

Submittal

General Contractor North American Pipeline Services, LLC

Job Name: SEWER & MANHOLE REHABILITATION

Contract Number: SR-01-15-15B

Submitted to: North American Pipeline Services, LLC
210 Bennett Road, Freehold, NJ 07728

Engineer: Maser Consulting, P.A.
331 Newman Springs Road, Suite 203, Red Bank, NJ 07701
Project No. 15001124A

Allstate Submittal #: 3

Item Submitted: Polyester Resin

Manufacturer: Interplastic Corp. AOC
1225 Willow Lake Blvd 955 Hwy 57 E
Saint Paul, MN 55110 Collierville, TN 38017

Date Submitted: March 17, 2016

Specification Section: 02607

Item is as specified
in contract documents: Yes

Certification Statement:

By this submittal, I hereby represent that I have determined and verified all field measurements, field construction criteria, materials, dimensions, catalog numbers and similar data and I have checked and coordinated each item with other applicable approved shop drawings and contract requirements.

Submitted By:



Al Hickson
Allstate Power Vac, Inc

PRODUCT INFORMATION

Polyester Resin for Underground Sewer Pipe Liners



TYPICAL CAST MECHANICAL PROPERTIES (2) SEE BACK PAGE

Test	Units of Measure	Nominal	Test Method
Tensile Strength	psi/MPa	6,770/47	ASTM D 638
Tensile Modulus	psi/GPa	800,000/5.5	ASTM D 638
Tensile Elongation	%	1.6	ASTM D 638
Flexural Strength	psi/MPa	11,020/76	ASTM D 790
Flexural Modulus	psi/GPa	740,000/5.1	ASTM D 790
Heat Distortion Temp.	°F/°C @ 264 psi	259/126	ASTM D 648
Barcol Hardness		42	ASTM D 2583

*Typical properties are not to be construed as specifications.

DESCRIPTION

The Vipel L758-LTI is a high molecular weight unsaturated polyester resin. The Vipel L758-LTI provides the corrosion resistance, durability and toughness that is required for cured in place pipe applications.

FEATURES

- Excellent catalyzed pot life
- Superior mechanical properties
- High molecular weight

TYPICAL LIQUID PROPERTIES (1) SEE BACK PAGE

Test	Units of Measure	Nominal
Viscosity @ 25°C/77°C, RVF Brookfield Spindle #4 @ 20 RPM	cps	5,800
Thix Index 2/20	-	2.5+
Color	-	Opaque
Specific Gravity @ 25°C/77°C	-	1.29
Non-Volatiles	%	30
Gel Time @ 140°F with (1.0% Di-(4-tert-butyl-cyclohexyl) peroxydicarbonate and 0.5%		
Trigonox [®] C)	minutes	12
Pot Life @ 25°C/77°C (1% Di-(4-tert-butyl-cyclohexyl) peroxydicarbonate and + 0.5%		
Trigonox [®] C)	hours	40

Trigonox is a trademark of Akzo Nobel Chemicals

Vipel® L758-LTI Polyester Resin

PERFORMANCE GUIDELINES

A. Keep full strength catalyst levels between 1.0% - 3.0% of the total resin weight.

B. Maintain shop temperatures between 18°C/65°F and 32°C/90°F and humidity between 40% and 90%. Consistent shop conditions contribute to consistent gel times and will help the fabricator make a high quality part.

STORAGE STABILITY

Resins are stable for three months from date of production when stored in the original containers away from sunlight at no more than 25°C/77°F.

During the hot summer months, no more than two months stability at 30°C/86°F should be anticipated. After extended storage, some drift may occur in gel time and viscosity.

Storage in plastic totes made out of materials such as polyethylene (PE) or polypropylene (PP), in particular translucent PE/PP, will accelerate gel formation and result in a significantly reduced storage stability.

Storage of this resin outdoors in translucent plastic totes may reduce the storage stability to only a few weeks. AOC cannot assume responsibility for gel formation under these storage conditions.

SAFETY

See appropriate Material Safety Data Sheet for guidelines.

ISO 9001:2008 CERTIFIED

The Quality Management Systems at every AOC manufacturing facility have been certified as meeting ISO 9001:2008 standards. This certification recognizes that each AOC facility has an internationally accepted model in place for managing and assuring quality. We follow the practices set forth in this model to add value to the resins we make for our customers.

FOOTNOTES

(1) The pot life times shown are typical but may be affected by catalyst, promoter and inhibitor concentrations in resin, and environmental temperature. Variations in gelling characteristics can be expected between different lots of catalysts and at extremely high humidities. Pigment and fillers can retard or accelerate gelation. It is recommended that the fabricator check the gelling characteristics of a small quantity of resin under actual operating conditions prior to use.

(2) Based on tests on Vipel L758-LTI pipe at 77°F/25° and 50% relative humidity. Castings were prepared using 1.0% Perkadox 16 and 0.5 Trig-onox C.

The information contained in this data sheet is based on laboratory data and field experience. We believe this information to be reliable, but do not guarantee its applicability to the user's process or assume any liability for occurrences arising out of its use. The user, by accepting the products described herein, agrees to be responsible for thoroughly testing each such product before committing to production.

Our recommendations should not be taken as inducements to infringe any patent or violate any law, safety code or insurance regulation. © 2014, AOC, LLC

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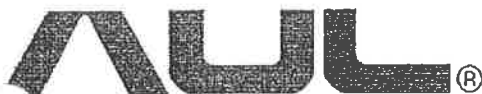
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Doc. No. AOC-Vipel® L758-LTI
Effective Date: April, 2014



World Leader in Resin Technology

MSDS #: 16485V4

WHMIS (Canada)



B-2 D-2A D-2B

NFPA (USA)

Fire



Health

Reactivity

Specific hazard

HMIS (USA)

Health hazards	* 2
Flammability	3
Physical hazards	2
Personal protection	(X)

Protective clothing



Section 1. Chemical product and company identification

Trade name L758-LTI-14

Product type Polyester Resin Solution

Chemical family Aromatic.

Material uses Used in the manufacture of thermoset plastic parts.

Manufacturer AOC, LLC
950 Highway 57 East
Collierville, TN U.S.A. 38017
Website: www.aoc-resins.com
Phone Number: (901) 854-2800
8am-5pm (Central Time) Mon-Fri

In case of emergency

CHEMTREC (US): 24 hours/7 days (800) 424-9300
CANUTEC (Canada): 24 hours/7 days (613) 996-6666

Section 2. Hazards identification

OSHA status This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Routes of entry Eye contact, Skin contact, Inhalation, Ingestion

Potential acute health effects
Eyes: Severe eye irritant which may result in redness, burning, tearing and blurred vision.
Skin: Skin irritant which may result in burning sensation. Repeated or prolonged skin contact may cause dermatitis.
Ingestion: Ingestion may result in mouth, throat and gastrointestinal irritation, nausea, vomiting and diarrhea.
Inhalation: Inhalation of spray mist or liquid vapors may cause upper respiratory irritation and possible central nervous system effects including headaches, nausea, vomiting, dizziness, drowsiness, loss of coordination, impaired judgement and general weakness.

