

## **ADDENDUM January 2018**

### **Updates for the 13<sup>th</sup> Edition NPCA QC Manual**

#### **QCM-001, Rev. 0, 1-1-18**

The NPCA Quality Assurance Committee has again raised the bar on quality for NPCA Plant Certification. The format of notifying members and certified plants of these changes will not change for 2018. All members and certified plants will receive multiple email blasts through Certification Express to the designated primary and secondary contact for each NPCA member and certified plant.

There are a number of changes, additions and several updates along with editorial changes to the 13<sup>th</sup> Edition for program year 2018 and membership will have a 60-day review and comment period that begins November 1, 2017 and ends on December 31, 2017.

Changes for 13<sup>th</sup> Edition – January 2018 are as follows:

The Table of Contents has been renumbered to accommodate expanded and/or new language throughout the manual as detailed below.

#### **On page 1 under FOREWORD:**

Changed the Quality Assurance Committee roster to reflect the membership of the 2016 – 2017 committee.

#### **On page 5 under DISCLAIMERS:**

Added item 4: Codes that do not apply to the NPCA Plant Certification Program include Building Energy Code, Building Fire Code, and Underwriters Laboratory.

#### **Beginning on page 13 under 2.2.2 Aggregates:**

##### 2.1.2 Aggregates

Fine and Coarse aggregates shall conform to the requirements of ASTM C33, "Standard Specification for Concrete Aggregates." In addition, aggregates shall be evaluated **per ASTM C1778,"Standard Guide for Reducing Risk of Deleterious Alkali-aggregate reaction on Concrete"** and documentation maintained on file at the plant for potential deleterious expansion due to alkali reactivity, unless the aggregates are received from a state department of transportation approved source **and are known not to be reactive**. Evidence of compliance shall be a certification from the supplier that the aggregate meets the ASTM C33 standard.

#### 2.1.2.1 Aggregate Gradation

Fine aggregate shall be tested for gradation for each 1,500 tons (1,350 metric tons) of fine aggregate used, or once a month, whichever occurs first.

**On page 26 under 3.1.1.3 Section added for Dry-cast / Zero Slump Concrete:**

#### 3.1.1.3 Dry-Cast / Zero Slump Concrete

Plants using dry-cast / zero slump concrete shall include specific quality control procedures in their plant-specific QC manual, as discussed in 1.1.2. At a minimum, detailed written procedures shall address the steps necessary for initial mix qualification and subsequent daily quality control operations.

Initial mix qualifications shall be documented in the plant files. Documentation shall, include trial batching and in-depth concrete testing. Mix qualification procedures shall include the establishment of acceptable tolerance ranges for test results of daily quality control testing.

Subsequent daily quality control operations must follow the daily quality control testing acceptance criteria established during the initial mix qualification.

The remaining subsection were renumbered.

**On page 37 under COMMENTARY of Section 4.1.3, added language:**

*Forms that are well built and properly maintained can be used almost daily for 20 years or more. Quality forms are rugged yet produce surface defect -free products within dimensional tolerances. Typically, form dimension tolerances should be about half the product tolerances specified.*

***Follow your form manufacturers form leveling and setup recommendations.***

*It is suggested that plants give each piece of forming equipment a unique identification number in order to easily track and document their measurements*

**On page 70 under Section 4.8.6 Plant Requirements, removed language:**

#### 4.8.6 Plant Requirements:

1. Storage areas shall be maintained firm and level such that products are not damaged during handling and do not sink into the ground.
2. Products shall be stored to minimize damage.
3. The QC Inspector shall inspect the storage area and the stored product daily.
4. A final inspection of products prior to shipment shall be made. This inspection shall be documented in the plant records. The inspection shall include verification that the product conforms to project specifications, plans and other contract documents, contains the proper post-pour inspection markings, and that repairs have been made and inspected where needed.

5. ~~The QC Inspector shall spot check the final inspection of the products, loading and tie-down procedures. Removed~~

**Beginning on page 76 Section 5.3 CONCRETE TESTING, added language:**

5.3 CONCRETE TESTING \*

For all concrete testing, plant personnel shall take immediate corrective action whenever the test result does not fall within the established acceptable tolerance range from the documented initial mix qualification.

5.3.1 Slump, Slump Flow, and Visual Stability Index

5.3.1.1 Slump

A slump test shall be performed for each 150 cubic yard (115 cubic meters) of concrete **of each mix design**, or once a day, whichever comes first. Slump tests shall be performed in accordance with ASTM C143, "Standard Test Method for Slump of Hydraulic-Cement Concrete." SCC, no-slump, or dry-cast concrete does not need to be tested for slump.

