APÉNDICES

APÉNDICE A

HOJA TÉCNICA DE LA RESINA EPÓXICA FABRICADA POR PINTURAS UNIDAS 1431 ROJO ÓXIDO

PINTURAS MARINAS INDUSTRIAL & PETROQUIMICA PRIMER EPÓXICO

Cod: 1431 Rojo óxido
Catalizador Poliamida Cod: DC-010

DESCRIPCIÓN:

Primer Epóxico es una imprimación epóxica anticorrosiva de dos componentes, el componente A pintura epóxica que contiene además cromato de zinc con el componente B catalizador DC-010 que es una Poliamida, que al mezclarse producen una película dura y resistente a la corrosión en superficies ferrosas, de muy buena adherencia y flexibilidad, utilizado además como promotor de adherencia en superficies no ferrosas y como excelente primer para concreto.

USO RECOMENDADO:

Como base anticorrosivo sobre acero y superficies metálicas, aluminio, fibra de vidrio, galvanizado y otras superficies no ferrosas, como primer en obras vivas, obra muerta, cubiertas, superestructuras, sentinas, tanques de agua dulce o salada de embarcaciones, para estructuras, maquinarias, equipos industriales, instalaciones marinas o portuarias, puentes, plataformas de

perforación, pisos de concreto y todo metal que este en atmósferas con alta contaminación industrial. Resistencia a temperaturas de 120º C en seco y 70º C en inmersión.

PROPIEDADES FÍSICAS Y DATOS DE APLICACIÓN:

Color	1431 Rojo Oxido	
Acabado	Semibrillante	
Sólidos por volumen	55 ± 2 %	
Número de componentes	Dos	
Proporción de la mezcla	4 partes por volumen de Componente A 1 parte por volumen de curador DC 010	
Tiempo de vida útil de la mezcla	6 Horas a 25º C 4 Horas a 30º C	
Punto de inflamación:	Mayor de 21º C	
Espesor recomendado	Húmedo: 136 micras / 5 - 6 mils. Seco: 75 micras / 3 mils.	
Rendimiento teórico:	7.3 m / litro a 75 micras / 3 mil *	
Método de aplicación:	Pistolas: sin aire (Airless) convencional, Brocha y Rodillo	
Dilución:	Reductor Epóxico 1170 diluir Máx.5 % por Vol.	
Diámetro de boquilla:	19 – 21 mils.	
Presión de boquilla:	175 bar/2500 psi.	
Limpieza de equipos:	Reductor Epóxico Cod. 1170	
Tiempo de secamiento (Repintado):		
Temperatura	Mínimo	Máximo
A 25º C (77º F)	8 horas	Indefinido
A 35º C (95º F)	6 horas	Indefinido
* No esta considerando el porcentaje de pérdida por aplicación		

PREPARACIÓN DE SUPERFICIE:

Acero nuevo:

- Lavado/desengrasado con UNIJAB Cod. 25 hasta eliminar grasas, aceites, polvo o cualquier contaminante, enjuagar con agua dulce, dejar secar.

- Chorreado abrasivo hasta obtener la limpieza de grado metal blanco Sa3/ SSPC SP5 con un perfil de rugosidad de 25 a 37 micrones o como mínimo el grado cerca de metal blanco SA 21/2 / SSPC – SP10 según especificaciones Sueca/Americana con un perfil de rugosidad de 25 a 37 micrones.

- Aplicar una capa de Primer Epóxico Cod. 1431 / DC010 Rojo Oxido.

Superficies no ferrosas:

- Lavado/desengrasado con UNIJAB Cod. 25 hasta eliminar grasas, aceites, polvo o cualquier contaminante, enjuagar con agua dulce, dejar secar.

- Aplicar Epóxico promotor de adherencia 1431 Rojo óxido / DC01.

- Si se va aplicar como promotor de adherencia sobre superficies no ferrosas se puede aplicar un espesor de película seca de 30 a 50 micras.

Concreto nuevo y Baldosas:

- La superficie debe de tener un curado mínimo de 25 a 30 días, con esto evitaremos que el agua retenida afecte la adherencia y el curado, no se debe de enlucir / paletear el piso.

- Lavar con ácido UNIACID la superficie por espacio de 20 minutos con el fin de eliminar la alcalinidad superficial.

- Pasado los 20 minutos neutralizar con UNIJAB hasta llegar al pH 7 Neutro.

- Mínimo dejar secar de 48 a 72 horas.

- Aplicar una capa de Primer Epóxico Cod. 1431 / DC010 Color Rojo Oxido, diluida a un 20 a 30 % con reductor epóxico cod. 1170.

Concreto envejecido y Baldosas

- Eliminar grasas, aceites, polvo y cualquier contaminante con UNIJAB.

- Posteriormente hacer los pasos indicados en concreto nuevo.

- Si hay pintura antigua el técnico de Pinturas Unidas S.A. deberá realizar pruebas de adherencia y compatibilidad.

MANTENIMIENTO:

- Eliminar costras de óxido y herrumbre con herramientas manuales según las normas ST2 / SSPC SP2.

- Lavado/desengrasado con UNIJAB Cod. 25 hasta eliminar grasas, aceites, polvo o cualquier contaminante, enjuagar con agua dulce.

- Chorreado abrasivo mínimo al grado SA 2, si no es posible realizar limpieza con herramienta mecánica según norma ST3 / SSPC SP3 la misma que será inspeccionada por el técnico de Pinturas Unidas.

APLICACIÓN:

- Se revuelve por separado y con una espátula limpia los componentes A y B, hasta obtener una perfecta homogenización.

- Mezclar cuatro partes del componente A con una parte del componente B, antes de aplicar se debe dejar unos 15 minutos como tiempo de inducción.

- Si se va a aplicar sobre epóxicos antiguos, se recomienda primero lavar la superficie con UNIJAB, aplicar chorreado abrasivo mínimo SA2/SSPC SP6 o realizar limpieza mecánica según especificaciones ST3/SSPC SP3.

- Antes de aplicar capas de pintura, observar que la temperatura de la superficie se encuentre mínimo 3º C por encima de la temperatura de rocío.

- Capa precedente: ninguna

- Capas subsiguientes: Poliuretanos, Coaltar, Epóxico Poliamida, Unimastic, Unistrong, Uni antideslizante, Marine Enamel.

PRECAUCIONES DE SEGURIDAD:

- Utilice equipos de protección personal (guantes, lentes de seguridad y mascarillas para vapores orgánicos), provea adecuada ventilación cuando se aplique la pintura en espacios cerrados o sin circulación de aire, aún cuando se provea ventilación se debe usar protección respiratoria, protección para la piel y ojos, cuando se este aplicando la pintura, no fume en las áreas de aplicación y mantenga la pintura alejada de chispas y llamas.

- Al contacto con la piel lavar con agua y jabón. Si llega a los ojos lave con abundante agua y obtenga atención médica. Si hay inhalación de vapores, traslade la persona a un sitio ventilado.

- Al ser ingerido no induzca al vómito. Busque atención médica con urgencia. Nota para el médico: no hay antídoto específico, el tratamiento debe ser sintomático.

- Mantenga el producto fuera del alcance de los niños.

- Este producto no es cancerígeno, no posee indicadores toxicológicos hasta el momento ni efectos adversos a la salud, si se manipula correctamente.

- No lavarse las manos y el cuerpo con Reductor, Thinner o Solvente.

Medidas para combatir incendios:

- Medios de extinción apropiados: Polvo químico seco, espuma, CO2, agua en forma de Neblina.

- Protección contra incendio o explosión: Manténgase alejado de fuentes de ignición y electricidad estática. Conecte a tierra los equipos para manipulación. Enfriar con agua los recipientes expuestos al fuego.

