At its mid-year meeting in Indianapolis, the NPCA Quality Assurance Committee made updates and changes to the NPCA QC Manual in a number of sections.

The format for notifying members and certified plants of these changes will not change in 2020. Members and certified plants be notified of changes in Certification Express emails distributed to the designated primary and secondary contacts and liaison to the auditor. A letter outlining changes will also be mailed to the liaison to the auditor for each certified plant location.

The 14th Edition of the Quality Control Manual will include several changes, and editorial updates that will take effect at the start of the 2020 program year. Please see the posted manual for all of the editorial changes made in red highlighted text. Members will have the opportunity to review and comment on the changes during a 60-day comment period from Nov. 1, 2019 to Dec. 31, 2019.

The Table of Contents has been renumbered as required to accommodate the changes in language throughout the manual as detailed below.

Under FOREWORD:

Updated the Quality Assurance Committee roster to reflect the membership of the 2018 – 2019 committee members. The first edition of the NPCA QC Manual was published in 1987 in consultation with the members of the National Precast Concrete Association and has been revised regularly since then. The fourteenth edition for 2020 was approved October 2019 by NPCA’s Quality Assurance committee.

NPCA Quality Assurance Committee Members (2018 - 2019):

- Andrew Nashawaty, Scituate Concrete Pipe Corp. (Chairman)
- Joel Sheets, Tindall Corporation (Board Liaison)
- Eric Barger, C.R. Barger & Sons Inc.
- Frank Bowen, Rosetta Hardscapes
- Lynn Grimm, Lindsay Precast Inc
- Marvin Hanks, ParkUSA
- Hugh Martin, Oldcastle Infrastructure
- Kelly Patterson, Columbia Precast Products LLC
- Jay Sajadi, Florida Department of Transportation
- Rusty Stever, Jensen Precast
- Jason Tucker, Texas Department of Transportation
- Javier Vela, Forterra Pipe and Precast
- James Walker, Wilbert Vaults of Houston
- Drew Wieser, Wieser Concrete Products Inc.
Under Section 1.1.2 Plant-Specific Quality Control Manual:
1.1.2.10 was clarified regarding product dimensional tolerances. In addition, an Education example was added to the commentary under 1.1.4 Continuous Improvement.

STANDARD

1.1.2 Plant-Specific Quality Control Manual

The plant shall have a plant-specific QC manual that details the production and QC policies and procedures used by the plant. The manual shall be compiled in one notebook or binder for easy review by plant personnel or by an inspector. At a minimum, the manual shall include the requirements of this manual and the following sections:

1. Management QC policy statement
2. Company QC personnel organizational chart
3. Description of responsibilities for QC personnel
4. Description of training requirements for QC personnel, production staff, forklift operators and drivers.
5. Housekeeping plan
6. Product pre-pour, casting, post-pour and final inspection procedures
7. Plant curing procedures for all seasons
8. Minimum strength requirements for stripping and shipping product
9. Product repair policy and procedures
10. **Product dimensional tolerances unless shown on product detail drawings and/or production documentation.**
11. Form tolerances and maintenance policy
12. Mix design qualification and testing procedures
13. Raw material testing policy and procedures
14. Equipment calibration policy and procedures
15. Product performance test policy and procedures applicable to Chapter 6

COMMENTARY

A plant-specific quality control procedural manual should specifically define any attributes or practices unique to the plant. The plant specific manual should be reviewed a minimum of every twelve (12) months and updated as necessary.

Standard Operating Procedures (SOP) are a good way to define QC expectations.

A review process of all QC records should be incorporated into the plant’s QC operations with the intent of continually improving operations and quality. This can include a periodic review of documentation indicating nonconforming materials, production procedures and/or products and establishing appropriate corrective action.

Products manufactured
16. Examples of all documentation and forms used by plant to record QC and production processes

17. Documentation of products manufactured under franchise or licensing agreements, including all design specifications and drawings.

Under Section 1.1.4 Continuous Improvement: COMMENTARY

An additional example for education was added.

STANDARD

1.1.4 Continuous Improvement

The plant shall engage in continuous improvement activities each and every year and keep on file objective evidence of these activities in the form of documentation, policies and procedures, and visual example.

Continuous improvement activities shall be demonstrated in one or more of the following areas:

1. Production
2. Processes
3. Facilities
4. Operational

COMMENTARY

By definition, ‘continuous improvement’ is an ongoing effort to improve products, services or processes. Organizations efforts can seek incremental improvement over time or breakthrough improvement all at once.

Examples of Continuous Improvement Activities that qualify include, but are not limited to:

Production: Documented rearrangement of the production floor based on work flow or new product introduction.
Process: A documented 5s or 6s activity in the plant.
Process: Batching Kaizen – using quality data (raw
In order to be considered for continuous improvement points, the plant shall first, at a minimum do two of the following:

1. Actively participate in the Producer Portal (see Part 2.5 of the Plant Terms and Conditions);
2. Perform semi-annual self-audits using the self-audit tool available in the Producer Portal (see example Self-Audit report in Appendix B);
3. Educate plant staff beyond quality personnel (see Part 2.5 of the Plant Terms and Conditions).

