TEC Services
Testing • Engineering • Consulting

September 29, 2017

Chemical Construction Company
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Subject: **Report of Product Testing – ASTM C603/C920/D412/D792**
Product: Chemcon Self-Leveling Sealant
TEC PRO 17-1401
TEC Laboratory No: 17-573

Testing Engineering & Consulting Services, Inc. (TEC Services) is an AASHTO R18, ANS/IEC/ISO 17025:2005, and Army Corps of Engineering accredited laboratory. TEC Services is pleased to present this report of testing on the Chem Construction Sealant received at our laboratory in August, 2017. Testing was performed in accordance with the terms and conditions of our Service Agreement. It is our understanding that the submitted product is designated as a Type S, Class 25, Grade P | Use T_2, M, NT sealant per ASTM C920-14 *Standard Specification for Elastomeric Joint Sealants.* These test results pertain only to the sample tested.

The purpose of the testing was to evaluate the submitted coating in accordance with the following test methods:

ASTM C639-15	*Standard Test Method for Rheological (Flow) Properties of Elastomeric Sealants*
ASTM C1183-13	*Standard Test Method for Extrusion Rate of Elastomeric Sealants*
ASTM C661-15	*Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer*
ASTM C1246-00(2012)	*Standard Test Method for Effects of Heat Aging on Weight Loss, Cracking, and Chalking of Elastomeric Sealants After Cure*
ASTM C679-15	*Standard Test Method for Tack-Free Time of Elastomeric Sealants*
ASTM C510-05(2011)	*Standard Test Method for Staining and Color Change of Single- or Multicomponent Joint Sealants*
ASTM C793-05(2010)	*Standard Test Method for Effects of Laboratory Accelerated Weathering on Elastomeric Joint Sealants*

- ASTM C719-14 *Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle)*
- ASTM C794-15 *Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants*
- ASTM C603 *Standard Test Method for Extrusion Rate and Application Life of Elastomeric Sealants*
- ASTM D412 *Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension*
- ASTM D792 *Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement*

ASTM C639 – Vertical & Horizontal Displacement

A closed-end stainless steel channel 6.00 inches in length, 0.75 inches wide, and 0.50 inches in depth was conditioned at 4.4± 2°C for two hours. At the end of the conditioning period, the channel was filled with the subject product and returned to the conditioning chambers. At the end of a four hour period, the sealant was examined for flow properties. Test results are reported in Table 2**.**

ASTM C1183 – Extrusion Rate

The subject product was transferred to a 6 fluid oz polyethylene cartridge fitted with a polyethylene nozzle 2.5 inches in length with a 0.125 inch diameter orifice. The filled cartridge was placed into an air powered caulking gun attached to an air supply capable of maintaining a pressure of 40 ± 1 psi. The sealant was extruded into a pre-weighed cup for a period of 1 minute. The weight of the cup was subtracted from the final weight to determine the mass of sealant extruded in one minute. Test results are reported in Table 2.

ASTM C661 – Durometer Hardness

Two 3.00 inch x 6.00 inch x 0.25 inch specimens were cast on aluminum plates and allowed to cure for 21 days prior to testing – 7 days at standard conditions of 73.4 ± 3.6ºF and a relative humidity of 50 ± 2%, followed by 7 days at 100 ± 3.6°F and a relative humidity of 95%, and finally 7 days at standard conditions. The Shore A Durometer was firmly pressed into each specimen. Readings were recorded when the pressure foot contacted the surface of the specimen. Three readings were recorded from three areas. Individual and average test results are reported in Table 3.

ASTM C1246 – Heat Aging

Three 6.00” x 3.00” 20 gage aluminum panels were cleaned and weighed to the nearest 0.01 grams. The subject product was extruded into a 5.00” x 1.50” template and struck off at a thickness of 1/8” on each aluminum panel. The specimens were cured for 28 days at standard conditions of 73.4 ± 3.6ºF and a relative humidity of 50 ± 4%. At the end of the cure period, each specimen was weighed to the nearest 0.01 grams. Two of the three specimens were placed in a forced-draft oven at 158 ± 3.6ºF for 21 days. The third specimen remained at standard conditions to serve as a control. At the end of the 21 day heat-aging period, the specimens were removed from the oven and allowed to cool for one hour. All three specimens were weighed again to calculate the percent weight loss during the heat aging process. Test results are reported in Table 4.

