INLINER SOLUTIONS

NON-STYRENE VINYL ESTER RESIN SUBMITTAL

AOC EcoTek® L040-TNVG-LV

Included Information:

- AOC Product Information Sheet
- Safety Data Sheet (SDS)
- AOC ISO 9001 Certifications
- ASTM F1216 One Month Chemical Resistance Testing
- ASTM D5813 One Year Chemical Resistance Testing
- ASTM D2990 Data Analysis
- Infrared Spectra

AOC PRODUCT INFORMATION SHEET

Your Formula for Success
RESINS | GEL COATS | COLORANTS

VIPEL® L040-TNVG-LV VINYL ESTER RESIN

Product Information

ENHANCED ULTRA LOW VOC RESIN FOR UNDERGROUND SEWER PIPE LINERS

Typical Cast Mechanical Properties[1]			
Test	**Unit of Measure**	**Nominal**	**Test Method**
Tensile Strength	psi/MPa	7,440/51	ASTM D 638
Tensile Modulus	psi/GPa	670,000/4.6	ASTM D 638
Tensile Elongation	%	1.9	ASTM D 638
Flexural Strength	psi/MPa	12,580/87	ASTM D 790
Flexural Modulus	psi/GPa	710,000/4.9	ASTM D 790
Heat Distortion Temp.	°F/°C @264 psi	243/117	ASTM D 638

Typical Liquid Properties[2]		
Test	**Unit of Measure**	**Nominal**
Viscosity, @25°C/77°F, RVF Brookfield Spindle #4 @ 20 rpm	cps	3,500
Thix Index 2/20	-	>2
Color	-	Light Brown
Specific Gravity @ 25°C/77°F	-	1.28
Gel Time, @140°F	minutes	33
Pot Life @ 25°C/77°C	hours	40

Typical properties are not to be construed as specifications.

DESCRIPTION

The Vipel L040-TNVG-LV is an enhanced, ultra-low VOC resin designed for CIPP applications. L040-TNVG-LV does not contain any styrene monomers or hazardous air pollutants.

BENEFITS

The Vipel L040-TNVG-LV molecular architecture provides an excellent balance of corrosion and physical properties.

- **Contains no styrene**
- **Excellent catalyzed pot life**
- **Superior mechanical properties**

VIPEL®

L040-TNVG-LV VINYL ESTER RESIN

PERFORMANCE GUIDELINES

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

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

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 the appropriate Material Safety Data Sheet for guidelines.

ISO 9001:2015 CERTIFIED

The Quality Management Systems at every AOC manufacturing facility have been certified as meeting ISO 9001:2015 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.) Based on tests of Vipel L040-TNVG-LV at 73°F/23°C and 50% relative humidity. All thixotropic resins should be mixed well prior to use. Testing conducted on cast resin plate.

(2.) The gel times shown are typical but may be affected by catalyst, promoter, inhibitor concentration, resin, mold, and shop temperature. Variations in gelling characteristics can be expected between different lots of catalysts and at extremely high humidities. Pigment and/or filler 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.

AOC

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RESINS | GEL COATS | COLORANTS

AOC World Headquarters
955 Highway 57 East, Collierville, TN 38017

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AOC-Resins.com

Pub VIPEL L040-TNVG-LV
Effective Date: September 2018

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SAFETY DATA SHEET (SDS)

Section 1. Identification

Product name L040-TNVG-LV
Product type Vinyl Ester Resin
Chemical family Aromatic.
SDS No. NA-1508:2936 (Version: 3.1)

Relevant identified uses of the substance or mixture and uses advised against

Identified uses Used in the manufacture of thermoset plastic parts.
Uses advised against No additional information.

Supplier's details

United States:

AOC, LLC
955 Highway 57 East
Collierville, TN 38017
Phone Number: (901) 854-2800
Hours: 8AM-5pm (Central Time) Mon-Fri

E-Mail: aoc.sds@aoc-resins.com
Website: www.aoc-resins.com

Canada:

AOC, LLC
38 Royal Road
Guelpha, Ontario Canada N1H 1G3
Phone Number: (519) 821-5180
Hours: 8am-5pm (Eastern) Mon-Fri

Emergency telephone number

CHEMTREC Within USA and Canada	+1 (800) 424-9300	CCN1023
CHEMTREC Outside USA and Canada	+1 (703) 527-3887	
CANUTEC Within Canada	+1 (613) 996-6666	

Section 2. Hazards identification

OSHA/HCS status

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

Classification of the substance or mixture

SKIN CORROSION/IRRITATION – Category 2 – H315
SERIOUS EYE DAMAGE/ EYE IRRITATION – Category 2 – H319
SENSITIZATION (Skin) – Category 1 – H317
SPECIFIC TARGET ORGAN TOXICITY (SINGLE EXPOSURE) (Respiratory system) – Category 3 – H335

GHS label elements

Hazard pictograms

Signal word

Warning

Hazard statements

H315: Causes skin irritation.
H319: Causes serious eye irritation.
H317: May cause an allergic skin reaction.
H335: May cause respiratory irritation.

Precautionary statements

General

P101: If medical advice is needed, have product container or label at hand.
P102: Keep out of reach of children.

Prevention

P261: Do not breathe vapor or mist.
P270: Do not eat, drink or smoke when using this product.
P264: Wash hands thoroughly after handling.
P271: Use only outdoors or in a well-ventilated area.
P272: Contaminated work clothing should not be allowed out of the workplace.
P280: Wear protective gloves/protective clothing/eye protection/face protection.

