Hetron™ epoxy vinyl ester resins

Resin selection guide for corrosion resistant FRP applications

HETRON™

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Foreward

Hetron™ and Derakane™ epoxy vinyl ester resins are designed and manufactured by Ashland. These resins possess outstanding corrosion-resistant properties and satisfy critical requirements in Fiber-Reinforced Plastic (FRP). Because of their outstanding corrosion-resistant properties, Hetron and Derakane resins are particularly well suited for demanding industrial applications.

This latest edition of the Hetron Resin Selection Guide describes the various Hetron resins, and presents detailed chemical resistance data engineers need for specifying and designing corrosion-resistant FRP applications. It has been simplified and CAS numbers have been added to make it more user-friendly. Several products including Hetron 970/35, Hetron 942/35, Hetron 92 and Hetron 99P have been removed as well as all Aropol™ Polyester resins. For information on any of these products, please contact Ashland Technical Service at hetron@ashland.com.

Recommendations provided in this guide apply to "state-of-the-art" corrosion-resistant structures. Typically these structures have a corrosion barrier that is 2.5 to 6.3 mm (100 to 250 mils) thick and are designed for contact with a specific chemical environment. The first layer of the corrosion barrier usually is 0.3 to 0.8 mm (10 to 20 mils) thick and is 95% resin, reinforced by one or two surfacing veils. This layer is then backed with 2 to 6 mm (90 to 230 mils) of 75% resin, reinforced with chopped strand mat (powder binder only). Finally, the corrosion barrier is backed with a structural laminate that provides the strength and stiffness for the overall corrosion-resistant composite structure.

Because many of the variables that affect the performance of a laminate are beyond Ashland's control, no warranty concerning the use of Hetron epoxy vinyl ester resins can be made. Recommendations herein are based on a variety of sources, including evaluations of actual field service performance, laboratory (ASTM C581) and field tests of FRP laminate construction, and the combined knowledge of an experienced staff. The service conditions shown in this bulletin are believed to be well within the capabilities of Hetron epoxy vinyl ester resins when laminates are properly designed, fabricated, and installed. For the design of FRP equipment, prospective users of Hetron resins should refer to the appropriate industry standards and design guidelines.

For more information, contact Ashland Technical Service at hetron@ashland.com or visit www.hetron.com. Information on Derakane Epoxy Vinyl Ester Resins can be found at derakane@ashland.com or by visiting www.derakane.com.

We have a Hetron™ Resin for your FRP Equipment Needs.

Resin Series	Characteristics	Suggested Applications
HIGH PERFORMANCE EPOXY VINYL ESTER		
Hetron 980/35	High performance epoxy vinyl ester resin formulated to provide maximum heat and corrosion resistance to strong oxidizing chemicals.	Equipment requiring maximum corrosion resistance to pulp and paper bleaching chemicals.
Hetron FR998/35	Flame retardant epoxy vinyl ester resin. Class I (ASTM E84) without antimony additives. Improved resistance to hydrocarbon solvents and oxidizing media. Superior thermal properties.	Equipment requiring superior corrosion resistance and thermal properties to standard flame retardant epoxy vinyl ester resins. Flame retardant applications where translucency is required.
EPOXY VINYL ESTER		
Hetron 922	Corrosion resistant to both strong acids and bases. Inherent toughness provides fabrication advantages and resistance to both impact and thermal shock damage.	Equipment where strong acids and bases are encountered. Meets FDA regulation Title 21 CFR.177.2420.
Hetron FR992	Flame retardant version of Hetron 922 epoxy vinyl ester resin. Class I (ASTM E84) with the addition of FR synergists.	Flame retardant equipment requiring the corrosion resistance and toughness of Hetron 922 resin.
Hetron 980	Superior corrosion resistance to Hetron 922 resin. Improved thermal properties.	Equipment requiring superior thermal properties and corrosion resistance to that of Hetron 922 resin.
CHLORENDIC POLYESTER		
Hetron 197 Series	Highly corrosion and heat resistant. Low flame spread Class II (ASTM E84) can be achieved with the addition of FR synergist.	Equipment where maximum corrosion and heat resistance to wet chlorine and other oxidizing chemicals is desired. **Not for caustic service.**
FURFURYL ALCOHOL RESIN		
Hetron 800	Excellent resistance to both organic solvents and aqueous systems. Not recommended for strong oxidizers.	Equipment requiring corrosion and heat resistance beyond the capabilities of standard FRP equipment. Requires special manufacturing and equipment handling techniques. Contact Ashland Technical Service at hetron@ashland.com for proper resin usage and suggested applications.

Consult Technical Data Sheet for each resin's cure system, physical properties, and flame spread capabilities. Consult this Resin Selection Guide for temperature and concentration limits for specific environments. For any clarification or specialty applications contact Ashland Technical Service at hetron@ashland.com

ADVANTAGES

Fiberglass reinforced plastic (FRP) has been used for various types of equipment in the chemical processing industry since the early 1950s. Its use has continued to grow in pulp and paper, power, waste treatment, semi-conductor, mineral processing, petrochemical, pharmaceutical, and other industries. Process vessels of all shapes and sizes, scrubbers, hoods, ducts, fans, stack liners, pipes, pumps, pump bases, mist-eliminator blades, grating, and tank lining systems are just a few examples of products made of FRP.

The chief reason for the popularity of these materials is their excellent resistance to corrosion. When choosing the best material of construction, FRP is often chosen due to its:

- Superior corrosion resistance to a wide range of acids, bases, chlorides, solvents, and oxidizers.
- Excellent heat resistance
- Electrical and thermal insulation
- High strength-to-weight ratio

ALSO

- Low maintenance – No Painting!
- Requires no cathodic protection, rust-free
- Ease of repair

Industry must deal with many different corrosion environments. **That's why Ashland Performance Materials provides different types of resins for FRP equipment.** A variety of resins is available through one source, Ashland Performance Materials, to provide the corrosion resistance required to handle the many different corrosion environments encountered by industry.

TESTING AND TECHNICAL SERVICE INFORMATION

Ashland's materials evaluation laboratory in Dublin, Ohio, constantly evaluates the performance of Hetron, and Derakane resin laminates for corrosive service both in the field and in the laboratory. Additional evaluations are currently being conducted. While primary research and development activities are based at our company headquarters in the US, we also maintain product development teams in Europe, South America and Asia to ensure we develop solutions to our global customer base.

Standard test laminate kits are supplied by Ashland for exposure in your laboratory or under your actual field conditions in accordance with ASTM C581. After exposure, they can be returned to Ashland for physical and visual examination and evaluation. Subsequently, a report will be issued with our recommendations based on the test results.

When requesting resin recommendations for corrosion resistant FRP equipment applications, users or specifiers should be prepared to supply the following data:

- All chemicals to which the equipment will be exposed: feedstocks, intermediates, products and by-products, waste materials, and cleaning chemicals
- Normal operating concentrations of chemicals, maximum and minimum concentrations (including trace amounts)
- pH range of the system
- Normal operating temperatures of the equipment, maximum and minimum temperatures
- Duration of normal, maximum and upset operating temperatures
- Abrasion resistance and/or agitation requirements
- Equipment size
- Manufacturing methods
- Flame retardance requirements
- Thermal insulation requirements

For questions regarding any of the recommendations listed in this guide, for recommendations for a particular application not listed, or to request a test kit or additional literature, contact Ashland Technical Service at:

E-mail: hetron@ashland.com
Mail: Ashland Performance Materials
Composite Polymers Division
Box 2219
Columbus, Ohio 43216
USA

INTERNET

For the most up-to-date corrosion information, product data sheets, and the Ashland Corrosion Chronicle, visit our websites at:

www.hetron.com,
www.derakane.com,
www.ashland.com.