As an Education example, the plant may register for a free NPCA one-hour webinar and train the entire plant over a lunch hour. Alternatively, the plant may also register for four free 15-minute Precast Learning Labs and use them as plant-wide toolbox talks while collecting signatures to prove attendance.

Under Section 2.3.5 Fiber Reinforcement: COMMENTARY language was removed.

**STANDARD**

2.3.5 Fiber Reinforcement

Data shall be provided to show conclusively that the type, brand, quality and quantity of fibers to be included in the concrete mix are not detrimental to the concrete or to the precast concrete product.

**COMMENTARY**

Only two types of fibers are typically used: synthetic and steel fibers. Fibers should not be used to replace primary structural reinforcing steel.
Fiber reinforced concrete shall conform to ASTM C1116, “Standard Specification for Fiber-Reinforced Concrete and Shotcrete,” (Type I or Type III).

Synthetic fibers are typically used in concrete to reduce plastic shrinkage cracks and/or to improve impact resistance. They can help to reduce chipping of products that are stripped. Synthetic fibers do not increase the compressive strength of concrete. Synthetic fibers are characterized as micro or macro fibers. Micro fibers are typically used to reduce plastic shrinkage cracks and improve impact resistance. Macro fibers can be used in some situations as secondary reinforcement.

Steel and some synthetic fibers increase the flexural strength of concrete, but the concrete mix should be designed so that the mix is workable. It is important to follow manufacturer’s instructions on introducing the fibers into the mix and on safety precautions.

Under Section 4.5.3 Curing with Heat and Moisture: the frequency of testing was modified.
Concrete shall not be subjected to steam, hot air, or other means of accelerated curing until after the concrete has attained its initial set. This does not include chemical admixtures. Record the initial set of the concrete (ASTM C403) a minimum of once quarterly when heat-curing. Steam, if used, shall be applied within a suitable enclosure that permits free circulation of the steam. If hot air is used for curing, precautions shall be taken to prevent moisture loss from the concrete. These requirements do not apply to products cured with steam under pressure in an autoclave.

The ambient curing temperature (for both wet-cast and dry-cast products) shall be monitored and documented a minimum of once per week, when employing accelerated curing with heat and moisture. The plant shall then establish an ambient curing cycle that ensures that the ambient curing temperature does not exceed 150 degrees F (65 degrees C) unless measures to prevent delayed ettringite formation (DEF) are employed. In addition, the rise in ambient curing temperature shall be limited to a maximum of 40 degrees F (22 degrees C) per hour.

Gas-fired heaters shall not be used to directly heat exposed concrete surfaces due to the risk of severe carbonation of the concrete.

This section applies to curing with heat and moisture for the purposes of accelerating the strength gain of the concrete, not the maintenance of form and/or ambient temperatures at relatively low temperatures. Accelerated curing heat should not be applied to concrete until about 30 minutes after initial set of the concrete. Initial set can be determined in accordance with ASTM C403, “Standard Test Method for Time of Setting of Concrete Mixtures by Penetration Resistance.” If heat is applied too soon, concrete can be damaged permanently. It is important that the heat does not dry out the surface of the concrete, otherwise the concrete near the surface will be weak and chalky. Concrete cured with heat will gain strength rapidly, but long-term strength gains are reduced.

Under Section 6.2.1.2 Three-Edge Bearing Testing – Add optional testing to the Standard:

<table>
<thead>
<tr>
<th>STANDARD</th>
<th>COMMENTARY</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.2.1.2Three-Edge Bearing Testing *</td>
<td>* Critical Requirement – plants participating in the NPCA Plant Certification Program must receive a minimum passing grade,</td>
</tr>
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</table>
shall be a minimum of one test per year for each size (and class) of pipe, or as described below, whichever is greater. TEB tests are not required for sizes that have less than 100 pieces manufactured during the current program year if the plant has compressive and proof of design test data on file. Current test reports shall be dated not more than one year at the end of the month from the date of the last test or certification.

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Class</th>
<th>Test Frequency*</th>
</tr>
</thead>
<tbody>
<tr>
<td>12” – 15”</td>
<td>Class V and below</td>
<td>1 / 1000 pieces</td>
</tr>
<tr>
<td>18” – 36”</td>
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<tr>
<td>18” – 36”</td>
<td>Class V</td>
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</tr>
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<td>Class III and below</td>
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</tr>
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<td>1 / 200 pieces</td>
</tr>
<tr>
<td>66” and larger</td>
<td>All Classes</td>
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</tr>
</tbody>
</table>

For unreinforced concrete pipe, verification of conformance to applicable standards (ASTM C14 and C985) shall be demonstrated by performance of three-edge bearing testing in accordance with ASTM C497. The plant shall test up to the specified design strength ultimate load at the frequency required by the project specifications.

For pipe designed by direct methods with standard installations, three-edge bearing shall not be required.

If allowed by project specifications or authority having jurisdiction, compressive strength cylinder testing and companion rational design calculations may replace TEB testing.

