



**DIRECTIVE CONCERNING PRE-ELECTION LOGIC AND
ACCURACY TESTING OF VOTING SYSTEMS ISSUED BY THE
SECRETARY OF THE COMMONWEALTH**

**Date: October 18, 2019
Version: 1.1**

Pursuant to Section 1105-A of the Pennsylvania Election Code, 25 P. S. §3031.5, and revised as required by Act 150 of 2002, the following Directive is issued by the Secretary of the Commonwealth for all pre-election logic and accuracy testing in the Commonwealth of Pennsylvania.

As you know, pre-election Logic and Accuracy Testing (L & A Testing) is necessary to ensure that ballot marking devices and scanners are properly configured and in good working order prior to being delivered to the various voting locations in your county. Pre-election L & A Testing is also necessary to ensure that the tabulating elements of voting systems are accurately tabulating voted ballots. These primary goals are obvious, but there are other benefits of conducting robust pre-election L & A testing. It provides election officials an important opportunity to identify errors in election configuration and ballot configuration, as well as ballot printing errors (missing races, missing party identification, misspellings of candidate names, incorrectly worded ballot referenda, etc.). It can also expose inadequate or faulty election supplies, like incorrect paper stock and memory cards that haven't been properly wiped of data and reformatted. Robust pre-election L & A testing is your best chance prior to Election Day to demonstrate to political parties, candidates, the media, and most importantly to voters that they should feel confident in the integrity of elections.

To ensure that all voting systems are performing as programmed and accurately tabulating votes cast during an election, all jurisdictions must conduct Logic and Accuracy (L&A) Testing. **Jurisdictions must complete the attached attestation at least 15 days prior to every election held in the jurisdiction and must be submitted via email to "RA-STBEST@pa.gov".**

L&A testing is conducted by processing a pre-defined voting variation on ballots that are marked to tabulate to a predetermined result. The Department does not recommend completely automated L&A testing, which automatically records votes for each candidate. The Department also discourages the use of 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. All components being used on election day, including accessible devices, central scanners, back up equipment and any Electronic Poll Books being used, must be part of the L&A testing.

Primary Purposes of Pre-election Testing:

- Verifying that the election is correctly defined and ballots are properly configured.
 - All configuration settings follow requirements
 - All ballots are accurately defined, including:
 - The party(s) nominating candidates are properly identified
 - All necessary contests (races) are properly programmed, including special elections, retention elections, and ballot questions
 - Ballot styles are properly mapped to their respective precincts
 - Candidate names are accurately spelled
 - Audio files are present and properly configured for all candidates and ballot questions
- All votes are aggregated and tabulated correctly, verifying that all accompanying hardware is in working order.
- Verifying that all configurations meet certification standards and conditions.
- Verifying that the voting systems are properly programmed.
- Verifying that the voting system software/firmware works as expected.

L & A Testing Prerequisites:

- Finalize and advertise as applicable the dates, times and location of pre-election logic and accuracy (L& A) testing. Notify political parties and registered organizations. The notification must at the minimum follow the requirements as mandated by 25 P. S. §3031.10(d) and 25 P. S. §3031.14 about voting system preparation and testing of the central tabulation equipment respectively.

- Review the Secretary of the Commonwealth's certification report for your voting system to ensure that the voting system components are being prepared to meet all conditions of the report.
- Proofread all balloting materials at every stage of setup and production. Use more than one proofreader, if at all possible. Ensure that the proof reading happens on ALL types of ballots, including election day ballots, absentee ballots, provisional ballots, bilingual or alternative language ballots, accessible (audio) ballots, non-partisan ballots, etc. Please find attached as Appendix B, the ballot proofing checklist used by Department of State. Jurisdictions can use this checklist as a starting point and must add additional items specific to their jurisdiction.
- Ensure that you have adequate staff to conduct public testing.
- Ensure that you have adequate space to conduct public testing.
- Ensure that you have an inventory of all devices to be used on election day, including equipment not directly assigned to a specific polling place.
- Prepare test deck/test scenarios for use during L & A testing in addition to any test decks/test scenarios provided by vendors. A test deck is a set of predefined voting patterns with pre-determined results for the election, which allows you to compare the results after testing is completed.
 - Prepare test deck/test scenarios for ALL ballot configurations.
 - Prepare test deck/test scenarios to include ALL types of ballots applicable to the election – preprinted paper ballots, ballot on demand, ballot marking devices, DRE ballots, accessible ballots, non-partisan ballots, bilingual ballots, etc.
 - Prepare test deck/test scenarios that include votes for all candidates and ballot positions, including retention elections, ballot questions, candidates for special elections that are held concurrent with regularly scheduled elections, etc.
 - Prepare test deck/test scenarios that include straight party voting

scenarios and include all applicable scenarios of PA straight party method identified in Attachment C to the Directive for electronic voting systems published by BCEL on June 12, 2018.

