, that machine must be marked and must not be used on Election Day.
- 2) Explain clearly to observers if any discrepancies are noted.

Central Count Scanners

Test central scanners used at the election office. Jurisdictions using precinct and central scanners can re-scan the ballots used for precinct scanner testing on central scanners to test the central scanners.

Central Count Scanner Setup and Preparation

- 1) Set each voting machine to be tested to “election mode” rather than “test mode.”
- 2) Review and confirm that the prepared test decks contain all the applicable test cases suggested in the “tabulation test voting variation” section of this document.

- 3) Load each central scanner with the pre-labeled memory cards and prepare them for scanning as you would on Election Day.
- 4) Perform all the actions that would happen at the beginning of the central scanner use on election night.
 - a. Be sure the tabulator is set for the correct election.
 - b. Open the polls and validate the accuracy of the information displayed on the screens.
 - c. Print zero reports and validate the reports, including checking the date and time, precinct polling place details, election, and that contest totals are zero.
- 5) Once the polls are “open” and a zero report is generated, the bipartisan team should validate and confirm that all contests and candidates have zero votes recorded for each central scanner.

Test Deck Scanning

- 1) The bipartisan team must then begin scanning the ballots on each central scanner in exactly the same manner as on Election Day.
- 2) Batch ballots as you would on Election Day and prepare them for scanning. Reuse the same ballots marked for precinct scanner testing.
- 3) Fold several marked absentee/mail-in ballots to ensure that the folds do not interfere with the scanning.
- 4) Once all ballots from the test deck have been scanned into an individual machine, the team must “close” the polls and run a totals report.
- 5) The team should compare the results reported by the voting system to the expected results, confirm the accuracy of or discrepancies in the results, and determine if the system has passed or failed the test. Any discrepancies indicating a failure must be investigated, resolved, and the system must then be re-tested.
- 6) If a test deck is run and the pre-determined vote count is different than the voting system's tabulated results, the test team should document the problem, and then compare the unique voting variation (test plan) with the test deck pattern to ensure that the test deck was made correctly and that all ballots were scanned.

- 7) Any corrections to the test deck itself, or to the casting of the test deck, should be made, and the test deck should be re-run until two error-free test results are produced. If the tested voting system fails to produce two error-free results, the system should not be used in any election until the problem is resolved and a new round of pre-election testing is successfully completed.
- 8) The pre-election test results reports should be signed by the test team and placed in secure storage for any record retention periods the jurisdiction may require. After all voting systems for which a particular ballot style is valid have been tested, the test deck should be similarly stored with all corresponding reports, audit trails and log sheets.
- 9) The test should be documented by the testing team on a log created specifically for this purpose. The log shall include, but is not limited to:
 - a. The date the test was executed,
 - b. The names of the persons who performed the test and recorded the results,
 - c. The serial number of the machine on which the test was executed,
 - d. The machine's protective counter number as it appeared both at the beginning and conclusion of testing,
 - e. The name or description of the test performed,
 - f. The version number of the software under test,
 - g. The test result – either “pass” if the results match the expected results exactly, or “fail” if there is even one discrepancy.

Test Closing Procedures

- 1) Perform the end-of-central scanning activities as on Election Day.
- 2) Gather media, including redundant (back-up) media if applicable, with results, upload to the election management system, and generate consolidated result reports. It is a good practice to use redundant media on Election Day whenever possible. Ensure that the redundant media is also included in testing.
- 3) Document the testing results as you would the official results.
- 4) Retain and seal all pre-election testing materials.
- 5) Prepare machines for Election Day use:

- a. Clear totals.
- b. Clear the results on the tabulator.
- c. Insert new printing tapes.
- d. Shut the machine down.
- e. Lock and seal the devices.

6) Review the seals and locks once again and document the validation.

Any discrepancies noted during the L&A testing must be evaluated in detail to identify the root cause of the problem. If the problem is isolated to a specific machine, that machine must be marked and must not be used on Election Day.

- 1) Explain clearly to observers if any discrepancies are noted to ensure that everyone present completely understands the process and conclusion.
- 2) Ensure that there is a mix of all types of ballots used by the jurisdiction for the election.

Hybrid Ballot-Marking Device

Hybrid devices must be tested for both the ballot-marking device functionality and the scanning and tabulation functionality. Counties using hybrid devices must follow the below guidelines for performing L&A testing.

Hybrid Ballot-Marking Device Setup and Preparation

- 1) Set each voting machine to be tested to “election mode” rather than “test mode.”
- 2) Review and confirm that the prepared test decks contain all the applicable test cases suggested in the “tabulation test voting variation” section of this document.
- 3) Load each device with the pre-labeled memory cards specific to each Election Day precinct.
- 4) Perform all the actions that would take place on Election Day. The goal is to test all actions as they would happen on Election Day.
- 5) Be sure the tabulator is set for the correct election.
- 6) Open the polls and validate the accuracy of the content displayed on screens and public counters.

- 7) Print zero reports and validate the reports. Check the date and time, precinct polling place details, election, and that contest totals are zero.
- 8) Once the polls are “open” and a zero tape is generated, the bipartisan team should sign the zero tape to identify the officials participating in the test for each precinct scanner.

Test Deck Marking and Scanning

- 1) The bipartisan team must then begin marking and scanning the ballots on each voting system for which a given ballot style is valid.
- 2) The team should follow the ballot instructions while marking and processing ballots to ensure that the instructions are clear.
- 3) The testing should include marking of at least one ballot using any feature intended to provide voting system access for persons with disabilities. While one team member is marking and casting ballots, the other team member should monitor the equipment to ensure that it is functioning properly.
- 4) After printing each ballot, review the ballots produced by the BMD to ensure the printed ballots match the choices that were made on the BMD screen. Review the printed ballot to ensure that the contests are listed in the correct order; all the races, including retention races, show the candidate names; and ballot questions are identifiable before casting the ballot.
- 5) The team must review and confirm that all configured error messages display properly.
- 6) Once all ballots from the test deck have been voted into an individual machine, the team must “close” the polls and run a totals report.
- 7) The team should compare the results reported by the voting system to the expected results, confirm the accuracy of and any discrepancies in the results, and determine if the system has passed or failed the test. Any discrepancies indicating a failure must be investigated, resolved, and the system must then be re-tested.
- 8) If a test deck is run and the pre-determined vote count is different than the voting system's tabulated results, the test team should document the problem, and then compare the unique voting variation (test plan) with the test deck pattern to ensure that the test deck was made correctly and that all ballots were scanned.

- 9) Any corrections to the test deck itself, or to the casting of the test deck, should be made and the test deck should be re-run until two error-free test results are produced. If the tested voting system fails to produce two error-free results, the system should not be used in any election until the problem is resolved and a new round of pre-election testing is successfully completed.
- 10) The pre-election test results reports should be signed by the test team and placed in secure storage for any record retention periods the jurisdiction may require. After all voting systems for which a given ballot style is valid have been tested, the test deck should be similarly stored with all corresponding reports, audit trails and log sheets.
- 11) The test should be documented by the testing team on a log created specifically for this purpose. The log shall include, but is not limited to:
 - a. The date the test was executed,
 - b. The names of the persons who performed the test and recorded the results,
 - c. The serial number of the machine on which the test was executed,
 - d. The machine's protective counter number as it appeared both at the beginning and conclusion of testing,
 - e. The name or description of the test performed,
 - f. The version number of the software under test,
 - g. The test result – either “pass” if the results match the expected results exactly or “fail” if there is even one discrepancy.
- 12) Jurisdictions must test and prepare any hybrid devices intended to be used as backup devices. Since it is hard to predict where the device could be used, the best approach is to test two random ballot styles. Scan ballots following the tabulation test voting pattern.

Test Closing Procedures

- 1) Perform the end-of-day polling place activities as on Election Day.
- 2) Gather media (including redundant media if applicable) with results, upload to the election management system and generate consolidated result reports. It is a good practice to use redundant media on Election Day whenever possible. Ensure that the redundant media is also included in testing.

- 3) Document testing results as you would the official results.
- 4) Retain and seal all pre-election testing materials.
- 5) Prepare the machines for Election Day use:
 - a. Clear totals.
 - b. Clear the results on the tabulator.
 - c. Insert new printing tapes.
 - d. Shut the machines down.
 - e. Lock and seal the devices.
- 6) Review the seals and locks once again and document the validation. The best practice is to have one person prepare the machine and then have one or two reviewers review the seals and locks.

Any discrepancies noted during the L&A testing must be evaluated in detail to identify the root cause of the problem.

- 1) If the problem is isolated to a specific machine, that machine must be marked and must not be used on Election Day.
- 2) Explain clearly to observers if any discrepancies are noted to ensure that everyone present completely understands the process and conclusion.
- 3) Ensure that there is a mix of all types of ballots used by the jurisdiction for the election.

Vote Tabulation Software Check

Test the result tabulation software by loading and generating summary reports of all test votes.

- 1) Gather all the media used for vote capture from precinct scanners/hybrid devices and central scanners (including redundant media if applicable) with results, upload to the election management system, generate the consolidated result reports, and compare them to the expected results.
- 2) It is a good practice to use redundant media on Election Day whenever possible. Ensure that the redundant media is also included in testing. Document testing results as you would the official results.

- 3) Check the audit log or cast vote records associated with individual ballots of every unique ballot design to confirm that functionality of each contest and candidate is correct. This can also be done by sending the ballots to adjudication and reviewing them there.

Election Night Reporting (ENR)

- 1) Generate the ENR files for reporting to the Department of State and publishing to your county's website.
- 2) Ensure that the counting groups on the reports are configured in accordance with the Pennsylvania Election Results Reporting and Ballot Definition Directive.
- 3) Ensure that contests are listed in the correct order, candidate names are spelled correctly, and the report segments are correct on each report type. For example, ensure that a precinct-level report is showing the results from each precinct accurately.
- 4) Test the ENR file submission process and, if the timeline for testing the Department of State ENR does not align with the county L&A testing timeline, safely store the extract files for use during the assigned testing window. Counties must submit multiple files during the ENR file submission testing to ensure that all the candidates' vote totals by reporting group and turnout information are validated on the Department of State website.

Electronic Poll Books (EPBs)

The county board of elections must test EPBs being used at the polling place as part of the L&A testing.

- 1) Load the required voter data onto the EPBs and ensure that the configuration meets the approval conditions from the Secretary of the Commonwealth.
- 2) Ensure the accuracy of the voter data on each device.
- 3) Test all Election Day check-in activity workflows on all the devices.
- 4) Print any reports as you would do on election night and validate the results.
- 5) Test any check-in activity workflows that would take place on Election Day – e.g., regular check-in, ID verification, absentee/mail-in voter, provisional voter, etc.
- 6) Test the ballot-spoiling procedures if the EPB is being used to track the number of ballots spoiled.

- 7) Test the connectivity between two devices assigned to a polling place and ensure that check-in data is synced between the devices.
- 8) Prepare electronic poll books for Election Day use:
 - a. Clear test data.
 - b. Lock and seal the devices.
- 9) Review the seals and locks once again and document the validation. The best practice is to have one person prepare the machine and then have one or two reviewers review the seals and locks.

Post-Election Verification Testing for Central Tabulation Equipment

- 1) Central tabulation equipment requires additional post-election verification testing prior to finalizing the election results. At the conclusion of the central tabulation of ballots and prior to the completion of the official canvass, the central scanner(s) must pass the same test using the same test deck(s) used during the pre-election testing.
- 2) To ensure that test deck ballots are not inadvertently intermingled with election ballots, L&A testing ballots must be labeled, bundled together, and kept separately from other election records. Counties can follow the best practice of labeling the L&A ballots with appropriate notation on each ballot while marking contests for testing. For example, write "LA1" on the first L&A ballot in an area not interfering with the barcode.

Maintaining L&A Testing Results

All documentation, test decks, and any test data including, but not limited to, copies of ballot programming used for required maintenance tests, shall be maintained in secure locked storage in accordance with the requisite records retention schedule. Gather all reports and ballots as you would for official elections and file them along with the test deck used. Note any corrections and explanations and retain and seal all artifacts from pre-election testing.

The Department recommends maintaining a file for the life cycle of each voting machine component, starting with acceptance testing when you purchase the equipment. Document important events that take place during the voting machine life cycle including, but not limited to, acceptance testing, trusted build validation, upgrade acceptance testing, each election L&A testing, and election use. The document must provide a complete history of the voting machine components.

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Version	Date	Description
1.0		Initial document release
2.0	9.25.2023	Addition of central scan post-election verification testing
3.0	3.07.2024	Removal of functionality deck testing and expanded certification form

ARCHIVED – Refer to Department of State website for current information

APPENDIX A

TLP:CLEAR

**COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF STATE
CERTIFICATION OF LOGIC AND ACCURACY TESTING**

County name: _____ Election date: _____

Number of precincts participating in election: _____

Voting system vendor: _____

Voting system name and version: _____

Primary system configuration: ☐ hand-marked paper ballots ☐ ballot-marking devices

I do hereby certify that _____ County has completed pre-election logic and accuracy testing for all its electronic voting system components pursuant to the Directive on Logic and Accuracy Testing on (date) _____.

During the test process, a predetermined test deck was prepared, and ballots were marked and tabulated. The results reported by the voting system matched the expected results, and the testing included all equipment to be used for the election, including backup devices.

The testing included the following:

Component	Details	Completed?
<u>Test Deck</u> <ul style="list-style-type: none"> The test deck included absentee, mail-in, Election Day, and provisional ballots (ballot sets) for each precinct (ballot styles). The test deck included ballots produced on all vendor and county BOD printers and BMDs. 	Test pattern used in the test deck: Recommended (unique totals) <input type="checkbox"/> Incremental/Decremental <input type="checkbox"/> Alternating <input type="checkbox"/>	Yes <input type="checkbox"/> No <input type="checkbox"/>
<u>Notice</u> <ul style="list-style-type: none"> The county board timely notified the chair of each recognized political party. 	Notice was sent to the chairman of each recognized political party on _____.	Yes <input type="checkbox"/> No <input type="checkbox"/>
<ul style="list-style-type: none"> The county board timely notified each registered citizens' organization. 	Notice was sent to the chair or presiding officer of each registered citizens' organization on _____.	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
<ul style="list-style-type: none"> The county board provided at least 48 hours' notice to the public. 	The county board provided public notice on _____.	Yes <input type="checkbox"/> No <input type="checkbox"/>
<u>Ballot-Marking Devices (BMDs) and Backup BMDs</u> <ul style="list-style-type: none"> Each BMD was tested to ensure functionality for each feature. Printed ballots matched candidate selections on screen. Ballots created by BMD were included in the test deck to enable testing of precinct scanners. Hybrid BMDs accurately tabulated results. 	Standard BMDs <input type="checkbox"/> Hybrid BMDs <input type="checkbox"/> # of BMDs to be deployed: _____ # of BMDs tested: _____ # of backup BMDs in reserve: _____ # of Backup BMDs tested: _____	Yes <input type="checkbox"/> No <input type="checkbox"/>

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<u>Precinct Scanners and Backup Scanners</u> <ul style="list-style-type: none"> • Test deck was scanned into each precinct scanner that will be deployed. • Ballots were accepted and rejected appropriately. • Ballots produced the expected results. 	# of scanners to be deployed: _____ # of scanners tested: _____ # of backup scanners in reserve: _____ # of backup scanners tested: _____	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
<u>Central Count Scanners and Backup Scanners</u> <ul style="list-style-type: none"> • Test deck was scanned into each Central Count Scanner that will be used. • Ballots were accepted and rejected appropriately. • Ballots produced the expected results. 	# of scanners to be deployed: _____ # of scanners tested: _____ # of backup scanners in reserve: _____ # of backup scanners tested: _____	Yes <input type="checkbox"/> No <input type="checkbox"/>

Signature of Chief Clerk
or Authorized Representative

Name of Chief Clerk
or Authorized Representative

Date

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