ASTM C679 – Tack Free Time

Chem Construction Sealant was extruded into a rectangular template 1/8" in depth having inside dimensions of 3.75" x 1.00" on an aluminum plate. The specimen was tested by lightly touching the surface of the sealant with a film of polyethylene wrapped over a finger. When the sealant was able to be touched lightly without adhering to the polyethylene, the sealant specimen was covered with a polyethylene strip and loaded with a 30 gram brass weight. After a 30 second period, the weight was removed and the polyethylene strip was removed by pulling it 90° away from the sealant. The sealant was considered tack free when no sealant adhered to the strip after the 30 second loading period. The specimen was tested every minute for the first ten minutes after the template was filled and struck off, every 2 minutes for the next ten minutes, every 5 minutes for the next 160 minutes, then every hour until the tack-free time was achieved. Test results are reported in Table 2.

ASTM C510 – Stain & Color Change

Four 5.00 inch x 1.50 inch x 0.25 inch mortar tiles were prepared and allowed to cure for 4 hours at 73.4 ± 3.6 ºF and a relative humidity of 50 ± 4%. Chem Construction Sealant was applied to two of the mortar tiles at a thickness of 0.25 inches and allowed to cure for 24 hours. The other two tiles served as a control. The two coated specimens and the two control specimens were placed inside the QUV accelerated weathering machine for 100 hours under 340 nm UV light. Specimens were visually examined for stain and color change. No stain or color change was observed in the mortar tile substrates. The Chem Construction Sealant specimens exhibited no staining or cracking.

ASTM C793 – Accelerated Weathering

The subject product was extruded into a template having inside dimensions of 5.00" x 1.50" on three 6.00" x 3.00" x 0.01" aluminum plates and struck off at a thickness of 1/8". The specimens were allowed to cure for 21 days at standard conditions of 73.4 ± 3.6 ºF and a relative humidity of 50 ± 4%. Two specimens were placed inside the QUV accelerated weathering machine for 250 hours under 340 nm UV light. One specimen remained unexposed at standard conditions to serve as a control. Specimens were examined after the UV exposure period for cracking and discoloration. The sealant exhibited minimal signs of cracking. All three specimens and a 0.5" steel mandrel were then placed in a freezer at -15° ± 4ºF for 24 hours. At the end of this period, each specimen was bent 180° along its width around the mandrel, sealant side outward, within one second. Specimens were examined for cracks in the bend area. The specimens exhibited minimal signs of cracking.

ASTM C719 – Adhesion & Cohesion

Six specimens were prepared and tested in accordance with ASTM C719. Three specimens were prepared by bonding together two 3.0" x 1.0" x 1.0" mortar substrates with a 2.0" x 0.5" x 0.5" bead of Chem Construction Sealant such that the sealant was flush with the substrates on one side and offset 0.5" on all other sides. Three specimens were prepared by bonding together two 3.00" x 0.25" x 0.25" anodized aluminum substrates with a 2.0" x 0.5" x 0.5" bead of the subject product so that the sealant was flush with the substrates on one side and offset 0.5" on all other sides. Mortar substrates were weathered to a CSP-3 surface profile prior to bonding. Specimens were allowed to cure for 21 days prior to testing – 7 days at standard conditions of 73.4 ± 3.6ºF and a

relative humidity of 50 ± 2%, followed by 7 days at 100 ± 3.6°F and a relative humidity of 95%, and finally 7 days at standard conditions. The specimens were then immersed in water for a period of 7 days. At the end of the immersion period, the specimens were removed from the water and allowed to dry completely at standard conditions. The specimens were compressed to a joint width of 0.325" and placed in an oven at 158° F for seven days. The specimens were removed from the oven, allowed to cool, and placed into the Hockman Cycle test apparatus. The specimens were subjected to ten cycles of compression to 0.325" and extension to 0.675" at a rate of 0.125" per hour. Finally the specimens were subjected to ten cycles of extension at -15°F and compression at 158°F. Test results are reported in Table 2.

