
Prequalification Requirements For Precast Concrete Drainage Products

THIS EDITION HAS TWO DIVISIONS.

**DIVISION I THE REQUIREMENTS FOR PLANTS PREQUALIFIED IN
ACCORDANCE WITH CSA STANDARD A257 AND OPSS
1821.**

SEE PAGE 2

**DIVISION II THE REQUIREMENTS FOR PLANTS PREQUALIFIED IN
ACCORDANCE WITH CSA STANDARD A23.4.**

SEE PAGE 39.

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INTRODUCTION:

This document has been revised to include the requirements of CSA Standard A23.4 "Precast Concrete – Materials and Construction". The procedural requirements are found in Division II of this document.

DIVISION I

PRODUCTS MANUFACTURED IN ACCORDANCE WITH CSA A257 AND OPSS 1821 AND APPLICABLE ASTM STANDARDS.

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DIVISION I – PLANTS PREQUALIFIED TO CSA A257 AND OPSS 1821 AND APPLICABLE ASTM STANDARDS.

1.0 SCOPE

1.1 Background of the Plant Prequalification Program

The Ontario Water Resources Commission (OWRC) and the Ontario Concrete Pipe Manufacturers established the Plant Prequalification Program in 1965. The program was established to set uniform manufacturing standards, procedures and quality control to ensure that a high quality product was being delivered to all projects. The program was administered by the OWRC and subsequently, Ministry of the Environment (MOE) staff.

In 1990, the Ministry of the Environment withdrew from direct involvement in the administration of the program, and the Plant Prequalification Committee assumed overall responsibility for the program, including any administration previously carried out by the MOE. With this change in administration, the program was strengthened, as agencies directly affected by the quality of precast concrete drainage products were obligated to become more active in the program.

From 1992 until 1995, the Ontario Concrete Pipe Association worked with the Ministry of Environment as it went through changes in name, structure and mandate. The logo of the program was changed to reflect the change from MOE to MOEE, as the Ministry changed to the Ministry of Environment and Energy in the early 1990's. Then, in 1995, the MOEE passed its commitment to the Program to the Ontario Clean Water Agency (OCWA), since the staff that historically had an interest in quality control were transferred to OCWA. The Plant Prequalification Program enjoyed the participation of OCWA for about one year, but there was uncertainty about the role of the MOEE. The MOEE was still shown as a member of the Program Logo; however, OCWA participated on the Committee. OCWA reports to a Board of Directors that in turn reports to the Ministry of Environment and Energy. In late 1996, the situation was clarified as both the MOEE and OCWA withdrew from the Program. The MOEE's mandate had changed to administration and policy development, and OCWA was a commercial body that would purchase precast concrete drainage products for their projects.

After the withdrawal of the MOEE and OCWA, the partners left in the program were the Municipal Engineers Association (MEA), the Ministry of Transportation of Ontario (MTO), and the Ontario Concrete Pipe Association (OCPA). Since the concrete pipe industry works closely with Ontario Provincial Standards (OPS) in specification development and maintenance, it was a reasonable decision to approach OPS for involvement on the Plant Prequalification Advisory Committee, especially considering the direct relationship between the MTO and OPS.

Today, the Plant Prequalification Advisory Committee comprised of representatives from the MEA, MTO, OPS, OCPA and CPA administers the Plant Prequalification Program. The Committee activities are governed by the Prequalification Committee Function document, which is in Appendix G.

1.2 How the Plant Prequalification Program Works

Owners of infrastructure projects that purchase precast concrete drainage products from prequalified plants, receive products that have been tested for quality through the manufacturing process and inspected upon completion. Concrete drainage products supplied from a prequalified plant comply with the requirements of the latest editions of CSA standards for concrete pipe, CSA A257.1, A257.2, A257.3, A257.4, ASTM C507M, and OPSS 1351. Reinforced concrete box units (including three sided structures) shall comply with the latest edition of the Ontario Provincial Standards Specification (OPSS) 1821 and the Canadian Highway Bridge Design Code, CAN/CSA S6. Concrete Pressure Pipe complies with AWWA C301 or C302.

Application by any producer for a Prequalification Certificate is made through the Chair of the Plant Prequalification Advisory Committee. Applications shall cover the full range of products that the manufacturer wishes to be on the certificate covered by the standards listed above.

An Engineer is retained to carry out an independent inspection of the applicant's plant and Product. Samples of products are tested and the Engineer prepares a detailed report. The Engineer submits a letter to the Chair which states compliance or non-compliance with the prequalification requirements, together with a recommendation. The Chair issues the Prequalification Certificate. If the detailed inspection cannot be completed, the remaining required inspections shall be carried over to the following year(s) until all the required work can be completed. If product is produced that was not tested during the detailed inspection, sufficient product shall be set aside for testing by the engineer.

Annual intermediate inspections in the following two years shall continue and product made shall be sampled and tested as required.

The Certificate states the product to which the prequalification applies and is normally valid for 12 months after the date of issue.

Each year, plants are inspected by the Engineer that checks and tests to ascertain whether quality control and the standard of workmanship are being maintained at a satisfactory level. This is considered an intermediate inspection. Every third year, the Engineer undertakes detailed inspection and testing, and submits a report comparable to the original inspection for prequalification

A Prequalification Certificate may be cancelled at any time with respect to any product. The Manufacturer is given a limited amount of time to correct deficiencies, otherwise, the Prequalification Certificate is lost and the prequalification process shall start anew.

These prequalification requirements apply to plants supplying or from which it is proposed to supply Precast Concrete Drainage Products, pursuant to a specification requiring that such product be supplied from a plant approved by the Prequalification Committee. All such Precast Concrete Drainage Products supplied to a project shall have been manufactured in a plant which has been prequalified by the Prequalification Committee and for which the Manufacturer has a Prequalification Certificate issued by the Prequalification Committee, which is valid at the time of manufacture and delivery of the Product. Ontario Concrete Pipe Association membership is not a prerequisite for Prequalification.

The manufacturer shall allow the Engineer full access to their facilities and exempt the Engineer from any statements of non-disclosure that may normally be required of visitors to their facilities.

2.0 BASIS OF ACCEPTANCE

2.1 New Plants Seeking Prequalification

Step 1: The producer's manufacturing facility will be inspected to determine if the equipment and materials are available to produce the new product.

Step 2: After the producer begins production of the product, the plant and product will be inspected to ensure compliance with the document "Prequalification Requirements for Precast Concrete Drainage-Products."

Step 3: If equipment has not been used for five (5) years, it shall be inspected to ensure that it meets the requirements of the document "Prequalification Requirements for Precast Concrete Drainage Products."

If the plant meets the above requirements, Prequalification will be granted. There will be no preliminary category.

Prequalified plants manufacturing new Products:

All Prequalified plants must notify the inspection service of any new product they wish to manufacture. An inspection will then be scheduled to take place after production of the new product begins.

Summary of requirements for all Prequalified plants:

All plants must meet the requirements of the "PLANT PREQUALIFICATION REQUIREMENTS FOR PRECAST DRAINAGE PRODUCTS" and all applicable OPS, CSA, ASTM and AWWA standards.

Specific items that are checked prior to issuing the certificate and prior to any testing are as follows:

A) Plant Facilities:

The plant facilities shall be such that the production of product is protected from the weather. If production is outside, there shall be sufficient cover and heat to ensure that the units are not subjected to extreme heat or cold.

B) Storage Materials:

All materials shall be stored so that contamination or deterioration does not occur. Aggregates must be stored in a free draining stockpile and must not be allowed to segregate.

Material in liquid form must not be allowed to freeze.

Powdered material must be protected from moisture.

C) Batching and Mixing:

Cement shall be measured on a scale and in a hopper that is separate from the aggregates. The hopper can be attached to the same hopper for aggregates. Bagged cement may be used.

All scales shall be calibrated at least once a year.

Mixers shall be equipped with a sensing device for automatically controlling the water or indicating the water in a mix (alternatively, water can be measured by mass or volume, but volume measurements cannot be affected by water line pressure).

Mixers must be equipped with a timing device.

The plant must be capable of producing concrete that conforms to CSA Standards, which is 10 to 35 ° C at all time.

D) Production Facilities:

The plant must be equipped with concrete handling equipment, forms or molds, product handling equipment and all other equipment necessary to produce a satisfactory product.

E) Curing:

All products must be cured in a sealed kiln or curing chamber using saturated steam and/or water spray.

Wet cast box units must be cured in the forms and the ends of wet cast box units and all dry cast box units shall be cured by steam and/or water and/or membrane until the strength has achieved 25 MPa.

Curing facilities must be equipped with automatic recording devices, except for box unit curing.

F) Storage:

All products must be stored so that the potential for damage is minimized.

G) Quality Control:

The plant must be equipped or have access to:

- Go-No-Go gauges

- Equipment measuring devices

- Three-edge bearing frame

- Equipment for hydrostatic testing

- Equipment for casting concrete cylinders and for testing concrete cylinders

- Equipment for freeze-thaw testing

- Air void analysis of hardened concrete

- Recent test data

H) Personnel:

The plant must have quality control department supervised by an experienced person that can conduct the entire necessary test as outlined in the Prequalification document, and relevant OPS and CSA Standards. Training requirements for the Quality Control Personnel are included in Section 12.