Control de Exposición / protección personal:

- Protección respiratoria: Semimáscara con filtro para vapores orgánicos.

- Protección de los ojos: Anteojos de seguridad contra productos químicos.

- Protección de las manos: Guantes de PVC o resistentes a solventes orgánicos.

- Otros: De acuerdo con las condiciones de trabajo.

Indicaciones Ecológicas:

Evitar la contaminación de cursos de agua. Si el Producto ingresa a cursos de agua, informar de no consumir la misma. Los residuos del producto deberán ser tratados conforme la legislación en vigor.

Los desechos como wipe, liencillo, franela, papeles, envases vacíos y desechos inservibles del trabajo de pintura se deben de ubicar en recipientes cerrado para ser asignado en la basura industrial, no quemar los desechos de Pintura y solvente, no botar en drenajes, tuberías de descargas de aguas residuales, de haber derrame de pintura con arena o tierra detener, luego recoger y colocar en el respectivo tacho de basura industrial.

PINTURAS UNIDAS S.A. fabrica sus productos cumpliendo con las normas de Seguridad e Higiene Industrial establecidas en su manual de funcionamiento.

ALMACENAMIENTO, EMBALAJE Y TRANSPORTE:

- Tiempo de Vida: 12 meses a 25º C (77º F) sujetos a reinspecciones posteriores.

- Almacenar en condiciones secas a la sombra y alejada del fuego, calor e ignición.

- Condiciones de transporte y embalaje: normales PRESENTACION.
    - Componente A Caneca / Galón Mermado.
    - Componente B Código DC010 Galón / Litro Mermado.

OBSERVACIÓN

Pinturas Unidas S.A. no se hace responsable del uso del producto para una aplicación distinta a la que se esta recomendando si se desea información adicional estaremos prestos a realizar una inspección con nuestros técnicos de campo.

Nuestro teléfono es 04 – 2 893680 Ext. 161- 162- 163.

e- mail: unidas@unidas.com.ec
lplaza@unidas.com.ec

PRESENTACION

- Componente A Código1431 Rojo Oxido: Caneca / Galón Mermado.

- Componente B Código DC 010: Galón / Litro Mermado.

APÉNDICE B

HOJAS TÉCNICAS DEL AGENTE CURADOR

JEFFAMINE D-230

JEFFAMINE® D-230 Epoxy Curing Agent

JEFFAMINE® D-230 is a polyether diamine with low color, low viscosity, and moderate reactivity in epoxy curing. The polyether backbone gives cured resins with relatively high elongation and good toughness and thermal shock resistance. It can be blended with higher-viscosity curing agents to reduce viscosity, or with cycloaliphatics to improve the elongation of higher-T_g cured resins.

Typical Physical Properties		Epoxy Formulation Properties[a]	
Brookfield viscosity, cps (77°F)	9	Viscosity, cps (25°C)	600
Specific gravity, 20/20°C	0.948	Pot life (min) (time to 10,000 cps)	~280
Density, lb/gal, 20°C	7.9	Peak exotherm T, °C (°F)	64 (147)
Flash point, PMCC, °F	250	Time to peak T, min	395
Water, wt%	0.1	T_g, °C (°F)	90 (194)
Total acetylatables, meq/g	8.7	Tensile strength, psi	9800
Total amine, meq/g	8.4	Elongation, %	10
Primary amine, meq/g	8.2	Flexural strength, psi	15700
Amine hydrogen eq. wt.	60	Flexural modulus, psi	454000

[a] The resin was a liquid DGEBA resin of approximately 12,500 cps and 188 eew; test panels were cured for 2 hr at 80°C (175°F) and 3 hr at 125°C (257°F); the T_g was determined by DSC.

The D-230 (32 phr) should be mixed thoroughly with the resin. Curing at elevated temperature is desirable to develop the full properties shown above. Good properties can be obtained, however, with cures at lower temperatures. For room temperature cures a cure accelerator (such as Huntsman Accelerator 399, 2-10 phr) is generally added.

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Main Offices: Huntsman Corporation / P. O. Box 27707 / Houston, Texas 77227-7707 / 713-235-6000

Technical Services Section: P. O. Box 15730 / Austin, Texas 78761 / 512-483-0056

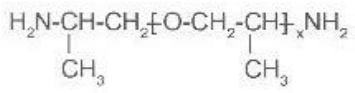
Technical Bulletin

HUNTSMAN

JEFFAMINE® D-230 POLYOXYPROPYLENEDIAMINE

[CAS 9046-10-0]

STRUCTURE



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DESCRIPTION

JEFFAMINE D-230 polyoxypropylenediamine is one of a family of Huntsman Corporation's polyamines having as their backbones repeated oxypropylene units. As shown by the above structure, JEFFAMINE D-230 is a difunctional primary amine having an average molecular weight of approximately 230. Its amine groups are located on secondary carbon atoms at the ends of an aliphatic polyether chain.

JEFFAMINE D-230 is light in color, low in viscosity and vapor pressure, high in primary amine content, and completely miscible in a wide variety of solvents, including water.

SALES SPECIFICATIONS

Appearance	Colorless to slight yellow with slight haze
Color, Pt-Co	100 max.
Total acetylatables, meq/g	8.3 min. 9.1 max.
Primary amine, % of total amine	97 min.
Total amine, meq/g	8.1 min. 8.7 max.
Water, %	0.25 max.

TYPICAL PHYSICAL PROPERTIES

Brookfield viscosity, cps, 25°C (77°F)	9
Specific gravity, 20/20°C	0.9480
Density, lb/gal, 20°C	7.9
Refractive index, n_D^{20}	1.4466
Flash point, PMCC, °C (°F)	121 (250)
Vapor pressure, mm Hg/°C	1/100 10/133
pH, 5% aqueous solution	11.7
Equivalent weight with epoxies ("Amine hydrogen equivalent weight," or AHEW)	60

AVAILABILITY

JEFFAMINE D-230 is available in tank cars, tank wagons, 55-gallon drums of 430 pounds net weight, and 5-gallon cans. Samples are available from any Huntsman Corporation sales office.

APPLICATIONS

JEFFAMINE D-230 polyoxypropylenediamine undergoes reactions typical of primary amines. Because of its unique structure, however, JEFFAMINE D-230 has found its most significant use as an epoxy curing agent. The use of JEFFAMINE D-230 leads to tough, clear, impact-resistant coatings, castings, and adhesives. Examples include coatings for decoupage and furniture, reinforced composites, electrical encapsulation, and lamination. Coatings made with unmodified JEFFAMINE D-230 are free of the surface "blush" prevalent with many amine curing agents. JEFFAMINE D-230 has found its way into

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Technical Services Section: P.O. Box 15730 / Austin, Texas 78761 / 512/459-6543

HUNTSMAN

MATERIAL SAFETY DATA SHEET

READ AND UNDERSTAND MATERIAL SAFETY DATA SHEET BEFORE HANDLING OR DISPOSING OF PRODUCT

MSDS CODE AND NAME	:	*JAD230 JEFFAMINE® D-230*
DATE ISSUED	:	3/31/2003
DATE PRINTED	:	3/31/2003

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

MATERIAL IDENTITY

MSDS CODE AND NAME

JAD230 JEFFAMINE® D-230

Chemical Name and/or Family or Description:

Polyoxypropylenediamine

COMPANY INFORMATION

Huntsman Petrochemical Corporation
P.O. Box 27707
Houston, TX 77227-7707

TELEPHONE NUMBERS
Transportation Emergency
Company: (409) 727-0831
CHEMTREC: (800) 424-9300
Medical Emergency: (409) 722-9673 (24 Hour)
General MSDS Assistance: (713) 235-6432
Technical Information: (512) 459-6543

2. COMPOSITION AND INFORMATION ON INGREDIENTS

THE CRITERIA FOR LISTING COMPONENTS IN THE COMPOSITION SECTION ARE AS FOLLOWS: CARCINOGENS ARE LISTED WHEN PRESENT AT 0.1 % OR GREATER; COMPONENTS WHICH ARE OTHERWISE HAZARDOUS ACCORDING TO OSHA ARE LISTED WHEN PRESENT AT 1.0 % OR GREATER; NON-HAZARDOUS COMPONENTS ARE LISTED AT 3.0 % OR GREATER. THIS IS NOT INTENDED TO BE COMPLETE COMPOSITIONAL DISCLOSURE. REFER TO SECTION 14 FOR APPLICABLE STATES' RIGHT TO KNOW AND OTHER REGULATORY INFORMATION.

