Underground Precast Product Joints

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aka *retired consultant*

1

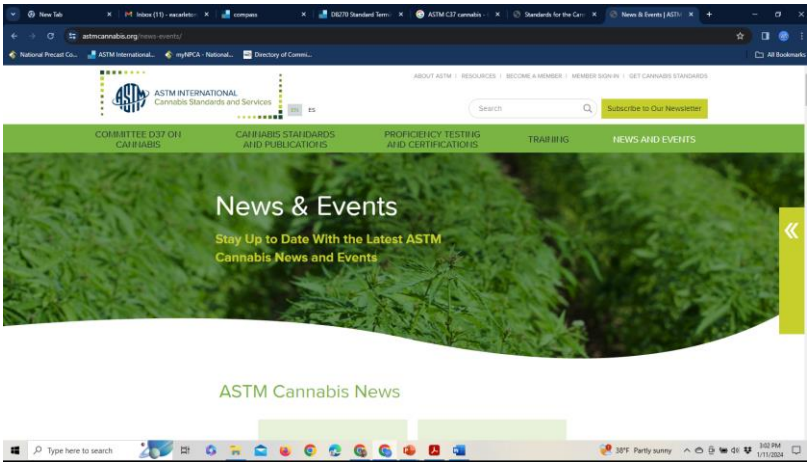
New Product Opportunity: Underground Precast Product "Joints"

Hawaiian Pot Bunker

UK Nuclear Pot Bunker

2

ASTM Committee D37 on Cannabis



1,200 members 30+ countries 50+ standards

3

Todays Objectives

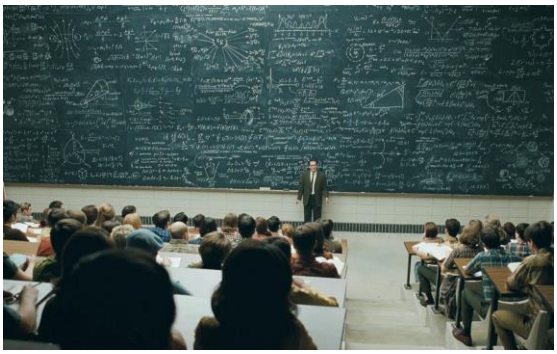
For attendees to have better understanding of:

- What ASTM Standards are and are not.
- A review of the respective buried precast product joint standards.
- Describe the precast manufacturers responsibilities regarding joint fabrication and testing.
- Summarize best practices when manufacturing and testing precast product joints.
- Suggestion of how to comply with the respective product joint standards.

4

Lecture vs. Discussion

One way dialog



Two-way dialog

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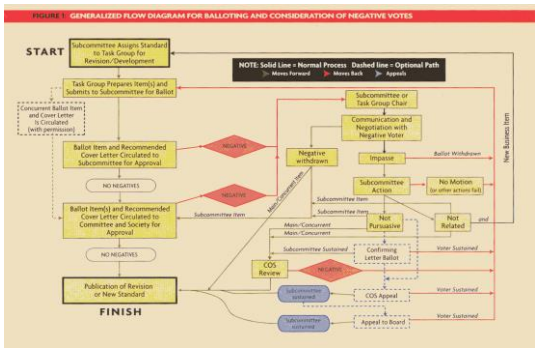
What ASTM Standards Are and Are Not

- **Standard** – guide (ASTM, AASHTO)

Consensus Based Process



Talk to me later about the minimal costs and great benefits to join ASTM.

6

What ASTM Standards Are and Are Not

- **Standard** – guide (ASTM, AASHTO).
- **Specification** – specific instructions and requirements often referencing standards.
- **Contract** – legal binding agreement between two parties to adhere to the items described in the specification.
- **Code** – laws that set minimum requirements for building construction**.**

7

The “Guide” has become a legally binding “Contract”.

- If you reference compliance to an ASTM product or testing standard via **quote, letter, purchase order or product stamp,** you have made an implicant contract or agreement that your product will be in full compliance, unless specific provisions have been included in writing of exceptions being made.

8

Let's dig into *the dope on* buried Joints

Product Standards

- Septic Tanks – C1227, Gravity Grease Interceptors – C1613, Utility Structures – C858, Water & Wastewater Structures – C913
- Non-reinforced Pipe – C14, Reinforced Pipe – C13, Circular Manholes – C478,
- Box Culverts C1577

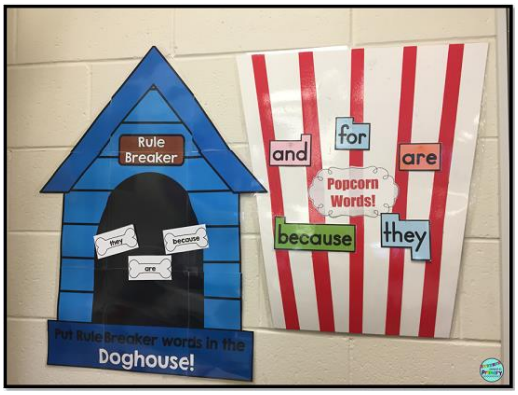
Joint Standards

- Joints for Concrete Pipe & Manholes Using Rubber Gaskets – C443, Joints for Pipe, Manholes, Box Sections Using Preformed Flexible Sealents – C990, Joints for Box Using Rubber Gaskets – C1677, External Joint Wrap- C877

9

Note: This Presentation is a Rule Breaker.

Rule Breaker



Minutia

Minutia art by Marina Medhat

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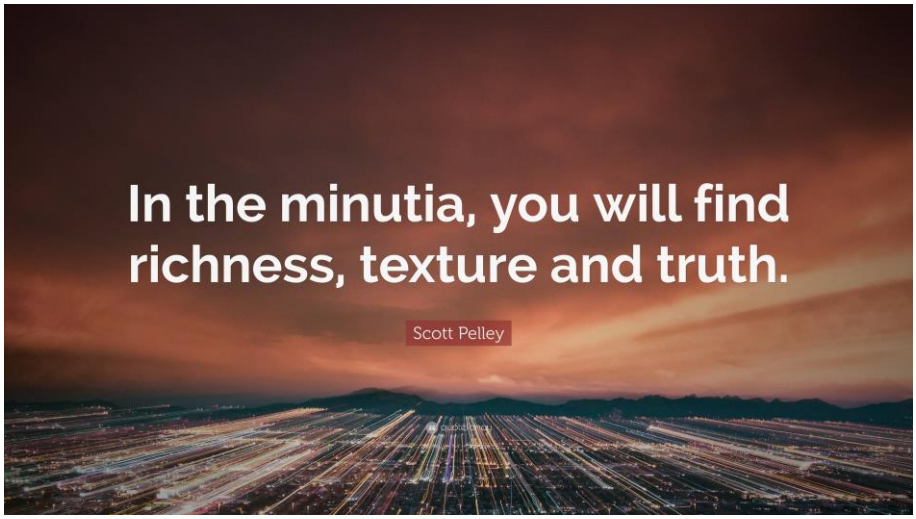

11

1st What is the joint performance expectation?