This individual must be familiar with the testing procedures.

2.2 Specifications

The Precast Concrete Drainage Products supplied from a prequalified plant shall comply with the requirements of the latest editions of CSA Standards for Concrete Pipe, A257 Series, or ASTM C507M and the Appendices hereto.

The reinforced concrete box units shall comply with the latest edition of OPSS 1821.
Three sided precast units shall comply with the latest edition of CSA S6
Concrete pressure pipe shall comply with AWWA C301 or C302.

This Prequalification document is a requirement of OPSS 1351, 1820 and 1821.

3.0 DEFINITIONS

3.1 **DEFINITIONS:** for the purpose of this document, the following definitions apply:

Association means the Ontario Concrete Pipe Association (1986) Inc. (OCPA).

Designated Internal Dimension(s) means the diameter used to identify the Precast Concrete Drainage-Product.

Design Change means a reduction in steel area (cage design), in wall thickness, or in minimum concrete strength or a change in joint detail for a given precast concrete drainage-product size and strength classification.

Engineer means the professional engineer acting for the Committee.

Gasket means a preformed flexible rubber compound used to seal the joint between the bell and spigot of the Precast Concrete Drainage Product.

Header Ring means a machined element that forms the tongue or spigot end of the Precast Concrete Drainage Product and which remains on it during some or all of its curing cycle.

Manufacturer means a specific plant, which manufactures Precast Concrete Drainage Products and is prequalified by the Committee.

Pallet means an element that forms the bell end of the Precast Concrete Drainage Product, which remains on it during some or all of its curing cycle.

Precast Concrete Drainage Product means all sewer pipes, maintenance hole units, catchbasins, reinforced box units and fittings. Also referred to as the product.

The Plant Prequalification Program Advisory Committee is a committee established through the OCPA, which will include a member from each of the MEA, OPS, MTO and CPA. Also, referred to as the Committee.

Prequalification Stamp means the stylized 'P', inside a black triangle, as illustrated below:



<u>Size</u>	<u>Stamp Size (Minimum)</u>
150 - 250 mm pipe	64 mm high x 75 mm rocker radius
300 mm + pipe	100 mm high x 150 mm rocker radius
All Other Products	100 mm high

Tongue Former means a machined element that forms the tongue or spigot end of the Product, which remains with the machinery during production and is not on the Product during any part of its curing cycle.

3.2 REFERENCES: this document refers to the following specifications or standards:

ASTM C507M – ASTM Standard Specification for Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe.

ASTM C14 – Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe.

ASTM C76 – Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.

ASTM C478 – Standard Specification for Circular Precast Reinforced Concrete Manhole Sections.

ASTM C1433 – Standard Specification for Precast Reinforced Concrete Monolithic Box Sections for Culverts, Storm Drains, and Sewers.

AWWA C300 Series – American Water Works Association standard specifications for concrete pressure pipe.

CSA A23.1 – CSA Standard CAN/CSA-A23.1, Concrete Materials and Methods of Construction.

CSA A23.2 – CSA Standard A23.2, Test Methods and Standard Practices for Concrete.

CSA A23.4 – CSA Standard A23.4, Precast Concrete – Materials and Construction.

CSA A3000 – CSA Standard A3000 Cementitious Materials Compendium.

CSA A257.0 – CSA Standard CAN/CSA-A257.0, Methods for Determining Physical Properties of Circular Concrete Pipe, Manhole Sections, Catchbasins, and Fittings.

CSA A257.1 – CSA Standards CAN/CSA-A257.1, Non-reinforced Circular Concrete Culvert, Storm Drain and Sewer Pipe.

CSA A257.2 – CSA Standard CAN/CSA-A257.2, Reinforced Circular Concrete Culvert,

Storm Drain and Sewer Pipe.

CSA A257.3 – CSA Standard CAN/CSA-A257.3, Joints for Circular Concrete Sewer and Culvert Pipe Using Rubber Gaskets.

CSA A257.4 – CSA Standard CAN/CSA-A257.4, Precast Reinforced Circular Concrete Manhole Sections, Catchbasins and Fittings.

CSA S6 – Canadian Highway Bridge Design code.

OPSS 1351 – Ontario Provincial Standard Specification 1351, Material Specification for Precast Reinforced Concrete Components for Maintenance Holes, Catchbasins, Ditch Inlets and Valve Chambers.

OPSS 1820 – Ontario Provincial Standard Specification 1820, Material Specification for Circular and Elliptical Concrete Pipe.

OPSS 1821 – Ontario Provincial Standard Specification 1821, Material Specification For Precast Reinforced Concrete Box Culverts and Box Sewers.

The Owner may specify other Federal, Provincial or Municipal specifications.

4.0 Prequalification Procedure

- 4.1 Each application for a prequalification certificate shall cover the full range of drainage products manufactured and must be addressed in writing to:

*Chair, Prequalification Committee
c/o Ontario Concrete Pipe Association (1986) Inc.
447 Frederick Street, 2nd Floor, Kitchener, ON N2H 2P4*

- 4.2 The Association will require the applicant to deposit funds in an amount to be stipulated by the Engineer, sufficient to cover the estimated cost for carrying out the inspection and testing and preparing a report thereon and any non-member administration fee. Any unused balance of the deposit will be refunded to the applicant in due course. Should the deposit be insufficient to cover the costs, the applicant will be required to deposit further funds to make up the deficiency.
- 4.3 The Engineer will carry out an inspection of the applicant's plant, have product samples tested and report to the Committee verifying compliance or otherwise with these Prequalification requirements together with a recommendation. At the discretion of the Engineer, further investigation or testing may be requested. Information may be required from the applicant relating to customers or projects to which the applicant has supplied products.

A detailed report shall be prepared which shall include test reports for all products shown on the Prequalification Certificate.

- 4.4 If the Engineer is satisfied that the applicant's plant, quality control and product meet these requirements, the Committee will issue a Prequalification Certificate. This certificate will state the sizes and classes of pipe, maintenance hole units and/or boxes and joint types to which the prequalification applies. The Prequalification Certificate will normally be valid for a period of 12 months after the date of issue.

- 4.5** After issuing a Prequalification Certificate, the Committee will normally require a further inspection of the Plant, testing of product and filing of a written report by the Engineer as follows:

At three year intervals: Detailed inspection and testing and filing of a written report comparable to the original inspection for prequalification purposes.

At intermediate one-year intervals: Less detailed inspection, checking and testing mainly for ascertaining whether quality control and the standard of workmanship are being maintained at a satisfactory level.

An Interim report (Appendix E) must be submitted to the Engineer by the Plant 6 months after any of the above inspections.

The above-mentioned inspection and testing will be performed by the Engineer.

- 4.6** To obtain renewal of the Prequalification Certificate, the Engineer shall inspect the operations prior to the expiry date of the certificate. The Engineer may require revision to the existing certificate and/or further inspection and testing to be carried out before recommending the renewal of the certificate.
- 4.7** The cost of further inspection, testing and reports shall be borne by the Manufacturer. Payment procedures will be in accordance with clause 4.2.
- 4.8** The Committee may cancel a Prequalification Certificate at any time with respect to any or all product(s) should it consider that the Manufacturer has failed to comply with the Prequalification Requirements. If such cancellation applies only to certain product, the Committee will issue an interim certificate valid for a stated limited period listing the products to which the cancellation does not apply.
Only one interim certificate will be issued to a plant. The plant must submit a corrective action plan within 30 days after the inspection. The corrective action plan must include disposition of non-conforming product. The plant will then be inspected within 90 days to determine compliance. Failure to comply with the requirements will result in immediate cancellation of the certificate.
- 4.9** An inspection of the plant will be carried out before a Prequalification Certificate is cancelled and the Manufacturer will be notified of the reasons for the cancellation.
- 4.10** If a Manufacturer has voluntarily allowed the Prequalification Certificate to lapse, or if the certificate has been cancelled, then the Manufacturer will be treated as a new applicant if the Manufacturer applies to have the certificate renewed. The Manufacturer will be responsible for all associated inspection fees.

5.0 Information By Manufacturer

- 5.1** The Manufacturer shall ensure that each purchaser of products is provided with installation instructions relating to the specific type of Product supplied.
- 5.2** The Manufacturer shall notify the Committee promptly of any changes made in the supervisory quality control personnel at the plant and shall provide information regarding the qualifications and experience of new supervisory personnel.

- 5.3** The Manufacturer shall notify the Committee promptly of any design changes and provide proof of conformance to CSA A23.1, A23.2, A257.1, A257.2, A257.3, A257.4, S06, ASTM C507M, OPSS 1351, 1821, or AWWA C301 or C302.
- 5.4** The Manufacturer shall at the request of the Committee or Engineer make available information with respect to the purchase of product from the Manufacturer. The information requested may include sizes, classes and amount of Product supplied, type of joint, names of purchaser, owner, consulting engineer, project name and the time during which the order was delivered. In some cases, the Engineer may request further information from the Manufacturer. The above information covering a period of not less than 2 years shall be kept on file so that it may be referred to at the plant at any time by the Engineer.
- 5.5** The Manufacturer shall keep a record for box production showing the date, dimension, design earth cover and quantity of product being manufactured each day.
- 5.6** The Manufacturer shall keep all records required by Section 6.0 to 11.0 of these requirements for a period of not less than 2 years.