Potential chronic health effects
CARCINOGENIC EFFECTS:
Styrene:
Classified A4 (not classifiable for human or animal) by ACGIH.
Classified 2B (possible for human) by IARC.
Classified as "reasonably anticipated to be a human carcinogen" by NTP.
An increased incidence of lung tumors was observed in mice from a recent inhalation study. The relevance of this finding is uncertain since data from other long-term animal studies and from epidemiology studies of workers exposed to styrene do not provide a basis to conclude that styrene is carcinogenic to humans.
Talc:
Classified A2 (suspected for human) by ACGIH.
Classified 1 (proven for human) by IARC.
Classified "known to be human carcinogen" by NTP.
Crystalline Silica:
Classified A2 (suspected for human) by ACGIH.
Classified 1 (proven for human) by IARC.
Classified "known to be human carcinogen" by NTP.
MUTAGENIC or TERATOGENIC EFFECTS: No known effect according to our database.

Section 3. Composition/information on ingredients

Name	CAS #	% by weight
1) Styrene	100-42-5	31.0
2) Talc	14807-96-6	20 - 30
3) Crystalline Silica	14808-60-7	0.1 - 1

Section 4. First aid measures

Eye contact	Flush with a continuous flow of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Use of buffered baby shampoo will aid in removal. Seek medical attention.
Skin contact	Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. If irritation persists, seek medical attention.
Inhalation	Move the victim to a safe area as soon as possible. Allow the victim to rest in a well-ventilated area. If breathing is difficult, give oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.
Ingestion	Do not induce vomiting. Seek immediate medical attention.

Section 5. Fire-fighting measures

The product is:	Flammable liquid, Class IC.
Auto-ignition temperature	914°F(490°C) Styrene
Flash point	87.6°F (31°C) Styrene
Flammable limits	Lower: 0.9% Upper: 6.8% (Styrene)
Products of combustion	May produce carbon monoxide, carbon dioxide, and irritating or toxic vapors, gases or particulate.
Fire hazard	Flammable in the presence of open flames, sparks, or heat.
Explosion hazard	Can react with oxidizing materials. Explosive in the form of vapor when exposed to heat or flame. Material may polymerize when container is exposed to heat (fire) and polymerization will increase pressure in a closed container which may cause the container to rupture violently.
Fire-fighting media and instructions	SMALL FIRE: Use carbon dioxide, foam, dry chemical or water fog to extinguish. LARGE FIRE: Evacuate surrounding areas. Use carbon dioxide, foam, dry chemical or water fog to extinguish. Wear self-contained breathing apparatus (SCBA) and full fire-fighting protective clothing. Cool containing vessels with water spray in order to prevent pressure build-up, autoignition or explosion. Prevent run off to sewers or other water ways.

Section 6. Accidental release measures

Small spill	Absorb with an inert material and place in an appropriate waste disposal container.
Large spill	Stop leak if without risk. Eliminate all ignition sources. Contain with an inert material, recover as much as possible and place the remainder in an appropriate waste disposal container. Warn unauthorized personnel to move away. Prevent entry into sewers or confined areas.

Section 7. Handling and storage

Handling	WARNING! Use only in well-ventilated areas. Store away from direct sunlight. Avoid inhalation and contact with eyes, skin, and clothing. Wear appropriate personal protective equipment for your task. Ground and bond all containers when transferring the material. Empty containers may retain product and product vapor. Do not expose to heat, flame, sparks or other ignition sources such as cutting, welding, drilling, grinding or static electricity. Do not pressurize. Provide adequate safety showers and eyewashes in the area of use.
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Section 7. Handling and storage

Storage

Keep away from heat. Keep away from sources of ignition. Keep container tightly closed. Keep in a cool, well-ventilated place. Containers should be grounded.

Section 8. Exposure controls/personal protection

Exposure limits	Styrene	ACGIH TLV (United States, 3/2012). Absorbed through skin. TWA: 20 ppm 8 hour(s). TWA: 85 mg/m ³ 8 hour(s). STEL: 40 ppm 15 minute(s). STEL: 170 mg/m ³ 15 minute(s). OSHA PEL Z2 (United States, 11/2006). TWA: 100 ppm 8 hour(s). AMP: 600 ppm 5 minute(s). CEIL: 200 ppm NIOSH REL (United States, 6/2009). TWA: 50 ppm 10 hour(s). TWA: 215 mg/m ³ 10 hour(s). STEL: 100 ppm 15 minute(s). STEL: 425 mg/m ³ 15 minute(s).
	Talc	NIOSH REL (United States, 6/2008). TWA: 2 mg/m ³ 10 hour(s). Form: Respirable fraction OSHA PEL Z3 (United States, 9/2005). STEL: 1 f/cc 30 minute(s). Form: not containing asbestos TWA: 20 mppcf 8 hour(s). Form: not containing asbestos ACGIH TLV (United States, 1/2008). TWA: 0.1 f/cc 8 hour(s).
	Crystalline Silica	OSHA PEL Z3 (United States, 9/2005). Notes: 250/(SiO ₂ +5) TWA: 250 mppcf 8 hour(s). Form: Respirable OSHA PEL Z3 (United States, 9/2005). Notes: 10/(SiO ₂ +2) TWA: 10 mg/m ³ 8 hour(s). Form: Respirable OSHA PEL 1989 (United States, 3/1989). TWA: 0.1 mg/m ³ , (as quartz) 8 hour(s). Form: Respirable dust ACGIH TLV (United States, 3/2012). TWA: 0.025 mg/m ³ 8 hour(s). Form: Respirable fraction NIOSH REL (United States, 6/2009). TWA: 0.05 mg/m ³ 10 hour(s). Form: respirable dust OSHA PEL Z3 (United States, 9/2005). Notes: 30/(%SiO ₂ +2) TWA: 30 mg/m ³ 8 hour(s). Form: Total dust.
Engineering controls	Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective occupational exposure limits. Provide adequate safety showers and eyewashes in the area of use.	
Personal protection	Personal protective equipment may vary depending on the job being performed. Eye/face: Wear eye protection such as safety glasses with side shields, splash goggles or face shield with safety glasses. Skin: Avoid skin contact. Impervious gloves should be worn. Other items may include long sleeves, lab coats, or impervious jackets. Respiratory: Determine if airborne concentrations are below the recommended exposure limits in accordance your company's PPE program and regulatory requirements. If they are not, select a NIOSH-approved respirator that provides adequate protection from the concentration levels encountered. Air-purifying respirators are generally adequate for organic vapors. Use positive pressure, supplied-air respirators if there is potential for an uncontrolled release, if exposure levels are unknown, or under circumstances where air-purifying respirators may not provide adequate protection. Reference OSHA 29 CFR 1910.134.	
Personal protection in case of a large spill	Chemical resistant gloves, full protective suit, and boots. Respiratory protection in accordance with OSHA regulation 29 CFR 1910.134. A self-contained breathing apparatus should be used to avoid inhalation of the product vapors.	

Section 9. Physical and chemical properties

Physical state	Liquid.
Color	Grey.
Odor	Aromatic.
Molecular weight (g/mol)	1000 to 15000
Boiling point	293°F(145°C) Styrene
Melting point	Not available.
pH (1% soln/water)	Not applicable.
Vapor pressure	4.5 mm Hg@ 68°F (20°C) Styrene
Vapor density	3.59 Styrene (Air = 1)
Specific gravity	1.29 (Water = 1)
Partition coefficient: n-octanol/water	Not available.
Evaporation rate	Not available.
Odor threshold	0.14 ppm Styrene
Solubility in water	Slight.
Dispersibility properties	Not dispersed in water.