Section 2. Hazards identification

Response

P302+P352: IF ON SKIN: Wash with plenty of soap and water.
P333+P313: If skin irritation occurs, get medical advice/attention.
P362+P364: Take off contaminated clothing and wash it before reuse.
P304+P340: IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P305+P351+P338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P337+P313: If eye irritation persists, get medical advice/attention.
P312: Call a POISON CENTER or doctor/physician if you feel unwell.
P391: Collect spillage.

Storage

P403 + P235: Store in a well-ventilated place. Keep cool.
P233: Keep container tightly closed.
P405: Store locked up.

Disposal

P501: Dispose of contents and container in accordance with all local, regional, national and international regulations.

Hazards not otherwise classified

None known.

Section 3. Composition/information on ingredients

Substance/mixture Mixture.

Ingredient name	CAS number	%
(1-methyl-1,2-ethanediyl)bis[oxy(methyl-2,1-ethanediyl)] diacrylate	42978-66-5	≥25 - ≤50

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact

Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Use of buffered baby shampoo will aid in removal. If irritation persists, get 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.

Skin contact

In case of contact, immediately flush skin with plenty of water. Remove contaminated clothing and shoes. If irritation persists, seek medical attention. Wash contaminated clothing before reuse. Clean shoes thoroughly before reuse.

Ingestion

Wash out mouth with water. Remove dentures if any. Stop if the exposed person feels sick as vomiting may be dangerous. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Seek immediate medical attention.

Most important symptoms/effects, acute and delayed

Eye contact

Causes serious eye irritation.

Inhalation

May cause respiratory irritation.

Skin contact

May cause allergic skin reactions with repeated exposure.

Ingestion

Irritating to mouth, throat and stomach.

Over-exposure signs/symptoms

Eye contact

Adverse symptoms may include the following: pain or irritation, watering, redness.

Section 4. First aid measures

Inhalation

Adverse symptoms may include the following: respiratory tract irritation, coughing.

Skin contact

Adverse symptoms may include the following: irritation, redness.

Ingestion

Adverse symptoms may include the following: Irritating to mouth, throat and stomach..

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician

Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

See toxicological information (Section 11)

Section 5. Fire-fighting measures

Extinguishing media

Suitable extinguishing media

Use dry chemical, CO_2, water spray (fog) or foam.

Unsuitable extinguishing media

Do not use water jet.

Specific hazards arising from the chemical

No specific fire or explosion hazard.

Hazardous thermal decomposition products

No specific data.

Special protective actions for fire-fighters

Fire water contaminated with this material must be contained and prevented from being discharged to any waterway, sewer or drain.

Special protective equipment for fire-fighters

Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel

No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Do not touch or walk through spilled material. Shut off all ignition sources. No flares, smoking or flames in hazard area. Avoid breathing vapor or mist. Provide adequate ventilation.

For emergency responders

If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment. See also the information in "For non-emergency personnel".

Environmental precautions

Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air). Water polluting material. May be harmful to the environment if released in large quantities.

Methods and materials for containment and cleaning up

Small spill

Stop leak if without risk. Move containers from spill area. Dilute with water and mop up if water-soluble. Alternatively, or if water-insoluble, absorb with an inert dry material and place in an appropriate waste disposal container. Use spark-proof tools and explosion-proof equipment. Dispose of via a licensed waste disposal contractor.

Large spill

Stop leak if without risk. Move containers from spill area. Approach release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see Section 13). Use spark-proof tools and explosion-proof equipment. Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilled product. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures

Put on appropriate personal protective equipment (see Section 8). Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. Do not breathe vapor or mist. Do not ingest. Avoid contact with eyes, skin and clothing. Avoid release to the environment. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Do not enter storage areas and confined spaces unless adequately ventilated. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Store and use away from heat, sparks, open flame or any other ignition source. Use only non-sparking tools. Take precautionary measures against electrostatic discharges. Empty containers retain product residue and can be hazardous. Do not reuse container.

Advice on general occupational hygiene

Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities

Store in accordance with local regulations. Store in a segregated and approved area. Store in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10) and food and drink. Eliminate all ignition sources. Segregate from oxidizing materials. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination. Refer to the product label and/or technical data sheet for further information.

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

None.

Appropriate engineering controls

Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapor or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.

Individual protection measures

Hygiene measures

Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection

Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists or dusts.

Hand protection

Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.

Body protection

Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection

Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection

Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Section 9. Physical and chemical properties

Appearance

Physical state	Liquid.
Color	Beige.
Odor	Acrylate
Odor threshold	Not available.
pH	*Not applicable.*
Melting point	Not available.
Boiling point	*Not applicable.*
Flash point	>201°F / >94°C
Evaporation rate	Not available.
Flammability (solid, gas)	*Not applicable.*
Lower and upper explosive (flammable) limits	Not available.
Vapor pressure	Not available.
Vapor density	Not established.
Relative density	1.038 (Water = 1)
Solubility	Negligible.
Partition coefficient: n-octanol/water	Not available.
Auto-ignition temperature	Not available.
Decomposition temperature	Not available.
Viscosity	Not available.
Molecular weight	Not available.

Section 10. Stability and reactivity

Reactivity

No specific test data related to reactivity available for this product or its ingredients.

Chemical stability

The product is stable. Stable under recommended storage and handling conditions (see Section 7).

Possibility of hazardous reactions

Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid

Avoid all possible sources of ignition (spark or flame). Do not pressurize, cut, weld, braze, solder, drill, grind or expose containers to heat or sources of ignition.