6.0 Materials

6.1 Aggregate Specifications

Suppliers of coarse and fine aggregate for concrete must meet the requirements of either the Ontario Provincial Standard Specifications (OPSS) or CSA A23.1.

6.2 Fine Aggregate

A sieve analysis of the sand from each source of supply shall be conducted daily. The results of the sieve analysis shall be recorded showing the Manufacturer's operating requirements. These reports shall show the source of the sand and who performed the test.

The Manufacturer may require the Supplier to supply a weekly vendor's certificate with a sieve analysis taken from that week's shipment, stating that the product meets the Manufacturer's requirements. In this case, the daily sieve analysis by the plant will not be required.

6.3 Coarse Aggregate

A sieve analysis of each type of stone shall be conducted daily for each source of supply. A report shall be prepared showing the results of the sieve analysis. The report shall show the source and type of stone and who performed the test.

The Manufacturer may require the Supplier to supply a weekly vendor's certificate with a sieve analysis taken from that week's shipment, stating that the product meets the Manufacturer's requirements. In this case, the daily sieve analysis by the plant will not be required.

Petrographic tests shall be obtained from the supplier at least once per year and maintained on file.

6.4 Cementing Materials

Vendor's certificates and/or test reports shall be obtained not less frequently than once per month or for each shipment from each supplier, indicating that any cementing material used conforms to CSA A3000.

6.5 Reinforcing Steel

Vendor's certificates and/or test reports shall be obtained, not less frequently than once per month or for each shipment from each supplier, indicating that any reinforcing steel used conforms to the appropriate CSA Standard or ASTM Standard. For box units, welded wire fabric shall meet a minimum 4% elongation at ultimate specified breaking strength measured over a 100 mm gauge length, including at least one cross wire. If a plant is manufacturing its own steel, the plant must have equipment or access to the equipment needed to conduct the necessary tests.

6.6 Gaskets

Vendor's certificates and/or test reports shall be obtained not less frequently than once per month or for each shipment from each supplier indicating that the material conforms to CSA A257.3. The Shore durometer hardness shall be stated on the certificate.

6.7 Joint Material

Vendor's certificates and/or test reports must conform to the appropriate standard.

6.8 Admixtures

Vendor's certificates and/or test reports shall be obtained, no less frequently than once per month or for each shipment from each supplier, indicating that any admixture material used conforms to project requirements.

7.0 Material Preparation

7.1 Batching

7.1.1 Standard Mixes

The Manufacturer shall have a chart showing standard mixes for all product produced. The information on the mix shall include the amount of each of the ingredients (i.e. the amount of fine and course aggregate, cementing materials, admixtures, if any, and the wet and dry mixing times). All materials shall be measured in one system (metric or imperial).

7.1.2 Batching Records

The mix design and the quantity of concrete batched each day shall be recorded. Records shall be kept to verify that the actual mix design has been used.

7.1.3 Moisture Control

Each mixer shall be equipped with a sensing device for automatically controlling the water content in the mix or indicating the water content of the mix.

Alternatively, all added mixing water shall be measured by either mass or volume. If added water is to be measured by volume, the device shall be so arranged that measurements will not be affected by variable pressure in the water supply line.

7.2 Mixing

7.2.1 Mixing Time Controls

The mixer shall either be equipped with an automatic timing device or there shall be a timer for the operator.

8.0 Manufacturing

8.1 Moulds, Pallets, Header Rings and Tongue Formers

Moulds, pallets, header rings, tongue formers and all other forming equipment shall be cleaned and/or lubricated prior to use.

8.2 Reinforcing Steel Preparation

The Manufacturer shall have a chart showing the type of wire cage, or reinforcing (i.e. the spacing of the wires or bars and the gauge of the wires or sizes of bars for each type of Product). The chart shall also show the dimensional requirements and tolerances.

The Manufacturer shall ensure that all reinforcing steel used is clean and free from excessive loose rust.

8.3 Marking of Product

All Products shall be marked in accordance with the requirements of CSA Standard A257.1, A257.2, A257.4, or ASTM C507M or OPSS 1821 or AWWA C301 or C302, respectively. In addition, they shall bear the Prequalification stamp indicating that the Product is in accordance with these Requirements. The markings shall be on the inside or outside of the Product. The date stamp identification system shall be year, month and day, unless an alphanumeric identification, system is used.

The Prequalification stamp is not to be used on any Product for which the plant is not prequalified to supply.

8.4 Curing

8.4.1 Requirements

All Products shall be cured in an adequately sealed kiln or curing chamber using either saturated steam, water spray or membrane curing for a period of time long enough to ensure that the required strength is attained at time of shipment. The maximum curing temperature shall be 70°C and each kiln or hood shall be equipped with a device to ensure that this temperature is not exceeded. When the outside temperature is below 4°C, the temperature in the kiln or curing hood shall be lowered gradually and the kiln ventilated to prevent thermal shock to the Product. Box units shall be cured in

accordance with the requirements of OPSS 1821. Concrete pressure pipe shall be cured in accordance with AWWA C301 or C302.

8.4.2 Controls

The curing temperature may be controlled either manually or automatically.

8.4.3 Records

Each kiln shall be equipped with an automatic recording device showing the times and temperatures throughout the curing cycle.

9.0 Inspection and Testing

9.1 Visual Inspection

All Products shall be carefully inspected visually for flaws in the joint surfaces and other defects.

9.2 Gauging/Measuring

The Manufacturer shall have "go-no-go" gauges for checking each size of circular pipe or maintenance hole produced at the plant up to and including 1200 mm designated internal diameter. These gauges shall be designed to provide a rapid and accurate means of checking joint dimensions. One side of the gauge shall be set at the maximum allowable diameter of the spigot or tongue at a given point and the other side of the gauge shall be set at the minimum allowable diameter of the spigot or tongue at the same point.

One hundred percent of each size of circular pipe and maintenance holes manufactured up to and including 1200 mm, designated internal diameter shall be accurately checked with the "go-no-go" gauges before stockpiling. Products failing the test will be rejected.

Circular pipe or maintenance holes greater than 1200 mm designated internal diameter shall be measured or gauged to check joint dimensions. For each production run of 25, at least one joint shall be checked with either of these methods. A test fit of the Product may be made instead.

All circular pipe and maintenance holes manufactured shall be checked for all dimensions at least once a year in accordance with the dimensional requirements of CSA A257. For different lengths of maintenance holes from the same form, all dimensions shall be checked for only one length. Dimensions for catchbasins shall be checked to ensure that the cover to reinforcing steel is adequate. Records shall be kept of these dimensional checks.

Elliptical pipe shall be measured to ensure that they meet the dimensional requirements of ASTM C507M. For each production run of 25 units, a record shall be made to show that all dimensions have been checked on at least one unit.

Box units shall be measured to ensure they meet the dimensional requirements of OPSS 1821. For each production run of 15 units, a record shall be made to show that all dimensions have been checked on at least one unit on wet cast and 2 units on dry cast.

Concrete pressure pipe shall be manufactured in accordance with AWWA C301 or C302 and shall have dimensional checks completed in accordance with the specifications.

9.3 Three-Edge Bearing Tests (Pipe Only)

In the case of reinforced concrete pipe, the load shall be applied to the minimum of 0.3 mm crack requirement in accordance with CSA Standard A257.2 or ASTM C507M. In the case of non-reinforced pipe, the load shall be the ultimate load in accordance with CSA A257.1 for the size and class of pipe being tested.

A minimum of 1 pipe in 400 produced in each size and class shall be tested in three edge-bearing. If less than 400 pipes in a given size and class are produced in a 2 year period, a test must be conducted. If a pipe size and class has not been produced for 2 years, this test shall be conducted at the start of the production run. For each pipe design, a minimum of one test taken to the ultimate design load shall be kept on file.

A minimum of one test report per size and class produced in excess of 900 mm diameter, shall be certified by a Professional Engineer. The professional engineer may be an employee of the company. These test reports shall show the actual reinforcing steel design (wire size and spacing) along with the concrete design strengths. See sample Appendix "D".

Should a Product fail to meet the requirement of the three edge-bearing test, the Manufacturer shall:

- Test three (3) additional pipe from the same production run, if the pipe passes, the run is prequalified;
- If any of the above does not pass, the production run shall be reclassified to the load strength determined from the three edge-bearing tests conducted.

9.4 Water to Cementing Materials Ratio (Wet Cast Only)

The water content of each concrete mix shall be determined. The Manufacturer shall have printouts or shall record the amount of water included in each mix along with the other materials (cement, supplementary cementing materials, aggregate and admixtures).

The moisture content of the aggregates shall be determined by:

The Supplier of the aggregate or the manufacturer shall determine the moisture content using acceptable methods such as CSA Standard A23.2-11A and A23.2-12A or utilization of moisture meters or moisture probes.

9.5 Hydrostatic Tests (Pipe Only)

The Manufacturer shall make periodic hydrostatic tests as set out in Appendix "A" to determine the adequacy of the design of the pipe and joints. All pipe sizes up to and including 900 mm, designated internal diameter produced must be tested in accordance with the frequency set out in Appendix "A" and with all classes represented at least once every 6 months. If a pipe size has not been produced for 2 years, this test shall be conducted at the start of the production run.