Section 10. Stability and reactivity

Stability	This product is normally stable, but can become unstable at elevated temperatures and undergo polymerization, which could produce heat and fumes resulting in over-pressurization and rupture in a closed container.
Instability temperature	>170°F (77°C)
Conditions of Instability	Heat.
Incompatibility with various substances	Polymerizes in the presence of organic peroxides, oxidizing materials, or heat.
Corrosivity	Our database contains no additional remark on the corrosivity of this product

Section 11. Toxicological information

Toxicity to animals	Name	Result	Species	Dose	Exposure
	Crystalline Silica	TDLo Oral	Rat	120 g/kg	-
	Styrene	LD50 Intraperitoneal	Rat	898 mg/kg	-
		LD50 Oral	Rat	5000 mg/kg	-
		LD50 Oral	Rat	2650 mg/kg	-
		TDLo Dermal	Rat	26.4 mg/kg	-
		LC50 Inhalation	Rat	11800 mg/m3	4 hours
		Vapor			
		LC50 Inhalation Gas.	Rat	2770 ppm	4 hours
Special remarks on toxicity to animals	Lung effects that have been observed in mouse studies have been shown in some studies to be the result of mouse specific enzymes (not in humans) that enable the mechanism for producing cancer in mice.				
Special remarks on chronic effects on humans	A study of long term effects of workers exposed to styrene levels in the range of 25-35 ppm, 8 hour TWA, indicated a possible mild hearing loss.				

Section 11. Toxicological information

Special remarks on other toxic effects on humans

Talc:

Exposure to dusts containing talc can be toxic and can produce acute and chronic effects. Contact with dusts may irritate the eyes. Breathing dust may irritate the nose and throat and cause coughing and chest discomfort. There are reports that relatively mild pneumoconiosis can develop after years of occupational exposure to mixed dusts containing talc. Prolonged inhalation may also produce a fibrotic response.

Section 12. Ecological information

Ecotoxicity

Toxic to aquatic organisms. Should not be released to sewage system or other bodies of water at concentrations above limits established in regulations or permits.

Section 13. Disposal considerations

Waste disposal

Recycle to process, if possible. Consult your local or regional authorities. Ignitable characteristic.

Section 14. Transport information

DOT

UN1866; Resin Solution; 3; III.

Labels



TDG

UN1866; Resin Solution; 3; III.

IATA/IMDG

UN1866; Resin Solution; 3; III

Additional information

US regulations require the reporting of spills when the amount exceeds the Reportable Quantity (RQ) for specific components of this material. See CERCLA in Section 15, Regulatory Information, for the Reportable Quantities.

Section 15. Regulatory information

Other regulations

This section does not reference all applicable regulatory compliance lists.

TSCA: All Ingredients are listed or compliant with TSCA.

DSL: All ingredients are listed or compliant with the NSNR.

Proposition 65 Warning: This product contains a chemical(s) known to the State of California to cause cancer, birth defects and/or reproductive harm.

SARA 302 component(s): None.

SARA 313 component(s): Styrene.

CERCLA(RQ): Styrene - 1000 lbs. (453.6 kg)

Section 16. Other information

Prepared by

AOC, LLC - Corporate Regulatory Affairs.

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LEGAL DISCLAIMER

The information contained in this data sheet is furnished in good faith and without warranty, representation, or inducement or license of any kind, except that it is accurate to the best of AOC, LLC's knowledge, or was obtained from sources believed by AOC, LLC to be reliable. The accuracy, adequacy or completeness of health and safety precautions set forth herein cannot be guaranteed, and the buyer is solely responsible for ensuring that the product is used, handled, stored, and disposed of safely and in compliance with applicable federal, state or provincial, and local laws. AOC, LLC disclaims liability for any loss, damage or personal injury that arises from, or is in any way related to, use of the information contained in this data sheet.

PRODUCT INFORMATION

Corrosion Resistant Resin for Underground Sewer Pipe Liners



TYPICAL CAST MECHANICAL PROPERTIES (2) SEE BACK PAGE

Test	Units of Measure	Nominal	Test Method
Tensile Strength	psi/MPa	11,120/77	ASTM D 638
Tensile Modulus	psi/GPa	540,000/3.7	ASTM D 638
Tensile Elongation	%	2.6	ASTM D 638
Flexural Strength	psi/MPa	17,110/118	ASTM D 790
Flexural Modulus	psi/GPa	550,000/3.8	ASTM D 790
Cat Distortion Temp.	°F/°C @ 264 psi	252/122	ASTM D 648
Barcol Hardness		43	ASTM D 2583

*Typical properties are not to be construed as specifications.

TYPICAL LIQUID PROPERTIES (1) SEE BACK PAGE

Test	Units of Measure	Nominal
Viscosity @ 25°C/77°C, RVF Brookfield		
Spindle #4 @ 20 RPM	cps	5,600
Thix Index 2/20	-	>3
Color	-	Opaque
Specific Gravity @ 25°C/77°C	-	1.1
Non-Volatiles	%	60
Gel Time @ 140°F with (1.0% Di-(4-tert-butyl-cyclohexyl) peroxydicarbonate and 0.5%		
Trigonox® KSM	minutes	14
Pot Life @ 25°C/77°C (1% Di-(4-tert-butyl-cyclohexyl) peroxydicarbonate and + 0.5%		
Trigonox® KSM	hours	45

Trigonox is a trademark of Akzo Nobel Chemicals

DESCRIPTION

The Vipel® L758-NET-14 is a high molecular weight unsaturated polyester resin. Vipel® L758-NET-14 Series provides the corrosion resistance, durability and toughness that is required for cured in place pipe applications.

BENEFITS

AOC's Vipel® L758-NET-14 molecular architecture provides an excellent balance of corrosion and physical properties.

FEATURES

- Excellent catalyzed pot life
- Superior mechanical properties
- High molecular weight
- High viscosity version

Vipel® L758-NET-14 Series Polyester Resin

PERFORMANCE GUIDELINES

A. Keep full strength catalyst levels between 1.0% - 3.0% of the total resin weight.

B. Maintain shop temperatures between 18°C/65°F and 32°C/90°F and humidity between 40% and 90%. Consistent shop conditions contribute to consistent gel times and will help the fabricator make a high quality part.

STORAGE STABILITY

Resins are stable for three months from date of production when stored in the original containers away from sunlight at no more than 25°C/77°F.

During the hot summer months, no more than two months stability at 30°C/86°F should be anticipated. After extended storage, some drift may occur in gel time and viscosity.

Storage in plastic totes made out of materials such as polyethylene (PE) or polypropylene (PP), in particular translucent PE/PP, will accelerate gel formation and result in a significantly reduced storage stability.

Storage of this resin outdoors in translucent plastic totes may reduce the storage stability to only a few weeks. AOC cannot assume responsibility for gel formation under these storage conditions.

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See appropriate Material Safety Data Sheet for guidelines.

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FOOTNOTES

(1) The pot life times shown are typical but may be affected by catalyst, promoter and inhibitor concentrations in resin, and environmental temperature. Variations in gelling characteristics can be expected between different lots of catalysts and at extremely high humidities. Pigment and fillers can retard or accelerate gelation. It is recommended that the fabricator check the gelling characteristics of a small quantity of resin under actual operating conditions prior to use.

(2) Based on tests on Vipel® L758-NET-14 pipe at 77°F/25° and 50% relative humidity. Castings were prepared using 1.0% Perkadox 16 and 0.5 Trigonox C.

The information contained in this data sheet is based on laboratory data and field experience. We believe this information to be reliable, but do not guarantee its applicability to the user's process or assume any liability for occurrences arising out of its use. The user, by accepting the products described herein, agrees to be responsible for thoroughly testing each such product before committing to production.