Incompatible materials

Reactive or incompatible with the following materials: oxidizing materials

Hazardous decomposition products

Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Ingredient name	Result	Species	Dose	Exposure
(1-methyl-1,2-ethanediyl)bis[oxy (methyl-2,1-ethanediyl)] diacrylate	LD50 Oral	Rat	6200 mg/kg	-

Irritation/Corrosion

Ingredient name	Result	Species	Score	Exposure	Observation
(1-methyl-1,2-ethanediyl)bis[oxy (methyl-2,1-ethanediyl)] diacrylate	Eyes - Severe irritant	Rabbit	-	24 hours 100 microliters	-
	Skin - Moderate irritant	Rabbit	-	500 milligrams	-

Sensitization

May cause sensitization by skin contact.

Carcinogenicity

Classification

Section 11. Toxicological information

Ingredient name	ACGIH	IARC	NTP
None of the components are listed.			

Mutagenicity

No mutagenic effect.

Reproductive toxicity

Not considered to be toxic to the reproductive system.

Teratogenicity

No known effect according to our database.

Specific target organ toxicity (single exposure)

No known effect according to our database.

Specific target organ toxicity (repeated exposure)

No known effect according to our database.

Aspiration hazard

No known effect according to our database.

Potential acute health effects

Eye contact

Causes serious eye irritation.

Inhalation

May cause respiratory irritation.

Skin contact

May cause allergic skin reactions with repeated exposure.

Ingestion

Irritating to mouth, throat and stomach.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact

Adverse symptoms may include the following: pain or irritation, watering, redness.

Inhalation

Adverse symptoms may include the following: respiratory tract irritation, coughing.

Skin contact

Adverse symptoms may include the following: irritation, redness.

Ingestion

Adverse symptoms may include the following: Irritating to mouth, throat and stomach..

Section 12. Ecological information

Toxicity

Ingredient name	Result	Species	Exposure
(1-methyl-1,2-ethanediyl)bis[oxy (methyl-2,1-ethanediyl)] diacrylate	EC50 3.68 mg/l	Algae	96 hours
	LC50 35.96 mg/l	Daphnia	48 hours
	LC50 4.9 mg/l	Fish	96 hours

Persistence and degradability

Not available.

Bioaccumulative potential

Ingredient name	$LogP_{ow}$	BCF	Potential
(1-methyl-1,2-ethanediyl)bis[oxy (methyl-2,1-ethanediyl)] diacrylate	2	46.83	low

Mobility in soil

Soil/water partition coefficient (K_{OC})

Not available.

Other adverse effects

No known effect according to our database.

Section 13. Disposal considerations

The information in this section contains generic advice and guidance. The list of Identified Uses in Section 1 should be consulted for any available use-specific information provided in the Exposure Scenario(s).

Disposal methods

The generation of waste should be avoided or minimized wherever possible. Empty containers or liners may retain some product residues. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Avoid disposal. Attempt to use product completely in accordance with intended use. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible.

Special precautions

This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Empty containers or liners may retain some product residues. Do not cut, weld or grind used containers unless they have been cleaned thoroughly internally. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Section 14. Transport information

DOT / TDG/ IMDG/IMO / ICAO/IATA and National regulations.

UN number	UN3082
Proper shipping name	Environmentally hazardous substance, liquid, n.o.s.(Tri(propylene glycol) diacrylate)
Transport hazard class(es)	9 
Packing group	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. **IMDG** No additional information. **IATA** No additional information.
Environmental hazards	Marine pollutant: Yes.
Special precautions for user	**Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Section 15. Regulatory information

International regulations lists

United States inventory (TSCA 8b)	All components are listed or exempted.
Australia (AICS)	Not determined.
Canada (DSL)	At least one component is not listed in DSL but all such components are listed in NDSL.
China (IECSC)	Not determined.
Europe (EINECS)	Not determined.
New Zealand (NZIoC)	Not determined.
Philippines (PICCS)	Not determined.
Japan	**Japan inventory (ENCS)**: Not determined. **Japan inventory (ISHL)**: Not determined.
Malaysia (EHS Register)	Not determined.
Republic of Korea (KECI)	Not determined.
Taiwan (CSNN)	Not determined.

U.S. Federal regulations

SARA 311/312

Per the June 13, 2016 Federal Register notice, EPA harmonized the EPCRA 311/312 hazard categories with the 2012 OSHA hazard communication standard for classifying and labeling of chemicals (i.e. GHS). Please refer to Section 2 of the SDS to identify the appropriate hazard categories for reporting purposes.

SARA 313

Section 15. Regulatory information

	Ingredient name	CAS number
Form R - Reporting requirements	None.	

CERCLA RQ - None.

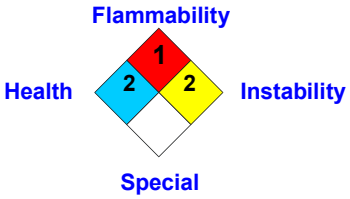
State regulations

California Prop. 65

Not available.

Section 16. Other information

National Fire Protection Association (U.S.A.)



History

Date of issue	09/20/2018
Date of previous issue	08/15/2018
Version	3.1
Prepared by	AOC Corporate Regulatory Affairs
Key to abbreviations	ATE = Acute Toxicity Estimate BCF = Bioconcentration Factor GHS = Globally Harmonized System of Classification and Labelling of Chemicals IATA = International Air Transport Association IBC = Intermediate Bulk Container IMDG = International Maritime Dangerous Goods LogPow = logarithm of the octanol/water partition coefficient MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution) UN = United Nations

Indicates information that has changed from previously issued version.

Notice to reader

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.

This Safety Data Sheet (SDS) and its content are the confidential and proprietary information of AOC and it may not be modified, altered, deconstructed, or presented in any other manner, without the explicit authorization of AOC and/or its legal counsel.