Hydrostatic testing shall be conducted on 3 pipes in line with gaskets. Tests conducted are in straight alignment, deflected and differential load as outlined in the Prequalification Procedures.

One Pipe Failure

- If one out of the three pipes in a hydrostatic test fails then two of the three pipes must be replaced, including the failed pieces. The replacement pipes must be from the same days production and pass all of the tests;
- For each failure, there must be two tests which pass for the run of pipe;
- If the hydrostatic tests continue to fail, then all of the pipes in that run are considered to have failed;
- If this occurs, only the pipe passing the test may be stamped as Prequalified (i.e.: the plant may test the entire pipe in a run to determine which is acceptable).

Two Pipe Failure

- If two or more pipes fail, the test is considered a failure;
- For each failure, there must be two tests which pass for the run of pipe;
- If the hydrostatic tests continue to fail, then all of the pipes in that run are considered to have failed;
- If this occurs, only the pipe passing the test may be stamped as Prequalified (i.e.: the plant may test the entire pipe in a run to determine which is acceptable).

The plant is required to include the test results in the six-month interim report. The six-month interim report sent to the engineer must include details about failures and the remedial action taken.

9.6 Hydrostatic Tests (Maintenance Holes Only)

The Manufacturer shall make periodic hydrostatic tests as set out in Appendix "A". Hydrostatic testing shall be conducted on three maintenance hole riser sections in line (vertically or horizontally) with gaskets. The bulkhead joints are not tested.

- If one out of the three maintenance holes in a hydrostatic test fails then two of the sections must be replaced, including the failed piece. The replacement product must be from the same day's production and pass all of the tests;
- If two or more sections fail, the test is considered a failure;
- For each failure, there must be two tests which pass for the run of maintenance hole;
- If the hydrostatic tests continue to fail, then all the maintenance holes in that run are considered to have failed;
- If this occurs, only the product passing the test may be stamped as Prequalified (i.e.: the plant may test the entire product in a run to determine which is acceptable).

The plant is required to include the test results in the six-month interim report. The six-month interim report sent to the engineer must include details about failures and the remedial action taken.

9.7 Concrete Compressive Strength Tests

Concrete compressive strength for box units shall be checked in accordance with OPSS 1821. Concrete compressive strength for Maintenance Holes shall be checked in accordance with CSA A257.4, except that cylinders shall be tested monthly.

Should a sample taken for the purposes of determining the compressive strength fail, the Manufacturer shall proceed in accordance with CSA A23.1.

9.8 Maintenance Hole Step Tests

Step tests shall be conducted in accordance with OPSS 1351 for both horizontal and vertical loading, except that tests shall be done monthly.

Should a Product fail the step tests, the Manufacturer shall:

- Inspect the remaining steps for the manhole riser section (minimum riser height to be 1.219 m);
- Re-install new steps for all failed tests;
- Test the new installation in accordance with the step test requirements;
- Reinstallation may continue for up to three units. If the test fails, the piece is then rejected.

9.9 Salt Scaling tests

The plant may do salt scaling tests in accordance with MTO LS412.

9.10 Manufacturer's Laboratory Requirements

The Manufacturer shall ensure the quality control laboratory used for the quality assurance of the precast concrete products meets the requirements of the Manufacturer's Laboratory Requirements set out in Appendix F.

10.0 Joints

10.1 Dimensions

The Manufacturer shall have complete and detailed drawings of the joint design for all Products showing the dimensions of the concrete surfaces. In addition, for pipe the drawings shall show the dimensions and the Shore durometer hardness of the gasket material with permissible tolerances. The Manufacturer shall furnish copies of such drawings to the Engineer, if so requested.

11.0 TEST EQUIPMENT

11.1 The Manufacturer shall have equipment for making the following tests and measurements:

- a) Hydrostatic Tests
- b) Three Edge-Bearing Tests (Pipe Only)
- c) Casting concrete compressive cylinders.

11.2 Equipment Checks

11.2.1 Scales

Batching scales shall be calibrated at least once per year by an experienced scale service company and a certificate of accuracy shall be obtained and posted on the equipment for reference.

11.2.2 Pallets (Circular)

Pallets shall be checked for accuracy of dimension up to and including 1200 mm when:

- a) received as new equipment, and
- b) repaired.

A test fit shall be made for Product larger than 1200 mm at the start of a production run.

Any pallets, which do not conform to the Manufacturer's tolerances, as referred to in clause 10.1 hereof shall not be used in the production of Product.

11.2.3 Header Rings and Tongue Formers (Circular)

Metal (i.e. steel or cast iron) header rings or tongue formers shall be checked for accuracy of dimension up to and including 1200 mm when:

- a) received as new equipment, and
- b) repaired.

In addition, a test fit shall be made for Product larger than 1200 mm at the start of a production run when received as new equipment or when repaired.

Header rings of any material other than steel or cast iron shall be checked for accuracy of dimension when new, when repaired and at least once each month by plant personnel.

11.2.4 "Go-no-go" Gauges

The "go-no-go" gauges required by clause 9.2 hereof shall be checked for dimensional accuracy each day that they are used and a record shall be kept of the checks.

11.2.5 Calibrations

All inspection, measuring, and test equipment shall be calibrated in accordance with the following table 11.2:

Table 11.2 Inspection Measuring and Test Equipment Calibrations-CSA A23.4 requirements

TEST EQUIPMENT	TYPICAL MEASUREMENT	INTERVAL OF CALIBRATION	MINIMUM INSTRUMENT GRADUATION	ACCURACY OF MEASUREMENT	CHECKED BY
Go-No-Go Pipe Spigot Gauges	Pipe Spigot Tolerances	Prior to Usage	Checked by vernier or micrometer	Yes/No	QA
Master Spigot Gauges	Go-No-Go Gauge Tolerances	Yearly	0.001 inch	± 0.004 inch	QA
Header Gauges	Equipment Suitability	Yearly	0.001 inch	± 0.004 inch	QA
Vernier Gauge	All Go-No-Go Gauges	Every 3 Years	0.001 inch	± 0.001 inch	Out Source Certification
Micrometer	Reinforcing	Every 3 Years			
Pressure Gauge	Hydrostatic Test	Yearly	1 psi	+1 psi -0 psi	QA/Out Source
D-Load	D-Load Test	Yearly	500 and 2000 lb	± 1%	Out Source
Batching Scales	Batch Weights	Div I: Yearly Div II: Every 6 months	10 lb	± 2% aggregate ± 1% cement ± 1% water	Out Source
Temperature Recorders	Kiln Temperature	Every 3 Years	2°C	± 2°C	Out Source
Feeler Gauge	D-Load Test	Yearly	0.001 inch	Yes/No	QA
Torque Wrench	Boot Installation	Every 5 Years	1 inch-pound	± 1 inch-pound	Out Source
Gram Scale	Sieve Analysis	Yearly	0.1g	± 1g	QA
Water meters	Batch Volumes	Div I: Yearly Div II: Every 3 months	0.2 Liter	± 1%	QA
Admixture Dispensers	Batch Volumes	Every 3 Months	As per supplier	± 3%	Out Source
Cylinder Testing Machine	Compressive Strength	Yearly		± 1%	Out Source
Slump Cone	Slump	Every 3 Months		10 mm	QA/Out Source
Air Meter	Air Content	Every 3 Months	0.1%	± 1%	QA/Out Source

NOTE

Plants certified to PPP Division II are required to include a similar table in their Quality Assurance Manual that addresses their specific requirements.

This table is repeated in Division II.

12.0 QUALITY CONTROL PERSONNEL

- 12.1** Each plant shall have a quality control section headed by a trained and qualified employee that shall have the responsibility of ensuring that the specified tests are carried out. Products not conforming to these requirements are to be segregated and withheld from shipment. The head of the quality control section shall keep adequate records of all tests made, together with their results and shall keep a record of tests on equipment.
- Quality Control Personnel within the precast concrete manufacturing facilities shall receive regular training provided by the Manufacturer, to ensure the quality control processes are performed correctly by the Staff, and the information gathered is analyzed and maintained in accordance with the Program.
- Quality Control Personnel shall require certification consisting of ACI Concrete Field Testing Technician Grade 1 and achieve greater than a 90% mark in the Plant Prequalification Requirements for Precast Concrete Drainage Products exam.
- The certificate shall be valid for 5 years after which time the Quality Control personnel shall require recertification.
- The plant shall have a minimum of one person from Quality Control and one person from Production successfully passing the PPP exam.

13.0 PLANT INSPECTIONS

- 13.1** The Engineer shall have the right at all reasonable times to visit and inspect the procedures used in the manufacture of drainage Products covered by these Requirements. The Manufacturer shall provide access and all reasonable facilities and assistance for the Engineer to carry out such inspection, including the use of the test equipment referred in clause 11.0 hereof.

14.0 RESPONSIBILITY FOR ADEQUACY OF PRODUCT

- 14.1** The issuing of a Prequalification Certificate by the Committee does not relieve the Manufacturer of the responsibility for the adequacy of any Products produced. It is the responsibility of a purchaser to determine the conformance of any Products purchased to the appropriate standard or specification.