ASTM C794 – Adhesion-in-Peel

Four test specimens were prepared on mortar substrates and four test specimens were prepared on anodized aluminum substrates and tested at an age of 21 days. A bead of the subject product 4.00 inches in length was applied to each substrate. A 1.00" x 10.00" strip of aluminum 20-mesh was immediately placed on the sealant and lightly tapped such that it was embedded in the wet sealant 2 mm from the substrate surface. A second bead of sealant was applied and a tooling device was used to strike it off at a depth of 4 mm, such that the wire mesh was embedded uniformly at the midpoint of the sealant depth. The specimens were allowed to cure at standard conditions of 73.4 ± 3.6ºF and a relative humidity of 50 ± 2% until the time of testing. Immediately prior to testing, the loose end of the wire mesh strip was bent back 180° and the sealant-substrate interface was cut slightly by a razor. The mortar substrate was secured to the base of the testing apparatus and the mesh strip was secured by a grip. The screen was pulled at a rate of 2.0 inches/minute for a total of 1 minute. The peak force was indicated by a load cell. The failure mode was considered adhesive if the sealant pulled away from the substrate and cohesive if the tear propagated through the sealant. Average and peak peel strength and failure mode is reported in Table 5.

ASTM D412 – Tensile Strength & Elongation

Five type one tensile strength specimens were cast by extruding FX-573 into a mold having a nominal thickness of 0.25 inches and a gage length of 2.00 inches. The specimens were allowed to cure for 28 days at ambient laboratory conditions of 73.4 ± 2ºF and a relative humidity of 50 ± 2%. Specimens were loaded into the testing apparatus and elongated at a rate of 20 ± 0.2 in/min until ultimate failure. Test results are reported in Table 6.

Table 1 – Chem Construction Sealant – Product Information

Mix ID	Chem Construction Sealant
Lot #	AA1601228
Kit Type	Cartridge, Single Component
Material Temperature	72.0 °F
Ambient Temperature	73.9 °F
Humidity	52%
Type	S
Grade	P
Class	25
Use	T_2, M, NT

Table 2 – Chem Construction Sealant Test Results Summary

Test Method	Notes	Test Property	Age	Average Result	Specification per ASTM C920	Pass/Fail
ASTM C639	Horizontal @ 4.4°C	Rheological - Flow after 4 hours conditioning	Plastic	Product exhibits smooth and level surface without deformation	Grade P: Product exhibits smooth and level surface without deformation	**Pass**
ASTM C1183		Extrusion Rate @ 40 psi	Plastic	78.3 mL/minute	Grade P: >10 mL/minute	**Pass**
ASTM C661	Shore A	Durometer Hardness	21 Days	15	Use T_2: < 25 Use NT: < 60	**Pass**
ASTM C1246		Visual Change Compared to Control	28 days	No Cracking or Chalking Rating = 0	No Cracking or Chalking	**Pass**
		Heat Aging - % Weight Loss		1.1%	< 7.0%	**Pass**
ASTM C679		Tack Free Time	Plastic	Pass	< 72 hours	**Pass**
ASTM C510	100 hours QUV-A 340 - Cycle 1	Stain & Color Change	7 days	No Stain or Color Change	No Stain or Color Change	**Pass**
ASTM C793	250 hours QUV-A 340 - Cycle 1	Accelerated Weathering - UV Exposure & Freezing	21 days	Minimal Cracking	No cracks greater than C793 Fig.1 Example #2	**Pass**
ASTM C719	Mortar Substrate	Bond Durability	21 days	0.0 in^2	< 1.5 in^2 debonded – cumulative 3 specimens	**Pass**
ASTM C794	Mortar Substrate	Adhesion in Peel - Peel Force	21 days	34.70 lbf	>5 lbf	**Pass**

Table 3 – ASTM C661 – Shore A Hardness Test Results

Specimen Identification	Area 1 0.125"	Area 2 0.250"	Area 3 0.500"	Average
Chem Construction Sealant	20	9	5	**15**
	21	11	9	
	33	15	9	

Table 4 – ASTM C1246 – Heat Aging

Specimen Identification	Uncoated Aluminum Substrate Weight (g)	Initial Weight (g)	Final Weight (g)	Weight Loss (%)	Average Weight Loss (%)	Visual Observations
Chem Construction Sealant	8.1936	26.7476	26.5180	1.24	**1.1**	Rating = 0 No cracking or chalking
	7.9160	20.5753	20.4532	0.96		Rating = 0 No cracking or chalking

Table 5 – ASTM C794 – Adhesion-in-Peel

Specimen Identification	Failure Mode	Peel Force (lbf)	Average Peel Force (lbf)
Chem Construction Sealant – Mortar Substrate	Cohesive	32.622	**34.70**
	Cohesive	32.637	
	Cohesive	34.996	
	Cohesive	36.478	