5.3.1.2 Slump Flow and Visual Stability Index

For SCC mixtures, slump flow and Visual Stability Index (VSI) tests shall be performed each day by testing the first batch of SCC as defined by the initial mix qualification process. Reject the concrete if the upper specification limit is exceeded. If the slump flow test result is less than the lower production range limit reject the concrete unless the mixture has been approved for vibration and is subsequently vibrated. Thereafter, slump flow and VSI testing shall be performed as follows:

- When changing mix designs
- When changing raw materials,
- and
- As required in Section 5.2.2.2

Slump flow and VSI tests shall be performed in accordance with ASTM C1611 "Standard Test Method for Slump Flow of Self-Consolidating Concrete"

5.3.2 Temperature

The temperature of fresh concrete **of each mix design** shall be measured when slump or air content tests are made and when compressive test specimens are made. The measured concrete temperature shall be recorded together with other fresh concrete test data. Concrete temperature testing shall be performed in accordance with ASTM C1064, "Standard Test Method for Temperature of Freshly Mixed Portland Cement Concrete."

### 5.3.3 Density (Unit Weight)

Tests for density (unit weight) of fresh concrete **of each mix design** shall be performed a minimum of once per week or every 150 cubic yards, whichever occurs first, to verify the yield of batch mixes. Density tests shall be performed for each 100 cubic yards (75 cubic meters) of lightweight concrete or once per month, whichever occurs first. Tests shall be performed in accordance with ASTM C138, "Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete." **Unless otherwise specified density (unit weight) does not need to be tested for dry-cast concrete.**

### 5.3.4 Air Content

For all wet-cast concrete **of each mix design** containing air-entrainment, tests for air content shall be made for each 150 cubic yards (115 cubic meters) of concrete, but not less often than once each day. For all wet cast concrete made without air-entrainment, tests for air content shall be made whenever compressive strength specimens are cast, but not less often than once per week. Air content shall be determined by either the pressure method, ASTM C231, "Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method," or the volumetric method, ASTM C173, "Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method." A density (unit weight) test, performed in accordance with ASTM C138, may be substituted for ASTM C231 or ASTM C173 after a correlation between air content and density (unit weight) has been established. **Air content does not need to be tested for dry-cast concrete.**

**On page 85 on Table 5.3.6 c, added language to remarks:**

- 5.3.1 **for each mix design**
- 5.3.2 **for each mix design**
- 5.3.3 **for each mix design**, except lightweight concrete
- 5.3.3 **for each mix design**
- 5.3.4 **for each mix design**
- 5.3.5.3 **for each mix design**, wet cast concrete
- 5.3.5.3 **for each mix design**, dry cast concrete

**Beginning on page 87 under Section 6.2 CONCRETE PIPE REQUIREMENTS, added language:**

## 6.2 CONCRETE PIPE REQUIREMENTS

Plants producing concrete pipe shall specifically conform to the requirements in section 6.2 of this manual.

### **6.2.1 STORMWATER CONCRETE PIPE REQUIREMENTS**

#### 6.2.1.1 Reinforcing Steel Inspection \*

As required in Section 4.1.5 and 4.2.1, maintain documentation of reinforcing cage inspections with information on the required cage design versus the actual cage used, including WWR style, steel area, wire diameter, cage diameter, cage length, and welded/tied wire laps.

Concrete pipe reinforcing steel checks shall be performed on a minimum of one (1) reinforcing steel cages or 3% of each fabrication run daily, whichever is greater, chosen on a random basis by QC personnel, regardless of fabrication method. These checks shall be documented and maintained in the plant records for a minimum of three (3) years.

6.2.1 **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.

<u>Pipe Size</u>	<u>Class</u>	<u>Test Frequency*</u>
12" – 15"	Class V and below	1 / 1000 pieces
18" – 36"	Class IV and below	1 / 800 pieces
18" – 36"	Class V	1 / 400 pieces
42" – 60"	Class III and below	1 / 400 pieces
42" – 60"	Class IV and V	1 / 200 pieces
66" and larger	All Classes	As require by project specifications

~~\* In addition to the above testing requirements, a minimum of one test per year to ultimate load shall be performed on each size and class up to 60" of pipe manufactured to verify that the applicable specified ultimate load can be achieved.~~

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 for installed conditions **by direct methods** with soil interaction **standard installations**, three-edge bearing shall not be required.