Product and/or Component(s) Carcinogenic According to:

OSHA IARC NTP OTHER NONE X

Composition:

Chemical Name	CAS Number	Exposure Limits	Range in %
Poly(oxy(methyl-1,2-ethanediyl)),alpha-(2-aminomethylethyl)omega-(2-aminomethylethoxy)-	9046-10-0		100.00

3. HAZARD IDENTIFICATION

EMERGENCY OVERVIEW

Appearance:

Colorless to slightly yellow liquid with a slight haze

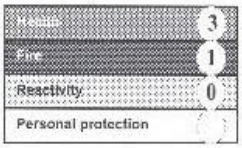
Odor:

Ammonia-like

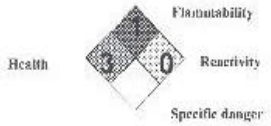
WARNING STATEMENT

DANGER ! CORROSIVE - CAUSES EYE AND SKIN BURNS
HARMFUL OR FATAL IF SWALLOWED
CAUSES RESPIRATORY TRACT IRRITATION AND CAN CAUSE DAMAGE
ASPIRATION HAZARD IF SWALLOWED -
CAN ENTER LUNGS AND CAUSE DAMAGE

Hazardous Material Information System (United States)



National Fire Protection Association NFPA (United States)



POTENTIAL HEALTH EFFECTS

Primary Route of Exposure

Eye X Skin X Inhalation X Ingestion

Effects of Overexposure

Acute:

Eyes: Causes irritation, experienced as pain, with excess blinking and tear production, and seen as extreme redness and swelling of the eye and chemical burns of the eye. Severe eye damage may cause blindness.

Skin: Causes severe irritation with pain, severe excess redness and swelling with chemical burns, blister formation, and possible tissue destruction. Other than the potential skin irritation effects noted above, acute (short term) adverse effects are not expected from brief skin contact; see other effects, below, and Section 11 for information regarding potential long term effects.

Inhalation: Vapors or mist, especially as generated from heating the material or as from exposure in poorly ventilated areas or confined spaces, are irritating and cause nasal discharge, coughing, and discomfort in nose and throat. Prolonged or repeated overexposure may result in lung damage.

Ingestion: Causes burning of mouth, throat, and stomach with abdominal and chest pain, nausea, vomiting, diarrhea, thirst, weakness, and collapse. Aspiration may occur during swallowing or vomiting, resulting in lung damage.

Sensitization Properties: This product is not expected to be a human skin sensitizer based on animal data.

Chronic:

Repeated skin contact may cause a persistent irritation or dermatitis. Repeated inhalation may cause lung damage.

Medical Conditions Aggravated by Exposure:

Skin contact may aggravate an existing dermatitis (skin condition). Overexposure to vapor, dust or mist may aggravate existing respiratory conditions, such as asthma, bronchitis, and inflammatory or fibrotic respiratory disease.

Other Remarks:

This product contains one or more amines which may produce temporary and reversible hazy or blurred vision. Symptoms disappear when exposure is terminated.

4. FIRST AID MEASURES

Eyes:

Immediately flush eyes with large amounts of running water for at least 15 minutes. Hold eyelids apart while flushing to rinse entire surface of eye and lids with water. Do not attempt to neutralize with chemical agents. Obtain medical attention immediately. Continue flushing for an additional 15 minutes if medical attention is not immediately available.

Skin:

Immediately remove contaminated clothing and shoes. Under a safety shower, flush skin thoroughly with large amounts of running water for at least 15 minutes. Do not attempt to neutralize with chemical agents. Get medical attention immediately. Discard or decontaminate clothing and shoes before reuse.

Ingestion:

If person is conscious and can swallow, immediately give two glasses of water (16 oz.), but do not induce vomiting. This material is corrosive. If vomiting occurs, give fluids again. Have a physician determine if condition of patient will permit induction of vomiting or evacuation of stomach. Do not give anything by mouth to an unconscious or convulsing person.

Inhalation:

If inhaled, remove to fresh air. If not breathing or in respiratory distress, clear person's airway and start artificial respiration. With a physician's advice, give supplemental oxygen using a bag-valve mask or manually triggered oxygen supply.

Other Instructions:

Swallowing of this corrosive material may result in severe ulceration, inflammation, and possible perforation of the upper alimentary tract, with hemorrhage and fluid loss. Aspiration of this product during induced emesis can result in severe lung injury. If evacuation of stomach is necessary, use method least likely to cause aspiration, such as gastric lavage after endotracheal intubation. Contact a Poison Control Center for additional treatment information.

5. FIRE-FIGHTING MEASURES

Ignition Temperature - AIT (degrees C):

Not determined.

Flash Point (degrees C):

121.1 (250°F) (PMCC)

Flammable Limits % (Lower-Upper):

Lower: Not determined.
Upper: Not determined.

Recommended Fire Extinguishing Agents And Special Procedures:

Use water spray, dry chemical, foam or carbon dioxide to extinguish flames. Use water spray to cool fire-exposed containers. Water or foam may cause frothing.

Unusual or Explosive Hazards:

None

Special Protective Equipment for Firefighters:

Wear special chemical protective clothing and positive pressure self-contained breathing apparatus. Approach fire from upwind to avoid hazardous vapors and toxic decomposition products. Decontaminate or discard any clothing that may contain chemical residues.

6. ACCIDENTAL RELEASE MEASURES (Transportation Spills: CHEMTREC (800)424-9300)

Procedures in Case of Accidental Release, Breakage or Leakage:

Ventilate area. Avoid breathing vapor. Wear appropriate personal protective equipment, including appropriate respiratory protection. Contain spill if possible. Wipe up or absorb on suitable material and shovel up. Prevent entry into sewers and waterways. Avoid contact with skin, eyes or clothing.

7. HANDLING AND STORAGE

Precautions to be Taken in

Handling:

Minimum feasible handling temperatures should be maintained. Eye wash and safety shower should be available nearby when this product is handled or used.

Storage:

Periods of exposure to high temperatures should be minimized. Water contamination should be avoided. If stored above 100°F, a nitrogen atmosphere is recommended.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Protective Equipment (Type)

Eye/Face Protection:

Avoid eye contact. Chemical type goggles with face shield must be worn. Do not wear contact lenses.

Skin Protection:

Protective clothing such as coveralls or lab coats should be worn. Launder or dry-clean when soiled. Gloves resistant to chemicals and petroleum distillates required. When handling large quantities, impervious suits, gloves, and rubber boots must be worn.
Remove and dry-clean or launder clothing soaked or soiled with this material before reuse. Dry cleaning of contaminated clothing may be more effective than normal laundering. Inform individuals responsible for cleaning of potential hazards associated with handling contaminated clothing.

Respiratory Protection:

Airborne concentrations should be kept to lowest levels possible. If vapor, mist or dust is generated and the occupational exposure limit of the product, or any component of the product, is exceeded, use appropriate NIOSH approved air purifying or air supplied respirator after determining the airborne concentration of the contaminant. Air supplied respirators should always be worn when airborne concentration of the contaminant or oxygen content is unknown.