Our recommendations should not be taken as inducements to infringe any patent or violate any law, safety code or insurance regulation. © 2014, AOC, LLC

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**ASTM F1216 Test Results on 6 mm Felt Composite
L713-NET
One Month Results at 25°C**

	L713-NET (Isophthalic)	REQUIREMENTS %	PASS OR FAIL
CONTROL SAMPLE			
FLEXURAL STRENGTH, psi	8,142		
STANDARD DEVIATION	48		
FLEXURAL MODULUS, psi	510,105		
STANDARD DEVIATION	6,384		
TAP WATER			
FLEXURAL STRENGTH, psi	7,647		
STANDARD DEVIATION	749		
% FLEXURAL STRENGTH, psi RETENTION	94	>80	PASSED
FLEXURAL MODULUS, psi	506,626		
STANDARD DEVIATION	3,165		
% FLEXUARAL MODULUS RETENTION	99	>80	PASSED
5% NITRIC ACID			
FLEXURAL STRENGTH, psi	6,699		
STANDARD DEVIATION	818		
% FLEXURAL STRENGTH, psi RETENTION	82	>80	PASSED
FLEXURAL MODULUS, psi	482,282		
STANDARD DEVIATION	3,418		
% FLEXUARAL MODULUS RETENTION	95	>80	PASSED
10% PHOSPHORIC ACID			
FLEXURAL STRENGTH, psi	7,627		
STANDARD DEVIATION	452		
% FLEXURAL STRENGTH, psi RETENTION	94	>80	PASSED
FLEXURAL MODULUS, psi	457,576		
STANDARD DEVIATION	70,529		
% FLEXUARAL MODULUS RETENTION	90	>80	PASSED
10% SULFURIC ACID			
FLEXURAL STRENGTH, psi	7,637		
STANDARD DEVIATION	326		
% FLEXURAL STRENGTH, psi RETENTION	94	>80	PASSED
FLEXURAL MODULUS, psi	499,252		
STANDARD DEVIATION	10,060		
% FLEXUARAL MODULUS RETENTION	98	>80	PASSED

AMOCO GASOLINE			
FLEXURAL STRENGTH, psi	7,318		
STANDARD DEVIATION	670		
% FLEXURAL STRENGTH, psi RETENTION	90	>80	PASSED
FLEXURAL MODULUS, psi	510,580		
STANDARD DEVIATION	755		
% FLEXURAL MODULUS RETENTION	100	>80	PASSED
VEGETABLE OIL			
FLEXURAL STRENGTH, psi	7,806		
STANDARD DEVIATION	181		
% FLEXURAL STRENGTH, psi RETENTION	96	>80	PASSED
FLEXURAL MODULUS, psi	504,863		
STANDARD DEVIATION	11,570		
% FLEXURAL MODULUS RETENTION	99	>80	PASSED
0.1% DETERGENT			
FLEXURAL STRENGTH, psi	7,811		
STANDARD DEVIATION	422		
% FLEXURAL STRENGTH, psi RETENTION	96	>80	PASSED
FLEXURAL MODULUS, psi	436,808		
STANDARD DEVIATION	66,392		
% FLEXURAL MODULUS RETENTION	86	>80	PASSED
0.1% SOAP			
FLEXURAL STRENGTH, psi	7,318		
STANDARD DEVIATION	670		
% FLEXURAL STRENGTH, psi RETENTION	90	>80	PASSED
FLEXURAL MODULUS, psi	510,580		
STANDARD DEVIATION	755		
% FLEXURAL MODULUS RETENTION	100	>80	PASSED

The information contained in this data sheet is based on laboratory data and field experience. We believe this information to be reliable, but do not guarantee its applicability to the user's process or assume any liability for occurrences arising out of its use. The user, by accepting the products described herein, agrees to be responsible for thoroughly testing any application before committing to production.

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**ASTM F1216 Test Results on 6 mm Felt Composite
L713-NET
One Month Results at 25°C**

	L713-NET (Isophthalic)	REQUIREMENTS %	PASS OR FAIL
CONTROL SAMPLE			
FLEXURAL STRENGTH, psi	8,142		
STANDARD DEVIATION	48		
FLEXURAL MODULUS, psi	510,105		
STANDARD DEVIATION	6,384		
TAP WATER			
FLEXURAL STRENGTH, psi	7,647		
STANDARD DEVIATION	749		
% FLEXURAL STRENGTH, psi RETENTION	94	>80	PASSED
FLEXURAL MODULUS, psi	506,626		
STANDARD DEVIATION	3,165		
% FLEXUARAL MODULUS RETENTION	99	>80	PASSED
5% NITRIC ACID			
FLEXURAL STRENGTH, psi	6,699		
STANDARD DEVIATION	818		
% FLEXURAL STRENGTH, psi RETENTION	82	>80	PASSED
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STANDARD DEVIATION	3,418		
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FLEXURAL STRENGTH, psi	7,627		
STANDARD DEVIATION	452		
% FLEXURAL STRENGTH, psi RETENTION	94	>80	PASSED
FLEXURAL MODULUS, psi	457,576		
STANDARD DEVIATION	70,529		
% FLEXUARAL MODULUS RETENTION	90	>80	PASSED
10% SULFURIC ACID			
FLEXURAL STRENGTH, psi	7,637		
STANDARD DEVIATION	326		
% FLEXURAL STRENGTH, psi RETENTION	94	>80	PASSED
FLEXURAL MODULUS, psi	499,252		
STANDARD DEVIATION	10,060		
% FLEXUARAL MODULUS RETENTION	98	>80	PASSED

AMOCO GASOLINE			
FLEXURAL STRENGTH, psi	7,318		
STANDARD DEVIATION	670		
% FLEXURAL STRENGTH, psi RETENTION	90	>80	PASSED
FLEXURAL MODULUS, psi	510,580		
STANDARD DEVIATION	755		
% FLEXURAL MODULUS RETENTION	100	>80	PASSED
VEGETABLE OIL			
FLEXURAL STRENGTH, psi	7,806		
STANDARD DEVIATION	181		
% FLEXURAL STRENGTH, psi RETENTION	96	>80	PASSED
FLEXURAL MODULUS, psi	504,863		
STANDARD DEVIATION	11,570		
% FLEXURAL MODULUS RETENTION	99	>80	PASSED
0.1% DETERGENT			
FLEXURAL STRENGTH, psi	7,811		
STANDARD DEVIATION	422		
% FLEXURAL STRENGTH, psi RETENTION	96	>80	PASSED
FLEXURAL MODULUS, psi	436,808		
STANDARD DEVIATION	66,392		
% FLEXURAL MODULUS RETENTION	86	>80	PASSED
0.1% SOAP			
FLEXURAL STRENGTH, psi	7,318		
STANDARD DEVIATION	670		
% FLEXURAL STRENGTH, psi RETENTION	90	>80	PASSED
FLEXURAL MODULUS, psi	510,580		
STANDARD DEVIATION	755		
% FLEXURAL MODULUS RETENTION	100	>80	PASSED