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

### 6.2.1.3 Absorption Testing \*

Verification of conformance to the concrete absorption requirements of applicable standards shall be documented by performance of absorption testing in accordance with ASTM C497 (Test Method A or B). **Absorption testing can be performed by ASTM C642 using cores only and the absorption limits of ASTM C76 shall apply.** Testing shall be performed a minimum of once per year, on the mix design **(both wet-cast and dry-cast)** with the lowest amount of cementitious material used at each operation or manufacturing station. Both in-plant and laboratory testing shall be permitted.

### 6.2.1.4 Dimensional Checks

Verification of conformance to applicable dimensional requirements shall be performed and documented on a minimum of three concrete pipes or 3% of each day's production, whichever is greater, chosen randomly by plant quality control personnel.

Normal Post-pour inspection requirements apply to both wet-cast and dry-cast / machine-cast pipe, as required in Sections 4.6.4 and 4.6.5.

At a minimum, dimensional checks shall include internal diameter, wall thickness, and length of two opposite sides (measured directly across from each other). Joints must be checked for dimensional conformance with either manufacturer's specifications, applicable standards and/or specifying authorities. If project specifications or the authority having jurisdiction requirements are more stringent then they shall apply.

### 6.2.1.5 Joint Design and Testing

Joints shall be designed according to the applicable requirements in ASTM C443, ASTM C990, or as required by project ~~requirements~~ **specifications**. Critical dimensions and allowable tolerances shall be clearly indicated on the resulting joint design drawings. Joint designs drawings must be kept on file and readily available for routine and audit inspection personnel.

The plant shall perform and document joint proof-of-design leakage testing on each size of gasketed pipe produced at the plant. Testing shall be repeated whenever joint or gasket designs are modified. Joint proof-of-design testing, unless otherwise required by the authority or authorities having jurisdiction, shall consist of either vacuum or hydrostatic testing conducted in two configurations:

- 1) Assembled in-line (rectilinearly) and
- 2) Assembled with one side of the joint open 1/2-in. more than the opposite side.

### 6.2.1.6 Watertightness Hydrostatic Testing

Testing shall be performed according to the hydrostatic test method set forth in ASTM C497. Any water leaking from the joint being tested must be collected for measurement at the end of the test. Pipe shall be tested up to 3.0 psi for 10 minutes and the leakage shall not exceed:

0.041 oz / (inch internal pipe dia.)(ft. of pipe length)

Pipe that does not pass this test may be repaired and retested.

**This test shall be performed initially or whenever equipment or processes change.**

### 6.2.1.7 Watertightness Vacuum Testing

Testing shall be performed with a negative test pressure (vacuum) equivalent to 7 inches of mercury. The pipe being tested shall maintain a minimum of 6.9 inches of mercury throughout the test time period ( $T_{\text{test}}$ ), which is calculated as follows:

$$T_{\text{test}} \text{ (seconds)} = 1.5 \times \text{internal diam. of the pipe (inches)}$$

If the pipe being tested does not hold the required vacuum, it may be repaired and retested.

This test shall be performed initially or whenever equipment or processes change.

### 6.2.1.8 Gasket Quality Control

The plant shall ensure that the rubber joint gaskets supplied with precast and pipe products are suitable for the application. This suitability shall be determined through the following:

1. Annual certification of physical properties of the rubber compound as required by the specification under which the gaskets are supplied; and
2. Measurement or certification of critical gaskets physical characteristics including (at a minimum):
  - Cross-section height and width (profile and prelubricated gaskets only)
  - Volume (ASTM C497) and diameter (o-ring gaskets only)
  - Durometer (ASTM D2240)
  - Cut length (ASTM C497)
  - Splice strength

Measurement or certification shall be accomplished by any of the following methods:

- a. The gasket supplier shall furnish documentation of the required characteristics by sampling at least 1 gasket each quarter of each size and type supplied and provide the aforementioned measurements for those gaskets; or
- b. The gasket supplier shall furnish evidence of current registration of its quality system to a recognized third-party audited standard (e.g. – ISO 9001-2000) and certify that the aforementioned measurements are recorded and maintained within this system once per year; or
- c. Using specifications and tolerances as supplied by the gasket manufacturer and the precast manufacturer, the precast manufacturer or a competent third party technical service shall perform the aforementioned measurements above by sampling at least 1 of each 300 gaskets of each size and type received and maintain records of the measurements made. (If project specifications or the authority having jurisdiction require a frequency of testing greater than 1/300 then they shall apply.)