Table 6 – ASTM C412 – Tensile Strength and Elongation

ID	Gauge Length (in)	Width (in)	Thickness (in)	Area (in^2)	Peak Load (lbf.)	Peak Stress (psi)	% Elongation
1	1.31	0.251	0.0889	0.0223	4.105	184	1932
2	1.31	0.237	0.0795	0.0188	3.784	201	2032
3	1.31	0.228	0.0748	0.0170	3.487	205	1970
4	1.31	0.233	0.0996	0.0232	3.782	163	2003
5	1.31	0.222	0.0858	0.0190	3.930	206	2161
					Avg.	**192**	**2019**

Table 7 – ASTM C603 – Extrusion Rate at 50 psi

Specimen Identification	Test 1	Test 2	Test 3	Average Time (seconds)
Chem Construction Sealant	3	3	3	**3**

Table 8 – ASTM D792 – Specific Gravity

Specimen Identification	Specific Gravity
Chem Construction Sealant	**1.14**

Summary

Based on results to date the submitted product meets the following requirements:

ASTM C920 – Type S | Grade P | Class 25 | Use M, NT, T_2

Federal Specification TT-S-00230C, Type 1, Class A for Mortar Substrates

We appreciate the opportunity to provide our services to you on this project. Should you have any questions or comments regarding this report, please feel free to contact us at your convenience.

Sincerely,

TESTING, ENGINEERING & CONSULTING SERVICES, INC.