- Watertight
- Leak Resistant
- Silt Tight
- Soil Tight

12

1st What is the joint performance expectation? (AASHTO R82)

- **Watertight**-an "absolute term, i.e. ZERO leakage.
- **Leak Resistant**-a defined leakage rate.
- **Silt Tight**-resist infiltration of #200 sieve particles.
- **Soil Tight**-resist soil & gravel migration into joint.

2nd Is this for plant "proof of design, quality control, or installed project performance"?

13

Septic Tanks – C1227-23

1. Scope
1.1 Covers performance requirements for precast concrete septic tanks.
3. Terminology
3.2.22 *sealed joint, n*—joint that prevents liquid moving from one side of a precast concrete wall to the opposite side.
8. Quality Control and Sampling
8.1 Precaster certifying to: (*1*) water tightness, (*2*) physical dimensions, and (*3*) strength of structure.
8.2 Precaster may be required to select at random 1 of every 20 septic tanks to determine compliance with the provisions of this specification of ordered by purchaser.
9. Performance Test Methods
9.2 Test for leakage by vacuum or water.
9.2.1.4 The tank must hold the required pressure (**4 in Hg**) for 5 min. if not then the tank can be repaired per the manufacturer's recommendations and retested.
9.2.2 *Water-Pressure Testing*—Fill the tank with water, and let stand for 24 h. Add more water and start the test. The tank is approved if water level is held for 1 h.

14

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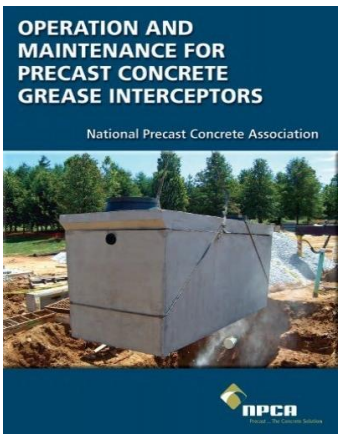
15

Grease Interceptors– C1613-22



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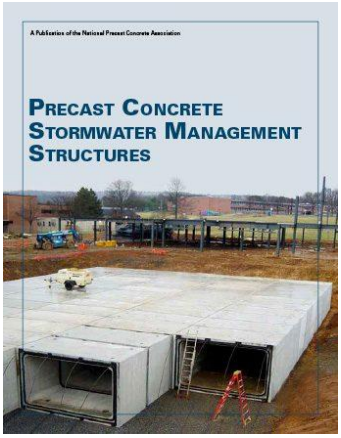
3. Terminology
3.2.10 *sealed joint, n*—joint that prevents liquid moving from one side of a precast concrete wall to the opposite side.
8. Quality Control and Sampling
8.1 Precaster certifying to: (*1*) water tightness, (*2*) physical dimensions, and (*3*) strength of structure.
9. Watertightness Test Methods
9.1 Watertightness testing shall use either vacuum testing or hydrostatic testing. [same criteria as C1227-23).
9.1.1 …If the tank fails the test, it shall be repaired and retested.
9.1.2 … If water is dripping in a steady stream, the tank shall be repaired and retested.

16

Water & Wastewater– C913-23



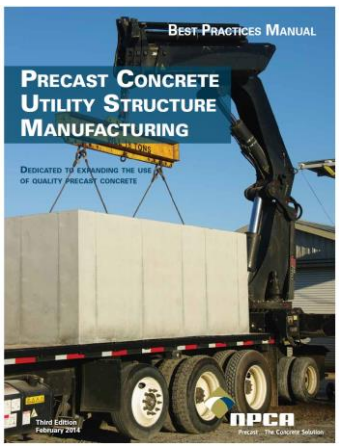
1. Scope
1.1 Describes the recommended design requirements and manufacturing practices for precast concrete water and wastewater structures with the exception of ……*pipe, box culvert, utility str., septic tanks, grease interceptors, manholes,…….*

3. Ordering Information
3.1 Structures to designed in accordance with Section 5 of this specification and found to meet the requirements when tested and inspected as specified in the standard shall be acceptable…….unless the purchaser has described another method.

5. Design Requirements
5.7 *Joints*—Where required, sealed joints in sectional precast concrete structures shall be of such a design to prevent unacceptable leakage when used with a sealant (Note 3) approved by the purchaser and acceptable to the manufacturer. The criteria for unacceptable leakage will be determined by the purchaser's specifications. Where potable water is involved, caution advises selecting a sealant that will not contaminate the water for its intended purposes.
Note 3—Refer to Specification C990 or Federal Specification SS-S-210A for guidance.

17

Utility Structures– C913-23

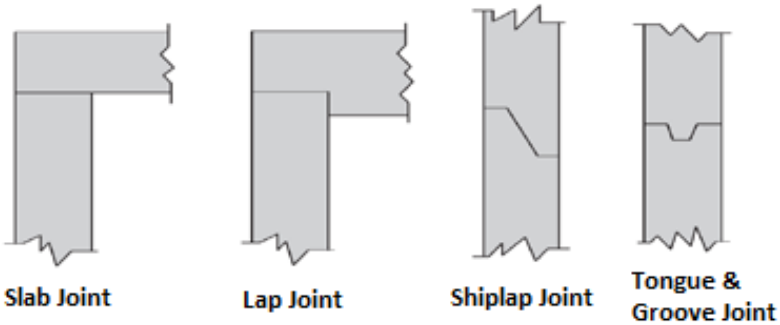


1. Scope
1.1 Describes the recommended design criteria and manufacturing practices for monolithic or sectional precast concrete utility structures.

7. Design Requirements
7.7 *Joints*—Joints in sectional precast concrete structure shall be designed to be self-aligning when assembling sections of the structure.
7.7.1 The manufacturer shall provide the same joint design on all units of identical size and type to ensure interchangeability.

18

Watertight!!!!



Three areas of focus:

1. Joints, 2. Risers, ~~3. Pipe Connections~~

19

Joints Using Preformed Flexible Joint Sealant– C990-09 (2019)

1. Scope

1.1 This specification covers joints for precast concrete pipe and box, and other sections using preformed flexible joint sealants for use in storm sewers and culverts which are not intended to operate under internal pressure or are not subject to infiltration or exfiltration limits. Joint material used in horizontal applications is intended to prevent the flow of solids through the joint.

1.2 For precast concrete manhole sections and other vertical structures, which are subject to internal or external pressure, infiltration or exfiltration limits are not prohibited from being specified. Joints in vertical structures covered by this specification are intended mainly to prevent the flow of solids or fluids through the joint.

7. Design of Joints

7.1.5 The annular space of the joint shall be equal or less than 1⁄2 in. or the maximum specified by the sealant manufacturer, whichever is the lesser.

20

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21

Joints Using Preformed Flexible Joint Sealant– C990-09 (2019)

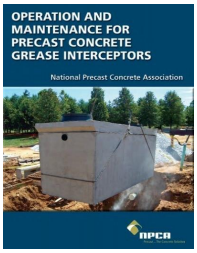
10. Performance Requirements for Joints

10.1 The sections are to be tested hydrostatically, assembled in straight alignment to develop a pressure of at least 10 psi for 10 minutes at the test joint. Alternate test methods are acceptable if 10 psi pressure is obtained at the tested joint….. no visible leakage. Moisture or beads of water appearing on the joint is acceptable.