Hetron™ Resins
CHEMICAL RESISTANCE INQUIRY FORM

Date:			Number of page:		
To:	Technical Service Hetron resins Ashland Performance Materials		From: Name:		
			Company:		
E-Mail:	hetron@ashland.com		E-Mail:		
Fax:	+1.614.790.6157		Fax:		
			Tel:		
Project name:	End-user:		Engineering:	Fabricator:	
Industry Sector/Process: (Chemical, Paper, Mining, Flue Gas…)					
Equipment Type: (Tank, Scrubber, Pipe / Duct, Lining...)	Tank or Pipe?		Other:		
	Full FRP Applications or lining on steel, concrete?				
Dimensions/Capacity: (Height, Diameter, Flow Rate…)					

Operating Conditions	Concentration / Units (g/L, oz/gal, %)		
Chemical environment or CAS Numbers (indicated on the Material Safety Data Sheet)	Minimum	Normal	Maximum
1)			
2)			
3)			
4)			

NOTE: Please show all major / minor components, Concentrations - including traces. (If insufficient space - please add extra sheet, or include the respective Material Safety Data Sheet)

Temperatures (°C) or (°F)?	Minimum:		Normal operating temperature:		Maximum: Design:	
Upsets:	Maximum Temperature, Duration (h), Frequency per year:					

Pressure (Bar,psi) / Vacuum :	pH –typical : Min, Normal, Max.:
Comments / notes: (eg.: unusual process conditions, Temperature cycling, high / low concentrations, addition & dilution, novel design or construction,Abrasion)	

INTRODUCTION

Liquid polyester and epoxy vinyl ester resins, as purchased from the resin supplier, are actually polymers dissolved in styrene monomer. The fabricator cures these resins to a solid state, reacting the polymer together with the styrene in the presence of glass reinforcements to produce a fiber reinforced rigid structure. The standards for these structures are defined by organizations such as ASTM and ASME.

The development and manufacture of Hetron, epoxy vinyl ester resins has been a continuing process since 1954. They have been used to fabricate thousands of different types of corrosion resistant FRP equipment. Many versions of Hetron resins have been developed for ease of handling during hand lay-up, spray-up, filament winding, pultrusion, centrifugal casting, resin transfer molding and other methods of commercial fabrication.

BASIS FOR RECOMMENDATIONS MADE IN THIS GUIDE

Through our experience since 1955 with corrosion resistant resins, we have learned that several resin chemistries are required to satisfactorily handle the wide range of corrosive chemicals found throughout industry. No single resin can be expected to perform well in all environments. That is why Ashland makes a variety of Hetron resins.

Resin recommendations must be conservative, reliable and firm. Recommendations are based on a variety of sources, including evaluations of actual field service performance, laboratory (ASTM C581) and field tests of FRP laminate construction, and the combined knowledge of an experienced staff. Much of the information in this guide is based on field experience. This guide is updated periodically to make use of the most recent available data. This usually results in the addition of chemical environments and resins. It may also result in raising or lowering the temperature or concentration at which a particular resin is recommended.

Unless otherwise noted, recommendations are based on ASTM C581 standard laminate construction utilizing glass surfacing mat and no additives or fillers. For press molded, pultruded and other parts fabricated without an ASTM C581 corrosion resistant liner, it is important to establish their corrosion resistance through testing. Synthetic surfacing mat is suggested for environments known to attack glass fiber reinforcement. Care must be taken with certain resin types (Hetron 197 series) as some synthetic surfacing mat/environment combinations may result in reduced corrosion resistance. Fillers should never be used without corrosion testing a representative laminate. Additives, such as antimony oxide for enhanced flame retardance, may affect the performance of the corrosion barrier. It is the fabricator's responsibility to determine suitability of the additive in a given application.

FDA APPLICATIONS

The Food and Drug Administration (FDA) does not approve specific resins, however, the agency does publish a list of acceptable raw materials which can be used to make resins. Raw materials used to manufacture Hetron 922 and selected other resins are listed as acceptable under FDA Regulations 21 CFR.177.2420. Halogenated raw materials are not listed under FDA regulation 21 CFR.177.2420. Ashland does not support applications for the resins listed in this guide where proprietary formulation disclosures are required. Please contact Ashland Technical Service if your application requires this type of information.

HOW TO USE THIS GUIDE

This Guide is a tabulation of the latest information regarding the resistance of Hetron resin-based FRP equipment under various corrosive operating conditions.

Special consideration should be given to fumes and splash and spill applications. In many cases where a recommendation for liquid service is given, that same resin can be used in fume service at temperatures and concentrations higher than that shown for the liquid. Tank lining applications also require special consideration due to the possibility of permeation by the corrosive material. However, extrapolations of this type must be made with caution and it is recommended that Ashland Technical Service be contacted at hetron@ashland.com for specific resin recommendations.

The following definitions will aid readers using this Guide.

Temperature – Temperature data is NOT necessarily the maximum service temperature. It is the upper temperature at which a resin has been tested, used or evaluated. A resin may be suitable for higher temperature operation but additional information or testing would be required in order to establish such performance.

A Dash (-) – Showing no tested temperature recommendation indicates that data is not available. It does not mean that the resin is unsuitable for that environment. Ashland recommends coupon testing for confirmation.

LS – Indicates that limited service life can be expected. This means that a greater than normally acceptable chemical attack will occur. FRP may be the most economical material of construction for this type of equipment but further study including life-cycle cost analysis comparisons with other materials of construction is recommended.

NR – Resin is not recommended.

EPOXY VINYL ESTER RESIN COMPOSITES

Epoxy vinyl esters are classified separately from polyesters due to their enhanced mechanical properties. They offer excellent physical strength and, in general, much better impact and thermal shock resistance than polyester resins. While the standard epoxy vinyl ester resins are limited to 104-121°C (220-250°F) in most applications, other versions with higher-density crosslinking are suitable for temperatures above 121°C (250°F).

These resins exhibit excellent resistance to acids, alkalis, hypochlorites, and many solvents. They are also suitable for flake glass and fiberglass reinforced linings for tanks, vats, floors, troughs, and similar applications.

HIGH PERFORMANCE EPOXY VINYL ESTER RESIN

Manufactured under a patented process, these resins offer maximum corrosion and temperature resistance to acids, alkalis, hypochlorites, and many solvents. These products have been formulated for maximum performance with methyl ethyl ketone peroxides. It is well documented that these catalysts provide optimal cure and thus maximum corrosion resistance.

Hetron 980/35: A novolac epoxy vinyl ester resin formulated with less than 35% styrene. Provides maximum heat and corrosion resistance to strong oxidizing chemicals.

Hetron FR998/35: Highly flame retardant epoxy vinyl ester resin formulated with less than 35% styrene. Excellent thermal properties and superior corrosion resistance to hydrocarbon solvents and oxidizing media. See Table 7 for ASTM E84 flame spread values for this and other flame retardant resins.

EPOXY VINYL ESTER RESIN

These resins offer excellent corrosion resistance to acids, alkalis, and some solvents.

Hetron 922: Provides excellent corrosion resistance up to 105ºC (220ºF).

Hetron FR992: A flame retardant resin suitable for use up to 105ºC (220ºF). Hetron FR992 resin is an excellent choice for applications requiring both chemical and flame resistance. See Table 7 for ASTM E84 flame spread values.

Hetron 980: A novolac modified epoxy vinyl ester resin with excellent corrosion resistance to about 121ºC (250ºF). Can be used when organic chemicals such as benzyl chloride, chlorobenzene, phenol, and divinyl benzene are present.

CHLORENDIC POLYESTER RESIN

Chlorendic resins are unsaturated, halogenated polyester resins. They are particularly well suited for equipment operating at elevated temperatures or in highly oxidizing environments such as hot, wet chlorine.

These resins are known for their ease of fabrication and are available in several user-friendly versions. They are particularly well suited for chimney liners, flue gas duct, chrome plating tanks, pickling tanks, and chlorine headers. Refer to Table 7 for specific flame spread values.

Hetron 197 Series: These resins are particularly good for acidic and oxidizing environments. Fabricators may choose the thixotropic Hetron 197-3 resin or the thixotropic and promoted Hetron 197P resin.