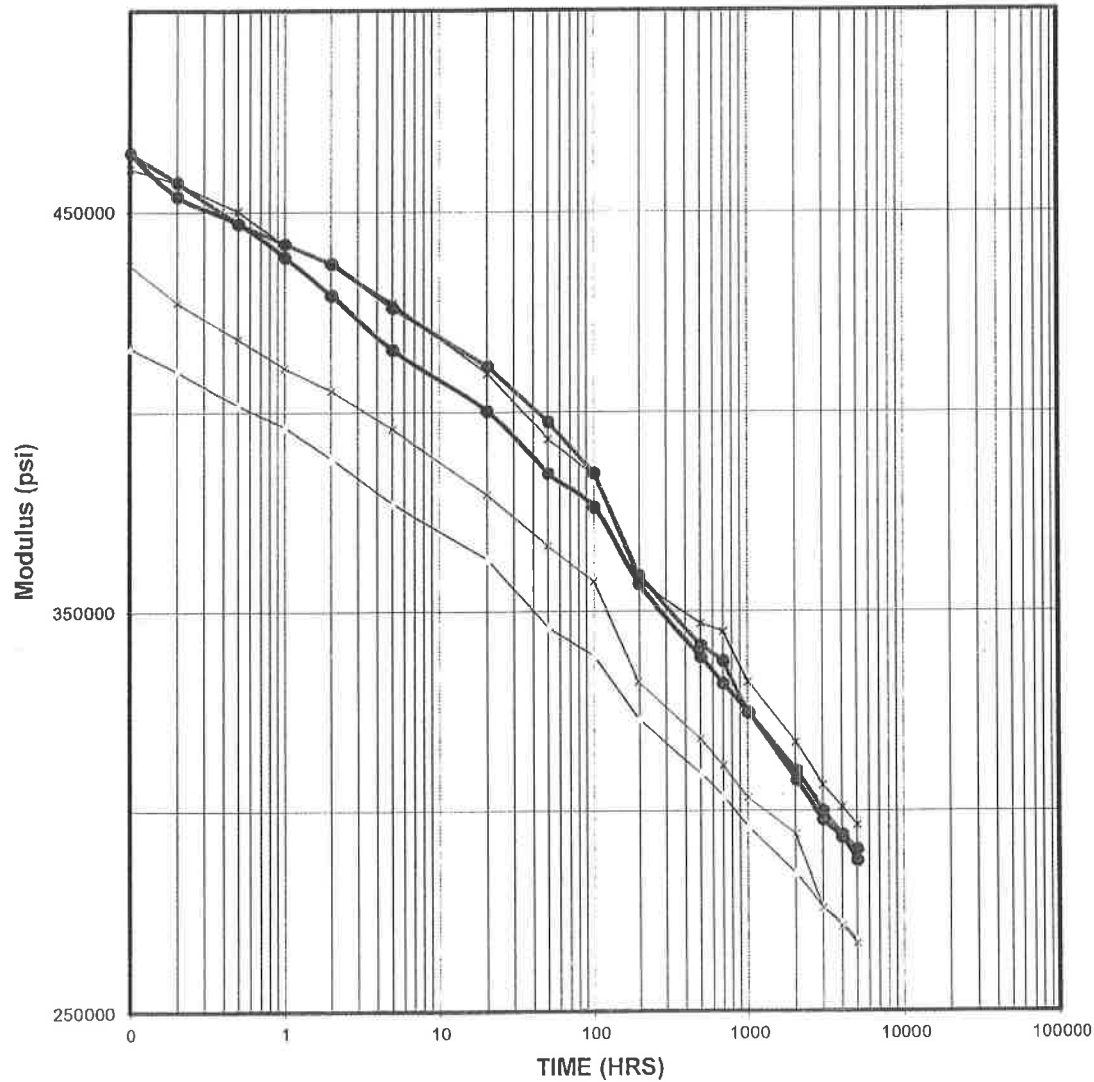
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HTS Pipe Consultants, Inc.

420 Pickering, Houston, Texas 77091
Tel: (713) 692-8373 Fax: (713) 692-8502

FLEXURAL CREEP ASTM D2990



Project Name:

Project No.:

Sample ID No.: L758-NET

HTS Report#: AOCF431.001

Tested Temperature: 71°F

Lab Humidity: 50%

Specimen Gage Length: 3.5"

Stress: 1250 psi

HTS Report AOCF431.001

Sample ID: L758-NET

Spec# 1

Thickness: 0.224" Width: 0.570"

<u>TIME (HRS)</u>	<u>Modulus (psi)</u>
0.02	493707
0.10	464665
0.20	457489
0.50	447131
1	442125
2	437231
5	426222
20	411422
50	397616
100	384706
196	359059
500	341469
700	337577
1004	324629
2012	310182
3020	299974
4004	294019
5012	290416

Spec# 2

Thickness: 0.224" Width: 0.562"

<u>TIME (HRS)</u>	<u>Modulus (psi)</u>
0.02	493707
0.10	464665
0.20	453983
0.50	447131
1	438850
2	429310
5	415753
20	400303
50	384706
100	376157
196	356896
500	338542
700	331904
1004	324629
2012	307765
3020	297713
4004	293291
5012	287596

Spec# 3

Thickness: 0.227" Width: 0.574"

<u>TIME (HRS)</u>	<u>Modulus (psi)</u>
0.02	433051
0.10	416098
0.20	410258
0.50	401799
1	396351
2	388451
5	377173
20	363117
50	345928
100	338909
196	322893
500	309322
700	303698
1004	296009
2012	284486
3020	275763
4004	271915
5012	267560

HTS Report AOCF431.001

Sample ID: L758-NET

Spec# 4

Thickness: 0.225" Width: 0.587"

<u>TIME (HRS)</u>	<u>Modulus (psi)</u>
0.02	450240
0.10	436900
0.20	427402
0.50	418308
1	411021
2	405371
5	395849
20	379302
50	366345
100	357464
196	332290
500	317959
700	311248
1004	303247
2012	294172
3020	275614
4004	271179
5012	266885

Spec# 5

Thickness: 0.225" Width: 0.571"