10.2 "*The user of this specification is advised that the hydrostatic test is intended only for use as a quality control test, and not as a simulated service test. The 10 psi pressure criterion for sections should not be considered an indication of the hydrostatic pressure capability of the joint and sealant under installed conditions*."

22

Septic Tanks – C1227-23
Grease Interceptors– C1613-22



C1227-23
10.3 *Joint Surfaces*—The following joint tolerances for water-retaining structures shall apply:
10.3.1 *Flexible Joint*—The sealed joint gap between two mating joint surfaces shall not exceed 3/8 in. (10 mm) before the joint sealant is applied.

C1613-22
10.3 *Joint Surfaces*—The joint tolerances for sealed joint gap between two mating joint surfaces shall not exceed 3⁄8 in. (10 mm) before the joint sealant is applied.

C990-09(19)
7.1.5 The annular space measured perpendicular to the sealant bearing surfaces of the assembled and centered joint shall not exceed 1⁄2 in. at any point or the maximum specified by the sealant manufacturer, whichever is the lesser.

Plant QC Manual
Max. Gap 1/2-inch = 3/8-inch production ± 1/8-inch (tolerance)
Max. Gap 3/8-inch = 1/4-inch production ± 1/8-inch (tolerance)

23

Tank Testing: Vacuum or Hydrostatic

24

Tank Testing: Vacuum or Hydrostatic

Retesting and "Proof-of-Design"
C1227-23
9.2.1.4 If the tank Fails the test. then the tank may be repaired per the manufacturer's recommendations and retested.
C1613-22
9.1.1 If the tank fails the test, it shall be repaired and retested.
9.1.2 If water is dripping in a steady stream, the tank shall be repaired and retested.

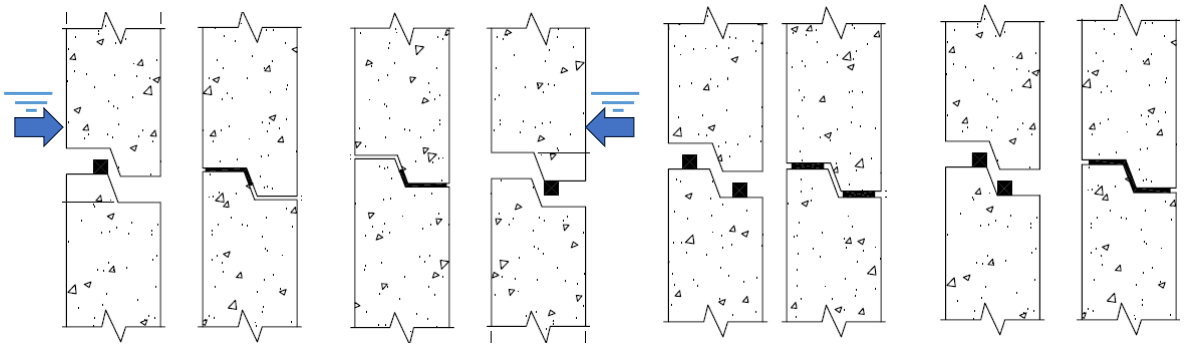
When to "repair" during test?

What is the "joint" to be tested?

25

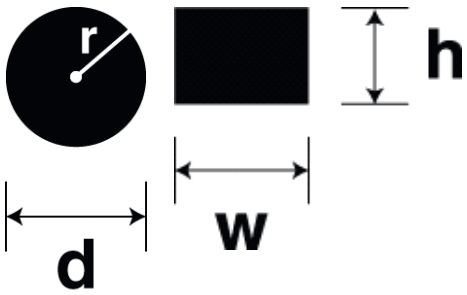
What Makes Precast Concrete Structures Watertight?

Proper application of C990 joint sealant. Different applications depending on nature of tank.



26

Size Matters: When is an inch not an inch?



What is "one inch" size sealant?

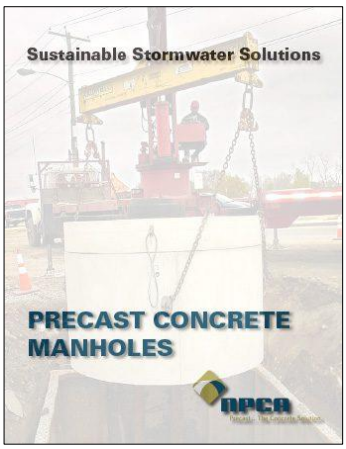
Area of a circle = $\pi d^2/4$
∴ 1" diameter sealant: Area is 0.785 sq. in.

Area of a rectangle = h × w
for a true "1-inch" rectangle: Area = 1.00 sq. in.
∴ a .95" × .825" = 0.785 sq. in. may be furnished.

The assumed minimum sealant deformation is 50% of the installed height. Talk to your sealant manufacturer about the specific design and joint requirements to provide satisfactory installed performance.

27

Manholes – C478/C478M-22



1. Scope
1.1 …the manufacture and purchase requirements of products used for the assembly and construction of circular vertical precast reinforced concrete manholes and structures used in sewer, drainage, and water works.

14. Risers and Conical Tops
14.6 *Joints*—risers and conical tops having male and female ends, so that the assembled sections shall make a uniform manhole, compatible with the tolerances given in 14.7.
14.6.1 "Joints are designed to perform in axial compression; therefore, shear or load testing of the joint is not required."
14.7.3 *Height of Two Opposite Sides*—two opposite sides of risers or conical tops shall not exceed 5⁄8 in. [16 mm].

28

Manholes – C478/C478M-22

No joint testing is specified in C478

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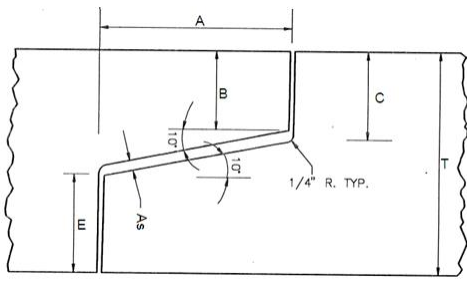
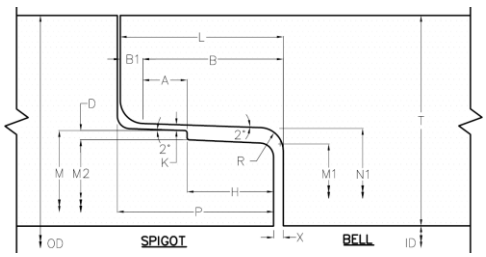
29