FURFURYL ALCOHOL RESIN

Furfuryl alcohol resin is based on a furan polymer derivative of furfuryl alcohol. It exhibits excellent resistance to strong alkalis and acids containing chlorinated organics and is superior to polyesters and epoxy vinyl esters in solvent resistance. Furfuryl alcohol resin is suitable for use up to about 121ºC (250ºF) for many corrosive applications. However, the furfuryl alcohol material is not suitable for oxidizing chemicals and should not be used for chromic or nitric acids, peroxides or hypochlorites.

Generally, the furfuryl alcohol resin is considered to be the best for all-around corrosion resistance. Fabrication and installation of equipment made with Hetron 800 resin requires special techniques that differ from those used with polyester and epoxy vinyl ester resins. Please contact Ashland Technical Service at hetron@ashland.com for assistance.

Hetron 800: Requires the use of strong organic acid catalysts. The most common material used is orthophthalyl chloride (e.g. CAT 803L-1).

PHYSICAL PROPERTIES

The properties in this guide are typical values. These values, which vary from sample to sample, are based on tests conducted in our laboratories. Typical values should not be construed as a guaranteed analysis of any specific lot or as specification items. See Table 1 (see next page) for typical mechanical properties of Hetron resin laminates and castings.

Additional data on each individual resin including liquid properties and curing information is contained in the Technical Data Sheet for that resin. Ashland maintains Material Safety Data Sheets for all of its products. Material Safety Data Sheets contain health and safety information for assisting you in developing appropriate product handling procedures to protect your employees and customers. Our Material Safety Data Sheets should be read and understood by all of your employees before using Ashland's products in your facilities.

BARCOL HARDNESS

Barcol hardness values are taken as an indication of surface cure. ASTM standards indicate that FRP equipment should have a Barcol hardness of at least 90% of the manufacturer's published value for each resin. See Table 1 (see page 9) for Barcol hardness values of Hetron resin castings. Experience indicates that Barcol hardness values are subject to a number of variables. In the case of a molded surface, these factors may be post cure, the curvature of a part or the use of one or more plies of synthetic surfacing veil. For non-molded resin surfaces, these factors may be paraffin wax, UV inhibitors, pigments, or other materials added to the resin. On a severely curved or irregular surface, an accurate Barcol hardness value may be impossible to obtain. In such cases, a flat sample using identical fabrication techniques should be monitored for cure during the manufacture of the actual part.

Experience indicates that Barcol hardness values of molded surfaces incorporating synthetic surfacing veil are less than the values of a comparable glass veil laminate. Reductions in Barcol hardness values of five units or more can be expected. Barcol hardness determination is used to check surface cure and is often accompanied by an acetone sensitivity test. The acetone sensitivity test is also valuable in judging cure when the use of the Barcol instrument is impractical. In this test, acetone solvent is liberally wiped over the test surface and allowed to evaporate. A tacky or soft surface during evaporation indicates under-cure.

TABLE 1 - MECHANICAL PROPERTIES[1] OF Hetron RESINS (US units)

		LAMINATES[2] AT TEMPERATURES											
		TENSILE STRENGTH, psi						TENSILE MODULUS, X 10^6 psi					
RESIN	Temp. °F	-45	77	150	200	250	300	-45	77	150	200	250	300
Hetron 980/35		18600	14700	14300	15600	15400	16800	1.93	1.68	1.45	1.55	1.51	0.95
Hetron FR998/35[3]		17500	14300	14500	17300	20400	17600	1.80	1.65	1.65	1.50	1.50	1.20
Hetron 922		17000	15900	21400	21400	17600	10800	1.30	1.49	1.33	1.21	0.93	0.70
Hetron FR992[3]		18500	17400	17000	20400	17300	13600	1.60	1.60	1.28	1.28	0.82	0.80
Hetron 980		14700	14300	20300	19200	16900	18300	1.87	1.56	1.46	1.09	0.99	1.04
Hetron 197-3		20100	16300	14100	15300	15200	16300	1.18	1.41	1.42	1.43	1.21	1.28
Hetron 800		15300	14700	14600	14100	12500	12300	1.28	1.47	1.31	1.05	1.05	1.06

1 Properties of production laminates will vary

2 Laminate sequence V M M Wr M Wr M. V=Veil M=Chopped Mat 1½ oz/ft2 Wr=Woven Roving 24 oz/yd2, ¼" thickness, post cured

3 Halogenated resins

4 Non-reinforced, post cured

TABLE 1 - MECHANICAL PROPERTIES[1] OF Hetron RESINS (SI units)

		LAMINATES[2] AT TEMPERATURES											
		TENSILE STRENGTH, MPa						TENSILE MODULUS, MPa					
RESIN	Temp. °C	-43	25	66	93	121	149	-43	25	66	93	121	149
Hetron 980/35		128	101	99	108	106	116	13300	11580	10000	10690	10410	6550
Hetron FR998/35[3]		121	99	100	119	141	121	12400	11380	11380	10340	10340	8270
Hetron 922		117	110	148	148	121	74	8960	10270	9170	8340	6410	4830
Hetron FR992[3]		128	120	117	141	119	94	11030	11030	8830	8830	5650	5520
Hetron 980		101	99	140	132	117	126	12890	10760	10070	7520	6830	7170
Hetron 197-3		139	112	97	105	105	112	8130	9720	9790	9860	8340	8830
Hetron 800		105	101	101	97	86	85	8830	10140	9030	7240	7240	7310

1 Properties of production laminates will vary

2 Laminate sequence V M M Wr M Wr M. V=Veil M=Chopped Mat 450 g/m2 Wr=Woven Roving 800 g/m2, 6.35 mm thickness, post cured

3 Halogenated resins

4 Non-reinforced, post cured.

LAMINATES[2] AT TEMPERATURES												CASTINGS[4]						
FLEXURAL STRENGTH, psi						FLEXURAL MODULUS, X 10^6 psi						TENSILE STRENGTH psi	TENSILE MODULUS x 10^5 psi	ELONGATION BREAK %	FLEXURAL STRENGTH psi	FLEXURAL MODULUS x 10^6 psi	HDT °F	BARCOL HARDNESS
-45	77	150	200	250	300	-45	77	150	200	250	300	77	77	77	77	77	-	77
19700	18400	19500	17400	18000	20000	1.04	1.02	0.92	0.88	0.87	0.75	12700	4.8	4.5	21800	5.1	270	45
28700	22800	22000	22700	21200	14700	1.20	1.05	0.90	0.90	0.90	0.60	13500	5.3	4.0	22000	5.7	275	40
23200	22400	23700	21800	11900	3300	1.04	0.90	0.89	0.81	0.55	0.04	12500	4.6	6.5	20500	5.0	221	30
24800	23900	24200	24400	19500	3100	1.16	1.03	1.07	0.96	0.79	0.07	13000	5.0	6.5	21000	5.2	227	35
21600	23500	19600	21300	20800	16900	1.14	1.01	0.99	0.89	0.83	0.70	13000	4.8	5.5	20000	5.0	250	35
23300	17900	18400	19900	20900	21200	1.12	0.99	0.89	0.87	0.75	0.87	5500	5.1	1.4	10000	5.5	184	40
32400	18000	21900	18600	17300	13100	1.06	1.11	0.93	0.84	0.72	0.66	5200	5.7	1.0	10500	5.8	212	45

LAMINATES[2] AT TEMPERATURES												CASTINGS[4]						
FLEXURAL STRENGTH, MPa						FLEXURAL MODULUS, MPa						TENSILE STRENGTH MPa	TENSILE MODULUS MPa	ELONGATION BREAK %	FLEXURAL STRENGTH MPa	FLEXURAL MODULUS MPa	HDT °C	BARCOL HARDNESS
-43	25	66	93	121	149	-43	25	66	93	121	149	25	25	25	25	25	25	25
136	127	134	120	124	138	7170	7030	6340	6070	6000	5170	88	3310	4.5	150	3520	132	45
198	157	152	157	146	101	8270	7240	6200	6200	6200	4140	93	3650	4.0	152	3930	135	40
160	154	163	150	82	23	7171	6210	6140	5580	3790	280	86	3170	6.5	141	3450	105	30
171	165	167	168	134	21	8000	7100	7380	6620	5450	480	90	3450	6.5	145	3580	108	35
149	162	135	147	143	117	7860	6960	6830	6140	5720	4830	90	3310	5.5	138	3450	121	35
161	123	127	137	144	146	7720	6830	6140	6000	5170	6000	38	3520	1.4	69	3790	140	40
223	124	151	128	119	90	7310	7650	6410	5790	4960	4550	36	3930	1.0	72	4000	100	45

POSTCURING THE LAMINATE

For a service temperature below 100ºC (212ºF): A postcure may extend the service life if the operating temperature is within 20ºC (40ºF) of the present CR guide maximum temperature for the service. This means that a postcure can be beneficial for solvent applications with a temperature limit of 25º-40ºC (80º-100ºF).