If any of the measurements required above indicate that the gasket is not within acceptable tolerances, additional testing shall be performed to determine if the remainder of the lot should be used. Gaskets which are not within acceptable tolerances shall be segregated from usable stock and clearly marked so as to preclude their use or transfer.

### 6.2.1.9 Plant Requirements:

1. As required in Section 4.1.5, 4.2.1 and 6.2.1, maintain documentation of reinforcing cage inspections with information on the required cage design versus the actual cage used.

2. Three-edge bearing testing techniques of concrete pipe, per ASTM C497 when required by the applicable ASTM standard, shall be witnessed by the agency inspector during an NPCA Plant Certification inspection. The plant inspector shall witness all three-edge bearing tests.
3. Test records and dimensional check documentation shall be maintained at the plant for a minimum of three (3) years.
4. Detailed reinforcing cage design drawings shall be readily available in the steel fabrication/production area.
5. Gasket certification records and/or quality control records shall be maintained at the plant for a minimum of three (3) years.
6. Joint design and proof-of-design testing documentation shall be maintained on file at the plant indefinitely.
7. As required in Section 4.1.3, maintain documentation of pallet, header and truing rings as long as each respective piece of forming equipment is in use at the plant.

## 6.2.2 SANITARY CONCRETE PIPE REQUIREMENTS

### 6.2.2.1 Reinforcing Steel Inspection \*

As required in Section 4.1.5 and 4.2.1, maintain documentation of reinforcing cage inspections with information on the required cage design versus the actual cage used, including WWR style, steel area, wire diameter, cage diameter, cage length, and welded/tied wire laps.

Concrete pipe reinforcing steel checks shall be performed on a minimum of one (1) reinforcing steel cages or 3% of each fabrication run daily, whichever is greater, chosen on a random basis by QC personnel, regardless of fabrication method. These checks shall be documented and maintained in the plant records for a minimum of three (3) years.

### 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.



Pipe Size	Class	Test Frequency*
12" – 15"	Class V and below	1 / 1000 pieces
18" – 36"	Class IV and below	1 / 800 pieces
18" – 36"	Class V	1 / 400 pieces
42" – 60"	Class III and below	1 / 400 pieces
42" – 60"	Class IV and V	1 / 200 pieces
66" and larger	All Classes	As require by project specifications

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 for installed conditions by direct methods with soil interaction standard installations, three-edge bearing shall not be required.

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

#### 6.2.2.3 Absorption Testing \*

Verification of conformance to the concrete absorption requirements of applicable standards shall be documented by performance of absorption testing in accordance with ASTM C497 (Test Method A or B). Absorption testing can be performed by ASTM C642 using cores only and the absorption limits of ASTM C76 shall apply. Testing shall be performed a minimum of once per year, on the mix design (both wet-cast and dry-cast) with the lowest amount of cementitious material used at each operation or manufacturing station. Both in-plant and laboratory testing shall be permitted.

#### 6.2.2.4 Dimensional Checks

Verification of conformance to applicable dimensional requirements shall be performed and documented on a minimum of three concrete pipes or 3% of each day's production, whichever is greater, chosen randomly by plant quality control personnel.

Normal Post-pour inspection requirements apply to both wet-cast and dry-cast / machine-cast pipe, as required in Sections 4.6.4 and 4.6.5.

At a minimum, dimensional checks shall include internal diameter, wall thickness, and length of two opposite sides (measured directly across from each other). Joints must be checked for dimensional conformance with either manufacturer's specifications, applicable standards and/or specifying authorities. If project specifications or the authority having jurisdiction requirements are more stringent then they shall apply.

#### 6.2.2.5 Joint Design and Testing

Joints shall be designed according to the applicable requirements in ASTM C361, C1628, or as required by the project specifications. Critical dimensions and allowable tolerances shall be clearly indicated on the resulting joint design drawings. Joint designs drawings must be kept on file and readily available for routine and audit inspection personnel.

If required by the project specifications or authority having jurisdiction, joint design and testing shall be performed in accordance with ASTM C361.

If required by the project specifications or authority having jurisdiction, joint design and testing shall be performed in accordance with ASTM C 1628.