SAMPLE

PREQUALIFICATION CERTIFICATE

This is to certify that the concrete sewer pipe plant and precast reinforced concrete box unit plant of

***XYZ Company
166 Anywhere Avenue
Heretown, Ontario
N8T 3M7***

has been found to comply with the Committee's Prequalification Requirements For Precast Concrete Drainage Products (August 1998)

This plant and its output are subject to periodic inspections and tests by the Engineer. Failure on the part of ***XYZ Company*** to maintain the required quality control or to comply with all prequalification requirements or failure of the Product manufactured at the said plant to comply with the standard specifications may, at the discretion of the Committee, result in the removal of the prequalification of this plant with respect to any or all sizes and classes of Product.

By issuing this Certificate, the Committee does not represent that all Product of the types referred to herein made by the Certificate Holder will meet the required standards, only that the Certificate Holder is capable of making such Product. It is the responsibility of the Contractor or others who acquire Product made by the Certificate Holder to ensure that such Product meets requirements satisfactory for its use.

The plant is prequalified to produce all sizes, classes and shapes of concrete drainage products listed on the following page(s).

Except as provided for above, this Certificate is valid from _____, 20xx to _____, 20xx.

Prequalification Certificate
Page 2 of 3

<u>CIRCULAR PIPE</u>	<u>GASKETS</u>	<u>GOVERNING SPECIFICATION</u>
150, 200, 250 mm diameter (Non-Reinforced)	Roll-on	CSA A257.1
300 to 1200 mm diameter (Reinforced)	Single Offset	CSA A257.2
1350 to 3000 mm diameter	Self Lubricating Gasket Confined "O" Ring Gasket	

All related Products: fittings, bends, reducers, increasers, plugs, caps, meter tee pipe and radius pipe.

<u>ELLIPTICAL PIPE</u>	<u>MORTAR JOINT</u>	<u>GOVERNING SPECIFICATION</u>
735 x 1145 TO 2465 x 3835	No Gaskets	ASTM C507M Horizontal and Vertical Elliptical Pipe

<u>MAINTENANCE HOLES</u>	<u>GASKET</u>	<u>GOVERNING SPECIFICATION</u>
1200 to 3600 mm diameter	Single Offset Self Lubricating Gasket	CSA A257.4

All related Products: base slabs, flat caps, transitions, risers, monolithic bases tapered tops, drop connections, prebenching and grade rings.

- 2400 x 1800 mm Valve Chambers
- 3000 x 2400 mm Utility Maintenance Holes
- 600 x 600 mm (115 mm wall) Single Catchbasin
- 600 x 600 mm (150 mm wall) Single Catchbasin
- 840 x 600 mm (115 mm wall) Curb Inlet
- 1450 x 600 mm Double Catchbasin
- 600 x 600 mm (150 mm wall) Ditch Inlet
- 1200 x 600 mm (150 mm wall) Ditch Inlet
- 2040 x 1705 Headwalls
- 2306 x 1883 Headwalls
- 2752 x 2061 Headwalls

REINFORCED CONCRETE BOX UNITS

GOVERNING
SPECIFICATION

DRY CAST

1800 x 900 mm	Wall and Slab 200 mm
1800 x 1200 mm	Wall and Slab 200 mm
2400 x 1200 mm	Wall and Slab 200 mm
2400 x 1500 mm	Wall and Slab 200 mm
2400 x 1800 mm	Wall and Slab 200 mm
3000 x 1500 mm	Wall and Slab 250 mm
3000 x 1800 mm	Wall and Slab 250 mm
3000 x 2100 mm	Wall and Slab 250 mm
3000 x 2400 mm	Wall and Slab 250 mm

OPSS 1821
ASTM C1433

STRUCTURAL PRODUCTS

Product required to meet CSA Standard A23.4 shall be listed here along with the category as detailed in A23.4..

Chairman, Prequalification Committee

Date of Issue

APPENDICES

“A” Hydrostatic Tests

“B” Conformance Requirements in Addition to CSA

“C” Vacuum Test Procedure

“D” Three-Edge Bearing Test Sample Report

“E” Interim Report

“F” Manufacturer Laboratory Correlation Requirements

**“G” Plant Prequalification Program for Precast Concrete Drainage Products
Prequalification Committee Function**

APPENDIX "A"

Hydrostatic Tests

1.0 Pipes in Proper Alignment *

Three pipes shall be assembled according to the Manufacturer's standard procedure. The end pipe shall be bulkheaded and restrained longitudinally except that each joint shall be allowed to open 6 mm. The pipe shall then be subjected to an internal hydrostatic pressure of 103 kPa for 10 minutes. At this pressure, there shall be no leakage at the joints or through the pipe walls. Moisture or beads of water adhering to the wall of the pipe will not be considered a leakage. At the Manufacturer's option, the test period may be extended up to 24 hours.

The Manufacturer may, at his option, allow the three test pipes to stand under a pressure of 103 kPa or less for a period of 24 hours before proceeding with the hydrostatic and differential load test.

2.0 Pipes in Maximum Deflected Position *

The test section shall be deflected until both joints have been deflected in accordance with CSA Standard A257.3. The pipes shall then be subjected to an internal hydrostatic pressure of 90 kPa for 10 minutes without showing leakage at the joints or through the pipe walls. At the Manufacturer's option, the test period may be extended up to 24 hours.

3.0 Joints Under Differential Load

The test section shall be supported on blocks or otherwise so that the two end pipes are supported and the middle pipe is freely suspended between the two end pipes and bearing only on the joints. The suspended pipe shall then be loaded in accordance with the following table, such load being in addition to the weight of the pipe and water:

APPENDIX “A”

TEST LOADS FOR PIPES UNDER DIFFERENTIAL LOAD

PIPE SIZE	LOAD PER METRE LAYING LENGTH	MAXIMUM LOAD
150 mm	15 kN	20 kN
200 mm	15 kN	20 kN
250 mm	20 kN	25 kN
300 mm	20 kN	25 kN
375 mm	30 kN	35 kN
450 mm	30 kN	35 kN
525 mm	40 kN	45 kN
600 mm and over	40 kN	45 kN

While under this load, the stressed joint shall show no leakage under 35 kPa internal hydrostatic pressure (for a period of 10 minutes). As an acceptable alternative, one-half of the load may be applied on the bell of the suspended pipe. Blocking under the supporting pipe or pipes shall be arranged so as to distribute the load transferred to these pipes in an adequate manner.

Hydrostatic Testing Frequency

Pipe Sizes	Frequency (minimum)
Up to 450 mm	1 test per 1000 pieces
525 and 600 mm	1 test per 500 pieces
675 to 900 mm	1 test per 400 pieces

4.0 Maintenance Holes

Maintenance holes may be assembled and tested in a similar fashion to pipe. Alternatively, the maintenance hole test can be done in a vertical position.

Hydrostatic Test Procedure – MH's

4.1 Maintenance Hole Set-up

Three 1.2-metre risers for 1200 mm diameter maintenance holes shall be placed on top of a standard base slab or a base made specifically for the test.

The top of the precast sections shall be bulkheaded and restrained longitudinally.

4.2 Exfiltration Allowance

The MH shall then be subjected to an internal hydrostatic pressure of 60kPa for a period of ten minutes. At this pressure, there shall be no leakage at the joints or through the MH walls. Moisture or beads of water adhering to the wall of the MH will not be considered a leakage.

Should the section fail, the manufacturer may leave the sections to soak for 24 hours and re-do the test.

4.3 Frequency

Hydrostatic tests shall be conducted on 1,200 mm designated internal diameter maintenance holes with the following frequency: Conduct one test for every 400 pieces, but not less than once every three months. This frequency applies to riser sections 1200 mm in height and higher. Testing shorter sections is optional.

***Notes:**

- 1. The total test period from completion of filling with water to end of the 10-minute leakage tests shall not exceed 48 hours.**
- 2. The manufacturers will have an obligation to test the product where higher pressures are expected in deep installations. A high water table may result in pressures of 90 kPa.”**

APPENDIX “B”

Conformance Requirements In Addition To CSA

1.0 Gasketed Joint Designs

In addition to complying with the requirements of CSA A257.3, the joints of pipe in sizes up to and including 900 mm designated internal diameter shall be of such design that they will withstand the forces caused by the compression of the gasket when joined and the stresses resulting from the differential load test specified in Appendix "A" without cracking or fracturing and shall be one of the following types:

1.1 Confined "O-ring"

Confined "O-ring" concrete pipe shall have a rubber gasket fitted into a recess or groove cast in the pipe tongue. The design angle of taper on the conical surface of the inside of the bell or groove and the spigot or tongue measured from a longitudinal trace on the inside surface of the pipe shall not be greater than 2 degrees. Measured slope may be 2.5 degrees.

1.2 Bell and Spigot Pipe with Roll-On Gasket

The inside surface of the bell and the outside surface of the spigot shall have a design slope no greater than 2 degrees measured from the longitudinal trace on the inside surface of the pipe except that pipe 250 mm designated internal diameter and smaller may have a design slope no greater than 3 degrees. Measured slopes may be one-half degree greater than designed slopes.