Ventilation:

Local exhaust ventilation recommended if generating vapor, dust, or mist. If exhaust ventilation is not available or inadequate, use NIOSH approved respirator as appropriate.

Exposure Limit for the Total Product:

None established for product.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance:

Colorless to slightly yellow liquid with a slight haze

Odor:

Ammonia-like

Boiling Point (degrees C):

260 (500°F)

Melting/Freezing Point (degrees C):

Not determined.

Specific Gravity (water=1):

0.948 @ 20/20°C

pH:

11.7 (5% aqueous)

Vapor Pressure:

1 mmHg at 100°C (212°F)

Viscosity:

9.5 cSt at 25°C (77°F)

VOC Content:

25% by ASTM D 2369

Vapor Density (Air=1):

>1

Solubility in Water (%):

>10

Other:

None

10. STABILITY AND REACTIVITY

This Material Reacts Violently With:

Air Water Heat Strong Oxidizers Others X None of these

Comments:

This material reacts violently with acids.

Products Evolved When Subjected to Heat or Combustion:

Toxic levels of ammonia, combustion products of nitrogen, carbon monoxide, carbon dioxide, irritating aldehydes and ketones may be formed on burning in a limited air supply.

Hazardous Polymerizations:

DO NOT OCCUR

11. TOXICOLOGICAL INFORMATION

TOXICOLOGICAL INFORMATION (ANIMAL TOXICITY DATA)

Oral:
LD50 2.88 g/kg (rat) slightly toxic
Dermal:
LD50 2.98 g/kg (rabbit) practically non-toxic
Inhalation:
Not determined

IRRITATION INDEX, ESTIMATION OF IRRITATION (SPECIES)

Eyes:
(Draize) Believed to be > 80.00 - 110.00 /110 (rabbit) extremely irritating
Skin:
(Draize) Believed to be > 6.50 - 8.00 /8.0 (rabbit) corrosive
Sensitization:
(Buehler) Negative - skin (guinea pig)

Other:

None

12. DISPOSAL CONSIDERATIONS:

Waste Disposal Methods:

This product has been evaluated for RCRA characteristics and does not meet the criteria of a hazardous waste if discarded in its purchased form. Under RCRA, it is the responsibility of the user of the product to determine at the time of disposal, whether the product meets RCRA criteria for hazardous waste. This is because product uses, transformations, mixtures, processes, etc. may render the resulting materials hazardous.

Remarks:

None

13. TRANSPORT INFORMATION

Transportation

DOT:

Proper Shipping Name:
Amines, liquid, corrosive, n.o.s. (polyoxypropylene diamine)

Hazard Class:
Class 8: Corrosive material

Identification Number:
UN2735

Packing Group:
III

Label Required:
Class 8: Corrosive

IMDG

Proper Shipping Name:
AMINES, LIQUID, CORROSIVE, N.O.S. (polyoxypropylene diamine)

Hazard Class
Class 8

Identification Number
UN2735

Packing Group
III

Label Required
Class 8 - Corrosive substances

ICAO

Proper Shipping Name:
Amines, liquid, corrosive, n.o.s. (polyoxypropylene diamine)

Hazard Class
Class 8

Identification Number
UN2735

Packing Group
III

Label Required
Class 8 - Corrosive

TDG

Proper Shipping Name:
Corrosive liquid, n.o.s. (polyoxypropylene diamine)

Hazard Class:
8

Identification Number:
UN1760

Packing Group:
III

Label Required:
Corrosive

14. REGULATORY INFORMATION

Federal Regulations:

SARA Title III:

Section 302/304 Extremely Hazardous Substances

Chemical Name	CAS Number	Range in %	TPQ	RQ
None.				

Section 311 Hazardous Categorization:
Acute X Chronic Fire Pressure Reactive N/A

Section 313 Toxic Chemical

Chemical Name	CAS Number	Concentration
None.		

CERCLA 102(a)/DOT Hazardous Substances:

Chemical Name	CAS Number	Range in %	RQ
None.			

States Right-to-Know Regulations:

Chemical Name	State Right-to-know
None.	

California Prop. 65:
The following detectable components of this product are substances, or belong to classes of substances, known to the State of California to cause cancer and/or reproductive toxicity.

Chemical Name	CAS Number
None.	

INTERNATIONAL REGULATIONS:

TSCA Inventory Status:
This product, or its components, are listed on or are exempt from the Toxic Substance Control Act (TSCA) Chemical Substance Inventory.

WHMIS Classification:
Class E: Corrosive

Canadian Inventory Status:

This product, or its components, are listed on or are exempt from the Canadian Domestic Substance List (DSL).

EINECS Inventory Status:

This product, or its components, are listed on or are exempt from the European Inventory of Existing Chemical Substances (EINECS) or the European List of Notified Chemical Substances (ELINCS).

Australian Inventory Status:

This product, or its components, are listed on or are exempt from the Australian Inventory of Chemical Substances (AICS).

Japan Inventory Status:

This product, or its components, are listed on or are exempt from the Japan Ministry of International Trade and Industry (MITI) inventory.

15. ENVIRONMENTAL INFORMATION

Aquatic Toxicity:

Not determined.

Mobility:

Not determined.

Persistence and Biodegradability:

Not determined.

Potential to Bioaccumulate:

Not determined.

Remarks:

None

16. OTHER INFORMATION 3/31/2003

None

THE INFORMATION CONTAINED HEREIN IS BELIEVED TO BE ACCURATE. IT IS PROVIDED INDEPENDENTLY OF ANY SALE OF THE PRODUCT FOR PURPOSE OF HAZARD COMMUNICATION AS PART OF HUNTSMAN'S PRODUCT SAFETY PROGRAM. IT IS NOT INTENDED TO CONSTITUTE PERFORMANCE INFORMATION CONCERNING THE PRODUCT. NO EXPRESS WARRANTY, OR IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE IS MADE WITH RESPECT TO THE PRODUCT OR THE INFORMATION CONTAINED HEREIN. DATA SHEETS ARE AVAILABLE FOR ALL HUNTSMAN PRODUCTS. YOU ARE URGED TO OBTAIN DATA SHEEETS FOR ALL HUNTSMAN PRODUCTS YOU BUY, PROCESS, USE OR DISTRIBUTE AND YOU ARE ENCOURAGED AND REQUESTED TO ADVISE THOSE WHO MAY COME IN CONTACT WITH SUCH PRODUCTS OF THE INFORMATION CONTAINED HEREIN.

TO DETERMINE APPLICABILITY OR EFFECTS OF ANY LAW OR REGULATION WITH RESPECT TO THE PRODUCT, USER SHOULD CONSULT HIS LEGAL ADVISOR OR THE APPROPRIATE GOVERNMENT AGENCY. HUNTSMAN DOES NOT UNDERTAKE TO FURNISH ADVICE ON SUCH MATTERS.

Date Issued: 3/31/2003.

Inquiries regarding MSDS should be directed to:

HUNTSMAN
Coordinator, Product Safety
P.O. Box 27707
Houston, TX 77227-7707

APÉNDICE C

HOJAS TÉCNICAS DE LAS NANOARCILLAS CLOISITE 20A Y CLOISITE 30B.

CLOISITE® 20A

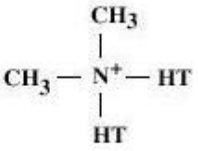
TYPICAL PHYSICAL PROPERTIES BULLETIN

Description:
Cloisite® 20A is a natural montmorillonite modified with a quaternary ammonium salt.

Designed Used:
Cloisite® 20A is an additive for plastics to improve various plastic physical properties, such as reinforcement, HDT, CLTE and barrier.