For service temperature above 100ºC (212ºF): Postcure in service may be sufficient, provided the resin specific minimum Bardol hardness values are reached before start up.

For service in pure and neutral salt solutions: Postcure may, in general, not be required, provided the resin specific minimum Barcol hardness values are reached and no acetone sensitivity is shown before start up.

When using a BPO / Amine cure system, postcure is strongly recommended and should be done withing two weeks of construction

Postcure conditions as outlined in EN 13121-2 are recommended. Minimum recommended postcure conditions are 80ºC (180ºF) for four hours.

THERMAL CONDUCTIVITY (K-VALUE)

The thermal conductivity of a glass reinforced laminate increases with glass content. The glass has a higher thermal conductivity than that of the resin. See Table 2 for thermal conductivity values.

TABLE 2a
THERMAL CONDUCTIVITY (TYPICAL k VALUES: BTU-IN/HR/FT2/ºF)

Resin	Casting	Composite M/M	Composite M/Wr/M/Wr
% Glass	0	25	40
Hetron FR998/35	1.30	1.52	1.84
Hetron 980/35	1.46	1.67	1.97
Hetron 922	1.28	1.37	1.50
Hetron FR992	1.24	1.46	1.73
Hetron 980	1.41	1.65	1.92
Hetron 197-3	1.01	1.08	1.29
Hetron 800	1.52	1.23	1.60

M = chopped mat 1½ oz/ft^2 Wr = woven roving 24 oz/yd^2

TABLE 2b
THERMAL CONDUCTIVITY W(m.K)

Resin	Casting	Composite M/M	Composite M/Wr/M/Wr
% Glass	0	25	40
Hetron FR998/35	0.19	0.22	0.27
Hetron 980/35	0.21	0.24	0.28
Hetron 922	0.18	0.20	0.22
Hetron FR992	0.18	0.21	0.25
Hetron 980	0.20	0.24	0.28
Hetron 197-3	0.15	0.16	0.19
Hetron 800	0.22	0.18	0.23

M = chopped mat 450g/m^2 Wr = woven roving 800g/m^2

To convert from W/(m K) to BTU in / (hr ft2 F), multiply by: 6,9334713
To convert from BTU in / (hr ft2 F) to W/(m K), multiply by: 0,1441314

GLASS CONTENT

Mechanical properties increase with greater reinforcement content. Laminate properties can be tailored by the choice of resin, type of reinforcement (chopped glass mat, unidirectional roving, woven roving, etc.), orientation of the reinforcement, and reinforcement content.

TABLE 3 (US units)
COMPOSITE PROPERTIES VERSUS GLASS CONTENT
(TYPICAL VALUES)

Resin	M/M	M/Wr/M/Wr/M
Glass content %	25	40
Hetron FR998/35		
Tensile Strength, psi	12050	23565
Tensile Modulus, x 10^6 psi	1.16	1.77
Flexural Strength, psi	21010	51979
Flexural Modulus, x 10^6 psi	0.79	1.55
Hetron 980/35		
Tensile Strength, psi	8395	25911
Tensile Modulus, x 10^6 psi	0.97	1.92
Flexural Strength, psi	16353	54805
Flexural Modulus, x 10^6 psi	0.81	1.52
Hetron 922		
Tensile Strength, psi	13220	18170
Tensile Modulus, x 10^6 psi	0.86	1.57
Flexural Strength, psi	26890	37410
Flexural Modulus, x 10^6 psi	0.99	1.51
Hetron FR992		
Tensile Strength, psi	11428	31434
Tensile Modulus, x 10^6 psi	0.98	2.03
Flexural Strength, psi	19869	61029
Flexural Modulus, x 10^6 psi	0.84	1.64
Hetron 980		
Tensile Strength, psi	11568	23948
Tensile Modulus, x 10^6 psi	1.06	1.73
Flexural Strength, psi	18903	49485
Flexural Modulus, x 10^6 psi	0.8	1.45
Hetron 197-3		
Tensile Strength, psi	11750	16960
Tensile Modulus, x 10^6 psi	0.77	1.46
Flexural Strength, psi	15650	39730
Flexural Modulus, x 10^6 psi	0.79	1.48
Hetron 800		
Tensile Strength, psi	8970	19670
Tensile Modulus, x 10^6 psi	0.79	1.34
Flexural Strength, psi	18250	32540
Flexural Modulus, x 10^6 psi	0.95	1.34

M = chopped mat 1½ oz/ft^2
Wr = woven roving 24 oz/yd^2

Mechanical properties of these constructions can be predicted by micro mechanics (lamination schedule) and the actual properties confirmed by testing. See Table 3 for composite physical properties versus glass content.

TABLE 3 (SI units)
COMPOSITE PROPERTIES VERSUS GLASS CONTENT
(TYPICAL VALUES)

Resin	M/M	M/Wr/M/Wr/M
Glass content %	25	40
Hetron FR998/35		
Tensile Strength, MPa	83	162
Tensile Modulus, MPa	7998	12204
Flexural Strength, MPa	145	358
Flexural Modulus, MPa	5447	10687
Hetron 980/35		
Tensile Strength, MPa	58	179
Tensile Modulus, MPa	6688	13238
Flexural Strength, MPa	113	378
Flexural Modulus, MPa	5585	10480
Hetron 922		
Tensile Strength, MPa	91	125
Tensile Modulus, MPa	5929	10825
Flexural Strength, MPa	185	258
Flexural Modulus, MPa	6826	10411
Hetron FR992		
Tensile Strength, MPa	79	217
Tensile Modulus, MPa	6757	13996
Flexural Strength, MPa	137	421
Flexural Modulus, MPa	5792	11307
Hetron 980		
Tensile Strength, MPa	80	165
Tensile Modulus, MPa	7308	11928
Flexural Strength, MPa	130	341
Flexural Modulus, MPa	5516	9997
Hetron 197-3		
Tensile Strength, MPa	81	117
Tensile Modulus, MPa	5309	10066
Flexural Strength, MPa	108	274
Flexural Modulus, MPa	5447	10204
Hetron 800		
Tensile Strength, MPa	62	136
Tensile Modulus, MPa	5447	9239
Flexural Strength, MPa	126	224
Flexural Modulus, MPa	6550	9239

M = chopped mat 450g/m^2
Wr = woven roving 800g/m^2

THERMAL EXPANSION/CONTRACTION

The thermal expansion of a composite decreases with increasing reinforcement content. This property is dependent on the type of reinforcement (chopped glass mat, unidirectional roving, woven roving, etc.), the orientation of the reinforcement, and reinforcement content. See Table 4 for thermal expansion values.

TABLE 4
COEFFICIENT OF LINEAR THERMAL EXPANSION[1]
(TYPICAL VALUES: x 10^{-5} mm/mm/°C or 10^{-5} in/in/°C)

Resin	Casting	Laminate M/M	Laminate M/Wr/M/Wr/M
Glass content %	0	25	40
Hetron FR998/35	5.04	2.75	2.01
Hetron 980/35	6.06	2.95	2.12
Hetron 922	5.68	2.83	2.19
Hetron FR992	5.10	3.11	1.99
Hetron 980	6.08	3.03	1.72
Hetron 197-3	5.26	2.99	2.32
Hetron 800	4.45	2.90	1.58

1 Harrop Thermodilatometric analyzer from -30 - 30°C. The CLTE is linear from -30 to 100°C (or -22°F to 212°F)for the glass reinforced laminates.