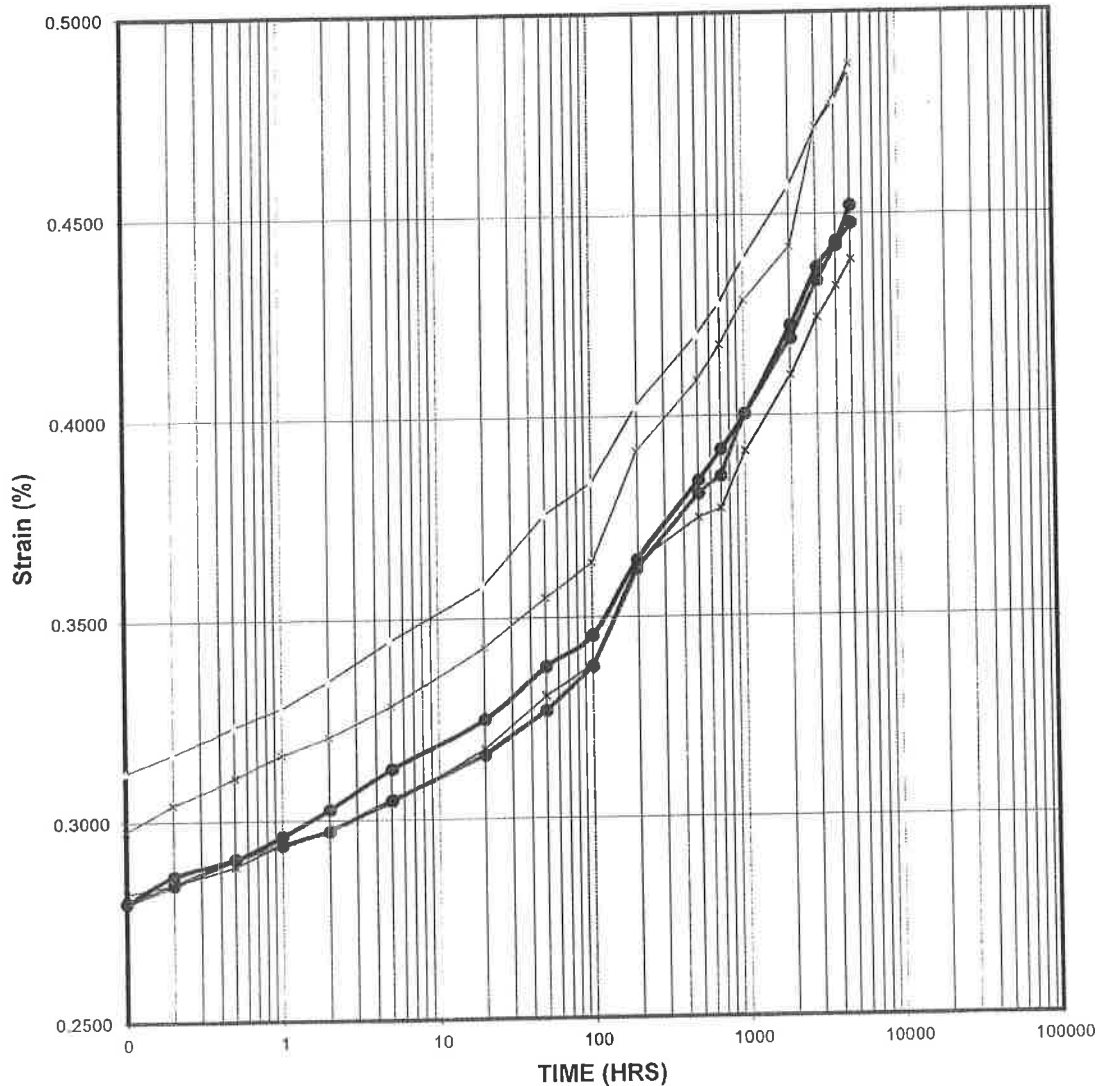
<u>TIME (HRS)</u>	<u>Modulus (psi)</u>
0.02	471852
0.10	460793
0.20	457221
0.50	450240
1	441809
2	436900
5	427402
20	409594
50	393210
100	384244
196	357464
500	348950
700	344921
1004	332290
2012	317105
3020	306397
4004	300926
5012	296389



HTS Pipe Consultants, Inc.

420 Pickering, Houston, Texas 77091
Tel: (713) 692-8373 Fax: (713) 692-8502

FLEXURAL CREEP ASTM D2990



Project Name:

Project No.:

Sample ID No.: L758-NET

HTS Report#: AOCF431.001

Tested Temperature: 71°F

Lab Humidity: 50%

Specimen Gage Length: 3.5"

Stress: 1300 psi

HTS Repor AOCF431.001

Sample ID: L758-NET

Spec# 1

Thickness: 0.224" Width: 0.570"

<u>TIME (HRS)</u>	<u>Strain (%)</u>
0.02	0.2633
0.10	0.2798
0.20	0.2842
0.50	0.2907
1	0.2940
2	0.2973
5	0.3050
20	0.3160
50	0.3269
100	0.3379
196	0.3621
500	0.3807
700	0.3851
1004	0.4005
2012	0.4191
3020	0.4334
4004	0.4421
5012	0.4476

Spec# 2

Thickness: 0.224" Width: 0.562"

<u>TIME (HRS)</u>	<u>Strain (%)</u>
0.02	0.2633
0.10	0.2798
0.20	0.2864
0.50	0.2907
1	0.2962
2	0.3028
5	0.3127
20	0.3248
50	0.3379
100	0.3456
196	0.3643
500	0.3840
700	0.3917
1004	0.4005
2012	0.4224
3020	0.4367
4004	0.4432
5012	0.4520

Spec# 3

Thickness: 0.227" Width: 0.574"

<u>TIME (HRS)</u>	<u>Strain (%)</u>
0.02	0.3002
0.10	0.3124
0.20	0.3169
0.50	0.3235
1	0.3280
2	0.3347
5	0.3447
20	0.3580
50	0.3758
100	0.3836
196	0.4025
500	0.4203
700	0.4281
1004	0.4392
2012	0.4570
3020	0.4714
4004	0.4781
5012	0.4859

HTS Report AOCF431.001

Sample ID: L758-NET

Spec# 4

Thickness: 0.225" Width: 0.587"

<u>TIME (HRS)</u>	<u>Strain (%)</u>
0.02	0.2887
0.10	0.2976
0.20	0.3042
0.50	0.3108
1	0.3163
2	0.3207
5	0.3284
20	0.3427
50	0.3549
100	0.3637
196	0.3912
500	0.4089
700	0.4177
1004	0.4287
2012	0.4419
3020	0.4717
4004	0.4794
5012	0.4871

Spec# 5

Thickness: 0.225" Width: 0.571"

<u>TIME (HRS)</u>	<u>Strain (%)</u>
0.02	0.2755
0.10	0.2821
0.20	0.2843
0.50	0.2887
1	0.2942
2	0.2976
5	0.3042
20	0.3174
50	0.3306
100	0.3383
196	0.3637
500	0.3747
700	0.3769
1004	0.3912
2012	0.4100
3020	0.4243
4004	0.4320
5012	0.4386



TEST REPORT

CLIENT: AOC, LLC
950 Highway 57 East
Collierville, TN 38017

Attention: Bill Moore Re: P.O. #8142

SAMPLES: One sample of felt laminate was submitted and identified by the client as L713-NET. The sample was received on October 31, 2007. The sample was cut into individual test coupons (each approximately 7" x 0.5") by Hauser Laboratories.

TESTING: Flexural creep testing was performed in general accordance with ASTM D2990-01, *Tensile, Compressive, and Flexural Creep and Creep-Rupture of Plastics*. Five (5) test coupons were randomly selected and tested per Section 6.3 of ASTM D2990, *Flexural Creep*, using a three-point static-load configuration, a 4.25 inch span, and a 400 psi testing stress. The ASTM D2990 flexural creep testing was performed at $23 \pm 2^\circ\text{C}$ and $50 \pm 5\%$ Relative Humidity throughout the duration of the testing. The testing was started on December 12, 2007 and was completed on March 3, 2009.

The client requested determination of the 50 year modulus. This was performed by extrapolating the most linear portion of the data set (from 20 hours through 10,000 hours duration) using linear trend line analysis contained within commercially available software (Microsoft Excel).

Chemical resistance testing was performed in accordance with ASTM D543-06, *Evaluating the Resistance of Plastics to Chemical Reagents*, using the guidelines set by ASTM D5813-04, *Standard Specification for Cured-in-Place Thermosetting Resin Sewer Pipe*, Section 8.2.1. Sets of five (5) test coupons were randomly selected and exposed to the reagents below for one year at 23°C . Following the chemical exposure, the coupons were tested in accordance with ASTM D790-07, *Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials*. The results of the flexural properties testing were compared to those of an additional set of five (5) coupons randomly selected and conditioned at $23 \pm 2^\circ\text{C}$ and $50 \pm 5\%$ Relative Humidity for the duration of the exposures.

Reagent	Concentration
Nitric acid	1%
Sulfuric acid	5%
ASTM Fuel C	100%
Vegetable oil	100%
Detergent	0.1%
Soap	0.1%
Sodium hydroxide	0.5%

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RESULTS: The individual creep specimen dimensions are displayed in Table 1. The raw time-displacement creep data are presented in Table 2. The creep test results through 10,000 hours test duration are presented in Table 3. For each specimen, flexural modulus versus time data is displayed in tabular format. Additionally, graphical data displaying the average log modulus versus log time is presented in Figure 1, and graphical data displaying the individual log modulus versus log time is presented in Figure 2.