Typical Properties:

Treatment/Properties:	Organic Modifier (1)	Modifier Concentration	% Moisture	% Weight Loss on Ignition
Cloisite® 20A	2M2HT	95 meq/100g clay	< 2%	38%



Where HT is Hydrogenated Tallow (~65% C18; ~30% C16; ~5% C14)
Anion: Chloride

(1) 2M2HT: dimethyl, dihydrogenatedtallow, quaternary ammonium

Typical Dry Particle Sizes: (microns, by volume)

10% less than:	50% less than:	90% less than:
2µ	6µ	13µ

Color: Off White

Density:

Loose Bulk, lbs/ft^3	Packed Bulk, lbs/ft^3	Specific Gravity, g/cc
7.35	13.55	1.77

X Ray Results: d_{001} =24.2Å

Southern Clay Products, Inc. 1212 Church Street Gonzales, Texas 78629 USA
Phone: (830) 672-2891 Fax: (830) 672-1903 US Toll Free: 1-800-324-2891

CLOISITE® 30B

TYPICAL PHYSICAL PROPERTIES BULLETIN

Description:

Cloisite® 30B is a natural montmorillonite modified with a quaternary ammonium salt.

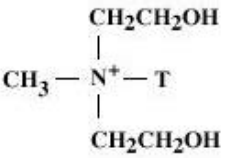
Not registered for supply to the European Union

Designed Used:

Cloisite® 30B is an additive for plastics to improve various plastic physical properties, such as reinforcement, HDT, CLTE and barrier.

Typical Properties:

Treatment/Properties:	Organic Modifier (1)	Modifier Concentration	% Moisture	% Weight Loss on Ignition
Cloisite® 30B	MT2EtOT	90 meq/100g clay	< 2%	30%



Where T is Tallow (~65% C18; ~30% C16; ~5% C14)
Anion: Chloride

(1) MT2EtOH: methyl, tallow, bis-2-hydroxyethyl, quaternary ammonium

Typical Dry Particle Sizes: (microns, by volume)

10% less than:	50% less than:	90% less than:
2μ	6μ	13μ

Color: Off White

Density:

Loose Bulk, lbs/ft^3	Packed Bulk, lbs/ft^3	Specific Gravity, g/cc
14.25	22.71	1.98

X Ray Results: d_{001} =18.5Å

Southern Clay Products, Inc. 1212 Church Street Gonzales, Texas 78629 USA
Phone: (830) 672-2891 Fax: (830) 672-1903 US Toll Free: 1-800-324-2891

Southern Clay Products
A Subsidiary of Rockwood Specialties, Inc.

MATERIAL SAFETY DATA SHEET

(Complies with OSHA CFR 1910.1200, ANSI Z 400.1-1993, Canada's WHMIS, EEC Directives and Mexico Requirements)

SECTION 1: CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Chemical product identification:	Alkyl Quaternary Ammonium Bentonite
Trade Name(s):	**Cloisite® 30B**
Product use:	**Plastics Additive**
Manufacturer Identification:	
Name:	Southern Clay Products, Inc.
Address:	1212 Church Street Gonzales, Texas USA 78629
Telephone:	(830) 672-2891; 8 a.m. - 5 p.m. (CST)

SECTION 2: COMPOSITION, INFORMATION ON INGREDIENTS

Chemical Names	**CAS No.**
Alkyl Quaternary Ammonium Bentonite	341537-63-1

Hazardous Ingredients:

stalline silica (quartz, 14808-60-7) is present at ≤0.5% as a naturally occurring component not removed from the clay ore in processing. See Section 11 for further information.

SECTION 3 HAZARDS IDENTIFICATION

HMIS Rating: **Health=1*** (possible hazard from chronic exposure to dust, see Section 11)
Flammability =1, **Reactivity** =1, **Personal Protective Equipment** =E

EMERGENCY OVERVIEW: Under normal usage or contained spills this material should not pose a significant emergency risk. If high dust levels are generated (dust clouds obscuring vision), this material has a potential to be a flammable and explosive hazard (See Section 5). Large spills should be contained with water mist and cleaned up using a method that will not generate excessive dust levels. This material is also very slippery when wetted with water, oils or solvents. Appropriate precautions should be taken to avoid slips and falls.

POTENTIAL HEALTH EFFECTS:

Eyes: May cause slight eye irritation. Direct contact should be avoided to prevent physical damage.

Skin: There is limited evidence of skin irritation of this product, however this material is a potential allergen due to its content of quaternary amine. Quaternary amine content of this product may cause dermatitis or itching in some individuals. Chronic dermal exposure effects for quaternary amine are not known.

Inhalation: Short term exposure to high dust levels could cause minor irritation. Long term dust exposure should be avoided due to the presence of quartz which can cause lung damage when inhaled. Control dust levels with engineering controls (local exhaust ventilation). Prevent dust inhalation with use of a NIOSH approved dust respirator if engineering controls are inadequate.

Carcinogenicity: IARC has classified crystalline silica as a human carcinogen.

Target Organs: Lungs

SECTION 4 HAZARDS IDENTIFICATION

Skin: Wash off with soap and water.
Eye: Flush with tepid water for 15 minutes. If irritation or pain persist, seek medical attention.
Inhalation: Remove person to fresh air. Seek medical attention if shortness of breath or irritation persists.
Ingestion: Could result in intestinal blockage. If large amounts are swallowed seek medical attention.
Notes to Physician:. Mixture is orally non-toxic. See Section 11 for additional toxicological data.

SECTION 5 : FIRE FIGHTING MEASURES

Excessive airborne dust may be a fire and explosion hazard.

Flashpoint:	Not applicable
Upper Explosive Limit:	Not applicable
Lower Explosive Limit:	0.05 oz/ft^3 (50g/m^3) airborne dust concentrations may ignite at 470°C.
Autoignition Temperature:	Not determined
Thin-film Ignition Temperature:	190°C.
Known or anticipated hazardous products of combustion:	Nitrogen oxides, carbon monoxide, hydrogen chloride
Basic fire fighting guidance:	Normal precautions for organic dusts should be provided. Avoid high dust concentrations and ensure all equipment is properly grounded to prevent static discharges.
Extinguishing media:	Water mist/fog, dry chemical, foam, carbon dioxide. AVOID water jets.

SECTION 6 : ACCIDENTAL RELEASE MEASURES

Wet down large spills with water mist to avoid generating excessive dust levels. Remove ignition and static electricity sources if large amounts of airborne dust are present. Caution: This material is very slippery when wet. Appropriate precautions should be taken avoid slips and falls.

Clean-up procedures and equipment: Use of a dustless vacuum system or shoveling. Flushing with water is also an acceptable method. Avoid dry sweeping or other methods that may generate high dust concentrations. Wear NIOSH approved dust respirator.

SECTION 7: HANDLING AND STORAGE

Handling: Adequate ventilation is necessary in handling areas to prevent excessive airborne dust. Explosion-proof equipment is recommended. Take precautions to ensure that all equipment is properly grounded in order to avoid static discharge.
Do not allow dust to collect on surfaces, in order to prevent explosion hazards.
Keep away from ignition sources, open flames and excessive heat.
Store separately from strong oxidizers and acids.

Storage: Store in closed containers in a dry area away from flames.

SECTION 8: EXPOSURE CONTROLS, PERSONAL PROTECTION

Engineering Controls
Provide general or local ventilation adequate to maintain airborne levels below occupational exposure limits.

Personal Protection Equipment:
Eye/face: Use safety glasses or goggles.
Skin: Use chemical resistant gloves.
Respiratory: Use a NIOSH approved, air purifying dust respirator if dust levels are above exposure limits. Half-masks are sufficient for normal use.