M = chopped mat 1½ oz/ft^2 or 450g/m^2
Wr = woven roving 24 oz/yd^2 or 800g/m^2

VOLUMETRIC CURE SHRINKAGE

Liquid resin decreases in volume during cure due to polymerization shrinkage. The linear shrinkage of a glass reinforced laminate is dependent on the type of reinforcement (chopped glass, mat, unidirectional roving, woven roving, etc.), the orientation of the reinforcement, and reinforcement contents. See Table 5 for typical volumetric shrinkage values.

TABLE 5
VOLUMETRIC CURE SHRINKAGE OF CASTINGS
(TYPICAL VALUES)

Resin	Density of Liquid (g/cm3)	Density of Solid (g/cm3)	Percent Shrinkage
Hetron 980/35	1.08	1.17	8.30
Hetron 922	1.04	1.14	9.60
Hetron FR992	1.14	1.24	8.80
Hetron 980	1.05	1.15	9.50
Hetron 197-3	1.14	1.24	8.10
Hetron 800	1.21	1.28	5.80

ELECTRICAL PROPERTIES

The cured resins have high dielectric constants and low dissipation factors. Dielectric constant is the ratio of the capacitance of a weakly conducting material to that of air. Dissipation factor is the loss of energy resulting when a polymeric material experiences molecular motion in an alternating electric field. See Table 6 for electrical properties of standard resin castings.

TABLE 6
ELECTRICAL PROPERTIES OF CLEAR CASTINGS
(TYPICAL VALUES PER ASTM D150)

Resin	Dielectric Constant[1]	Dissipation Factor	Average Dielectric Constant[2]
Hetron FR998/35	4.05	0.0051	4.16
Hetron 980/35	3.48	0.0039	3.50
Hetron 922	3.34	0.0123	3.39
Hetron FR992	3.29	0.0128	3.21
Hetron 980	3.44	0.0055	3.34
Hetron 197-3	3.04	0.0156	2.94
Hetron 800	5.35	0.0253	4.94

1 = KHz
2 = Average of 1 KHz 10KHz 100KHz and 1 MHz

FLAME RETARDANCE

Many Hetron epoxy vinyl ester resins are based on halogenated intermediates. These unique chemical structures account for their excellent corrosion resistance and also make these Hetron resin composites inherently flame retardant. For increased flame retardance, FR synergists can be added to many of these resins during fabrication. However, antimony oxide is not effective when added to non-halogenated resins. ASTM E84 "Standard Method of Test for Surface Burning Characteristics of Building Materials" (commonly referred to as the "Tunnel Test") is the accepted standard for determining flame spread values.

Current industry practice requires materials of construction for ducts, hoods, and other fume handling equipment to have a flame spread rating of 25 or less (commonly referred to as Class I). See Table 7 for specific flame spread values.

Several other tests commonly used for classifying smoke and flame retardant properties of FRP equipment include ASTM E162 "Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source (Radiant Panel Test)," ASTM E662 "Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials (Smoke Chamber)," UL94 "Standard Tests for Flammability of Plastic Materials for Party in Devices and Appliances."

For more specific information on these and other flame resistance test results (UL94, oxygen index, cone calorimeter), contact your sales or technical service representative. Ashland Technical Service can also be consulted for low smoke solutions.

TABLE 7
FLAME SPREAD VALUES OF COMPOSITES[1]
(TYPICAL VALUES PER ASTM E84)

Resin Type	Flame Spread	Class[2]
Control: Asbestos/Cement	0	I
Hetron FR998/35 (no antimony trioxide required)	<25	I
Hetron FR992 (with 3% antimony trioxide)	<25	I
Hetron 197 Series (with 5% antimony trioxide)	30	II
Control: Red Oak Lumber	100	III
Plywood	200	III
Non-Halogenated Resins	350-400	III

1 = 1/8" thick laminates with approximately 30% chopped glass mat
2 = Class I = 0 to 25 flame spread; Class II = >25 to 75 flame spread; Class III = >75 flame spread per the ASTM E84 tunnel test

Notes

English

1 Synthetic surfacing veil generally used, use non-apertured synthetic veil with Hetron 197 series resins

2 Post-cure strongly recommended

3 Benzoic peroxide / dimethyl aniline cure system generally used

4 Recommended provided that solvent used for dissolution is also recommended

5 Satisfactory up to maximum stable temperature for product

6 Check with technical service for specific resin recommendation

7 Probably satisfactory at higher temperatures, but temperature shown is the highest for which information

8 Double surfacing veil and a 5mm/200mil CR barrier should be used

9 Double C-veil recommended

10 Hetron 197 series appear to be unsuitable under cyclic conditions with some crazing but are resistant under static conditions

11 Within the solubility limits in aqueous solution

12 Above 50°C/120°F, acid resistant glass should be used in the CR barrier and may be used in the structural wall

13 Acid resistant glass should be used in the corrosion liner and may be used in the structural wall

14 If chemical composition is unknown, obtain Safety Data Sheet from supplier

15 Solution may discolor

16 The use of the resin above the maximum allowable design temperature as limited by national design standards may require approval of the relevant authorities

17 Hetron FR992 at higher temperatures

18 Hydrogen peroxide suppliers must approve materials of construction

19 Double veil generally used, either double synthetic or synthetic backed by C-veil, use non-apertured veil backed by C-veil with Hetron 197

20 Carbon veil recommended at higher temperatures listed

21 For concentration below 0,5% please contact the technical service

22 For potable water applications, please contact the technical service

NR Not recommended

"All" in concentration column refers to concentrations in water

"100" in concentration column refers to the the pure chemical

Spanish

1 Se recomienda usar generalmente velo sintético de superficie, utilice velo sintético tupido con la serie de resinas HETRON 197

2 Se recomienda realizar un post-curado

3 El sistema de curado utilizado generalmente está basado en Peróxido de Benzoilo (BPO) / Dimetil Anilina (DMA)

4 Se recomienda siempre que el disolvente utilizado para la disolución sea compatible con la resina

5 Satisfactorio hasta la temperatura máxima estable para el producto

6 Consulte con nuestro departamento de asistencia técnica para la recomendación de una resina específica

7 Probablemente satisfactoria a temperaturas más elevadas, la temperatura indicada es la más alta para la cual existen datos

8 Se recomienda un doble velo de superficie y una barrera anticorrosiva de 5 mm/200 mils

9 Se recomienda un doble velo de tipo C en la barrera anticorrosiva

10 Las series de resinas HETRON 197 parecen no ser adecuadas en condiciones cíclicas con la aparición de algunas grietas, pero son resistentes en condiciones estáticas

11 En los límites de solubilidad en solución acuosa

12 Por encima de 50ºC (120ºF) se recomienda vidrio resistente a los ácidos en la barrera anticorrosiva y es recomendable también su uso en la pared estructural

13 Es necesario emplear un vidrio resistente a los ácidos en la barrera anticorrosiva y es recomendable también su uso en la pared estructural

14 Si se desconoce la composición química pídale al proveedor la ficha de seguridad del producto

15 La solución puede decolorar

16 La utilización de la resina, por encima de la temperatura máxima de cálculo permitida por la norma de diseño elegida, puede requerir la aprobación de las autoridades competentes

17 Se recomienda la resina HETRON FR 992 para temperaturas elevadas

18 Los proveedores del peróxido de hidrogeno deben aprobar los materiales de construcción

19 Se recomienda generalmente el uso de doble velo, tanto el doble velo sintético como el velo sintético respaldado por velo tipo C, use velo tupido respaldado con velo tipo C para las resinas Hetron 197