AOC ISO 9001 CERTIFICATIONS

MANAGEMENT SYSTEM CERTIFICATE

Certificate no.:
CERT-08060-2006-AQ-HOU-ANAB

Initial certification date:
19 September, 2018

Valid:
18 September, 2021 – 17 September, 2024

This is to certify that the management system of

AOC, LLC

2552 Industrial Drive, Valparaiso, IN, 46383, USA

has been found to conform to the Quality Management System standard:

ISO 9001:2015

This certificate is valid for the following scope:

The manufacture of polyester resins

Place and date:
Katy, TX, 16 July, 2021

For the issuing office:
DNV - Business Assurance
1400 Ravello Drive, Katy, TX, 77449-5164, USA

Sherif Mekkawy
Management Representative

Lack of fulfilment of conditions as set out in the Certification Agreement may render this Certificate invalid.

ACCREDITED UNIT: DNV Business Assurance USA Inc., 1400 Ravello Drive, Katy, TX, 77449, USA - TEL: +1 281-396-1000. www.dnv.com

MANAGEMENT SYSTEM CERTIFICATE

Certificate no.:
CERT-9555-2006-AQ-HOU-ANAB

Initial certification date:
28 July, 1995

Valid:
28 July, 2021 – 27 July, 2024

This is to certify that the management system of

AOC, LLC

4620 North Galloway Road, LAKELAND, FL, 33810-6717, USA

has been found to conform to the Quality Management System standard:

ISO 9001:2015

This certificate is valid for the following scope:

The Design and Manufacture of Polyester Resin Products.

Place and date:
Katy, TX, 07 May, 2021

For the issuing office:
DNV - Business Assurance
1400 Ravello Drive, Katy, TX, 77449-5164, USA

Sherif Mekkawy
Management Representative

Lack of fulfilment of conditions as set out in the Certification Agreement may render this Certificate invalid.

ACCREDITED UNIT: DNV Business Assurance USA Inc., 1400 Ravello Drive, Katy, TX, 77449, USA - TEL: +1 281-396-1000. www.dnvglcert.com

MANAGEMENT SYSTEM CERTIFICATE

Certificate no.:
CERT-8016-2005-AQ-HOU-ANAB

Initial certification date:
22 January, 1996

Valid:
18 July, 2023 – 17 July, 2026

This is to certify that the management system of

AOC Resins and Coatings Company

38 Royal Road, Guelph, Ontario, N1H 1G3, Canada

has been found to conform to the Quality Management System standard:

ISO 9001:2015

This certificate is valid for the following scope:

The design, manufacture and shipping of unsaturated polyester type products, specialized resins, powders and coatings that are used in a variety of fibre reinforced plastics and composite industries intermediate uses in the manufacture of fibre reinforcements.

Place and date:
Katy, TX, 11 July, 2023

For the issuing office:
DNV - Business Assurance
1400 Ravello Drive, Katy, TX, 77449-5164, USA

Sherif Mekkawy
Management Representative

Lack of fulfilment of conditions as set out in the Certification Agreement may render this Certificate invalid.

ACCREDITED UNIT: DNV Business Assurance USA Inc., 1400 Ravello Drive, Katy, TX, 77449, USA - TEL: +1 281-396-1000. www.dnv.com

MANAGEMENT SYSTEM CERTIFICATE

Certificate no.:
CERT-2116-2006-AQ-HOU-ANAB

Initial certification date:
02 October, 2018

Valid:
16 October, 2021 – 15 October, 2024

This is to certify that the management system of

AOC, LLC

860 Highway 57 East, Collierville, TN, 38017-5204, USA

and the sites as mentioned in the appendix accompanying this certificate

has been found to conform to the Quality Management System standard:

ISO 9001:2015

This certificate is valid for the following scope:

The Design and Manufacture of Polyester and Vinyl Ester Resins, Gel Coats, Colorants and Related Specialty Products.

Place and date:
Katy, TX, 15 September, 2021

For the issuing office:
DNV - Business Assurance
1400 Ravello Drive, Katy, TX, 77449-5164, USA

Sherif Mekkawy
Management Representative

Lack of fulfilment of conditions as set out in the Certification Agreement may render this Certificate invalid.

ACCREDITED UNIT: DNV Business Assurance USA Inc., 1400 Ravello Drive, Katy, TX, 77449, USA - TEL: +1 281-396-1000. www.dnv.com

Certificate no.: CERT-2116-2006-AQ-HOU-ANAB
Place and date: Katy, TX, 15 September, 2021

Appendix to Certificate

AOC, LLC

Locations included in the certification are as follows:

Site Name	Site Address	Site Scope
AOC, LLC	860 Highway 57 East, Collierville, TN, 38017-5204, USA	Production, Quality, Shipping
AOC, LLC	830 Highway 57 East, Collierville, TN, 38107, USA	Management, Sales/TSO, Purchasing, Maintenance, Production, Quality, Shipping, Human Resources

ASTM F1216 ONE MONTH

CHEMICAL RESISTANCE TESTING

AOC
World Leader in Resin Technology

ASTM F1216 Test Results on 6 mm Felt Composite
L040-TNVG Ultra Low VOC Resin
One Month Results at 25°C