- Prepare test deck/test scenarios for ballots in all languages that is used on election day.
- Prepare test deck/test scenarios for bilingual or alternative ballots.
- Prepare test deck/test scenarios for accessible ballots.
- Prepare test deck/test scenarios that include write-in ballot selections.
- Prepare test deck/test scenarios that has blank ballot, overvoted ballot and under voted ballot.
- Include ballot marks that will trigger every configured warning on your equipment.
- Prepare test deck/test scenario in such a way that the vote totals for every candidate is different.
- Print test ballots using the same ballot stock used for election day ballots.

NOTE: For testing optical scanners, make sure you include a sample of types of ballots that would be used on election day. The Department recommends marking ballots similar to election day when possible, including incorrectly marked ballots to test warnings.

Excel spreadsheets can be used for documenting the voting variations to be used for creating a test desk and compiling anticipated results if you have no other specific software of choice. Using formulas in excel will allow you to calculate the anticipated test results and then compare to the results.

- Test every hardware component of the voting system(s), including but not limited to precinct scanners, central scanners (if applicable), ballot marking devices, touch screens, printers, memory cards and electronic poll books (if applicable), voting booths. The aim must be to mimic

election day activity as much as possible during the testing.

- Inspect the physical condition of the equipment and locks and sealing mechanisms to ensure they are intact.
 - Power on the devices and validate that the certified software/firmware is installed.
 - Check the batteries in voting systems that use batteries as either the primary power source or as backup to the primary power source.
 - Implement an inspection process to ensure that all batteries maintain adequate capacity for election day.
 - Implement a process to ensure that all batteries are fully charged for election day.
 - Inspect all media and ensure that they are labelled and numbered appropriately.
 - Ensure that media has been fully formatted if not using new media. Check the scanner heads on optical scanners.
 - Check the calibration of scanners.
 - Verify the calibration of DRE touch screens and replace or repair as needed.
 - Verify barcodes are recorded and interpreted correctly where applicable.
- Verify the date and time settings on all voting systems.

Conducting L & A Testing:

- Prepare a task list detailing every action to be taken during the L&A testing activity.
- Use pre-election auditing checklists to ensure that each step of L & A testing is completed, that the memory card is zeroed out, and the voting machine mode is set for election day.
- Load the election on the voting machines
- Set each voting machine to be tested in “Election Mode” rather than

“Test Mode.”

- When conducting both manual and automated L & A Testing, test all ballot types and configurations.
- Review and confirm that the prepared test decks contain all the applicable test cases suggested in the **Testing Prerequisites** section of this document.
- Perform all the actions that would happen on election day. If there is any integration between electronic poll books and voting systems, include that for the testing. The goal must be to test all actions as they would happen on election day.
 - Open Polls and validate the accuracy of the content displayed on screens and public counters
 - Print zero reports and validate the reports – date and time, precinct polling place details, election, and contest totals are zero
 - Process Ballots
 - Follow ballot instructions while marking and processing ballots to ensure that they are clear.
 - Validate that the public counter is increasing appropriately
 - Close polls
 - Validate that public counter values match the anticipated values based on the pre-determined vote counts
 - Run totals reports
 - Review results
- Test that all configured error messages display appropriately.
- Ensure that there is a mix of all types of ballots used by the jurisdiction for the election. Ensure that some of the optical scan test ballots are marked by hand.
- Test precinct-level scanners using the memory cards specific to those locations on election day whenever possible
- Review the audio set up of ballots.
- Review summary screen/review screen and review printed ballots for BMDs and DREs.

- Review accessibility features.
- Test at least 2 ballots using each available accessible device.
- Perform end of day polling place activities as on election day.
- Gather media (including redundant media if applicable) with results and upload to 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.
- Test the result tabulation software by loading and generating summary reports of all test votes.
- Test central scanners used at the election office. Jurisdictions using precinct and central scanners can rescan the ballots used for precinct scanner testing on central scanners to test the central scanners.
- Document testing results as you would official results.
- Retain and seal all pre-election testing materials.
- Prepare machines for election day use
 - Clear Totals
 - Completely reformat election media
 - Insert new printing tapes
 - Lock and seal the devices
- Review 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.
- Explain clearly to observers if any discrepancies are noted to ensure that everyone present completely understands the process and conclusion.

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 happen during the voting machine

life including but not limited to acceptance testing, trusted build validation, each election L&A testing and system upgrade acceptance testing. Document important data points for each event, including but not limited to date of test, software firmware version, ballot style tested, etc. so that the file provides a complete history of the voting machine components.