The plant shall perform and document joint proof-of-design leakage testing on each size of gasketed pipe produced at the plant. Testing shall be repeated whenever joint or gasket designs are modified. Joint proof-of-design testing, unless otherwise required by the authority or authorities having jurisdiction, shall consist of either vacuum or hydrostatic testing conducted in two configurations:

- 1) Assembled in-line (rectilinearly) and
- 2) Assembled with one side of the joint open 1/2-in. more than the opposite side.

#### 6.2.2.6 Watertightness Hydrostatic Testing

If required by the project specifications or authority having jurisdiction, testing shall be performed according to the hydrostatic test method set forth in ASTM C361. Pipe shall be tested up to 13.0 psi for 2 – ½ minutes with no leakage.

If required by the project specifications or authority having jurisdiction, testing shall be performed according to the hydrostatic test method set forth in forth in ASTM C1628. Pipe shall be tested up to 13.0 psi for 2 – ½ minutes with no leakage.

#### 6.2.2.7 Watertightness Requirements

If required by project specifications or the authority having jurisdiction, plants shall perform watertightness testing per the following:

Size	Frequency	Method	Test Criteria
12-36"	100%	Vacuum	ASTM C1618
12-36"	100%	Hydrostatic	ASTM C497
42" >	1 per 100	Vacuum	ASTM C1618
42" >	1 per 100	Hydrostatic	ASTM C497

#### 6.2.2.8 Off-Center Joint Proof of Design Testing

If required by project specifications or the authority having jurisdiction, plants shall perform and maintain records of Off-Center Joint Proof of Design testing per ASTM C497 on each applicable size of gasketed pipe. Testing shall be repeated whenever joint or gasket designs are modified.

#### 6.2.2.9 Joint Shear Proof of Design Testing

If required by project specifications or the authority having jurisdiction, plants shall perform and maintain records of Joint Shear Proof of Design testing per ASTM C497 on each applicable pipe size of gasketed pipe. Testing shall be repeated whenever joint or gasket designs are modified.

#### 6.2.2.10 Confined Gasket Proof of Design Testing

If required by project specifications or the authority having jurisdiction, plants shall perform and maintain records of Confined Gasket Proof of Design Testing per ASTM C361. Testing shall be repeated whenever joint or gasket designs are modified.

If required by project specifications or the authority having jurisdiction, plants shall perform and maintain records of Confined Gasket Proof of Design Testing per ASTM C1628. Testing shall be repeated whenever joint or gasket designs are modified.

#### 6.2.2.11 Gasket Quality Control

The plant shall ensure that the rubber joint gaskets supplied with precast and pipe products are suitable for the application. This suitability shall be determined through the following:

1. Annual certification of physical properties of the rubber compound as required by the specification under which the gaskets are supplied; and
2. Measurement or certification of critical gaskets physical characteristics including (at a minimum):
  - Cross-section height and width (profile and prelubricated gaskets only)
  - Volume (ASTM C497) and diameter (o-ring gaskets only)
  - Durometer (ASTM D2240)
  - Cut length (ASTM C497)
  - Splice strength

Measurement or certification shall be accomplished by any of the following methods:

- a. The gasket supplier shall furnish documentation of the required characteristics by sampling at least 1 gasket each quarter of each size and type supplied and provide the aforementioned measurements for those gaskets; or
- b. The gasket supplier shall furnish evidence of current registration of its quality system to a recognized third-party audited standard (e.g. – ISO 9001-2000) and certify that the aforementioned measurements are recorded and maintained within this system once per year; or
- c. Using specifications and tolerances as supplied by the gasket manufacturer and the precast manufacturer, the precast manufacturer or a competent third party technical service shall perform the aforementioned measurements above by sampling at least 1 of each 300 gaskets of each size and type received and maintain records of the measurements made. (If project specifications or the authority having jurisdiction require a frequency of testing greater than 1/300 then they shall apply.)

If any of the measurements required above indicate that the gasket is not within acceptable tolerances, additional testing shall be performed to determine if the remainder of the lot should be used. Gaskets which are not within acceptable tolerances shall be segregated from usable stock and clearly marked so as to preclude their use or transfer.