20 Se recomienda usar velo de carbono para las temperaturas más elevadas indicadas

21 Para concentraciones por debajo del 05% póngase en contacto con el servicio de asistencia técnica

22 Consulte con el departamento de asistencia técnica para aplicaciones que requieran el contacto con agua potable

NR: No recomendado

All: En la columna de concentración se refiere a la concentración en el agua

100: En la columna de concentración se refiere a las sustancias químicas puras

Chemical Names/CAS Numbers

CAS No.	Chemical Name
50-00-0	Formaldehyde
50-21-5	Lactic Acid
50-70-4	Sorbitol
50-78-2	Acetylsalicylic Acid
56-23-5	Carbon Tetrachloride
56-81-5	Glycerin or Glycerol
57-11-4	Stearic Acid
57-13-6	Urea
57-55-6	Propylene Glycol
60-24-2	Mercaptoethanol
60-29-7	Ethyl Ether
62-53-3	Aniline
62-76-0	Sodium Oxalate
64-02-8	Ethylenediaminetetraacetic acid, tetrasodium salt (EDTA)
64-17-5	Ethyl Alcohol
64-18-6	Formic Acid
64-19-7	Acetic Acid
64-67-5	Diethyl Sulfate
65-85-0	Benzoic Acid
67-56-1	Methyl Alcohol
67-63-0	Isopropyl Alcohol
67-64-1	Acetone
68-11-1	Thioglycolic Acid
68-12-2	Dimethyl Formamide
69-72-7	Salicylic Acid
71-36-3	Butyl Alcohol
71-43-2	Benzene
71-55-6	Trichloroethane (1,1,1-)
74-87-3	Methyl Chloride
74-90-8	Hydrocyanic Acid
74-96-4	Ethyl Bromide
75-00-3	Ethyl Chloride
75-04-7	Ethylamine
75-05-8	Acetonitrile
75-07-0	Acetaldehyde
75-09-2	Methylene Chloride
75-12-7	Formamide
75-15-0	Carbon Disulfide
75-21-8	Ethylene Oxide
75-36-5	Acetyl Chloride
75-45-6	Chlorodifluoromethane
75-52-5	Nitromethane
75-75-2	Methanesulfonic Acid
75-87-6	Chloral
75-99-0	Dichloropropionic Acid (2,2-)
76-01-7	Pentachloroethane
76-03-9	Trichloroacetic Acid
77-47-4	Hexachlorocyclopentadiene
77-73-6	Dicyclopentadiene
77-78-1	Dimethyl Sulfate
77-92-9	Citric Acid
78-10-4	Ethyl Silicate
78-87-5	Propylene dichloride
78-93-3	Methyl Ethyl Ketone
79-00-5	Trichloroethane (1,1,2-)
79-01-6	Trichloroethylene
79-06-1	Acrylamide
79-09-4	Propionic Acid
79-10-7	Acrylic Acid
79-11-8	Chloroacetic Acid
79-14-1	Glycolic acid
79-20-9	Methyl Acetate
79-41-4	Methacrylic Acid
81-16-3	Tobias Acid
84-69-5	Diisobutyl Phthalate
84-74-2	Dibutyl Phthalate
85-44-9	Phthalic Anhydride
85-52-9	Benzoylbenzoic Acid (o-)
89-08-7	Sulfophtalic Acid (4-)
91-20-3	Naphthalene
93-97-0	Benzoic Anhydride
95-50-1	Dichlorobenzene (o-)
96-13-9	Dibromopropanol (2, 3-)
96-22-0	Diethyl Ketone
96-23-1	Glycerol Dichlorohydrin
96-24-2	Glycerol Monochlorohydrin
97-99-4	Tetrahydrofuryl Alcohol
98-00-0	Furfuryl Alcohol
98-01-1	Furfural
98-07-7	Benzotrichloride
98-11-3	Benzenesulfonic Acid
98-83-9	Methylstyrene (Alpha-)
98-86-2	Acetophenone
98-87-3	Benzal Chloride
98-88-4	Benzoyl Chloride
98-95-3	Nitrobenzene
100-41-4	Ethylbenzene
100-42-5	Styrene
100-44-7	Benzyl Chloride
100-51-6	Benzyl Alcohol
100-52-7	Benzaldehyde
100-97-0	Hexamethylenetetramine
101-02-0	Triphenyl Phosphite
101-84-8	Diphenyl Oxide
102-71-6	Triethanolamine
104-15-4	Toluenesulfonic Acid
104-74-5	Lauryl Pyridinium Chloride
105-58-8	Diethyl Carbonate
106-89-8	Epichlorohydrin
106-93-4	Ethylene Dibromide
107-05-1	Allyl Chloride
107-06-2	Ethylene Chloride
107-07-3	Ethylene Chlorohydrin
107-13-1	Acrylonitrile
107-15-3	Ethylenediamine
107-21-1	Ethylene Glycol
107-22-2	Glyoxal
107-39-1	Diisobutylene
107-92-6	Butyric Acid
107-96-0	Mercaptopropionic (3-) Acid
108-10-1	Methyl Isobutyl Ketone
108-24-7	Acetic Anhydride
108-31-6	Maleic Anhydride
108-46-3	Resorcinol
108-88-3	Toluene
108-90-7	Chlorobenzene
108-94-1	Cyclohexanone
108-95-2	Phenol
109-43-3	Dibutyl Sebacate
109-89-7	Diethylamine
109-99-9	Tetrahydrofuran THF
110-16-7	Maleic Acid
110-61-2	Succinonitrile
110-82-7	Cyclohexane
110-91-8	Morpholine
111-40-0	Diethylenetriamine
111-42-2	Diethanolamine
111-46-6	Diethylene Glycol
111-76-2	Ethylene Glycol Monobutyl Ether
111-90-0	Diethylene Glycol Monoethyl Ether
112-27-6	Triethylene Glycol
112-34-5	Diethylene Glycol N-Butyl Ether
112-40-3	Dodecane
112-41-4	Dodecene
112-52-7	Lauryl Chloride
112-53-8	Dodecyl Alcohol
112-55-0	Lauryl Mercaptan
112-80-1	Oleic Acid
117-81-7	Dioctyl Phthalate
120-51-4	Benzyl Benzoate
121-03-9	Nitrotoluene (4-) Sulfonic Acid (2-)
121-43-7	Trimethyl Borate in Methyl Alcohol
121-44-8	Triethylamine
121-57-3	Sulfanilic Acid
121-69-7	Dimethylaniline (N,N)
123-51-3	Isoamyl Alcohol
123-76-2	Levulinic Acid (also 4-oxopentanoic acid)
123-86-4	Butyl Acetate
123-91-1	Dioxane
123-99-9	Azelaic Acid
124-07-2	Octanoic Acid
124-38-9	Carbon Dioxide
124-64-1	Tetrakis (Hydroxymethyl) Phosphonium Chloride
126-11-4	Nitromethane (tris, hydroxymethyl)
126-30-7	Neopentyl Glycol
126-72-7	Dibromopropyl Phosphate
126-73-8	Tributyl Phosphate
127-09-3	Sodium Acetate
127-18-4	Perchloroethylene
127-19-5	Dimethylacetamide
131-11-3	Dimethyl Phthalate
131-17-9	Diallylphthalate
140-31-8	Aminoethyl Piperazine
140-88-5	Ethyl Acrylate
141-43-5	Ethanolamine
141-78-6	Ethyl Acetate
141-91-3	Dimethyl Morpholine (2,6-)
141-97-9	Ethyl Acetoacetate
142-04-1	Aniline Hydrochloride
142-82-5	Heptane, n-
142-91-6	Isopropyl Palmitate
142-96-1	Dibutyl Ether (-n)
143-07-7	Lauric Acid
143-33-9	Sodium Cyanide
144-55-8	Sodium Bicarbonate
149-91-7	Gallic Acid
151-21-3	Sodium Lauryl Sulfate
151-50-8	Potassium Cyanide
298-07-7	Di (2-Ethylhexyl) Phosphoric Acid (DEHPA)
298-12-4	Glyoxylic Acid
298-14-6	Potassium Bicarbonate
301-04-2	Lead (II) Acetate
302-01-2	Hydrazine
497-19-8	Sodium Carbonate
506-64-9	Silver Cyanide
513-77-9	Barium Carbonate
526-95-4	Gluconic Acid
532-32-1	Sodium Benzoate
540-72-7	Sodium Thiocyanate
540-82-9	Ethyl Sulfate
541-41-3	Ethyl Chloroformate
542-16-5	Aniline Sulfate
542-75-6	Dichloropropene
543-59-9	Amyl Chloride
543-80-6	Barium Acetate
544-63-8	Myristic Acid
544-92-3	Copper Cyanide
545-06-2	Trichloroacetonitrile
583-52-8	Potassium Oxalate
584-08-7	Potassium Carbonate
593-81-7	Trimethylamine Hydrochloride
598-54-9	Copper Acetate
611-06-3	Dichloronitrobenzene (2,4-)
622-97-9	Methylstyrene (p-)
628-63-7	Amyl Acetate
630-08-0	Carbon Monoxide Gas
631-61-8	Ammonium Acetate
753-73-1	Dimethyltin Dichloride
759-94-4	Ethyl-N,N-di-n-propylthiolcarbamate (herbicide)
853-68-9	Anthraquinone Disulfonic Acid
868-18-8	Sodium Tartrate
929-06-6	Diglycolamine
1066-33-7	Ammonium Bicarbonate
1300-72-7	Sodium Xylene Sulfonate
1302-42-7	Sodium Aluminate
1303-96-4	Borax
1305-62-0	Calcium Hydroxide
1310-58-3	Potassium Hydroxide
1310-65-2	Lithium Hydroxide
1310-73-2	Sodium Hydroxide
1313-82-2	Sodium Sulfide
1314-85-8	Phosphorus Sesquisulfide
1317-65-3	Calcium Carbonate
1319-77-3	Cresylic Acid
1327-41-9	Aluminum Chlorohydrate
1330-20-7	Xylene
1330-96-4	Sodium Borate
1335-54-2	Diisopropanolamine
1336-21-6	Ammonium Hydroxide
1344-09-8	Sodium Silicate