Manhole Joint Geometry: Tongue & Groove or Single Offset

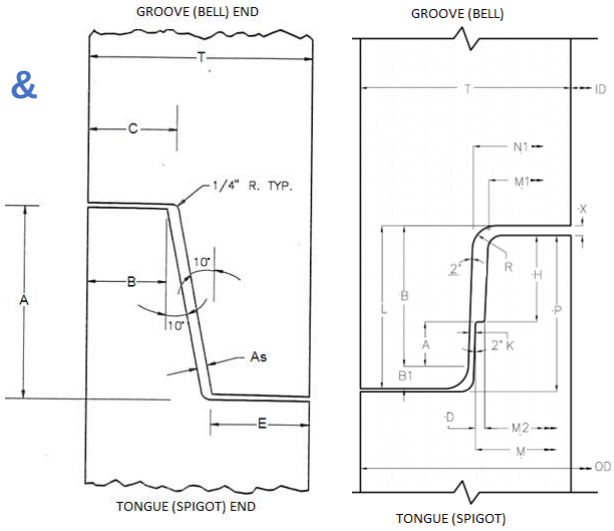




www.concrete-pipe.org

30

Manhole Joint Geometry: Tongue & Groove or Single Offset



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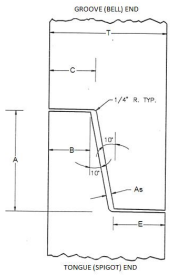

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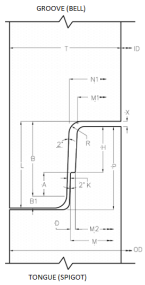

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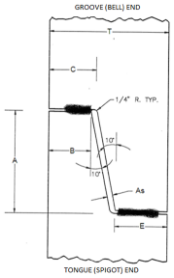

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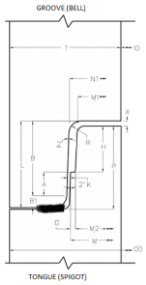
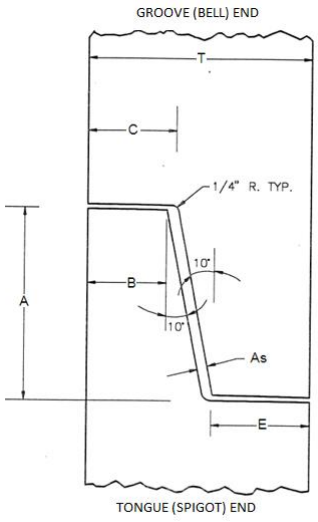


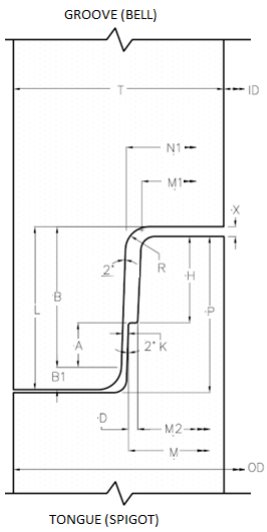
C990 Joint Sealant

Apply Sealant Per Manufacturer's Recommendation

33

Joint Geometry: ~~Mastic~~ or Gasket





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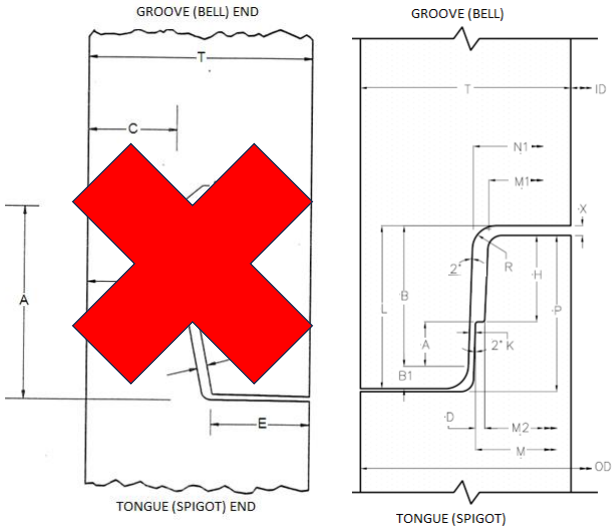

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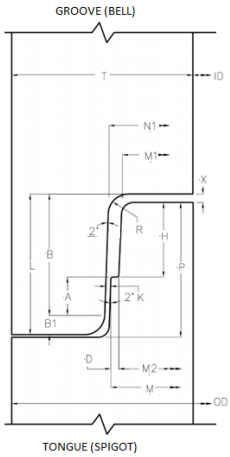
Joints Using Rubber Gaskets– C443-21



1. Scope

1.1"*This specification covers flexible leak-resistant joints for concrete pipe and precast manhole sections, using rubber gaskets for sealing the joints, where infiltration or exfiltration is a factor in the design. The specification covers the design of joints and the requirements for rubber gaskets to be used therewith, for pipe conforming in all other respects to Specification C14, Specification C76, or Specification C507 and precast manhole section conforming in all other respects to Specification C478/C478M, provided that if there is conflict in permissible variations in dimensions the requirements of this specification for joints shall govern."*

4. Basis of Acceptance

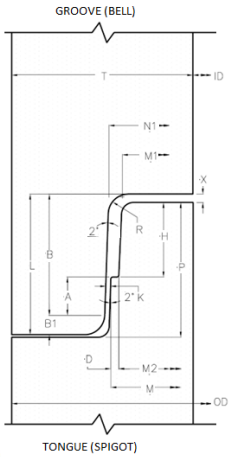
4.1 successful completion of the physical tests prescribed in this specification, if and when required, and by inspection for defects or other variance from design standard.

7. Design of Joints

7.1 "*The manufacturer shall furnish the owner with the detailed design of the joint or joints including design and durometer hardness of the rubber gasket proposed to be furnished under this specification.*"

36

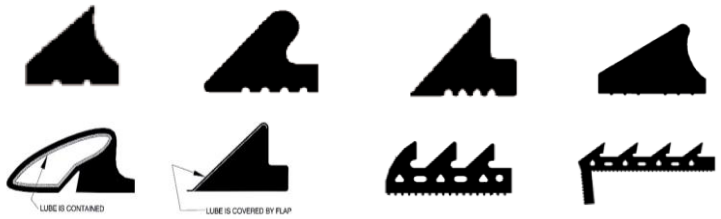
Joints Using Rubber Gaskets– C443-21



7. Design of Joints

7.1.5 …the gasket-bearing surfaces of the assembled and centered joint shall be not more than 75 % of the uncompressed height of the applied gasket including all manufacturing tolerances of the joint and gasket applied.

7.1.6 …design tolerances for the annular space between the gasket bearing surfaces shall not vary by more than 10 % of the uncompressed height of the applied gasket designated in the design. Tolerances for the gasket bearing surfaces are designated by manufacture that ensure the joint will go home without concrete-to-concrete contact with designated gasket installed.