#### 6.2.12 Plant Requirements:

1. As required in Section 4.1.5, 4.2.1 and 6.2.1, maintain documentation of reinforcing cage inspections with information on the required cage design versus the actual cage used.
2. Three-edge bearing testing techniques of concrete pipe, per ASTM C497 when required by the applicable ASTM standard, shall be witnessed by the agency inspector during an NPCA Plant Certification inspection. The plant inspector shall witness all three-edge bearing tests.
3. Test records and dimensional check documentation shall be maintained at the plant for a minimum of three (3) years.
4. Detailed reinforcing cage design drawings shall be readily available in the steel fabrication/production area.
5. Gasket certification records and/or quality control records shall be maintained at the plant for a minimum of three (3) years.
6. Joint design and proof-of-design testing documentation shall be maintained on file at the plant indefinitely.
7. As required in Section 4.1.3, maintain documentation of pallet, header and truing rings as long as each respective piece of forming equipment is in use at the plant.

#### **On page 99 under Section 6.3.3.1 Absorption Testing \*, language added:**

##### 6.3.3 Base, Riser and Cone Sections

##### 6.3.3.1 Absorption Testing \*

Verification of conformance to the concrete absorption requirements of ASTM C478 shall be documented by performance of absorption testing in accordance with ASTM C497 (Test Method A or B). Absorption testing can be performed by ASTM C642 using cores only and the absorption limits of ASTM C478 shall apply. Testing shall be performed a minimum of once per year, on the mix design (both wet-cast and dry-cast) with the lowest amount of cementitious material used at each operation or manufacturing station. Both in-plant and laboratory testing shall be permitted.

#### **On page 102 under Section 6.4.1 Absorption Testing, language added:**

##### 6.4.1 Absorption Testing

Absorption testing shall be performed and documented in accordance with ASTM C497 (Test Method A or B). Absorption testing can be performed by ASTM C642 using cores only and the absorption limits of ASTM C76 or C478 shall apply. Testing shall be performed a minimum of once per year, on the mix

design with the lowest amount of cementitious material at each operation or manufacturing station. Both in-plant and laboratory testing shall be permitted.

**On page 142 under PLANT TERMS AND CONDITIONS, PART 5, Subsection 5.2.2 wording change:**

5.2.2 Probationary Certification status shall remain in effect until such time when the plant is re-audited **or** **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 and receive a re-audit of the plant will not be considered for certification.

**Beginning on page 157, Grading Schedule, new sections added for Sanitary Concrete Pipe:** Schedule is not included in this document.

**APPENDIX A has been updated under ASTM Standards cited in the manual and Additional Relevant Precast Concrete Product-Specific ASTM International Standards:**

**Removed:**

- ASTM A416 “Standard Specification for Steel Strand, Uncoated Seven-Wire for Prestressed Concrete”
- ASTM C67 “Standard Test Method for Sampling and Testing Brick and Structural Clay Tile”
- ASTM C117 “Standard Test Method for Materials Finer than 75- $\mu$ m (No. 200) Sieve in Mineral Aggregates by Washing”
- ASTM C123 “Standard Test Method for Lightweight Particles in Aggregate”
- ASTM C142 “Standard Test Method for Clay Lumps and Friable Particles in Aggregates”

**Added:**

- ASTM C642 “Standard Test Method for Density, Absorption, and Voids in Hardened Concrete”
- ASTM C858 “Specification for Underground Precast Concrete Utility Structures”
- ASTM C1214 “Standard Test Method for Concrete Pipe Sewerlines by Negative Air Pressure (Vacuum) Test Method”
- ASTM C1244 “Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test Prior to Backfill”
- ASTM C1618 “Standard Test Method for Concrete Sanitary Sewer Pipe by Negative (Vacuum) or Positive Air Pressure”
- ASTM C1628 “Standard Specification for Joints for Concrete Gravity Flow Sewer Pipe, Using Rubber Gaskets”
- ASTM C1776 “ Standard Specification for Wet-Cast Precast Modular Retaining Wall Units”
- ASTM C1778 ”Standard Guide for Reducing Risk of Deleterious Alkali-aggregate reaction on Concrete”

- ASTM C1786 “Standard Specification for Segmental Precast Reinforced Concrete Box Sections for Culverts, Storm Drains and Sewers Designed According to AASHTO LRFD”
- ASTM C1818 “Standard Specification for Rigid Synthetic Fiber Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe”
- ASTM C1837 “Standard Specification for Production of Dry Cast Concrete Used for Manufacturing Pipe, Box, and Precast Structures”

Should you have any questions about the changes to the NPCA Quality Control Manual for Precast Concrete Plants 13<sup>th</sup> Edition, January 2018, please contact Phillip Cutler, P.E., director of quality assurance programs, [pcutler@precast.org](mailto:pcutler@precast.org), (800) 366-7731