Geoffrey Uhal
Laboratory Technician

James G. McCants III
Laboratory Manager

Attachments: Photos 1 - 5

Photo 1 – Adhesion in Peel – ASTM C719

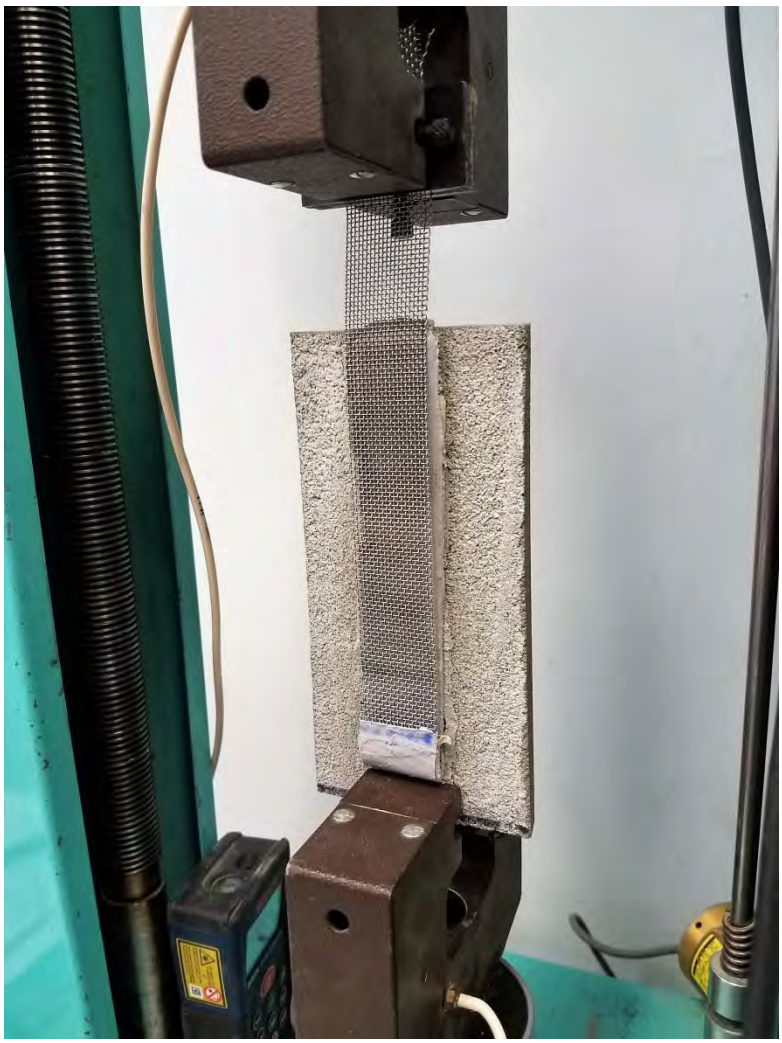

Photo 2 – Horizontal Displacement – ASTM C639

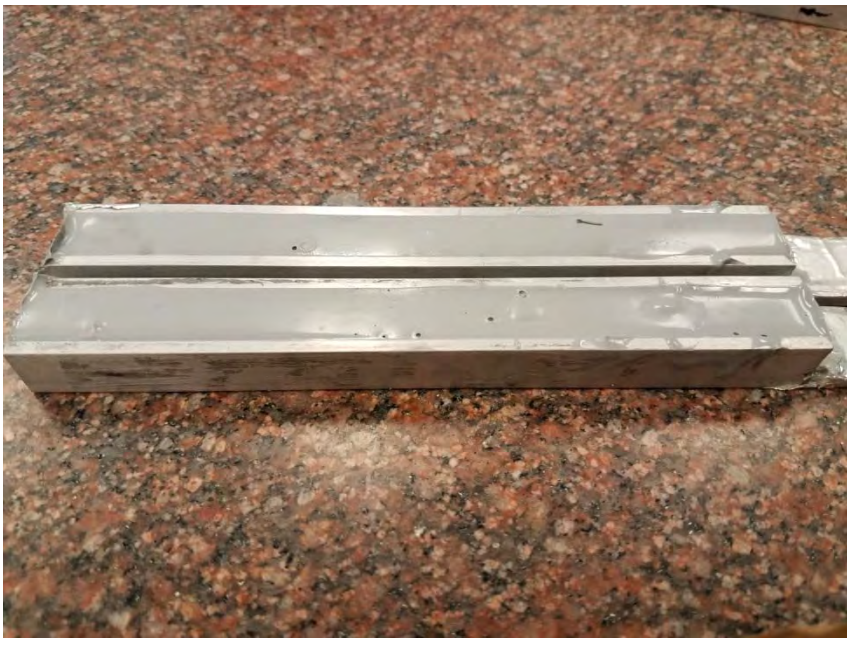