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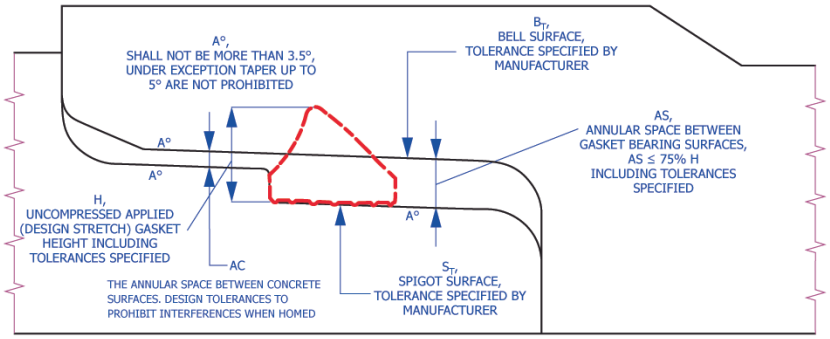


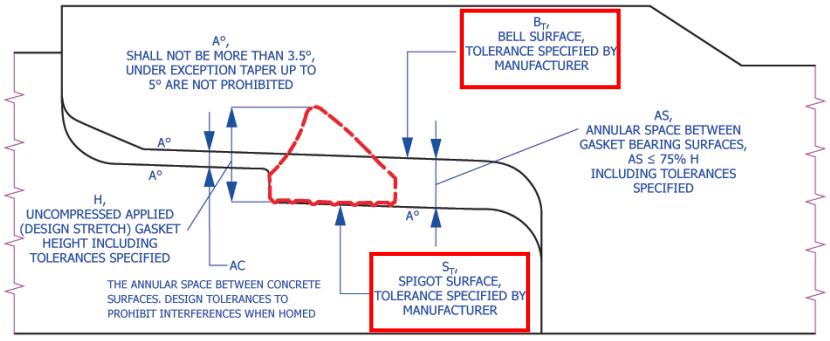
$B_T + S_T \leq 10\%$ H, BUT NOT GREATER THAN MANUFACTURER SPECIFIED DESIGN TOLERANCE

NOTE: GASKET PROFILE SHOWN IS FOR INFORMATIVE PURPOSES ONLY AND IS NOT INTENDED TO IMPLY IT TO BE THE PREFERRED OR INTENDED GASKET SHAPE FOR THIS STANDARD.
OTHER GASKET PROFILES ARE ACCEPTABLE IF IN COMPLIANCE TO THE PROVISIONS WHITHIN STANDARD

TONGUE (SPIGOT)

38

Joints Using Rubber Gaskets– C443-21



Note: For non-circular shaped gaskets, the applied gasket height is typically empirically determined.

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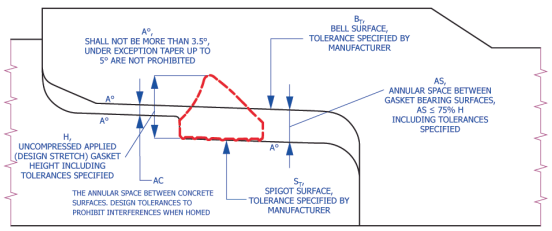
Joints Using Rubber Gaskets– C443-21



$B_T + S_T \leq 10\%$ H, BUT NOT GREATER THAN MANUFACTURER SPECIFIED DESIGN TOLERANCE

NOTE: GASKET PROFILE SHOWN IS FOR INFORMATIVE PURPOSES ONLY AND IS NOT INTENDED TO IMPLY IT TO BE THE PREFERRED OR INTENDED GASKET SHAPE FOR THIS STANDARD.
OTHER GASKET PROFILES ARE ACCEPTABLE IF IN COMPLIANCE TO THE PROVISIONS WHITHIN STANDARD

The purpose of this example is to demonstrate the necessary calculations that must be performed to determine if a given pipe joint and gasket combination will meet the design requirements of ASTM C443.

Analysis is based on the following given joint and gasket parameters:

Nominal Bell Diameter	B	=	27.831	in.
Nominal Spigot Diameter	S	=	27.179	in.
Design Bell Tolerance	B_T	=	0.021	in.
Design Spigot Tolerance	S_T	=	0.032	in.
Design Percent Gasket Stretch	$\%G_{str}$	=	20%	
Design Applied Gasket Height (*see Note 2*)	H	=	0.550	in.
Design Gasket Tolerance (percentage)	$\%G_T$	=	3%	

Check that the Design Percent Gasket Stretch does not Exceed the Max. Limit (30%) per 7.1.8

$\%G_{str}$ = 20% ≤ 30% Max. Limit **O.K.**

Check that the Design Gasket Tolerance does not Exceed the Max. Limit (3%) per 5.1

$\%G_T$ = 3% ≤ 3% Max. Limit **O.K.**

Check that Total Design Tolerances Do Not Exceed 0.10H per 7.1.6

Calculate the total design joint tolerance:

$T_{des} = B_T + S_T$

T_{des} = 0.021" + 0.032" = 0.053 in.

Check that the total design tolerance does not exceed 0.10 H as specified in 7.1.6:

0.10 H = 0.10 (0.550") = 0.055 in.

T_{des} = 0.053 ≤ 0.10 H = 0.055

O.K. - Total design joint tolerance does not exceed 0.10H

Check that Annular Space Does Not Exceed 75% of the Applied Gasket Height per 7.1.5

Calculate the nominal design annular space (A_S) of the joint (centered):

$AS = (B - S)/2$

AS = (27.831 – 27.179) / 2 = 0.326 in.

Calculate the maximum annular space (centered) including total design tolerance:

$AS_{max} = AS + T_{des}$

AS_{max}= 0.326" + 0.053" = 0.379 in.

Calculate the minimum gasket height including design tolerance:

$H_{min} = (1 - \%G_T) H$

H_{min}= (1 – 0.03) 0.550" = 0.534 in.

Check the Ratio of AS_{max} to H_{min}

(AS_{max}/ H_{min}) * 100% = (0.379" / 0.534") * 100% = **71.0%**

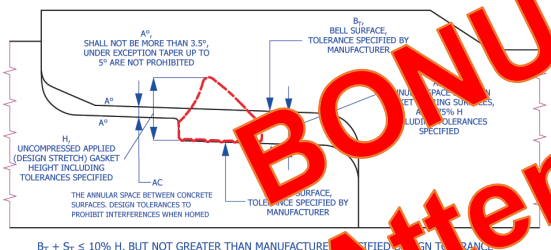
O.K. - Ratio is less than or equal to max. limit of 75%

Notes:

1. The calculations are for illustration purposes and are not intended to reflect or recommend a particular joint geometry.
2. For non-circular shaped gaskets, the applied gasket height is typically empirically determined.

40

Joints Using Rubber Gaskets– C443-21



$B_T + S_T \leq 10\%$ H, BUT NOT GREATER THAN MANUFACTURE[illegible]

NOTE: GASKET PROFILE SHOWN IS FOR INFORMATIVE PURPOSES ONLY [illegible] BE THE PREFERRED OR INTENDED GASKET SHAPE FOR THIS STANDARD. OTHER GASKET PROFILES ARE ACCEPTABLE IF IN COMPLIANCE TO THE [illegible]

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Design [illegible] Gasket Height	H	=	0.550 in.
Design [illegible]	$\%G_T$	=	3%

Check that the [illegible] Stretch does not Exceed the Max. Limit (30%) per 7.1.8

$\%G_{str}$ = 20 ≤ 30% Max. Limit **O.K.**

[illegible] that the Design Gasket Tolerance does not Exceed the Max. Limit (3%) per 5.1

$\%G_T$ = 3% ≤ 3% Max. [illegible] **O.K.**

[illegible] that Total Design Tolerances Do Not Exceed [illegible]H per 7.1.6

Calculate the total design joint tolerance:

$T_{des} = B_T + S_T$

T_{des} = 0.021" + 0.032" = 0.053 in.

Check that [illegible] total [illegible] does not [illegible] 0.10 H as specified in 7.1.6:

[illegible] 0.10 (0.[illegible]50") = 0.055 in.

T_{des} [illegible] 0.055

O.K. - Total [illegible]sign tolerance does not exceed 0.10H

Check that [illegible]nular Space Does Not Exceed 75% of the Applied Gasket Height per 7.1.5

[illegible]ominal design annular space (A_S) of the joint (centered):

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Notes:

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2. For non-circular shaped gaskets, the applied gasket height is typically empirically determined.

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THE PRECAST SHOW

41

Deformation Percent Limits

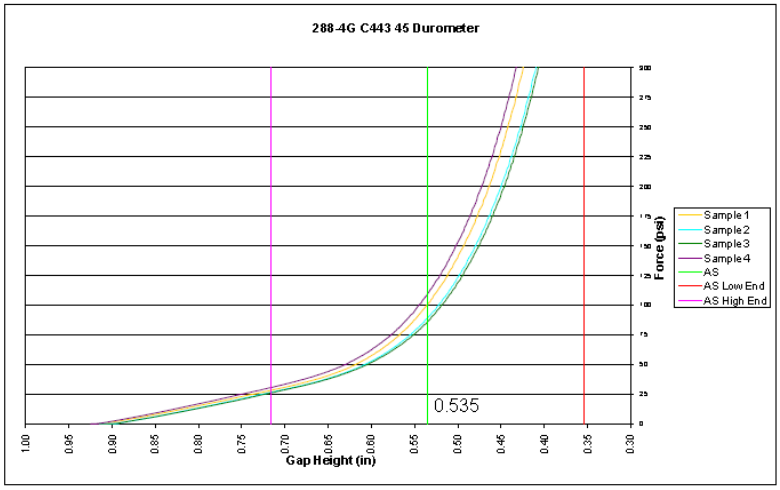
Why isn't the percent of deformation the best choice for gasket design? Gaskets and designs can be deformed the same and still exert different sealing force against the bell!

Deformation% :	**50%**	**50%**
Force:	**150 lbs./in**	**100 lbs./in**

THE PRECAST SHOW

42

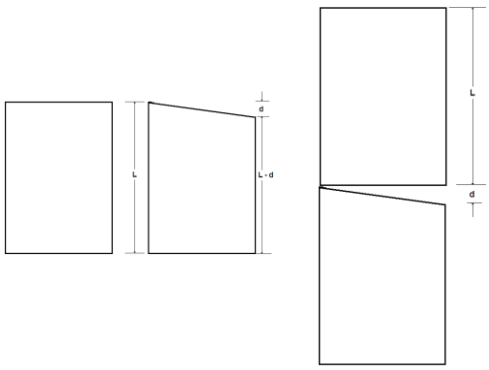
Deformation Percent Limits



Annular Space: 0.535 CAS: 0.181

43

Joints Using Rubber Gaskets– C443-21



8. Permissible Variations in Dimensions

8.1 The planes formed by the ends pipe and manhole sections shall not be more than 3⁄16 in. diameters 30 in. and smaller; or by more than **1⁄4 in. for diameters** 33 to 54 in.,,not more than **3⁄8 in. diameters** 60 in. and larger.

9. Performance Requirements for Joints

9.1 When required by the owner joints shall pass the following performance tests without leakage:

9.1.1 *Pipes or Manholes in Straight Alignment*—Hydrostatic tests on joints made on two sections, properly joints. The owner may require a second test. Adequate bulkheads are to be provided….

44

Joints Using Rubber Gaskets– C443-21

9. Performance Requirements for Joints
9.1.1 *Pipes or Manholes in Straight Alignment*—……
…the assembly shall be subjected to an internal hydrostatic pressure of 13 psi (30 ft) pressure head for 10 min.

Prefabricated Joint/Pipe Testing Apparatus

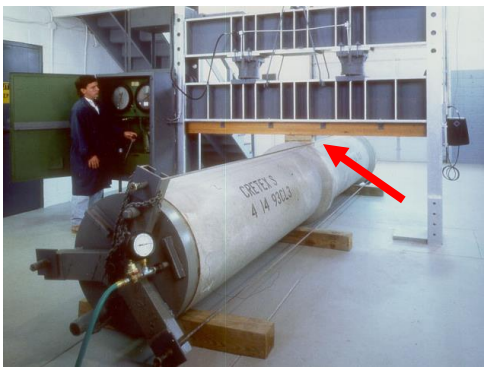
Prefabricated Bulkheads with Attachments C497

45

Joints Using Rubber Gaskets– C443-21

9. Performance Requirements for Joints
9.1.2 *Pipes or Manholes in Maximum Deflected Position*—
Upon completion of the in 9.1.1, the test sections shall be opened to create a position 1⁄2 in. wider than the assembled position on one side of the outside perimeter of the joint and shall be subjected to a hydrostatic pressure of 10 psi for 10 min.

Simple 1 Piece Joint Test Setup



Joint Shear Test Condition C1628 /C497

46

Joints Using Rubber Gaskets– C443-21

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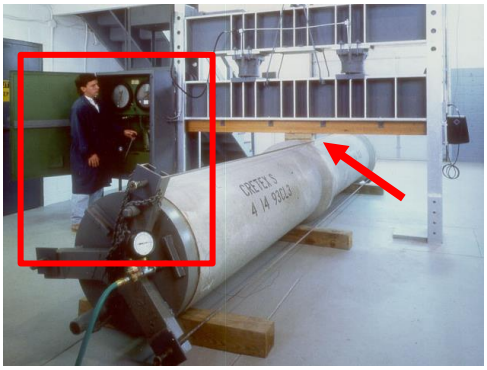

Joint Shear Test Condition C1628 /C497

47

Joints Using Rubber Gaskets– C443-21

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Joint Shear Test Condition C1628 /C497

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48

Joints Using Rubber Gaskets– C443-21

9. Performance Requirements for Joints
9.1.3 Unless prohibited by the owner, the manufacturer has the option to test the joint by methods which energize the rubber gasketed joint either internally or externally.

49

Joints Using Rubber Gaskets– C443-21

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50

Joints Using Rubber Gaskets– C443-21

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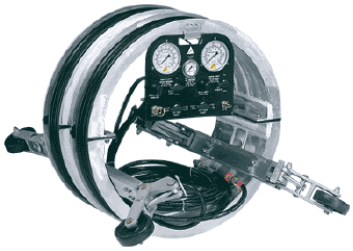

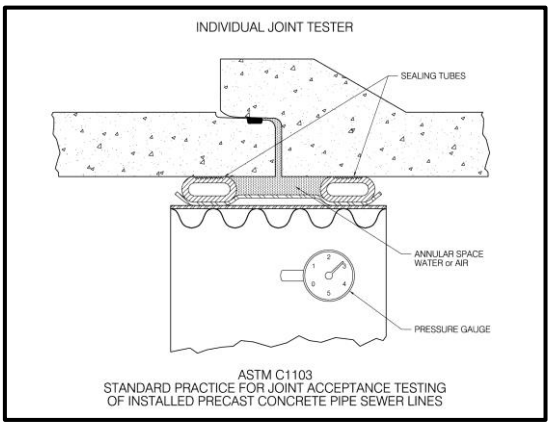

51

Joints Using Rubber Gaskets– C443-21

9. Performance Requirements for Joints
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"Easily accomplished with tools you already have at home"

52

Joints Using Rubber Gaskets– C443-21

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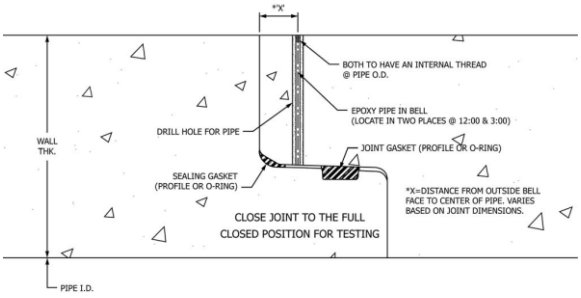
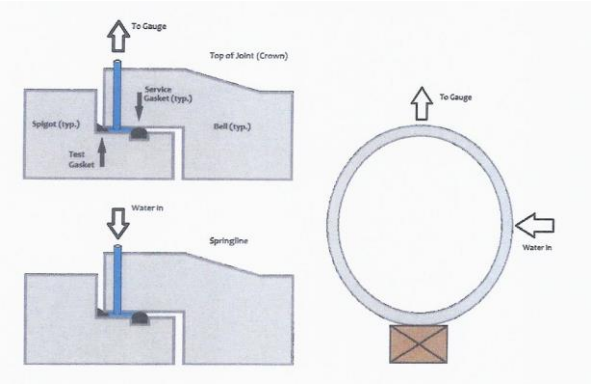




Hydrostatic External Joint Test Method C497

53

Joints Using Rubber Gaskets– C443-21

10. Storage
10.1 Store to the lubricant manufacturer's recommendations.
12. Certification
12.1 When requested by the owner, furnish written certification that the joint lubricant meets the requirements of this specification for the supplied.

Lube Matters!

54

NPCA Plant Certification Program

Stormwater RCP

- **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 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.
- **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).

Sanitary RCP

- **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.
- **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 forth in ASTM C1628. Pipe shall be tested up to 13.0 psi for 2 – ½ minutes with no leakage.

55

Proof-of-Design DONE, All OK?

56

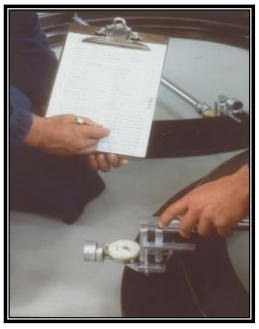
Proof-of-Design DONE, All OK?

For attendees to have better understanding of:

- ✓What ASTM Standards are and are not.
- ✓A review of the respective buried precast product joint standards.
- ➢Describe the precast manufacturers responsibilities regarding joint fabrication and testing.
- ➢Summarize best practices when manufacturing and testing precast product joints.
- ➢Suggestion of how to comply with the respective product joint standards.

57

Joint Equipment Measurement



4.1.3 Forms and Forming Equipment

All forms and forming equipment (including pallets, headers, truing rings) shall be measured prior to initial use and/or after repairs for dimensional conformance with applicable tolerances**.** Reports shall be maintained in the plant records for a minimum of three (3) years.

58

Finished Joint Measurement

6.2.1.4 & 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…. Joints must be checked for dimensional conformance with either manufacturer's specifications, applicable standards and/or specifying authorities.




59

Finished Joint Measurement

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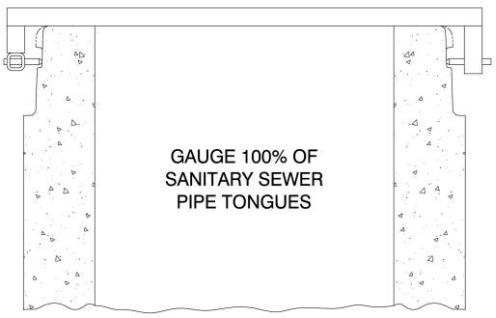
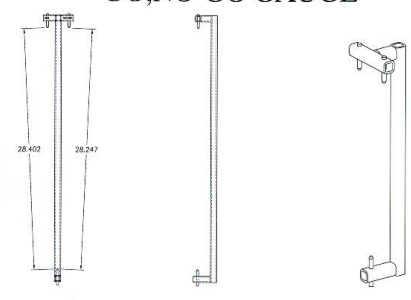
GO,NO-GO GAUGE



GO,NO-GO GAUGE



60

Finished Joint Inspection

4.6.4 Post-Pour Inspection -After products are stripped from the forms, they shall be inspected for conformance with the design. Items to be repaired shall be classified as “major” or “minor” defects, or as honeycombed areas.

4.6.5 Plant Requirements: A post-pour inspection shall be made and documented for 1 piece or 3%, whichever is greater, of each precast product produced.




61

Box Culverts – C1577-20e1

Photo credit Hamilton Kent

1. Scope*

1.1 …precast reinforced concrete box sections cast monolithically for culverts, storm water, industrial wastes and sewage.

9. Joints

9.1 The precast reinforced concrete box sections to have tongue and groove ends. The joints shall be cast that the sections can be installed constructing a continuous line of box sections compatible with the allowable variations given in Section 12.

9.2 Joints can meet Specification C1677, Specification C990 or other acceptable type as approved by the owner including, but not limited to, mortar, sealant or fabric wrapped joints.

www.concrete-pipe.org

62

Box Culvert Joints – C1677-11a(2017)

Photo credit Hamilton Kent

1. Scope
1.1 …flexible joints for concrete box sections, using rubber gaskets for leak resistant joints….
6. Design of Joints
6.1 The manufacturer is obligated to provide the owner a detailed design of the joint or joints ……
6.1.5 "*The space between the gasket-bearing surfaces of the assembled and centered joint shall be not more than 75 % of the uncompressed thickness of the installed gasket with all manufacturing tolerances applied. Minimum tolerances shall not be less than 10 % of the installed gasket height. The minimum off-center gasket deformation of the assembled joint at design closure shall not be less than 15 %. The joint design shall provide for the deflection of a box unit by opening one side of the outside joint surface of the joint 1/2 in. (13 mm) wider than the designed position without causing the deformation of the gasket to be less than 10 %."*

63

Box Culvert Joints – C1677-11a(2017)

9. Performance Requirements for Joints
9.1.1 *Boxes in Straight Alignment…*the joint to have a pressure of 5 psi (35 kPa) for 10 min. …water that drips from the joint that will dry up eventually on retesting are acceptable.
9.1.2 *Boxes in Maximum Deflected Position…*open the joint 1/2 in. (13 mm) wider on one side of the homed joint on the outside perimeter of the tested joint and apply an internal hydrostatic pressure of 3 psi (21 kPa) for 10 min. water that drips from the joint that will dry up eventually on retesting are acceptable.
9.1.3 *Off-Center Alignment*—When finishing the test in 9.1.1 and 9.1.2 the box joint be loaded to create maximum joint annular space to occur (i.e. concrete-to-concrete on the opposite side or 150 lb/in [26.3 KN/mm]).. The assembly shall than be retested as set forth to the 5 psi criteria for 10 min.

64

Box Culvert Joints – C1677-11a(2017)

Photo credit Garden State Precast

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65

External Sealing Bands– 877-21

C877 Type 3 Band – Tim Andrews Blessing the Joint

1. Scope

1.1 …external sealing bands used in conjunction with concrete pipe as defined in Terminology C822 and conforming to Specifications C14, C76, C412, C478/C478M, C506, C507, C655, C985, C1417, and C1433.

5. Materials and Manufacture for Sealing Bands

5.1 *Type I, Rubber and Mastic Bands:*

5.2 *Type II Plastic Film and Mesh Reinforced Mastic Bands:*

5.3 *Type III, Chemically-Bonded Adhesive Butyl Bands:*

Type A (Plastic backing band)

Type B (Rubber backing band)

C877 Type 2 Band

C877 Type 3 Band

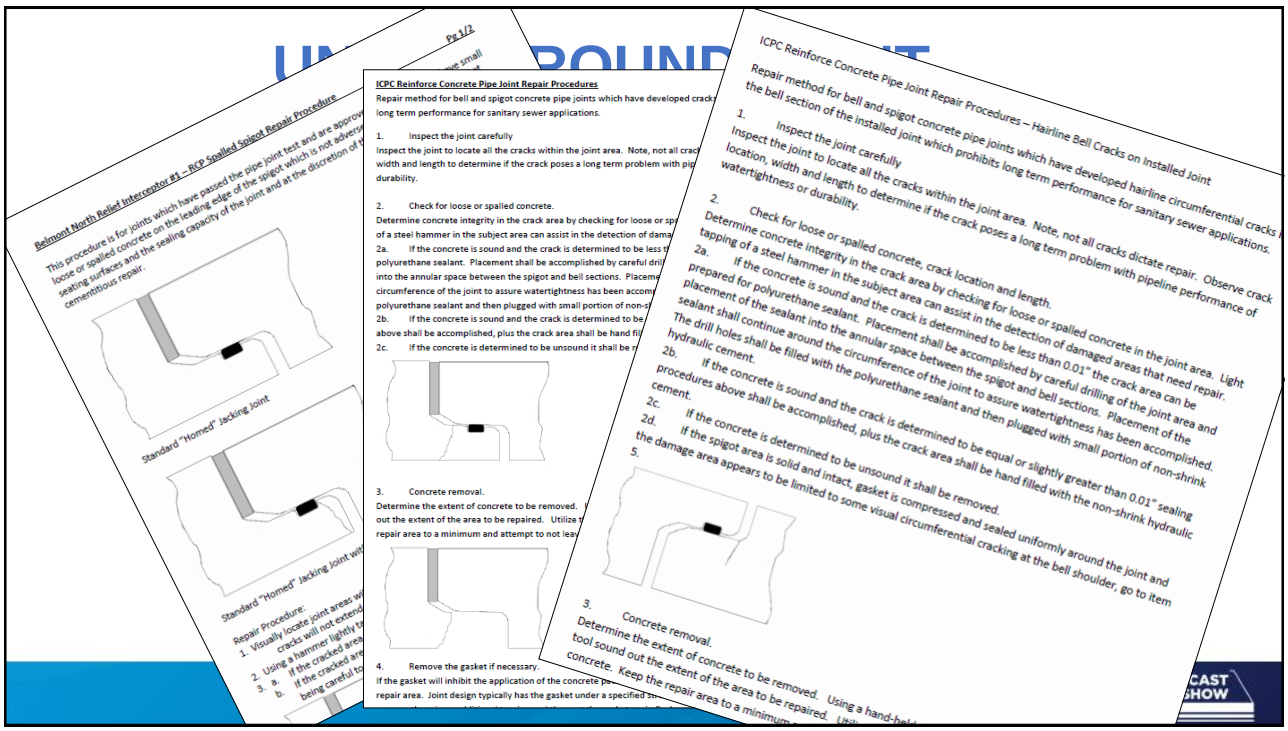
66

UNDERGROUND JOINT INSTALLATION SUCCESS

communication → BE PREPARED

- Have written instructions showing proper field installation of your products joint system.
- Have a written plant AND installed joint repair procedure reviewed and approved or ready to go with the expectations of responsibility.

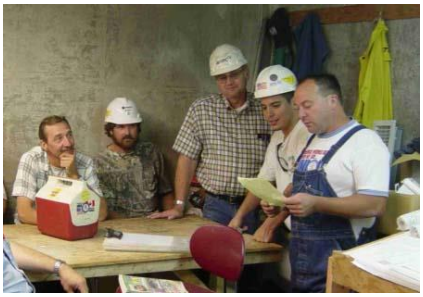
67



68

UNDERGROUND JOINT INSTALLATION SUCCESS

communication → **JOB SITE VISITS**



69

Today's Takeaways

- Fully read and understand all the ASTM (joint) standards you claim your products to comply.
- Management and production to review and implement the required joint design and corresponding "proof-of-design" testing.
- Develop inhouse or 3rd party reports of joint testing.
- Develop and implement on going QA/QC inspection and testing methods to verify on going compliance and appropriate testing frequencies. Keep records of all testing.
- Utilize your joint material or equipment suppliers' expertise!
- Prepare in advance plant and field joint repair procedures.
- Visit the jobsite of critical joint application to train contractor and inspectors.

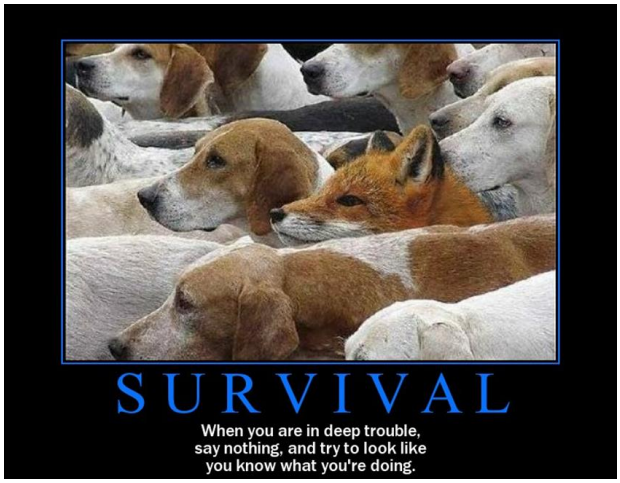
70

Today's Takeaways

At least 1 Gold Nugget

71

Questions?



Eric A. Carleton, P.E.
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EACarletonPE@gmail.com

72

Underground Precast Product Joints

Eric A. Carleton, P.E.

2024 The Precast Show

73

- You've carefully thought out all the angles.
- You've done it a thousand times.
- It comes naturally to you.
- You know what you're doing, its what you've been trained to do your whole life.
- Nothing could possibly go wrong, right ?

74

Think Again

75