CAS No.	Chemical Name
1344-67-8	Copper Chloride
1634-04-4	Methyl-Tert-Butyl Ether
1762-95-4	Ammonium Thiocyanate
1863-63-4	Ammonium Benzoate
2090-64-4	Carbonic acid
2235-54-3	Ammonium Lauryl Sulfate
2402-79-1	Tetrachloropyridine
3012-65-5	Ammonium Citrate
5329-14-6	Sulfamic Acid
5536-61-8	Sodium Methacrylate
6303-21-5	Hypophosphorous Acid
6484-52-2	Ammonium Nitrate
6915-15-7	Malic Acid
7320-34-5	Potassium Pyrophosphate
7439-97-6	Mercury
7446-09-5	Sulfur Dioxide
7446-11-9	Sulfur Trioxide
7446-70-0	Aluminum Chloride
7447-40-7	Potassium Chloride
7447-41-8	Lithium Chloride
7487-88-9	Magnesium Sulfate
7487-94-7	Mercuric Chloride
7488-52-0	Zinc Sulfite
7550-35-8	Lithium Bromide
7550-45-0	Titanium Chloride
7553-56-2	Iodine Vapor
7558-79-4	Disodium Phosphate
7558-80-7	Sodium Biphosphate
7601-54-9	Trisodium Phosphate
7601-90-3	Perchloric Acid
7631-90-5	Sodium Bisulfite
7631-99-4	Sodium Nitrate
7632-00-0	Sodium Nitrite
7646-78-8	Stannic Chloride
7646-85-7	Zinc Chloride
7647-01-0	Hydrochloric Acid or Hydrogen Chloride (gas)
7647-14-5	Sodium Chloride
7647-15-6	Sodium Bromide
7664-38-2	Phosphoric Acid
7664-39-3	Hydrofluoric Acid
7664-41-7	Ammonia
7664-93-9	Sulfuric Acid
7681-38-1	Sodium Bisulfate
7681-49-4	Sodium Fluoride
7681-52-9	Sodium Hypochlorite
7681-53-0	Sodium Monophosphate
7697-37-2	Nitric Acid
7704-34-9	Sulfur
7705-08-0	Ferric Chloride
7718-54-9	Nickel Chloride
7719-09-7	Thionyl Chloride
7719-12-2	Phosphorus Trichloride
7720-78-7	Ferrous Sulfate
7722-64-7	Potassium Permanganate
7722-76-1	Ammonium Phosphate (monobasic)
7722-84-1	Hydrogen Peroxide
7722-88-5	Tetrasodium Pyrophosphate
7726-95-6	Bromine
7727-15-3	Aluminum Bromide
7727-21-1	Potassium Persulfate
7727-43-7	Barium Sulfate
7727-54-0	Ammonium Persulfate
7732-18-5	Water
7733-02-0	Zinc Sulfate
7738-94-5	Chromic Acid
7757-79-1	Potassium Nitrate
7757-82-6	Sodium Sulfate
7757-83-7	Sodium Sulfite
7758-01-2	Potassium Bromate
7758-02-3	Potassium Bromide
7758-19-2	Sodium Chlorite
7758-29-4	Sodium Tripolyphosphate
7761-88-8	Silver Nitrate
7772-98-7	Sodium Thiosulfate
7772-99-8	Stannous Chloride
7773-01-5	Manganous chloride
7775-09-9	Sodium Chlorate
7775-11-3	Sodium Chromate
7775-27-1	Sodium Persulfate
7778-50-9	Potassium Dichromate
7778-54-3	Calcium Hypochlorite
7778-80-5	Potassium Sulfate
7779-86-4	Zinc Hydrosulfite
7779-88-6	Zinc Nitrate
7779-90-0	Zinc Phosphate
7782-41-4	Fluorine Gas
7782-50-5	Chlorine Gas
7782-77-6	Nitrous Acid
7782-99-2	Sulfurous Acid
7783-06-4	Hydrogen Sulfide
7783-13-3	Sodium Ammonium Phosphate
7783-18-8	Ammonium Thiosulfate
7783-20-2	Ammonium Sulfate
7783-28-0	Ammonium Phosphate, dibasic
7784-18-1	Aluminum Fluoride
7784-24-9	Potassium Aluminum Sulfate
7784-46-5	Sodium Arsenite
7785-87-7	Manganous sulfate
7786-81-4	Nickel Sulfate
7789-23-3	Potassium Fluoride
7789-32-4	Ammonium Bromide
7789-38-0	Sodium Bromate
7790-92-3	Hypochlorous Acid
7790-94-5	Chlorosulfonic Acid
7791-08-4	Antimony Oxychloride
8001-22-7	Soybean Oil
8001-30-7	Corn Oil
8001-69-2	Cod Liver Oil
8001-79-4	Castor Oil
8002-03-7	Peanut Oil
8002-74-2	Paraffin Wax
8002-92-4	Ammonium Carbonate
8006-64-2	Turpentine
8007-56-5	Aqua Regia
8007-69-0	Almond Oil
8008-20-6	Kerosene
8012-14-4	Sodium Hexametaphosphate
8013-07-8	Soybean Oil, epoxidized
8013-54-5	Chloroform
8027-16-5	Cresols, Mixture
8032-32-4	Naphtha
8052-42-4	Asphalt
8140-01-2	Cocamidopropyl Dimethylamine
9002-85-1	Polyvinylidiene Chloride (PVDC)
9002-86-2	Polyvinyl Chloride (PVC)
9002-89-5	Polyvinyl Alcohol
9003-04-7	Sodium Polyacrylate
9003-20-7	Polyvinyl Acetate Emulsion
9004-32-4	Carboxymethylcellulose
9005-25-8	Starch
9016-45-9	Ethoxylated Nonyl Phenol
10025-67-9	Sulfur Chloride
10025-73-7	Chromic Chloride
10025-87-3	Phosphorus Oxychloride
10025-91-9	Antimony Trichloride
10026-04-7	Silicone Tetrachloride
10034-85-2	Hydriodic Acid
10034-93-2	Hydrazine Sulfate
10035-10-6	Hydrobromic Acid or Hydrogen Bromide (gas)
10043-01-3	Aluminum Sulfate
10043-35-3	Boric Acid
10043-52-4	Calcium Chloride
10043-67-1	Aluminum Potassium Sulfate
10049-04-4	Chlorine Dioxide
10099-74-8	Lead (II) Nitrate
10101-53-8	Chromic Sulfate
10108-73-3	Cerous Nitrate
10137-74-3	Calcium Chlorate
10141-00-1	Chromium Potassium Sulfate
10196-04-0	Ammonium Sulfite
10361-37-2	Barium Chloride
10377-48-7	Lithium Sulfate
10377-60-3	Magnesium Nitrate
10421-48-4	Ferric Nitrate
10450-55-2	Ferric Acetate
10545-99-0	Sulfur Dichloride
10588-01-9	Sodium Dichromate
11120-25-5	Ammonium Tungstate
12028-48-7	Ammonium Metatungstate
12042-91-0	Aluminum Chlorohydroxide
12124-99-1	Ammonium Sulfide
12125-01-8	Ammonium Fluoride
12125-02-9	Ammonium Chloride
13473-90-0	Aluminum Nitrate
13478-10-10	Ferrous Chloride
13520-68-9	Ferrous Nitrate
13598-36-2	Phosphorous Acid, ortho-
13601-19-9	Sodium Ferrocyanide
13674-87-8	Dichloro-(2)-Propyl Phosphate
13746-66-2	Potassium Ferricyanide
13774-25-9	Magnesium Bisulfite
13826-88-5	Zinc Fluoborate
13846-18-9	Calcium Bisulfite
13943-58-3	Potassium Ferrocyanide
14216-75-2	Nickel Nitrate
14217-21-1	Sodium Ferricyanide
16721-80-5	Sodium Hydrosulfide
16872-11-0	Fluoboric Acid
16893-85-9	Sodium Fluorosilicate
16961-83-4	Fluorosilicic Acid
17194-00-2	Barium Hydroxide
18130-44-4	Titanium Sulfate
18483-17-5	Tannic Acid
24347-58-8	Butylene Glycol
25013-15-4	Vinyl Toluene
25155-30-0	Sodium Dodecylbenzenesulfonate
25265-71-8	Dipropylene Glycol
25339-17-7	Isodecanol
25340-17-4	Diethylbenzene
25567-55-9	Sodium Tetrachlorophenate
25639-42-3	Methylcyclohexanol
26248-24-8	Sodium Tridecylbenzene Sulfonate
27138-31-4	Dipropylene Glycol Dibenzoate
27176-87-0	Dodecylbenzene Sulfonic Acid
28348-53-0	Sodium Cumenesulfonate
29965-97-7	Cyclooctadiene
31142-56-0	Aluminum Citrate
35139-28-8	Ferric Sulfate
37267-86-0	Metaphosphoric Acid
50864-67-0	Barium Sulfide
51218-45-2	Metolachlor
61789-32-0	Fatty Acids
61789-40-0	Cocamidopropyl Betaine
61789-77-3	Dicoco Dimethyl Ammonium Chloride
61804-50-0	Divinyl Benzene
65996-63-6	Corn Starch
68131-30-6	Green Liquor (Pulp Mill)
68412-54-4	Nonyl (phenoxypoly (ethyleneoxy) ethanol, branched.
68439-57-6	Sodium alpha-Olefin Sulfonate
68476-34-6	Diesel Fuel
68514-06-7	Ammonium Bisulfite Liquor (black liquor)
68603-42-9	Coconut Fatty Acid
72674-05-6	Alpha Olefin Sulfonate
74552-83-3	Trichloroethane (1,1,1-)
84961-48-8	Coconut Oil
95077-05-7	Kaolin Slurry
97328-76-2	Carbonic Acid
99400-01-8	Calcium Sulfate
99551-14-1	Oils, Mineral (aliphatic)