Unless otherwise required by project specifications, three-edge bearing testing of elliptical and arch pipe shall not be required.
Under Section 6.2.2.2 Three-Edge Bearing Testing – Add optional testing to the Standard:

**STANDARD**

6.2.2.2 Three-Edge Bearing Testing *

For reinforced concrete pipe, verification of conformance to applicable standards (ASTM C76 and C655) shall be documented by performance of three-edge bearing testing in accordance with ASTM C497. The plant shall load the pipe up to the specified design strength D-load to produce a 0.01-inch crack. Test frequency shall be a minimum of one test per year for each size (and class) of pipe, or as described below, whichever is greater. TEB tests are not required for sizes that have less than 100 pieces manufactured during the current program year if the plant has compressive and proof of design test data on file. Current test reports shall be dated not more than one year at the end of the month from the date of the last test or certification.

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* Critical Requirement – plants participating in the NPCA Plant Certification Program must receive a minimum passing grade, as shown on the grading schedule, for section 6.2.2.2 and others designated as Critical Requirements, when applicable.

Three-edge bearing testing is critical since it is an industry-accepted method of verifying the strength and design of the pipe.

For unreinforced concrete pipe, verification of conformance to applicable standards (ASTM C14 and C985) shall be demonstrated
by performance of three-edge bearing testing in accordance with ASTM C497. The plant shall test up to the specified design strength ultimate load at the frequency required by the project specifications.

For pipe designed by direct methods with standard installations, three-edge bearing shall not be required.

If allowed by project specifications or authority having jurisdiction, compressive strength cylinder testing and companion rational design calculations may replace TEB testing.

Unless otherwise required by project specifications, three-edge bearing testing of elliptical and arch pipe shall not be required.

Under the Plant Terms and Conditions – Section 5.2.2 Probationary Status

5.2.2 Probationary Certification status shall remain in effect until such time when the plant is re-audited and for a period not to exceed 90 calendar days from the previous audit and the conditions calling for probationary status no longer exist, as determined by the audit agency and/or NPCA or its agent. Plants failing to pay the applicable fee within 30 days of the invoice date and receive a re-audit of the plant within 90 days from the previous audit will not be considered for certification.

Under the Plant Terms and Conditions – Section 5.4.1 Corrective Actions:

5.4 Corrective Actions

5.4.1 All plants passing their audit (regardless of score) must respond in writing indicating corrective action taken, or the justification for not taking corrective action to all deficiencies noted in their report. All plants failing to submit a written response with documented evidence within 45 days of the plant audit will receive probationary status and be subject to the conditions set forth in section 5.2.1; Probationary Status.

Documented evidence shall be supplied (photographs, completed inspection forms, test results, copies of material certifications) to illustrate compliance to requirements and of the corrective action taken to both NPCA and the agency.

Under the Plant Terms and Conditions – Section 7.2 Audits and Certification
7.2.4 Plants that apply to the program, pay applicable fees, receive their initial inspection after September 30 will be granted certification through December 31st of the following calendar year (15 months). Certification fees beyond year one are due on or before December 31st of each year.

The balance of Section 7.2 will be renumbered

Under the Plant Terms and Conditions – Section 8.3 Product Listing

8.3.1 Plants participating in the NPCA Product Listing Program are required to pass a watertightness test on a tank model chosen at random by the inspector on the day of the plant’s inspection each program year to maintain listing.

The balance of Section 8.3 will be renumbered

Under The Plant Terms and Conditions – Section 8.4 Renewal and Expiration:

8.4 Renewal and Expiration

8.4.1 The plant’s certification status shall be effective starting on the date of the initial audit, pending successful performance during the initial audit and subsequent re-audit, as detailed in the final audit report prepared by the audit agency. For NPCA Product Listing status shall be effective starting on the date of the passed plant audit and approval of the submittal package.

8.4.2 Upon renewal of NPCA certification each year, the plant gives NPCA permission to send electronic copies of plant inspection documents (reports, corrective actions to all deficiencies, and addendums) to a Department of Transportation (DOT) if so required by the DOT. NPCA will notify the plant of any request.

8.4.3 If the plant has not submitted payment of the program fees and any other paperwork required by the applicable program by January 1st each year, the plant’s certification shall automatically expire.

8.4.4 If the plant that has been decertified for any reason in the past, the plant shall agree to the following:
8.4.4.1 If the plant is decertified the plant is responsible for all applicable fees required to reenter the program as a new plant to the program. Additionally, plants that have been decertified will have their anniversary dates reset to the date of when they reentered the program.

8.4.4.2 Payment of all prior financial obligations must be made prior to renewal of this agreement or any other agreement regarding NPCA Plant Certification.

8.4.4.3 If a plant is decertified, all product listings are terminated.

Comments shall be made in writing: A website link to a comment form is needed or members can respond with comments via email to pcutle@precast.org.

Should you have any questions about the changes to the NPCA Quality Control Manual for Precast Concrete Plants 14th Edition, changes for program year 2020, please contact Phillip Cutler, P.E., director of quality assurance programs, pcutler@precast.org, (800) 366-7731