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Version History:

Version	Date	Description	Author
1.0	9.23.2019	Initial document release	Bureau of Election Security and Technology
1.1	10.18.2019	Resource account correction	Bureau of Election Security and Technology

Appendix A - L&A Testing Attestation

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

COUNTY OF _____

I do hereby certify that “XXXX” County has completed the pre-election testing requirements for logic and accuracy testing of all its electronic voting system components on “mm/dd/yyyy”.

**Signature of Chief Clerk
or Authorized Representative**

**Name of Chief Clerk
or Authorized Representative**

Election Date

Date

Appendix B – Department of State Ballot Proofing Checklist.

Election Year _____

County Name _____

Precinct Name _____

NOVEMBER SPECIMEN BALLOT REVIEW CHECKLIST

Statutory and General Requirements	
	Y/N
Specimen ballot contains the name of the county; the election district and/or ward and division number.	
All offices and ballot questions are represented on the ballot, including special elections held concurrent with the November election. (<i>Verify using official candidate list and certification report sent to county.</i>)	
Straight Party option is included at the beginning of the ballot for all parties/independent political bodies whose candidates are named on the ballot.	
All candidates are included on the ballot.	
All candidates are in correct ballot order.	
Names of all parties/independent political bodies are correctly spelled	
Ballot contains correct office title information: <ul style="list-style-type: none">○ Office titles are correctly spelled○ District-level office titles include the district number○ Office titles include correct number of vacancies to be filled (vote for one; vote for not more than _____)	
All “cross-nominated” candidates have next to or underneath their names the names of all parties/political bodies which nominated them.	
Opposite each candidate’s name (and each party/political body in the case of the straight party area) is a block, oval or other appropriate “target area” whereby the voter can select his/her choices.	
Each office contains the appropriate number of write-in spaces	

Election Year _____

County Name _____

Precinct Name _____

Instructions and Usability	
	Y/N
Are the general instructions clear about what the voter is being asked to do in order to properly cast his/her votes?	
Do the write-in instructions warn the voter not to write in the name of a candidate whose name appears on the ballot for that office?	
Do the instructions tell the voter what to do if he/she has made a mistake?	
Is the beginning and end of each office clearly defined?	
Are the instructions for each individual office clear?	
Do the instructions warn the voter about undervotes?	
Do the instructions warn the voter about overvotes?	
In the case of ballot screens for electronic voting systems, does the ballot contain a review screen?	
In the case of ballot screens for electronic voting systems, does the ballot contain clear instructions on what the voter must do to cast the ballot after the voter has reviewed his or her choices?	

COMMENTS:

Election Year _____

County Name _____

Precinct Name _____

PRIMARY SPECIMEN BALLOT REVIEW CHECKLIST

Statutory and General Requirements	
	Y/N
Specimen ballot contains the name of the county; the election district and/or ward and division number.	
All offices and ballot questions are represented on the ballot. (<i>Verify using official candidate list and certification report sent to county.</i>)	
All special elections and ballot questions are included on the “non-partisan” ballot for unaffiliated, political body and minor political party voters.	
All candidates are included on the ballot.	
All candidates are in correct ballot order.	
Either the county (for statewide and multi-county offices) or the municipality of residence is included next to the name of each candidate.	
Names of all parties and independent political bodies (if applicable) are correctly spelled.	
Ballot contains correct office title information: <ul style="list-style-type: none">○ Office titles are correctly spelled○ District-level office titles include the district number○ Office titles include correct number of vacancies to be filled (vote for one; vote for not more than _____)	
All “cross-nominated” candidates for special elections have next to or underneath their names the names of all parties/political bodies which nominated them.	
Opposite each candidate’s name (and each party/ political body in the case of the straight party area, if applicable) is a block, oval or other appropriate “target area” whereby the voter can select his/her choices.	
Each office contains the appropriate number of write-in spaces	

Election Year _____

County Name _____

Precinct Name _____

Instructions and Usability	
	Y/N
Are the general instructions clear about what the voter is being asked to do in order to properly cast his/her votes?	
Do the write-in instructions warn the voter not to write in the name of a candidate whose name appears on the ballot for that office?	
Do the instructions tell the voter what to do if he/she has made a mistake?	
Is the beginning and end of each office clearly defined?	
Are the instructions for each individual office clear?	
Do the instructions warn the voter about undervotes?	
Do the instructions warn the voter about overvotes?	
In the case of ballot screens for electronic voting systems, does the ballot contain a review screen?	
In the case of ballot screens for electronic voting systems, does the ballot contain clear instructions on what the voter must do to cast the ballot after the voter has reviewed his or her choices?	

COMMENTS: