



PRESS-SEAL GASKET CORPORATION

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TECHNICAL EVALUATION

Life/Performance Expectancy of Rubber Gaskets: Analysis of Water Transmission Gasket Installed in 1962

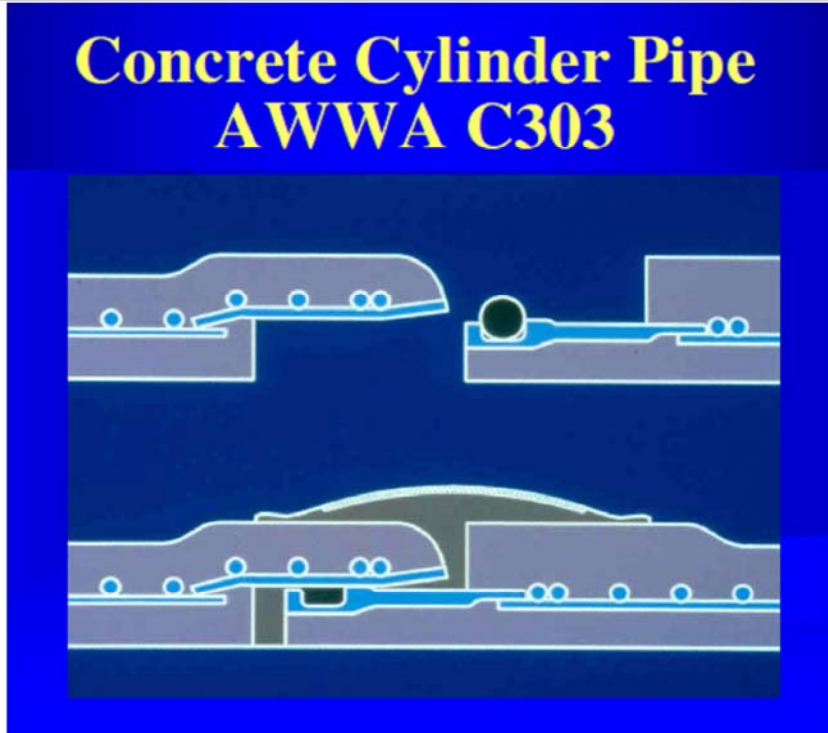
Report Date: June 6, 2011

Synopsis: *A rubber gasket in service since 1962 is analyzed and a service life in excess of 100 years is projected.*

Background: One sample of an o-ring gasket was supplied to Press-Seal by Ameron International Corporation, South Gate, California, for technical and laboratory evaluation. The sample was expedited through J-K Polysource, Sparks, Nevada.

The pipe from which the gasket was removed is denoted by AWWA C 303 as "Concrete Pressure Pipe, Bar-Wrapped, Steel Cylinder Type." This pipe is comprised of a steel cylinder, the interior diameter of which is coated with cementitious mortar through centrifugal casting. The outside diameter of the steel cylinder is wound with steel wire under tension and then coated with a protective mortar covering. Formed steel end rings provide a confined groove on the spigot for the gasket and a tapered bell section for the receiving end. It will be referred to in this report as "Concrete Cylinder Pipe".

The gasket sample was recovered from service when a section of 24" concrete cylinder pipe was removed so that a T-section could be installed. The original line was installed in 1962 and the gasket was removed in 2010, after 48 years of service in water transmission.



Schematic representation of sample gasket in assembled joint



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Physical Examination: The gasket as received was in overall good condition. It had areas covered in orangish residue consistent with installation in intimate proximity to steel, such as in steel ring pipe. There was no evidence any remaining lubricant from the original installation

The gasket was a molded product, as there was no detectable splice and there was a small parting line (area where molds halves join) around the diameter of the part. There were several areas of abrasion, including areas where the rubber surface had slight tears. This is likely due to the disassembly process, where the gasket would have adhered to the steel joint rings over the course of the years.

The gasket was measured and the following was found:

Length	71.375 inches (1813 mm)
Weight	0.913 lbs. (415 grams)
Diameter	~0.690 ~ 0.560 inches (~0.130 inch ovality)
	~17.56 ~ 14.22 mm (~3.34 mm ovality)
Volume	373 cc

The original gasket specification would have been 21/32" (16.67 mm) diameter o-ring for 24" concrete cylinder pipe and had the following dimensions:

Length	65.0 inches (1651 mm)
Diameter	0.656 inches (16.67 mm)
Volume	360 cc

These minor differences show the following:

1. The sample gasket demonstrates the effect of prolonged elongation in that it has assumed a profile of extended length with a reduced cross-section, despite the fact that the rubber demonstrates very low tension set properties, which is the tendency of a stretched gasket to become longer as a result of being stretched continuously.
2. The gasket shows compression ovality typical of a high-compression joint seal, such as that used in steel cylinder pipe.



Gasket laid out for measurement



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Inside measurement of gasket



Gasket end showing ovality



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Gasket showing abrasive separation

Laboratory Analysis: The following tests were conducted and the measurements obtained, along with AWWA Specification C 303 requirements:

<u>Test</u>	<u>AWWA Requirement</u>	<u>Test Result</u>
Tensile Strength	2700 psi min.	3524 psi
Elongation	400% min.	560%
Durometer	55 +/- 5 Shore A	57
Compression Set	20% max.	26.8%
Aged Tensile Reduction	<20%	6.8%
Determination of primary polymer		Natural Rubber (NR)

Discussion of Laboratory Analysis: This gasket appears to be made from a very polymer-rich grade of Natural Rubber. Its relatively low Specific Gravity (1.113) and its very high tensile properties would be almost impossible to duplicate with any other polymer. SBR may be a small polymer constituent, as it is frequently included in small quantities in rubber compounds for pressure pipe to reduce hysteresis.



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All physical properties of the gasket (except one) are well within Specification requirements and would be considered excellent for newly-made gasket, let alone a gasket in service for almost a half-century. The one result which is no longer within Specification requirements is Compression Set. This is somewhat puzzling as this property typically improves with age, at least in the short term. One possible explanation is that the axis of test for compression set is through the circular centerline. This would make the test measure at 90 degrees to the compression force of the joint. Given that the gasket shows ovality in this direction, it is probable that its properties measured in another axis were also affected by the amount of this compression.

General Discussion and Conclusions: Considering its many years of service, this gasket shows how durable rubber gaskets can be. The minor discrepancies that were noted did not affect its suitability for the application, and it was continued to seal until its removal was required. Projecting the likely changes in physical properties from manufacture to current testing, we project that this gasket would easily achieve a service life in excess of 100 years.

Respectfully submitted,

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