1.3 Single Offset

The spigot end shall be so formed that a single offset is formed on the leading end. The surface of the inside of the bell and the outside of the tongue shall be parallel and shall have a maximum designed slope of 2 degrees measured from a longitudinal trace on the inside of the pipe. Measured slopes may be 2.5 degrees.

2.0 Elliptical Reinforcing and Lift Holes

Elliptical reinforcing and lift holes are not permitted for pipe up to and including 900 mm designated internal diameter.

APPENDIX “C”

Vacuum Test Procedure

Shall be per CSA A257.4 Annex A

This annex does not form part of the Plant Prequalification Program Requirements.

APPENDIX "D"

Three Edge Bearing Test Sample Report

Date of Test _____ Test No. _____
Date of Manufacture _____
Pipe Manufacturer _____
Pipe Diameter _____
Pipe Class _____ Pipe Length _____
Governing Specification _____

Total Load to Produce	Actual Load kN.	Required Load kN.
Hairline Crack		
0.3 mm Crack		
Ultimate Load		

Steel Design	Inner	Elliptical	Outer
Concrete Mix Design Identification			

Tests Performed by:

_____ of _____

Technician Plant

_____ of _____

Technician Plant

Tests Certified/Witnessed by:

_____ of _____

Engineer Plant

_____ of _____

Engineer Plant

Tests Passed: Yes / No

Remarks: _____

APPENDIX “E”

Interim Report

Note: This report is to be submitted to the Consulting Engineer once a year after a regular inspection. Failure to do so will result in an automatic plant inspection.

TESTING:

List the number of tests done in the past six months by Product size and class. This list must correspond to plant records.

a) Three Edge Bearing tests:

b) Hydrostatic test (Pipe and Maintenance Holes):

c) Compressive Strength tests (Box Units and Maintenance Holes):

d) Durability tests (Air Void or Salt Scaling):

e) Dimensional Checks (Elliptical Pipe, Box Units and Maintenance Holes):

RECORD KEEPING:

Have you obtained the following certificates and/or test reports? If not, state reason and action taken. Are there new suppliers?

Sand: _____

Stone: _____

Cement: _____

Steel: _____

Gaskets: _____

Mix design changes: _____

Other: _____

Signed by: _____

APPENDIX “F”

Manufacturer Laboratory Correlation Requirements

Purpose:

In order to ensure Precast Concrete Product Manufacturers are providing consistent, well-made precast concrete drainage-products, the Plant Prequalification Program for Precast Concrete Drainage Products Committee has developed the manufacturer laboratory correlation requirements. The purposes of these requirements are,

- A) The Manufacturers are required to demonstrate their ability to consistently test and report concrete cylinders compressive strength data in accordance with applicable standards.
- B) The requirements will ensure producers are prequalified based on the MTO Contractors Quality Control Program

Standards:

- 1. CSA Standard CAN/CSA-A23.2-3C Making and Curing Concrete Compression and Flexural Test Specimens
- 2. CSA Standard CAN/CSA-A23.2-9C Compressive Strength of Cylindrical Concrete Specimens
- 3. Plant Prequalification Program for Precast Concrete Drainage-Products, August 1998 (as amended)

Frequency:

The manufacturer laboratory correlation is scheduled for two times per year. However, additional round robin testing can be undertaken upon request of a Manufacturer.

Administration:

The Ontario Concrete Pipe Association (OCPA) will arrange for the production of the cylinders and the distribution of the cylinders to the Manufacturers under the supervision of the Engineer. Results from the testing will be forwarded directly to the Engineer for analysis. Should corrective action be required, the Engineer will discuss any issues directly with the Manufacturer.

Procedure:

- 1. Under the supervision of the Engineer, a Manufacturer will be requested to produce a number of cylinders. The cylinders may be wet or dry cast and either 100 mm by 200 mm or 150 mm by 300 mm. A technician holding ACI Level 1 Certification shall cast the cylinders. It is the intent of the program to rotate this responsibility among the Manufacturers on a routine basis to ensure equity.
- 2. The cylinders will be shipped to the Manufacturers within three days of casting.
- 3. Each Manufacturer will be required to test two cylinders on the seventh (7th) day after casting in accordance with CSA Standard CAN/CSA-A23.2. A Technician holding ACI Level 1 Certification shall oversee the testing. The other two

cylinders shall be tested on the twenty-eighth (28th) day. Testing of the cylinders require them to be taken to failure in accordance with CSA.

4. The Manufacturers will report the findings, by Fax, to the Engineer by the tenth (10th) day for the seven (7) day test and by the thirty-first (31st) day for the twenty eight (28) day test.
5. The Engineer will report the results to the Manufacturers within a month of receipt of the information.
6. Should corrective action be required, the Engineer will contact the Manufacturer directly and request an action plan from the Manufacturer. Corrective action could include a review of your testing procedure, the recalibration of the test equipment, etc.
7. The Manufacturer will have fourteen (14) calendar days to file corrective action to the satisfaction of the Engineer. Non-compliance may result in the suspension or cancellation of the Plant Prequalification Certificate.

Evaluation:

The competence level shall be reported in accordance with the following analysis method (based on MTO Report EM-47).

PLANT LABORATORY CONCRETE
COMPRESSIVE STRENGTH CORRELATION TESTS

TEST RESULTS ANALYSIS PROCEDURE

Each plant has been assigned an identification number. Do not give your number out to other plants.

A statistical analysis was done on the 7 day and 28 day results. A determination of the mean and the standard deviation was made for all plants. Then the mean was determined for your test results. The difference in the mean between your plant and the mean for the overall results is divided by the standard deviation. This number can be positive or negative. Your rating is based on this number as follows:

if the number obtained is	< 1				Rating 5
if the number obtained is	> 1	to	=	< 1 ½	Rating 4
if the number obtained is	> 1 ½	to	=	< 2	Rating 3
if the number obtained is	> 2	to	=	< 2 ½	Rating 2
if the number obtained is	> 2 ½	to	=	< 3	Rating 1
if the number obtained is	> 3				Rating 0

The plant is expected to review their procedures and make corrections for low ratings, when

- i.) it receives a rating of 2 or lower
- ii.) it receives a p + p or p - p rating consistently (its test results are consistently above or below the overall mean)
- iii.) the difference in strength between the two companion cylinders is greater than the maximum acceptable range (4 x standard deviation)

Each time a correlation test is done, your results will be plotted on a time chart for you to follow your progress.

A plot has been made of all plants, so you can see your level compared to other plants

Appendix “G”

Plant Prequalification Program for Precast Concrete Drainage-Products Prequalification Committee Function - Approved June 25, 2001

1.0 **Mandate**

To manage the Plant Prequalification Program for Precast Concrete Drainage Products (Program) used to prequalify plants, Manufacturers and Products of the precast concrete drainage products industry, in a manner recognized by government and industry.

2.0 **Objectives**

- 2.1 To manage and administer the Program in accordance with the Prequalification Requirements for Precast Concrete Drainage Products document,
- 2.2 To regularly review and modify, where necessary, the Program to ensure it meets the need of Manufacturers, owners, engineers and contractors,
- 2.3 To publish and distribute updates to the Program,
- 2.4 To promote the inclusion of the Program in appropriate standards and specifications.

3.0 **Definitions**

For the purpose of this document, the following definitions and definitions contained in the Prequalification Requirements for Precast Concrete Drainage Products are used:

Alternate – an individual who has been authorized by a Committee Member who is unable to attend a Committee meeting, to act on his/her behalf at the meeting.

Committee Member – a representative of an industry association or government agency who has been appointed to the Prequalification Committee because of his/her special knowledge or expertise.

Non-Voting Member – a Committee Member who participates in all aspects of the committee activity, with the exception that he/she does not have a vote on business before the Prequalification Committee.

Voting Member – a Committee Member who participates in all aspects of the committee activity, and has a vote on business before the Prequalification Committee.

4.0 **Committee Structure**

4.1 **Membership**

The Prequalification Committee is made up of members from the public sector, represented by the Ministry of Transportation for Ontario (MTO), Ontario Provincial Standards for Roads and Public Works (OPS), and the Municipal Engineers Association (MEA), and the private sector, represented by the Ontario Concrete Pipe Association (OCPA) and the Concrete Precasters Association (CPA). Committee Members from the private sector organizations shall be employed by Prequalified Manufacturers.

4.2 **Voting Privileges**

The public sector is represented by the MTO, OPS and MEA each having one (1) Voting Member. The private sector is represented by two (2) Voting Members from the OCPA and one (1) Non-Voting Member from the CPA. Private sector members must be employed by Manufacturers who are prequalified. In addition, the Engineer and the Secretary sit on the Prequalification Committee as Non-Voting Members.

Voting privileges may be attained subject to at least two-thirds (2/3) of an organization's membership being prequalified. Non-voting privileges may be attained subject to one quarter (1/4) of the association members being prequalified.

4.3 Structural Revisions

As the Program evolves, organizations impacted by Program revisions may request inclusion on the Prequalification Committee. Membership is subject to the discretion of the Prequalification Committee.

4.4 Chair

The term of the Chair is five years. Committee Members may nominate candidates for election to the Chair. The Voting Members will select the Chair from the persons nominated. The Chair has an obligation to the Prequalification Committee to act impartially and to ensure that the process operates impartially.

4.5 Engineer

The Engineer is retained by the Committee to conduct inspections in accordance with the Plant Prequalification Program for Precast Concrete Drainage Products and reports to the Committee.

4.6 Secretary

The Executive Director of the OCPA or his representative acts as the Secretary to the Prequalification Committee.

5.0 Operation of the Prequalification Committee

5.1 Meetings

The Prequalification Committee shall meet annually or at the discretion of the Chair. Members may request special meetings be held, through the Chair.

5.2 Notice of Meetings and Agendas

Meeting notices shall be distributed, with the agenda, at least two (2) weeks before the date of the meeting to all Committee Members.

5.3 Attendance at Meetings

Committee Members are expected to attend all meetings and contribute to the work of the Prequalification Committee. Committee Members not able to attend may designate an Alternate to attend on the member's behalf.

5.4 Guests

Meetings shall normally be open to Committee Members (or their Alternates), however, upon specific request, guests may be permitted to attend when the Chair approves attendance before the meeting.

5.5 Quorum at Meetings

At least one-half of the public sector voting membership plus at least one-half of the total private sector voting membership shall constitute a quorum. In the absence of Committee Members, their Alternates shall be included when determining if a quorum exists. If there is no quorum, decisions made at a meeting shall not be final and shall be subject to ratification by the absent Voting Members through one of the following means;

5.5.1 Following the meeting, the Secretary shall poll the Voting Members for their votes/opinions and document the results including the identification of the member's comments, by name, in the minutes as a Secretary's note, or

5.5.2 The item shall be added to the Agenda for the next meeting and the decision ratified at that time.

5.6 Voting

The business of the Prequalification Committee shall be conducted by consensus. All attempts shall be made to gain consensus before a vote is called.

5.7 Minutes of Meetings

Formal minutes shall be prepared and distributed as soon as possible after a meeting (normally two weeks).

5.8 Distribution of Minutes

Minutes shall be distributed to all Committee Members and any guest attending the meeting. In addition, minutes shall be distributed to the Chair of the OCPA; the Chair of the CPA and all Manufacturers prequalified in accordance with the Program.

Prequalification Requirements For Precast Concrete Drainage Products

DIVISION II

PREQUALIFICATION REQUIREMENTS FOR PRODUCTS MANUFACTURED IN ACCORDANCE WITH CSA A23.4

STATEMENT

Plants prequalified under this division shall follow the requirements listed in Division I, where applicable, along with the requirements herein.

DIVISION II – PLANTS PREQUALIFIED TO CSA A23.4

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1.0 Scope

- 1.1 Plants that produce product in accordance with CSA Standard A23.4 shall be prequalified in the Structural non-prestressed categories as follows:

The classifications listed below can be found in Annex C of CSA A23.4-09. They will be included in the body of the standard, when the next edition is published (expected to be published in 2015).

Group B - Bridges

B1 - Precast Bridge Products

Precast concrete bridge products (B1) shall be conventionally reinforced precast concrete elements.

Group B1 products include non-prestressed bridge beams or slabs, piling, sheet piling, pile caps, retaining wall elements, median barriers, parapet walls, sound barriers, and engineered box culverts and three-sided structures not referenced in other Standards.

Group C - Commercial (Structural)

C1 - Precast Concrete Products

Precast concrete products (C1) shall be conventionally reinforced precast concrete elements.

Group C1 products include piling, sheet piling, pile caps, retaining wall elements, slabs, joists, stairs, seating members, columns, spandrels, beams, walls, tunnel segments or other similar products.

Group D – Drainage Products

D1 – Standard Precast Concrete Drainage Products

Group D products shall include reinforced, non-prestressed concrete structural elements with a primary function of drainage, and their related components. Products in Group D1 are box units with span greater than 3m, Open footing (3-sided) precast units with flat top slab or arch top – all sizes, Precast components for culverts such as wingwalls, retaining walls, headwalls, parapet walls, strip footings, pile caps, load distribution slabs, etc., rectangular manholes and chambers – all sizes

Group S – Standard Products

Group S products shall include plain or reinforced concrete elements, without architectural finishes that are not included in Groups B, or C, or D, and are required to be manufactured in accordance with the provisions of this Standard. Products in Group S are often manufactured for a particular application in custom-built forms on-demand or kept in inventory.

- 1.2 This Precast Concrete Prequalification Program evaluates precast concrete manufacturing companies against published standards. Audits shall be conducted by independent professional engineers.

- 1.3 Manufacturers will be evaluated on their quality assurance program, documentation, production facilities and procedures, management, engineering, personnel, equipment, finished products and assemblies in accordance with this Prequalification program.

- 1.4 Audits of precast concrete plants shall be conducted during production times, in order for the Engineer to ensure precast concrete production cycles have been observed for the classification listed on the plant certificate.
- 1.5 The Engineer shall complete the initial audit taking as much time as he/she deems necessary, to ensure that all of the operational, inspection and testing requirements have been observed.
- 1.6 Audits shall be conducted twice a year. One of the audits will be unannounced. There may be additional audits depending on the size of the plant and or problems encountered during regular audits.
- 1.7 An audit is typically a one-day audit. If additional time is required to complete the audit, it will be at the discretion of the auditing engineer.

2.0 BASIS OF ACCEPTANCE

2.1 Plants Seeking Prequalification

Step 1: The producer's manufacturing facility will be inspected to determine if the equipment and materials are available to produce the product.

Step 2: After the producer begins production of the product, the plant and product will be inspected to ensure compliance with this document "Prequalification Requirements for Precast Concrete Drainage-Products." – Division II.

Step 3: If equipment has not been used for five (5) years, it shall be inspected to ensure that it meets the requirements of this document "Prequalification Requirements for Precast Concrete Drainage Products – Division II.

If the plant meets the above requirements, Prequalification will be granted. There will be no preliminary category.

Prequalified plants manufacturing new Products:

All Prequalified plants must notify the inspection service of any new product they wish to manufacture. An inspection will then be scheduled to take place after production of the new product begins.

3.0 Definitions and Reference Publications

3.1 Definitions

In addition to the definitions of CSA Standard A23.4, the following definitions apply in this Prequalification Program: See also, definitions in Division I of this program.

Prequalified Manufacturing plant or plant whenever used in this document means a manufacturing facility at a specific location involved in the manufacture of precast concrete elements as defined in CSA Standard A23.4.

Plant Engineer means a person in the engineering profession with specific expertise in precast concrete who is registered or licensed to practice as a professional engineer in a jurisdiction in Canada.

Prequalification Stamp – see page 9, Division I.

Quality Assurance Manual (QAM) means a documented manual listing all of the requirements of CSA Standard A23.4, including plant procedures and records.

3.2 References

This Prequalification Program refers to the following publications and where such reference is made, it shall be to the current edition listed below, including all amendments published thereto. See also, references in Division 1 of this program.

CSA A23.1 – Concrete Materials and Methods of Construction.

CSA A23.2 – Test Methods and Standard Practices for Concrete.

CSA A23.3 – Design of Concrete Structures.

CSA A23.4 – Precast Concrete – Materials and Construction.

CSA A3000 – Cementitious Materials Compendium.

CSA S6 – Canadian Highway Bridge Design code.

The owner may specify other Federal, Provincial or Municipal specifications.

Plant Prequalification Program (PPP) Inspection Checklist.

Quality Assurance Manual (QAM).

4.0 Prequalification Procedure

- 4.1 Each application for a prequalification certificate shall be addressed in writing to:

Chair, Prequalification Committee

c/o Ontario Concrete Pipe Association (1986) Inc.

447 Frederick Street, 2nd Floor, Kitchener, ON N2H 2P4

and must cover the full range of products manufactured.

- 4.2 The Association will require the applicant to deposit funds in an amount to be stipulated by the Engineer, sufficient to cover the estimated cost for carrying out the inspection and preparing a report thereon and any non-member administration fee. Any unused balance of the deposit will be refunded to the applicant in due course. Should the deposit be insufficient to cover the costs, the applicant will be required to deposit further funds to make up the deficiency.
- 4.3 The Engineer shall have the right at all reasonable times to visit and inspect the procedures used in the manufacture of drainage Products covered by these Requirements. The Manufacturer shall provide access and all reasonable facilities and assistance for the Engineer to carry out such inspection.
- 4.4 The Engineer will carry out an inspection of the applicant's plant and report to the Committee verifying compliance or otherwise with these Prequalification requirements together with a recommendation. At the discretion of the Engineer, further investigation may be requested. Information may be required from the applicant relating to customers or projects to which the applicant has supplied products.

A detailed report shall be prepared for all products shown on the Prequalification Certificate.

For initial certification in a product group or category, the full production cycle must be audited.

- 4.5** If the Engineer is satisfied that the applicant's plant, quality control and product meet these requirements, the Committee will issue a Prequalification Certificate. This certificate will state the type of product along with the classification (s) listed in CSA A23.4.

The Prequalification Certificate will normally be valid for a period of 12 months after the date of issue.

Prequalification in a group/category shall not be granted if the appropriate product has not been produced within five years of the current audit.

- 4.6** After issuing a Prequalification Certificate, the Committee will normally require a further inspection/audit of the Plant and filing of a written report by the Engineer as follows:

Each year, a detailed audit will be conducted and filing of a written report comparable to the original inspection for prequalification purposes.

There shall be two audits each year. The plant will be notified of the date for one audit and the other one shall be unannounced.

The length of each of the audits shall be dependent on the size of the plant, the amount of product to be inspected and the co-operation of the plant personnel.

- 4.7** To obtain renewal of the Prequalification Certificate, the Engineer shall inspect the operations prior to the expiry date of the certificate. The Engineer may require revision to the existing certificate and/or further inspection to be carried out before recommending the renewal of the certificate.

- 4.8** The cost of further inspection and reports shall be borne by the Manufacturer. Payment procedures will be in accordance with clause 4.2. The frequency of inspections/audits may be increased depending on production or if the plant wants to add product to their certificate. A Precast plant or contractor seeking certification for production of precast concrete for a single project may want an inspection.

- 4.9** New precaster's/contractors seeking certification for production of precast concrete for a single project will be dealt with on a case by case basis when it comes to audit frequency. In no case, the audits/inspections be less than four audits/inspections during the first hundred eighty (180) days from the date of certification.

- 4.10** The plant shall be evaluated on a **PASS/CONDITIONAL/FAIL** system. Non-Conformances shall be deemed **CONDITIONAL OR FAILURES**. The auditing engineer has the authority to decide if the non-conformance is conditional or failure.

A non-conformance that is a failure, is one that will be cause for rejection of the product.

For non-conforming items that are not cause for rejection of the product, the plant will have 30 days to rectify the problem.

See clause 4.11 for the appeal process.

If they fail to rectify the problem, the PPP advisory committee is informed and the committee can vote on an action to be taken. The committee can vote to allow more time or depending on the severity, they can vote to withdraw the certificate.

- 4.11 The plant has the option of filing an appeal, if they believe the non-conforming item is not an issue, or if it has been resolved to their satisfaction.
- 4.12 If a Manufacturer has voluntarily allowed the Prequalification Certificate to lapse, or if the certificate has been cancelled, then the Manufacturer will be treated as a new applicant if the Manufacturer applies to have the certificate renewed. The Manufacturer will be responsible for all associated inspection fees.
- 4.13 The issuing of a Prequalification Certificate by the Committee does not relieve the Manufacturer of the responsibility for the adequacy of any Products produced. It is the responsibility of a purchaser to determine the conformance of any Products purchased to the appropriate standard or specification.

5.0 INFORMATION BY MANUFACTURER

- 5.1 The Manufacturer shall ensure that each purchaser of products is provided with installation instructions relating to the specific type of Product supplied.
- 5.2 The Manufacturer shall notify the Committee promptly of any changes made in the supervisory quality control personnel at the plant and shall provide information regarding the qualifications and experience of new supervisory personnel.
- 5.3 The Manufacturer shall notify the Committee promptly of any design changes and provide proof of conformance to CSA A23.1, A23.2, A23.3, A23.4, S06, ASTM Standards, OPSS Standards 1351 or 1821.
- 5.4 The Manufacturer shall at the request of the Committee or Engineer make available information with respect to the purchase of product from the Manufacturer. The information requested may include names of purchaser, owner, consulting engineer, project name and the time during which the order was delivered. In some cases, the Engineer may request further information from the Manufacturer. The above information covering a period of not less than 5 years shall be kept on file so that it may be referred to at the plant at any time by the Engineer.
- 5.5 The Manufacturer shall develop and maintain a Quality Assurance Manual (QAM) as required by this Program. The QAM shall be maintained up to date by the plant Quality Assurance Manager. The auditors shall review the QAM during every plant inspection.
- 5.6 Each plant shall have a quality control section headed by a trained and qualified employee that shall have the responsibility of ensuring that the specified tests are carried out. The head of the quality control section shall keep adequate records of all tests made, together with their results and shall keep a record of tests on equipment. Products not conforming to these test requirements are to be segregated and withheld from shipment.
- 5.7 Quality Control Personnel within the precast concrete manufacturing facilities shall receive regular training as specified below in Clause 11.0.

6.0 MATERIALS

- 6.1 The Manufacturer shall develop and maintain a Quality Assurance Manual (QAM) as required by this Program. See clause 5.5 above.
- 6.2 The QAM shall list all materials and the current standards or specifications the materials are required to meet.
- 6.3 The QAM shall have an approved vendors list with vendor's certificates on file at the plant.
- 6.4 The Manufacturer shall maintain records and certificates for the materials as required in Division I .(See clause 5 – Division I).

7.0 MATERIAL PREPARATION

- 7.1 The QAM shall describe the material preparation for the production of precast concrete elements as required by the standards or contract specifications.

8.0 MANUFACTURING

- 8.1 The safety codes and standards of the country and/or province shall govern all manufacturing facilities, equipment and personnel. The plant is required by law to follow such codes and standards.
- 8.2 All products shall be manufactured in accordance with CSA A23.4 and/or any federal or provincial standards or contracts. The more stringent requirements in the above-mentioned specifications shall be followed.
- 8.3 The QAM shall indicate the plant specific requirements for manufacturing the product.

9.0 INSPECTION AND TESTING

- 9.1 In addition to the requirements of Division I, where applicable, the following shall be conducted.
- 9.2 All inspection and testing requirements of CSA A23.4 and A23.1/2 shall be applied to products manufactured under this Division. Contract document requirements shall take precedence.
- 9.3 See also, the QAM for detailed inspection and testing reports.
- 9.4 If a Plant uses Ready Mix concrete, the supplier shall be certified with the Ready Mix Concrete Association in the applicable province.

10.0 TEST EQUIPMENT AND FACILITIES

- 10.1 The plant shall have adequate testing facilities with all necessary equipment for the testing of concrete, or shall have access to such facilities,

11.0 QUALITY CONTROL PERSONNEL

- 11.1 Quality Control Personnel within the precast concrete manufacturing facilities shall receive regular training provided by the Manufacturer, to ensure the quality control processes are performed correctly by the Staff, and the information gathered is analyzed and maintained in accordance with the Program.
- 11.2 Quality Control Personnel shall require certification consisting of ACI Concrete Field Testing Technician Grade 1. They shall also require certification and achieve greater than

a 90% mark in the Plant Prequalification Requirements for Precast Concrete Products manufactured in accordance with the "**CSA A23.4.exam**".

11.3 The certificate for the A23.4 exam shall be valid for 5 years after which time the Quality Control personnel shall require recertification.

11.4 The plant shall have all Quality Control personnel and all supervisors from Production successfully passing the above-mentioned exam based on A23.4.

11.5 The plant cylinder correlation program is voluntary for plants that are prequalified in accordance with Division I.

For plants that are prequalified in accordance with Division II (Prequalified to CSA A23.4), the correlation program is mandatory.

In addition, any plant that receives a rating of 2 or lower, must repeat the test immediately at their own expense.

The failing plant will be required to make 12 cylinders from one batch of concrete and send 8 of these cylinders to 2 other plants chosen by the auditing engineer.

See Division I - appendix F for details of the program.

Table 11.2 Inspection Measuring and Test Equipment Calibrations-CSA A23.4 requirements

TEST EQUIPMENT	TYPICAL MEASUREMENT	INTERVAL OF CALIBRATION	MINIMUM INSTRUMENT GRADUATION	ACCURACY OF MEASUREMENT	CHECKED BY
Go-No-Go Pipe Spigot Gauges	Pipe Spigot Tolerances	Prior to Usage	Checked by vernier or micrometer	Yes/No	QA
Master Spigot Gauges	Go-No-Go Gauge Tolerances	Yearly	0.001 inch	± 0.004 inch	QA
Header Gauges	Equipment Suitability	Yearly	0.001 inch	± 0.004 inch	QA
Vernier Gauge	All Go-No-Go Gauges	Every 3 Years	0.001 inch	± 0.001 inch	Out Source Certification
Micrometer	Reinforcing	Every 3 Years			
Pressure Gauge	Hydrostatic Test	Yearly	1 psi	+1 psi -0 psi	QA/Out Source
D-Load	D-Load Test	Yearly	500 and 2000 lb	± 1%	Out Source
Batching Scales	Batch Weights	Div I: Yearly Div II: Every 6 months	10 lb	± 2% aggregate ± 1% cement ± 1% water	Out Source
Temperature Recorders	Kiln Temperature	Every 3 Years	2°C	± 2°C	Out Source
Feeler Gauge	D-Load Test	Yearly	0.001 inch	Yes/No	QA
Torque Wrench	Boot Installation	Every 5 Years	1 inch-pound	± 1 inch-pound	Out Source
Gram Scale	Sieve Analysis	Yearly	0.1g	± 1g	QA
Water meters	Batch Volumes	Div I: Yearly Div II: Every 3 months	0.2 Liter	± 1%	QA
Admixture Dispensers	Batch Volumes	Every 3 Months	As per supplier	± 3%	Out Source
Cylinder Testing Machine	Compressive Strength	Yearly		± 1%	Out Source
Slump Cone	Slump	Every 3 Months		10 mm	QA/Out Source
Air Meter	Air Content	Every 3 Months	0.1%	± 1%	QA/Out Source

NOTE

Plants certified to PPP Division II are required to include a similar table in their Quality Assurance Manual that addresses their specific requirements.

This table is repeated in Division I.

END

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