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

pearance:	tan powder
Odor:	mild
Physical State:	solid
pH:	not applicable
Vapor Pressure:	not applicable
Vapor Density:	not applicable
Boiling Point:	not applicable
Melting Point:	decomposes at approx. 200°C.
Solubility in Water:	negligible
Specific Gravity:	1.9 – 2.1g/cc

SECTION 10: STABILITY AND REACTIVITY

Incompatibilities: Avoid contact with strong oxidizers or acids.
Conditions to avoid: Heat and open flame.
Stability: This material is stable under normal storage and handling conditions.
Hazardous Polymerization: not applicable

SECTION 11: TOXICOLOGICAL INFORMATION

The International Agency of Research on Cancer has determined that over exposure to crystalline silica can cause lung cancer in humans. Health affects from exposure to crystalline silica occur only when it is inhaled.

Inhalation Effects: Crystalline silica has been shown to cause silicosis, a lung disease. Crystalline silica only causes these conditions when inhaled.

Skin Contact: Prolonged skin contact may lead to drying or cracking of the skin due to water absorption properties of the clay.

Eye Contact: As with any dust, may be irritating to the eyes due to physical abrasion.

Medical Conditions Aggravated: Respiratory disorders. May pose as an allergen for persons who are strongly allergic to quaternary amines.

Occupational Exposure Limits: Studies have shown that the crystalline silica is evenly distributed throughout all particle sizes of this product. Keep dust levels below permissible limits

ACGIH TWA	ACGIII STEL	OSHA PEL (Respirable)	OSIIA PEL (Total Dust)
0.1 mg/m^3 (as quartz)	N.A.	10 mg/m3 / % SiO_2 + 2	30 mg/m3 / % SiO_2 + 2

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicological Information: None known.

SECTION 13: DISPOSAL CONSIDERATIONS

Though not classified as a hazardous waste, this material is unsuitable for incineration, chemical or biological degradation.
Dispose of in a manner in accordance with local and federal regulations.
This information applies to materials as manufactured; contamination or processing may change waste characteristics and requirements.

SECTION 14: TRANSPORT INFORMATION

This material is not regulated by the Department of Transportation

SECTION 15: REGULATORY INFORMATION

SARA 313:	None known
US TSCA Inventory:	Statutory mixture - All ingredients are listed on the inventory
European Inventory:	All ingredients are listed on the inventory
Canadian DSL:	All ingredients are listed on the inventory
Australian AICS:	All ingredients are listed on the inventory
Japanese ENCS:	All ingredients are listed on the inventory

California Proposition 65: Crystalline silica in airborne particles of respirable size is known to the state of California to cause cancer.

Europe

Quartz: Occupational Exposure Limits

Belgium = 0.1 mg/m^3 (TWA)	Finland = 0.2 mg/m^3 (TWA)
Denmark = 0.1 mg/m^3 (TWA)	Germany= 0.2 mg/m^3 (TWA)
Sweden = 0.1 mg/m^3 (TWA)	
U.K.= 0.1 mg/m^3 (respirable)	Switzerland= 0.15 mg/m^3 (TWA)
U.K.= 0.3 mg/m^3 (total dust)	
Russia – 14.0 mg/m^3 (STEL)	
Thailand = 10.0 mg/m^3 (respirable); 30.0 mg/m^3 (total dust)	

Note: Different countries apply quartz occupational exposure limits in different manners, depending on how they define "respirable" fraction, and mass percentage of a total mixture; consult local authorities for application.

SECTION 16: OTHER INFORMATION

Prepared by: Quality Engineering Department, Southern Clay Products, Inc.
Date of issue: Revision 6: January 20, 2005

APÉNDICE D

HOJA TÉCNICA DE PARAFINA HISTOSEC.

111609 Histosec® pastillas
punto de solidificación 56-58ºC medio de inclusión para histología

Información general del producto			
Número HS	2712 20 90	**WGK**	nwg (no contaminante del agua)
Clase de almacenamiento VCI	10-13 Otros líquidos y sustancias sólidas		

Número de artículo	Embalaje	Cantidad
1.11609.9025	Cartón corrugad.	25 kg

Datos químicos / físicos			
Solubilidad en agua	(20 ºC) casi insduble	**Temperatura de inflamabilidad**	> 100 ºC

Información de seguridad	
WGK	nwg (no contaminante del agua)

Almacenamiento / transporte			
Número HS	2712 20 90	**Clase de almacenamiento VCI**	10-13 Otros líquidos y sustancias sólidas
WGK	nwg (no contaminante del agua)		

Datos toxicológicos			
LD 50 oral	DL 50 oral rata > 5000 mg/kg	**LD 50 dérmica**	DL 50 dermal conejo > 3000 mg/kg

Especificaciones	
Solidification point (rotating thermometer method)	56 - 58 ºC
Effect of heating (at 60 ºC/100 g)	clear melt within max. 20 hours
Solubility in xylene (at 20 ºC/0.1 g in 5 ml)	clear solution within max. 20 hours
Cutting results (4 µm slices)	conforms
Solubility of slices in xylene	< 50 seconds

APÉNDICE E

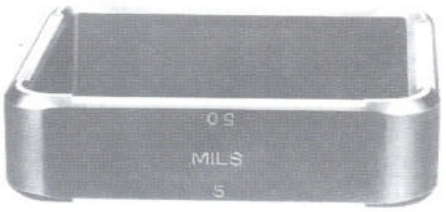
HOJA TÉCNICA DEL APLICADOR DE PELÍCULA GARDCO

APPLICATION

8-PATH WET FILM APPLICATORS

For laying down wet films of materials in predetermined thicknesses. These precision wet film applicators are used in conjunction with paper charts, hiding power charts, plate glass or any other smooth, flat surfaces. They are simple, accurate experimental or quality control devices that require no adjustments.

GENERAL INSTRUCTIONS



A small quantity (depending on length and thickness of film required) of the material to be checked is placed on the inside of the channel near the correct opening for the thickness desired. The applicator is then drawn down over the chart or other surface and a uniform thickness of film is produced for observation and test. A path with a depth or a clearance of one mil will lay down a film approximately 1/2 mil thick. A latex film will shrink considerably more, so paths of greater depths are required in order to obtain a dry film thick enough to check flexibility and toughness.

Film thicknesses deposited may vary from 40% to 80% of the actual clearance.

- Adhesives
- Board
- Ceramic Colors
- Cosmetics
- Driers
- Duplicating Inks
- Resins
- Lacquers
- Cellulose
- Oils
- Pigments
- Plastics
- Printing Inks
- Waxes & Hot Melts
- Metallic Powders
- Floor Polishes
- Varnishes
- Fillers
- Emulsions

The 8-Path applicators are available in three widths

CAT. NO.	Overall Width	Path Width	Actual Path Depth, Mils	Approx. Wet Film Thickness	Stainless Steel
1	3"	2"		0.5, 1, 1.5, 2,	$198.00
14	4"	3"	1, 2, 3, 4, 5, 6,	2.5, 3, 3.5,	238.00
15	5"	4"	7, 8 mils	4 mils	280.00
2	3"	2"		2.5, 5, 7.5	$207.00
24	4"	3"	5, 10, 15, 20,	10, 12.5, 15,	247.00
25	5"	4"	25, 30, 40, 50	20, 25	291.00
3	3"	2"	0.5, 1, 1.5,	0.25, 0.5, 0.75,	$215.00
34	4"	3"	2, 3, 4, 5, 6	1, 1.5, 2, 2.5, 3	290.00
35	5"	4"			329.00

ORDER INFORMATION: To order please use the following example.
AP - (CAT. NO.) SS

Paul N. Gardner Company, Inc.
316 NE 1st ST , POMPANO BCH, FL 33060
1-800-762-2478 • (954) 946-9454 • FAX (954) 946-9309

APÉNDICE F

NORMAS ASTM & INEN

ASTM D 823 – 95 (Reapproved 2001)

ASTM D 2794 – 93 (Reapproved 2004)

INEN 1001 (Basada en ASTM D 1474 – 68)

ASTM D 522 – 93a (Reapproved 2001)

ASTM D 1653 – 03

ASTM D 570 – 81 (Reapproved 1988)

ASTM D 1654 – 92 (Reapproved 2000)

ASTM B 117 – 03

CDU 667.613 INEN QU 04.05-302

Norma Ecuatoriana	PINTURAS Y PRODUCTOS AFINES. DETERMINACION DE LA DUREZA DE PELICULA. METODO DEL LAPIZ.	INEN 1 001 1983-04

DIRECCION NACIONAL DE NORMALIZACION INEN

1. OBJETO

1.1 Esta norma establece el método de ensayo para determinar la dureza de películas, igualmente la resistencia de la película a la ruptura y al rasgado combinado con la adherencia de la película al substrato.