Using the linear trend line analysis extrapolation of the most linear portion of the data set (from 20 hours through 10,000 hours duration; See Figure 1) the 50 year (438,000 hour) modulus was calculated to be 175,000 psi.

The results of the chemical exposure testing are presented in Table 4.

**DATA REVIEWED AND
REPORT WRITTEN BY:**


Douglas Bert
Scientist II

REPORT REVIEWED BY:


Steve Ferry
Managing Director, Hauser Laboratories

TABLE 1
INDIVIDUAL D2990 TEST SPECIMEN DIMENSIONS

Specimen Number	Width	Thickness
	in	in
1	0.530	0.266
2	0.556	0.272
3	0.554	0.252
4	0.566	0.268
5	0.558	0.269

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TABLE 2
FLEXURAL DISPLACEMENT DATA

TEMPERATURE: 23°C
RELATIVE HUMIDITY: 50%
STRESS: 400psi
SPAN LENGTH: 4.25 inches

Elapsed Time hours	Flexural Displacement (inches)				
	1	2	3	4	5
0.00	0.2204	0.2191	0.2232	0.2917	0.2429
0.02	0.2104	0.2058	0.2129	0.2797	0.2370
0.03	0.2103	0.2041	0.2123	0.2793	0.2370
0.12	0.2092	0.2022	0.2123	0.2790	0.2370
0.22	0.2092	0.2008	0.2123	0.2788	0.2370
0.52	0.2091	0.1988	0.2123	0.2781	0.2368
1.0	0.2090	0.1981	0.2123	0.2777	0.2367
2.0	0.2089	0.1975	0.2122	0.2772	0.2366
4.7	0.2088	0.1972	0.2120	0.2763	0.2365
19.7	0.2086	0.1968	0.2116	0.2744	0.2362
148.2	0.2078	0.1961	0.2108	0.2670	0.2358
507.1	0.2072	0.1955	0.2102	0.2609	0.2352
1003.7	0.2057	0.1941	0.2087	0.2580	0.2340
2131.9	0.2054	0.1938	0.2084	0.2566	0.2338
2734.4	0.2050	0.1935	0.2080	0.2557	0.2335
3380.7	0.2049	0.1934	0.2079	0.2553	0.2333
4055.7	0.2047	0.1930	0.2075	0.2547	0.2331
4708.7	0.2046	0.1930	0.2075	0.2544	0.2331
5404.9	0.2045	0.1928	0.2073	0.2541	0.2328
6243.7	0.2044	0.1928	0.2072	0.2540	0.2328
6910.3	0.2044	0.1927	0.2071	0.2536	0.2327
7611.4	0.2043	0.1927	0.2070	0.2533	0.2326
8351.5	0.2041	0.1925	0.2069	0.2531	0.2325
9189.7	0.2040	0.1924	0.2068	0.2528	0.2325
9890.7	0.2040	0.1924	0.2068	0.2526	0.2324
10731.2	0.2038	0.1923	0.2067	0.2519	0.2322

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TABLE 3
FLEXURAL CREEP DATA

TEMPERATURE: 23°C
RELATIVE HUMIDITY: 50%
STRESS: 400psi
SPAN LENGTH: 4.25 Inches

Elapsed Time	Flexural Modulus (psi)					
Hours	1	2	3	4	5	Average
0.00						
0.02	452600	332900	464400	374400	758700	476600
0.03	448100	295200	438800	362300	758700	460600
0.12	404100	262000	438800	353800	758700	443500
0.22	404100	241900	438800	348300	758700	438400
0.52	400500	218100	438800	330400	733800	424300
1.0	397000	210800	438800	320900	722000	417900
2.0	393600	205000	434800	309900	710500	410800
4.7	390200	202200	427100	291800	699400	402100
19.7	383600	198500	412400	259700	668100	384500
148.2	359200	192500	385800	181900	630500	350000
507.1	342900	187600	367900	145900	581400	325100
1003.7	307900	177100	329900	133300	503000	290200
2131.9	301700	175000	323200	128000	491900	284000
2734.4	293900	172900	314700	124800	476200	276500
3380.7	292000	172300	312600	123400	466300	273300
4055.7	288300	169700	304700	121400	456800	268200
4708.7	286500	169600	304700	120500	456800	267600
5404.9	284700	168300	300800	119500	443200	263300
6243.7	282900	168300	299000	119200	443200	262500
6910.3	282900	167700	297100	117900	438900	260900
7611.4	281100	167700	295300	117000	434600	259100
8351.5	277700	166400	293500	116400	430400	256900
9189.7	276000	165800	291700	115500	430400	255900
9890.7	276000	165800	291700	114900	426300	254900
10731.2	272700	165200	289900	112900	418400	251800

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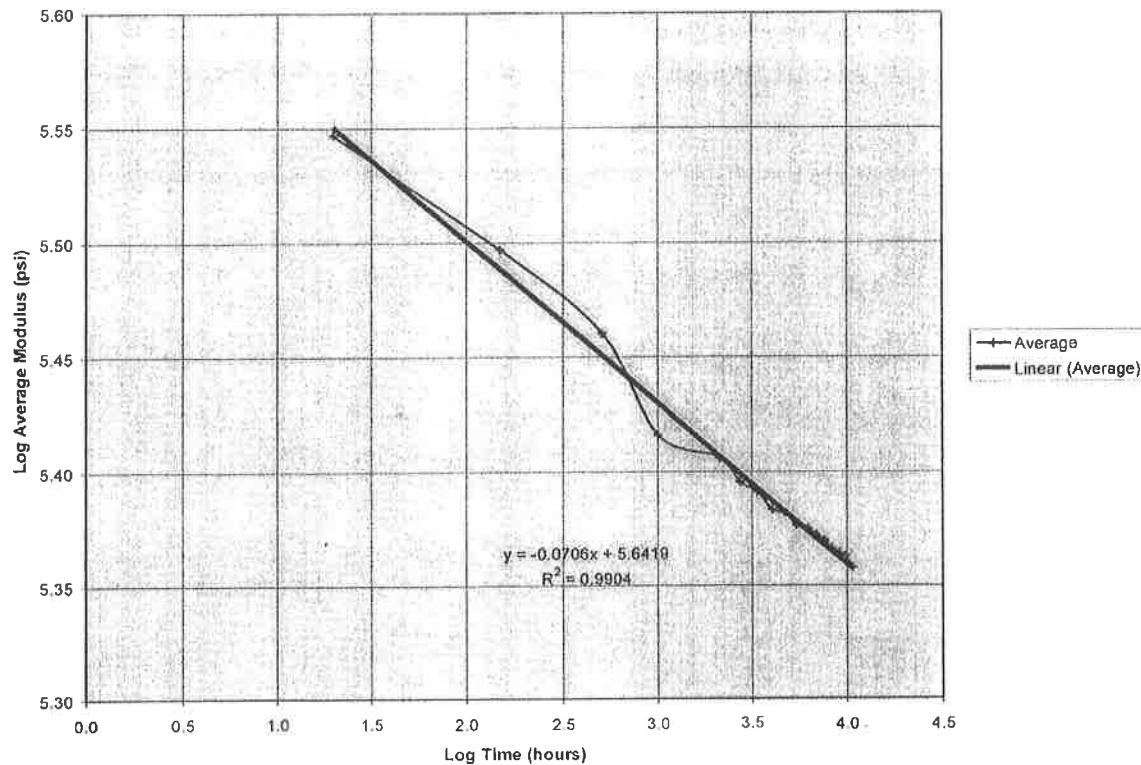
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FIGURE 1
AVERAGE LOG MODULUS VS LOG TIME
20 hours to 10,000 hours