Photo 3 – Specimens following UV Exposure– ASTM C793

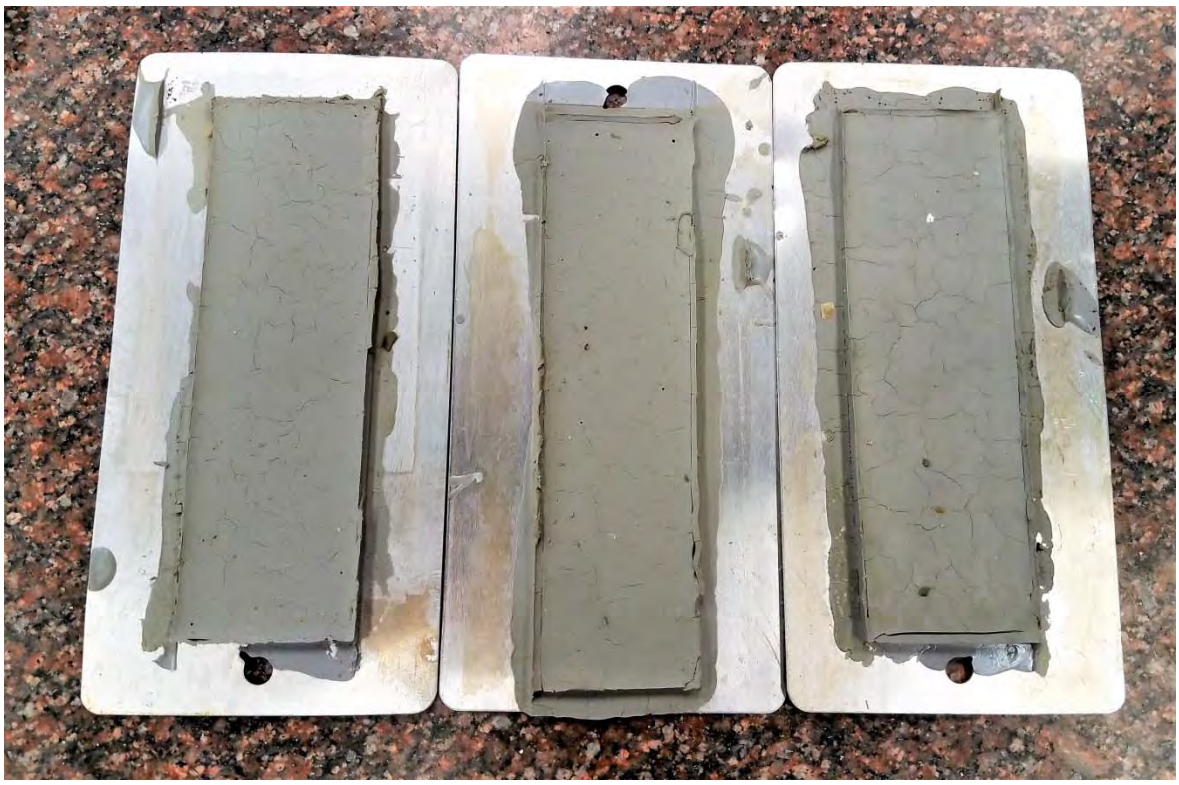

Photo 4 – Bend after Freezing – ASTM C793

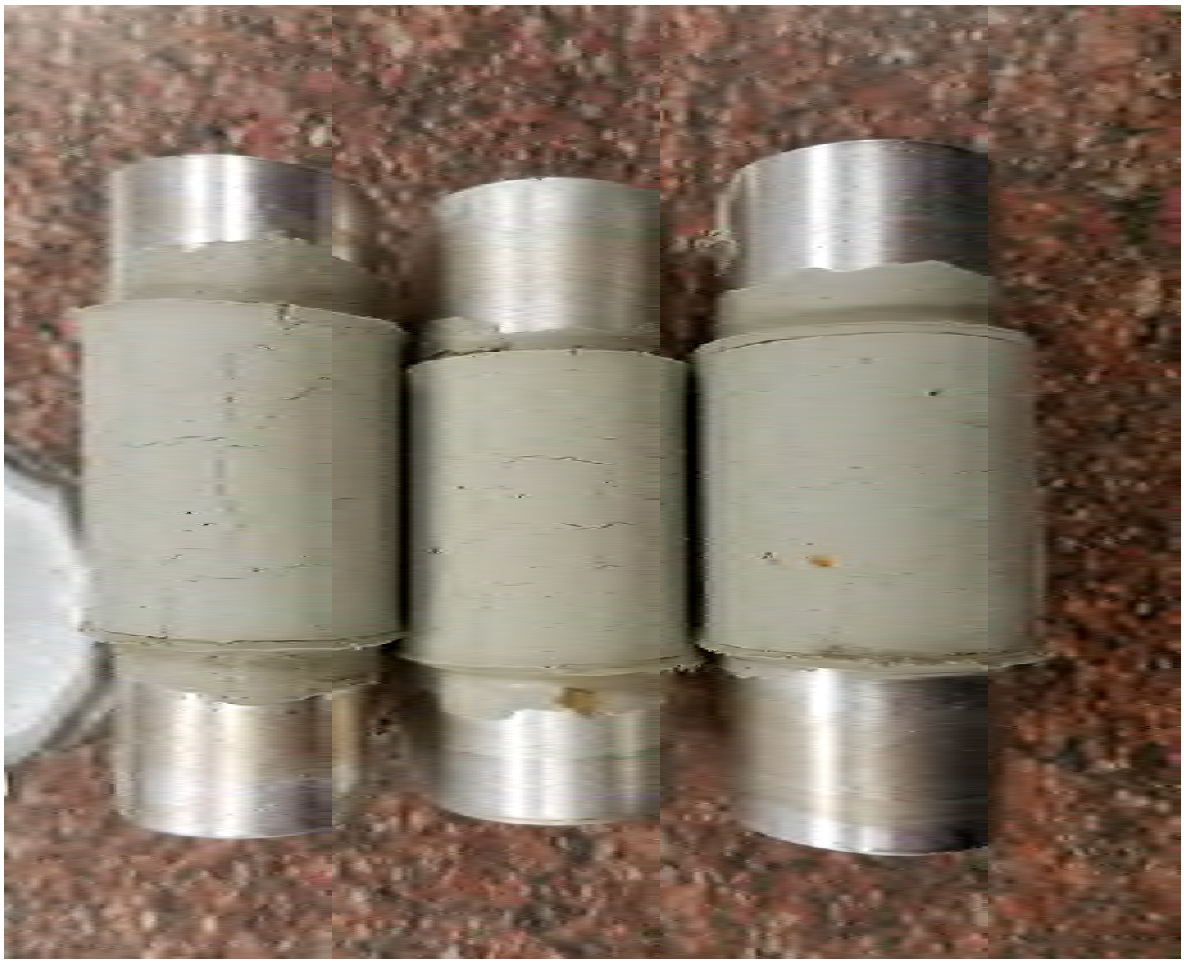

Photo 5 – Specimens after Extension/Compression Cycles – ASTM C719