2. METODOS DE ENSAYO

2.1 Resumen. El lápiz o mina de lápices se pasa por la superficie hasta cuando uno de estos rompa la película de pintura.

2.2 Aparatos

2.2.1 Un juego de lápices de dibujo o minas de lápices con dureza de 7 B hasta 8, HB, F y H son considerados estandard.

2.3 Preparación de la muestra

2.3.1 Se prepara un panel de vidrio o una lámina de acero laminada en frío, cuyas dimensiones son 190 x 115 x 0,8 mm, previamente limpiada con un disolvente apropiado. El espesor de película seca debe ser de 25,4 µm.

2.4 Procedimiento

2.4.1 Tajar los lápices removiendo la madera de la mina desnuda, de modo que se extienda 6 mm fuera de la madera. Debe tenerse cuidado de no raspar el borde de la mina. Lijar luego el extremo de la mina perpendicularmente a su eje hasta que esté plano, liso y de sección circular.

2.4.2 El lápiz se sostiene firmemente a un ángulo de 45° y se empuja sobre la película en dirección contraria del probador. Mientras el lápiz es empujado sobre la película de pintura, debe aplicarse suficiente presión hacia abajo para cortar la película hasta el substrato o hasta aplastar el borde agudo del lápiz. La estría debe tener un mínimo de 6 mm de largo. El proceso se repite usando sucesivamente lápices de diferente dureza, hasta encontrar el lápiz más duro que no produzca estría en la película. La dureza de este lápiz expresa la dureza de la película. Al efectuar la prueba, si el borde agudo de la mina se repone o se aplasta, deberá afilarse nuevamente.

2.5 Informe de resultados

2.5.1 La dureza se reporta como aquella comprendida entre la del primer lápiz que rompe la película y el inmediato anterior.

2.5.1.1 El informe deberá tener:

2.5.1.2 Dureza de la pintura.

2.5.1.3 Fecha del ensayo.

2.5.1.4 Número de ensayos.

2.5.1.5 Identificación del producto, muestra y fabricante.

2.5.1.6 Nombre del analista.

APENDICE Z

Z.1 NORMAS A CONSULTAR

INEN 1 006. *Pinturas y productos afines. Determinación de la adherencia.*

INEN 1 010. *Pinturas y productos afines. Determinación del poder cubritivo. Método del criptómetro.*

INEN 1 011. *Pinturas y productos afines. Determinación de los tiempos de secamiento.*

INEN 1 012. *Pinturas y productos afines. Determinación del espesor de película seca. Mediante el micrómetro.*

Z.2 BASES DE ESTUDIO

Norma ASTM D 1474 - 68. *Identification Hardnees of organic coatings.* American Society for Testing and Materials. Filadelfia, 1970. part 21.

Designation: D 570 – 81 (Reapproved 1988)ε1

An American National Standard

Standard Test Method for Water Absorption of Plastics[1]

This standard is issued under the fixed designation D 570; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

This test method has been approved for use by agencies of the Department of Defense. Consult the DoD Index of Specifications and Standards for the specific year of issue which has been adopted by the Department of Defense.

ε1 NOTE—Sections 1.3 and 2 were added editorially October 1988.

1. Scope

1.1 This test method covers the determination of the relative rate of absorption of water by plastics when immersed. The test method is intended to apply to the testing of all types of plastics, including cast, hot-molded, and cold-molded resinous products, and both homogeneous and laminated plastics in rod and tube form and in sheets 0.13 mm (0.005 in.) or greater in thickness.

1.2 The values stated in SI units are to be regarded as the standard. The values stated in parentheses are for information purposes only.

1.3 *This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Document

2.1 *ASTM Standard:*

D 647 Practice for Design of Molds for Test Specimens of Plastic Molding Materials[2]

3. Significance and Use

3.1 The test method for rate of water absorption has two chief functions: first, as a guide to the proportion of water absorbed by a material and consequently, in those cases where the relationships between moisture and electrical or mechanical properties, dimensions, or appearance have been determined, as a guide to the effects of exposure to water or humid conditions on such properties; and second, as a control test on the uniformity of a product. This second function is particularly applicable to sheet, rod, and tube arms when the test is made on the finished product.

3.2 Comparison of water absorption values of various plastics can be made on the basis of values obtained in accordance with 7.1 and 7.4.

3.3 The moisture content of a plastic is very intimately related to such properties as electrical insulation resistance, dielectric losses, mechanical strength, appearance, and dimensions. The effect upon these properties of change in moisture content due to water absorption depends largely on the type of exposure (by immersion in water or by exposure to high humidity), shape of the part, and inherent properties of the plastic. With nonhomogeneous materials, such as laminated forms, the rate of water absorption may be widely different through each edge and surface. Even for otherwise homogeneous materials, it may be slightly greater through cut edges than through molded surfaces. Consequently, attempts to correlate water absorption with the surface area must generally be limited to closely related materials and to similarly shaped specimens. For materials of widely varying density, relation between water-absorption values on a volume as well as a weight basis may need to be considered.

4. Apparatus

4.1 *Balance*—An analytical balance capable of reading 0.0001 g.

4.2 *Oven*, capable of maintaining uniform temperatures of 50 ± 3°C (122 ± 5.4°F) and of 105 to 110°C (221 to 230°F).

5. Test Specimen

5.1 The test specimen for molded plastics shall be in the form of a disk 50.8 mm (2 in.) in diameter and 3.2 mm (⅛ in.) in thickness (Note 1). Permissible variations in thickness are ±0.18 mm (±0.007 in.) for hot-molded and ±0.30 mm (±0.012 in.) for cold-molded or cast materials.

NOTE 1—The disk mold prescribed in the Molds for Disk Test Specimens Section of Practice D 647 is suitable for molding disk test specimens of thermosetting materials but not thermoplastic materials.

5.2 The test specimen for sheets shall be in the form of a bar 76.2 mm (3 in.) long by 25.4 mm (1 in.) wide by the thickness of the material. When comparison of absorption values with molded plastics is desired, specimens 3.2 mm (⅛ in.) thick should be used. Permissible variations in thickness shall be 0.20 mm (±0.008 in.) except for asbestos-fabric-base phenolic laminated materials or other materials which have greater standard commercial tolerances.

5.3 The test specimen for rods shall be 25.4 mm (1 in.) long for rods 25.4 mm (1 in.) in diameter or under, and 12.7 mm (½ in.) long for larger-diameter rods. The diameter of the specimen shall be the diameter of the finished rod.

5.4 The test specimen for tubes less than 76 mm (3 in.) in inside diameter shall be the full section of the tube and 25.4

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[1] This test method is under the jurisdiction of ASTM Committee D-20 on Plastics and is the direct responsibility of Subcommittee D 20.50 on Permanence Properties.

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[2] *Annual Book of ASTM Standards*, Vol 08.01.

mm (1 in.) long. For tubes 76 mm (3 in.) or more in inside diameter, a rectangular specimen shall be cut 76 mm (3 in.) in length in the circumferential direction of the tube and 25.4 mm (1 in.) in width lengthwise of the tube.

5.5 The test specimens for sheets, rods, and tubes shall be machined, sawed, or sheared from the sample so as to have smooth edges free from cracks. The cut edges shall be made smooth by finishing with No. 0 or finer sandpaper or emery cloth. Sawing, machining, and sandpapering operations shall be slow enough so that the material is not heated appreciably.

NOTE 2—If there is any oil on the surface of the specimen when received or as a result of machining operations, wash the specimen with a cloth wet with gasoline to remove oil, wipe with a dry cloth, and allow to stand in air for 2 h to permit evaporation of the gasoline. If gasoline attacks the plastic, use some suitable solvent or detergent that will evaporate within the 2-h period.

5.6 The dimensions listed in the following table for the various specimens shall be measured to the nearest 0.025 mm (0.001 in.). Dimensions not listed shall be measured within 0.8 mm (±1/32 in.).

Type of Specimen	Dimensions to be Measured to the Nearest 0.025 mm (0.001 in.)
Molded disk	thickness
Sheet	thickness
Rod	length and diameter
Tube	inside and outside diameter, and wall thickness

6. Conditioning

6.1 Three specimens shall be conditioned as follows:

6.1.1 Specimens of materials whose water-absorption value would be appreciably affected by temperatures in the neighborhood of 110 °C (230°F), shall be dried in an oven for 24 h at 50 ± 3 °C (122 ± 54°F), cooled in a desiccator, and immediately weighed to the nearest 0.001 g.

NOTE 3—If a static charge interferes with the weighing, lightly rub the surface of the specimens with a grounded conductor.

6.1.2 Specimens of materials, such as phenolic laminated plastics and other products whose water-absorption value has been shown not to be appreciably affected by temperatures up to 110 °C (230°F), shall be dried in an oven for 1 h at 105 to 110 °C (221 to 230°F).

6.1.3 When data for comparison with absorption values for other plastics are desired, the specimens shall be dried in an oven for 24 h at 50 ± 3°C (122 ± 5.4°F), cooled in a desiccator, and immediately weighed to the nearest 0.001 g.

7. Procedure

7.1 *24-h Immersion*—The conditioned specimens shall be placed in a container of distilled water maintained at a temperature of 23 ± 1°C (73.4 ± 1.8°F), and shall rest on edge and be entirely immersed. At the end of 24, +½, −0 h, the specimens shall be removed from the water one at a time, all surface water wiped off with a dry cloth, and weighed to the nearest 0.001 g immediately. If the specimen is 1/16 in. or less in thickness, it shall be put in a weighing bottle immediately after wiping and weighed in the bottle.

7.2 *2-h Immersion*—For all thicknesses of materials having a relatively high rate of absorption, and for thin specimens of other materials which may show a significant weight increase in 2 h, the specimens shall be tested as described in 7.1 except that the time of immersion shall be reduced to 120 ± 4 min.

7.3 *Repeated Immersion*—A specimen may be weighed to the nearest 0.001 g after 2-h immersion, replaced in the water, and weighed again after 24 h.

NOTE 4—In using this method the amount of water absorbed in 24 h may be less than it would have been had the immersion not been interrupted.

7.4 *Long-Term Immersion*—To determine the total water absorbed when substantially saturated, the conditioned specimens shall be tested as described in 7.1 except that at the end of 24 h they shall be removed from the water, wiped free of surface moisture with a dry cloth, weighed to the nearest 0.001 g immediately, and then replaced in the water. The weighings shall be repeated at the end of the first week and every two weeks thereafter until the increase in weight per two-week period, as shown by three consecutive weighings, averages less than 1 % of the total increase in weight, or 5 mg, whichever is greater; the specimen shall then be considered substantially saturated. The difference between the substantially saturated weight and the dry weight shall be considered as the water absorbed when substantially saturated.

7.5 *2-h Boiling Water Immersion*—The conditioned specimens shall be placed in a container of boiling distilled water, and shall be supported on edge and be entirely immersed. At the end of 120 ± 4 min, the specimens shall be removed from the water and cooled in distilled water maintained at room temperature. After 15 ± 1 min, the specimens shall be removed from the water, one at a time, all surface water removed with a dry cloth, and the specimens weighed to the nearest 0.001 g immediately. If the specimen is 1/16 in. or less in thickness, it shall be weighed in a weighing bottle.

7.6 *½-h Boiling Water Immersion*—For all thicknesses of materials having a relatively high rate of absorption, and for thin specimens of other materials which may show a significant weight increase in ½ h the specimens shall be tested as described in 7.5, except that the time of immersion shall be reduced to 30 + 1 min.

7.7 *Immersion at 50°C*—The conditioned specimens shall be tested as described in 7.5, except that the time and temperature of immersion shall be 48 ± 1 h and 50 ± 1°C (122.0 ± 1.8°F), respectively, and cooling in water before weighing shall be omitted.

7.8 When data for comparison with absorption values for other plastics are desired, the 24-h immersion procedure described in 7.1 and the equilibrium value determined in 7.4 shall be used.

8. Reconditioning

8.1 When materials are known or suspected to contain any appreciable amount of water-soluble ingredients, the specimens, after immersion, shall be weighed, and then reconditioned for the same time and temperature as used in the original drying period. They shall then be cooled in a desiccator and immediately reweighed. If the reconditioned weight is lower than the conditioned weight, the difference shall be considered as water-soluble matter lost during the immersion test. For such materials, the water-absorption value shall be taken as the sum of the increase in weight on

immersion and of the weight of the water-soluble matter.

9. Calculation and Report

9.1 The report shall include the values for each specimen and the average for the three specimens as follows:

9.1.1 Dimensions of the specimens before test, measured in accordance with 5.6, and reported to the nearest 0.001 in.,

9.1.2 Conditioning time and temperature,

9.1.3 Immersion procedure used,

9.1.4 Time of immersion (long-term immersion procedure only),

9.1.5 Percentage increase in weight during immersion, calculated to the nearest 0.01 % as follows:

$$\text{Increase in weight, \%} = \frac{\text{wet wt} - \text{conditioned wt}}{\text{conditioned wt}} \times 100$$

9.1.6 Percentage of soluble matter lost during immersion, if determined, calculated to the nearest 0.01 % as follows (Note 5):

$$\text{Soluble matter lost, \%} = \frac{\text{conditioned wt} - \text{reconditioned wt}}{\text{conditioned wt}} \times 100$$

NOTE 5—When the weight on reconditioning the specimen after immersion in water exceeds the conditioned weight prior to immersion, report "none" under 9.1.6.

9.1.7 The percentage of water absorbed, which is the sum of the values in 9.1.5 and 9.1.6, and

9.1.8 Any observations as to warping, cracking, or change in appearance of the specimens.

10. Precision and Bias[3]

10.1 *Precision*—An interlaboratory test program was carried out using the procedure outlined in 7.1, involving three laboratories and three materials. Analysis of this data yields the following coefficients of variation (average of three replicates).

	Within Laboratories	Between Laboratories
Average absorption above 1 % (2 materials)	2.33 %	4.89 %
Average absorption below 0.2 % (1 material)	9.01 %	16.63 %

10.2 *Bias*—No justifiable statement on the bias of this test method can be made, since the true value of the property cannot be established by an accepted referee method.

[3] Supporting data are available from ASTM Headquarters. Request RR: D-20-1064.

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