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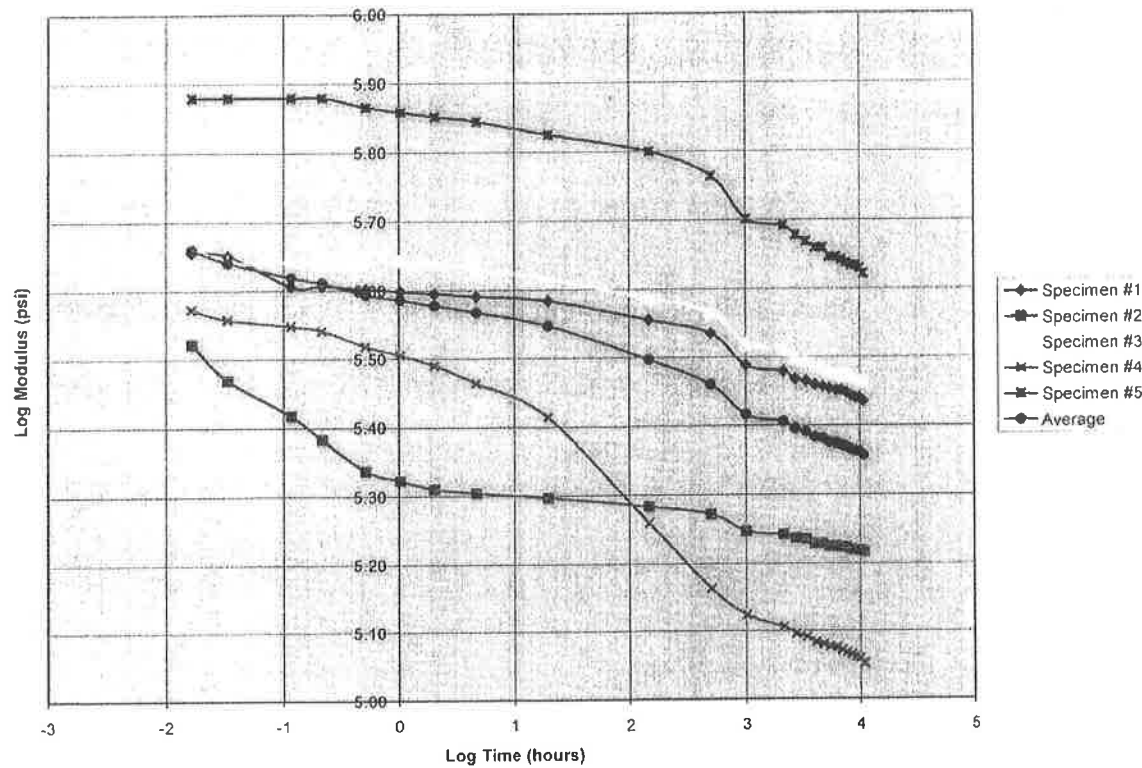
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FIGURE 2
LOG MODULUS VS LOG TIME



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TABLE 4
CHEMICAL RESISTANCE TEST RESULTS

Specimen Number	Flexural Yield Strength	Strain @ Flexural Yield Strength	Flexural Modulus (Tangent)
	psi	in	psi
L 713-NET Unexposed			
1	7910	1.7	506000
2	7980	1.8	491000
3	8230	1.8	500000
4	8590	2.5	521000
5	8270	2.3	551000
Average	8200	2.0	514000
Std. Dev.	270	0.4	24000
L 713-NET Nitric acid			
1	7450	1.6	512000
2	8830	1.9	504000
3	7390	2.4	478000
4	7950	1.7	506000
5	6710	1.5	488000
Average	7670	1.8	498000
Std. Dev.	790	0.4	14000
Retention of Flexural Modulus (%)			96.9
L 713-NET Sulfuric acid			
1	6230	1.3	489000
2	7390	1.5	514000
3	6450	2.1	499000
4	6410	1.4	480000
5	7420	1.7	479000
Average	6780	1.6	492000
Std. Dev.	580	0.3	14000
Retention of Flexural Modulus (%)			95.7

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TABLE 4 CONTINUED
CHEMICAL RESISTANCE TEST RESULTS

Specimen Number	Flexural Yield Strength	Strain @ Flexural Yield Strength	Flexural Modulus (Tangent)
	psi	in	psi
L 713-NET ASTM Fuel C			
1	6950	1.5	502000
2	7270	1.7	482000
3	8600	1.9	506000
4	7100	1.7	485000
5	7440	1.6	512000
Average	7470	1.7	497000
Std. Dev.	660	0.2	13000
Retention of Flexural Modulus (%)			96.7
L 713-NET Vegetable oil			
1	8000	1.7	505000
2	7970	1.8	503000
3	8370	1.8	515000
4	7740	1.6	500000
5	8420	1.9	503000
Average	8100	1.8	505000
Std. Dev.	290	0.1	6000
Retention of Flexural Modulus (%)			98.2
L 713-NET Detergent			
1	7960	2.9	508000
2	7840	1.8	513000
3	7940	2.2	497000
4	8120	2.5	506000
5	7930	1.7	510000
Average	7960	2.2	507000
Std. Dev.	100	0.5	6000
Retention of Flexural Modulus (%)			98.6

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TABLE 4 CONTINUED
CHEMICAL RESISTANCE TEST RESULTS

Specimen Number	Flexural Yield Strength	Strain @ Flexural Yield Strength	Flexural Modulus (Tangent)
	psi	in	psi
L 713-NET Soap			
1	7060	1.5	504000
2	6740	1.5	485000
3	7180	1.6	461000
4	7630	1.7	491000
5	7130	1.7	471000
Average	7150	1.6	482000
Std. Dev.	320	0.1	17000
Retention of Flexural Modulus (%)			93.8
L 713-NET Sodium hydroxide			
1	6350	1.4	466000
2	7790	4.1	476000
3	6170	2.3	463000
4	6250	2.3	476000
5	6530	2.5	470000
Average	6620	2.5	470000
Std. Dev.	670	1.0	6000
Retention of Flexural Modulus (%)			91.4

DISCUSSION: The equation of the line used to extrapolate the 50 year modulus is:
 $\text{Log(modulus in psi)} = -0.0706 * (\text{Log(time in hours)}) + 5.6419$

The extrapolated 50 year modulus is 175,000 psi.

The sample passed the chemical resistance requirements of ASTM D5813-04, Section 6.4.1., which states, "The specimens shall be capable of exposure to the solutions in Table 1 at a temperature of $73.4 \pm 3.6^\circ\text{F}$ ($23 \pm 2^\circ\text{C}$) with a percentage retention of flexural modulus of elasticity, when tested in accordance with 8.3, of at least 80% after one-year exposure".

For any feedback concerning our services, please contact the Managing Director or Trevor Boyce, President, at tboyce@microbac.com or Bob Morgan, Chief Operating Officer, at bmorgan@microbac.com. This report applies only to the sample(s) tested or analyzed. This report may be copied only in its entirety, unless prior written consent has been granted by an authorized agent of the Hauser Laboratories Division of Microbac Laboratories, Inc.

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