	L040-TNVG	REQUIREMENTS %	PASS OR FAIL
CONTROL SAMPLE			
FLEXURAL STRENGTH, psi	6,840		
STANDARD DEVIATION	325		
FLEXURAL MODULUS, psi	546,660		
STANDARD DEVIATION	19,767		
TAP WATER			
FLEXURAL STRENGH, psi	6,145		
STANDARD DEVIATION	197		
% FLEXURAL STRENGTH, psi RETENTION	90	>80	PASSED
FLEXURAL MODULUS, psi	465,249		
STANDARD DEVIATION	21,741		
% FLEXUARAL MODULUS RETENTION	85	>80	PASSED
5% NITRIC ACID			
FLEXURAL STRENGH, psi	5,897		
STANDARD DEVIATION	556		
% FLEXURAL STRENGTH, psi RETENTION	86	>80	PASSED
FLEXURAL MODULUS, psi	474,444		
STANDARD DEVIATION	16,337		
% FLEXUARAL MODULUS RETENTION	87	>80	PASSED
10% PHOSPHORIC ACID			
FLEXURAL STRENGH, psi	6,443		
STANDARD DEVIATION	338		
% FLEXURAL STRENGTH, psi RETENTION	94	>80	PASSED
FLEXURAL MODULUS, psi	519,767		
STANDARD DEVIATION	8,018		
% FLEXUARAL MODULUS RETENTION	95	>80	PASSED
10% SULFURIC ACID			
FLEXURAL STRENGH, psi	6,020		
STANDARD DEVIATION	85		
% FLEXURAL STRENGTH, psi RETENTION	88	>80	PASSED
FLEXURAL MODULUS, psi	509,846		
STANDARD DEVIATION	22,880		
% FLEXUARAL MODULUS RETENTION	93	>80	PASSED

AMOCO GASOLINE			
FLEXURAL STRENGH, psi	6,849		
STANDARD DEVIATION	663		
% FLEXURAL STRENGTH, psi RETENTION	100	>80	PASSED
FLEXURAL MODULUS, psi	616,959		
STANDARD DEVIATION	27,470		
% FLEXURAL MODULUS RETENTION	113	>80	PASSED
VEGETABLE OIL			
FLEXURAL STRENGH, psi	6,165		
STANDARD DEVIATION	266		
% FLEXURAL STRENGTH, psi RETENTION	90	>80	PASSED
FLEXURAL MODULUS, psi	522,144		
STANDARD DEVIATION	14,364		
% FLEXUARAL MODULUS RETENTION	96	>80	PASSED
0.1% DETERGENT			
FLEXURAL STRENGH, psi	6,231		
STANDARD DEVIATION	304		
% FLEXURAL STRENGTH, psi RETENTION	91	>80	PASSED
FLEXURAL MODULUS, psi	474,068		
STANDARD DEVIATION	10,297		
% FLEXUARAL MODULUS RETENTION	87	>80	PASSED
0.1% SOAP			
FLEXURAL STRENGH, psi	6,461		
STANDARD DEVIATION	141		
% FLEXURAL STRENGTH, psi RETENTION	94	>80	PASSED
FLEXURAL MODULUS, psi	486,253		
STANDARD DEVIATION	2,352		
% FLEXURAL MODULUS RETENTION	89	>80	PASSED

November. 2009

ASTM D5813 ONE YEAR

CHEMICAL RESISTANCE TESTING

AOC®
World Leader in Resin Technology

ASTM D5813 Test Results on 6 mm Felt Composite
L040-TNVG Ultra Low VOC Resin
One Year Results at 25°C

	L040-TNVG	REQUIREMENTS %	PASS OR FAIL
CONTROL SAMPLE			
FLEXURAL STRENGTH, psi	6,840		
STANDARD DEVIATION	325		
FLEXURAL MODULUS, psi	546,660		
STANDARD DEVIATION	19,767		
1% NITRIC ACID			
FLEXURAL STRENGH, psi	5,770		
STANDARD DEVIATION	327		
% FLEXURAL STRENGTH, psi RETENTION	84.4	>80	PASSED
FLEXURAL MODULUS, psi	525,785		
STANDARD DEVIATION	19,052		
% FLEXUARAL MODULUS RETENTION	96.2	>80	PASSED
5% SULFURIC ACID			
FLEXURAL STRENGH, psi	5,884		
STANDARD DEVIATION	118		
% FLEXURAL STRENGTH, psi RETENTION	86	>80	PASSED
FLEXURAL MODULUS, psi	515,604		
STANDARD DEVIATION	15,306		
% FLEXUARAL MODULUS RETENTION	94.3	>80	PASSED
100% GASOLINE			
FLEXURAL STRENGH, psi	5,651		
STANDARD DEVIATION	34		
% FLEXURAL STRENGTH, psi RETENTION	82.6	>80	PASSED
FLEXURAL MODULUS, psi	445,838		
STANDARD DEVIATION	10,995		
% FLEXURAL MODULUS RETENTION	81.5	>80	PASSED
100% VEGETABLE OIL			
FLEXURAL STRENGH, psi	6,629		
STANDARD DEVIATION	170		
% FLEXURAL STRENGTH, psi RETENTION	96.9	>80	PASSED
FLEXURAL MODULUS, psi	587,981		
STANDARD DEVIATION	24,438		
% FLEXUARAL MODULUS RETENTION	107	>80	PASSED

0.1% DETERGENT			
FLEXURAL STRENGH, psi	6,189		
STANDARD DEVIATION	198		
% FLEXURAL STRENGTH, psi RETENTION	90.4	>80	PASSED
FLEXURAL MODULUS, psi	529,849		
STANDARD DEVIATION	15,784		
% FLEXUARAL MODULUS RETENTION	96.9	>80	PASSED
0.1% SOAP			
FLEXURAL STRENGH, psi	5,870		
STANDARD DEVIATION	401		
% FLEXURAL STRENGTH, psi RETENTION	85.8	>80	PASSED
FLEXURAL MODULUS, psi	531,649		
STANDARD DEVIATION	19,242		
% FLEXURAL MODULUS RETENTION	97.3	>80	PASSED

June, 2011

ASTM D2990 DATA ANALYSIS

TEST REPORT

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

Attention: Bill Moore Re: P.O. #8701

SAMPLES: One sample of cured in place plastic pipe (CIPP) material was submitted and identified by the client as PET Felt with L040-TNVG Resin. The sample was received on May 2, 2010.

TESTING: Flexural creep testing was performed in general accordance with ASTM D2990-09, *Tensile, Compressive, and Flexural Creep and Creep-Rupture of Plastics*. Five (5) test specimens were randomly selected and tested per Section 6.3 of ASTM D2990, *Flexural Creep*, using a three-point static-load configuration, a 3.79 inch span, and a 1,406 psi testing stress (0.25% of short-term flexural modulus as determined by ASTM D790). The ASTM D2990 flexural creep testing was performed at 23±2°C and 50±5% Relative Humidity throughout the duration of the testing. The testing was started on June 2, 2010 and concluded on August 16, 2011.

The client requested determination of the 50 year modulus. This was performed by extrapolating the most linear portion of the data set (from 142.0 hours through 10,559.8 hours duration) using linear trend line analysis contained within commercially available software (Microsoft Excel).

RESULTS: The short-term flexural properties test results are presented in Table 1. The individual creep specimen dimensions are displayed in Table 2. The raw time-displacement creep data are presented in Table 3. The creep test results through 10,559.8 hours test duration are presented in Table 4. 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 142.0 hours through 10,559.8 hours duration; See Figure 1) the 50 year (438,000 hour) modulus was calculated to be 172,000 psi.

DATA REVIEWED AND REPORT WRITTEN BY:

Douglas Bert
Department Manager

REPORT REVIEWED BY:

Steve Ferry
Managing Director,
Hauser Laboratories Division

TABLE 1
SHORT-TERM FLEXURAL PROPERTIES TEST RESULTS

Specimen Number	Width	Thickness	Flexural Modulus
	in	in	psi
1	0.519	0.236	548000
2	0.517	0.238	561000
3	0.515	0.236	559000
4	0.515	0.235	560000
5	0.510	0.232	583000
Average			562000
Std. Dev.			13000
Span (in)			3.77
Speed of Testing (in/min)			0.10

TABLE 2
INDIVIDUAL D2990 TEST SPECIMEN DIMENSIONS

Specimen Number	Width	Thickness
	in	in
1	0.517	0.239
2	0.516	0.238
3	0.518	0.237
4	0.520	0.237
5	0.514	0.234

TABLE 3
FLEXURAL DISPLACEMENT DATA

TEMPERATURE: 23°C
RELATIVE HUMIDITY: 50%
STRESS:1406 psi
SPAN LENGTH: 3.79 inches

Elapsed Time (hours)	DIAL GAGE READINGS (inches)				
	1	**2**	**3**	**4**	**5**
0.00	0.2404	0.2552	0.2480	0.2571	0.2645
0.02	0.2136	0.2309	0.2225	0.2328	0.2349
0.03	0.2131	0.2200	0.2212	0.2319	0.2343
0.10	0.2126	0.2190	0.2208	0.2310	0.2335
0.20	0.2122	0.2185	0.2204	0.2304	0.2329
0.50	0.2113	0.2176	0.2195	0.2294	0.2319
1.0	0.2108	0.2172	0.2190	0.2288	0.2313
2.0	0.2100	0.2165	0.2184	0.2281	0.2306
5.0	0.2088	0.2154	0.2174	0.2268	0.2290
22.0	0.2067	0.2137	0.2157	0.2247	0.2267
51.0	0.2053	0.2126	0.2145	0.2233	0.2252
142.0	0.2025	0.2105	0.2124	0.2206	0.2225
218.3	0.2009	0.2095	0.2114	0.2191	0.2210
453.5	0.1979	0.2069	0.2089	0.2160	0.2177
550.7	0.1968	0.2062	0.2083	0.2151	0.2167
1365.1	0.1924	0.2021	0.2045	0.2104	0.2117
2063.7	0.1900	0.2001	0.2025	0.2080	0.2092
2856.2	0.1881	0.1987	0.2013	0.2063	0.2076
3581.7	0.1871	0.1979	0.2005	0.2054	0.2064
4585.8	0.1865	0.1973	0.1998	0.2048	0.2058
5764.6	0.1854	0.1965	0.1988	0.2034	0.2046
6506.8	0.1846	0.1958	0.1981	0.2027	0.2038
7438.2	0.1840	0.1952	0.1978	0.2024	0.2031
8037.0	0.1838	0.1949	0.1974	0.2019	0.2028
8784.8	0.1834	0.1946	0.1970	0.2015	0.2024
9266.5	0.1832	0.1943	0.1968	0.2012	0.2020
9862.5	0.1829	0.1942	0.1965	0.2009	0.2018
10559.8	0.1825	0.1937	0.1962	0.2005	0.2013

TABLE 4
FLEXURAL CREEP DATA

TEMPERATURE: 23°C
RELATIVE HUMIDITY: 50%
STRESS:1406 psi
SPAN LENGTH: 3.79 inches

Elapsed Time	Modulus (psi)					
Hours	1	2	3	4	5	Average
0.00						
0.02	525518	582003	556957	584467	485965	546982
0.03	515893	401780	529941	563593	476310	497503
0.10	506614	390681	522147	544159	464018	485524
0.20	499428	385359	514580	531930	455208	477301
0.50	483982	376135	498330	512727	441244	462484
1.0	475807	372175	489738	501856	433270	454569
2.0	463285	365444	479811	489743	424323	444521
5.0	445692	355343	464131	468731	405199	427819
22.0	417919	340787	439703	438350	380544	403461
51.0	401250	331987	423952	420193	366019	388681
142.0	371606	316391	398944	389111	342490	363708
218.3	356554	309468	388044	373751	330680	351699
453.5	331385	292809	363233	345561	307363	328070
550.7	323025	288626	357743	338156	300932	321696
1365.1	293414	266340	326492	304123	272435	292561
2063.7	279442	256673	312141	289257	260119	279526
2856.2	269290	250313	304120	279578	252804	271221
3581.7	264238	246818	298998	274711	247583	266469
4585.8	261296	244260	294656	271559	245052	263365
5764.6	256071	240931	288667	264479	240143	258058
6506.8	252399	238092	284617	261076	236978	254633
7438.2	249714	235711	282916	259644	234276	252452
8037.0	248832	234538	280680	257292	233137	250896
8784.8	247086	233377	278479	255441	231636	249204
9266.5	246222	232228	277391	254070	230153	248013
9862.5	244937	231847	275775	252714	229419	246938
10559.8	243245	229962	274178	250928	227604	245183

FIGURE 1
AVERAGE LOG MODULUS VS LOG TIME
142.0 hours to 10,559.8 hours

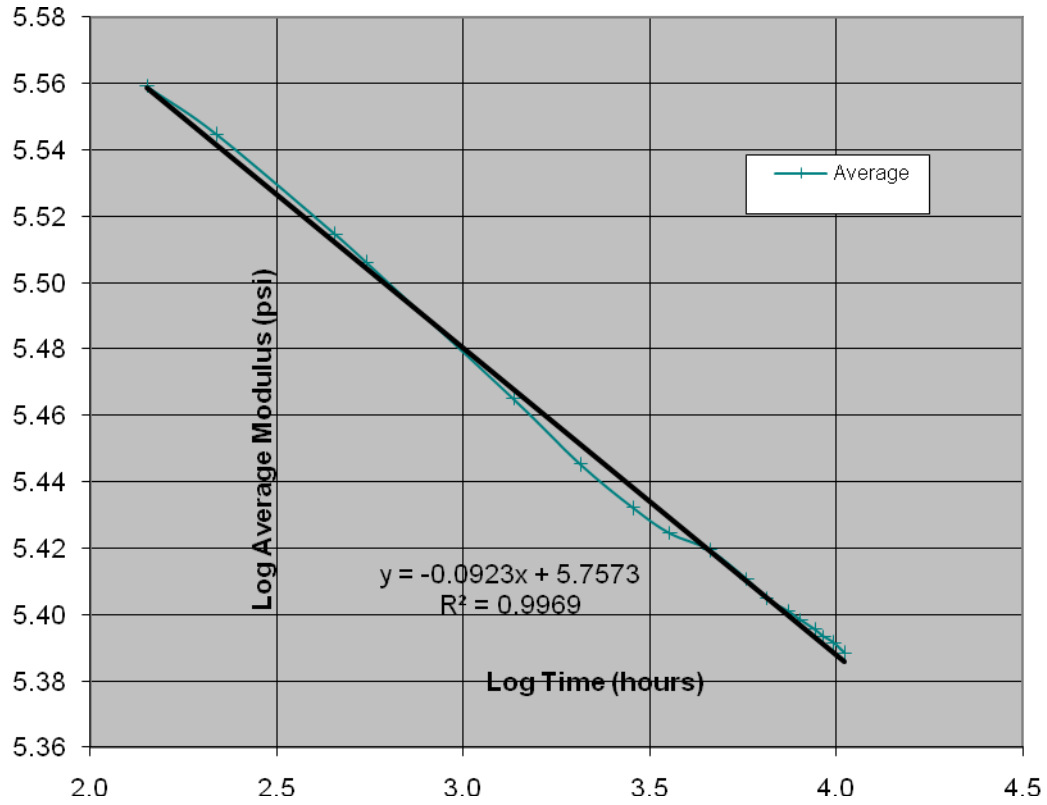
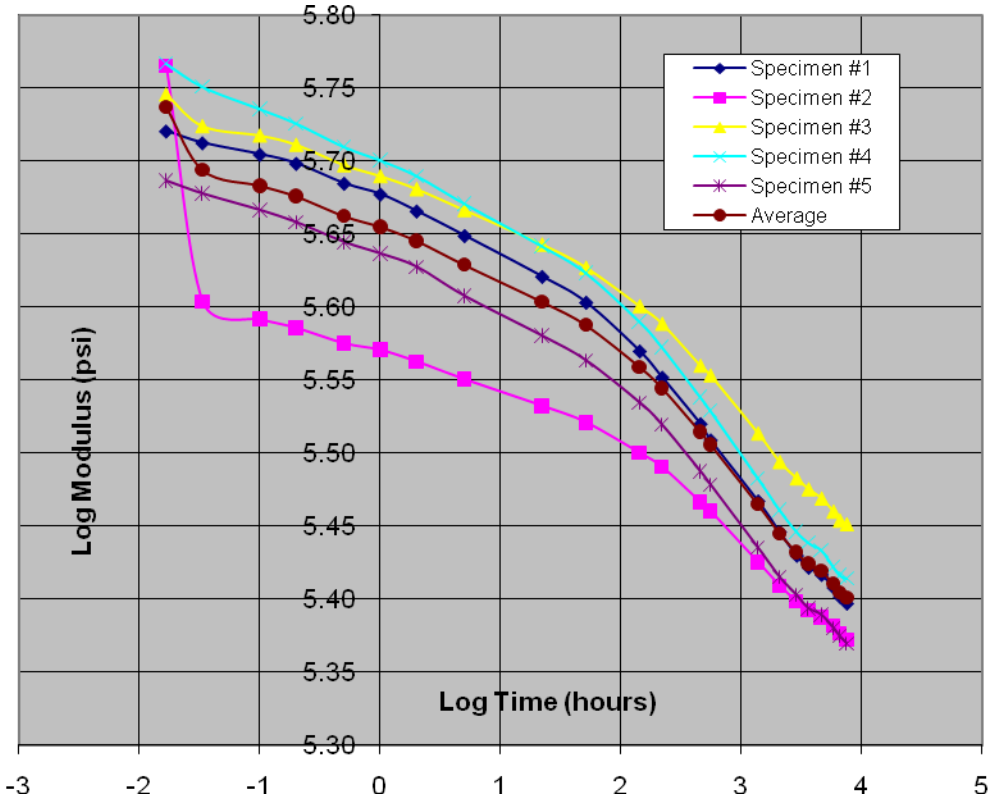
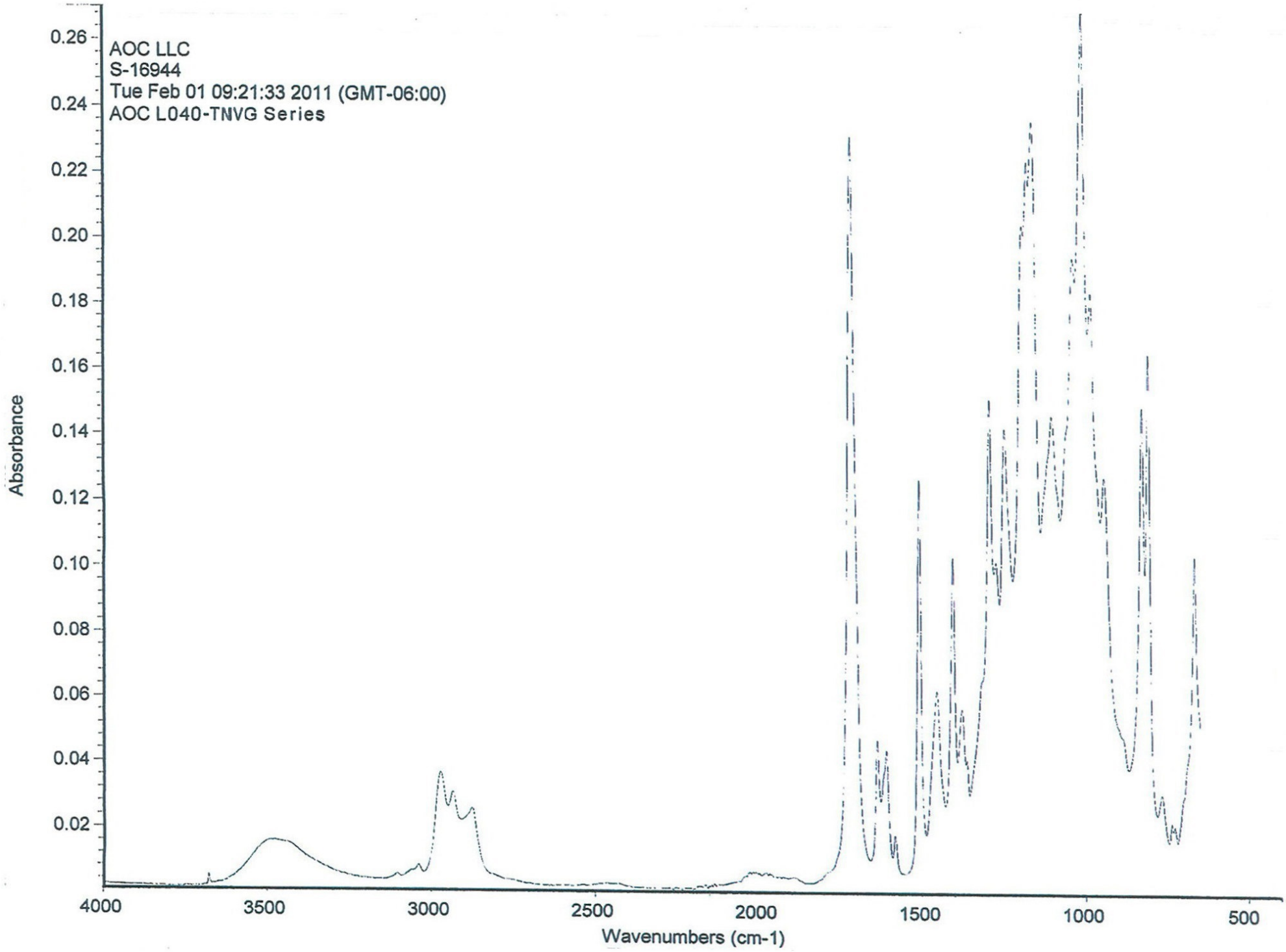


FIGURE 2
LOG MODULUS VS LOG TIME



INFRARED SPECTRA


AOC LLC
S-16944
Tue Feb 01 09:21:33 2011 (GMT-06:00)
AOC L040-TNVG Series
Absorbance
0.26
0.24
0.22
0.20
0.18
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
4000
3500
3000
2500
2000
1500
1000
500
Wavenumbers (cm-1)