Chemical Environment	Notes	Concentration (%)	Temperature (°C and °F) for HETRON Resin 922 °C / °F	980 °C / °F	980/35 °C / °F	FR 992 °C / °F	FR 998/35 °C / °F	800 °C / °F	197 °C / °F
Acetaldehyde	-	100	NR	NR	NR	NR	-	105/225	NR
Acetic Acid	21	0.5 to 10	100/210	100/210	100/210	100/210	100/210	105/225	100/210
Acetic Acid	-	11 to 25	80/180	80/180	100/210	100/210	100/210	105/225	80/180
Acetic Acid	-	26 to 50	80/180	65/150	100/210	80/180	100/210	-	80/180
Acetic Acid	-	51 to 75	45/110	45/110	65/150	45/110	65/150	-	45/110
Acetic Acid	-	76 to 85	45/110	45/110	45/110	45/110	45/110	-	45/110
Acetic Acid	2	86 to 100 (glacial)	NR	-	-	NR	-	-	LS40/LS100
Acetic Acid, Hydrogen Peroxide	-	95 / 1.5	-	-	-	-	-	-	30/90
Acetic Acid, Sodium Dichromate	-	70 / 30	-	-	-	-	-	-	LS65/LS150
Acetic Anhydride	-	100	NR	-	-	NR	NR	105/225	40/100
Acetone	15	100	NR	NR	NR	NR	NR	55/130	NR
Acetone, Toluene	15	50 / 50	NR	NR	NR	NR	NR	30/90	-
Acetonitrile	-	100	NR	NR	NR	NR	NR	25/80	NR
Acetophenone	-	100	NR	NR	NR	NR	NR	-	30/90
Acetyl Chloride	-	100	-	-	-	-	-	80/180	NR
Acetylsalicylic Acid	-	100	-	-	-	-	-	105/225	-
Acrylamide	-	50	25/80	25/80	40/100	25/80	40/100	-	25/80
Acrylic Acid	7	10	40/100	40/100	40/100	40/100	40/100	-	40/100
Acrylic Acid	7	25	40/100	40/100	40/100	40/100	40/100	-	40/100
Acrylic Acid	-	100	-	-	-	-	-	25/80	NR
Acrylic Acid Dispersion, Acrylonitrile	-	98 / 2	-	-	-	-	-	-	30/90
Acrylic Acid Dispersion, Vinylidene Chloride	-	98 / 2	-	-	-	-	-	-	30/90
Acrylic Acid Emulsion	-	100	50/120	50/120	-	50/120	-	-	-
Acrylonitrile (latex, dispersion)	-	-	NR	NR	-	NR	-	105/225	NR
Acrylonitrile, Acrylic Acid Dispersion	-	2 / 98	-	-	-	-	-	-	30/90
Activated Carbon Beds (water treatment)	-	100	-	-	-	-	100/210	-	95/200
Air, Humid (trace of sulfur fumes)	-	100	95/200	95/200	-	95/200	-	-	95/200
Alcohol (See Ethanol)	-	-	-	-	-	-	-	-	-
Alkyl Benzene Sulfonic Acid	21	All	-	80/180	-	80/180	80/180	-	40/100
Alkyl Benzenesulfonate	21	All	-	-	-	-	-	-	50/120
Allyl Chloride	-	100	NR	25/80	-	NR	25/80	30/90	-
Almond Oil (Artificial almond oil is Benzaldehyde CAS N°100-52-7).	-	100	-	-	-	-	-	50/120	-
Alpha Olefin Sulfonate	-	100	-	-	-	-	-	-	50/120
Alum, aluminum salt (See Aluminum sulfate)	-	-	-	-	-	-	-	-	-
Aluminum Bromide	-	Sat'd	70/160	70/160	-	70/160	-	120/250	-
Aluminum Chloride	-	Sat'd	100/210	120/250	120/250	100/210	120/250	120/250	100/210

See pages 50 and 51 for notes

Chemical Environment	Notes	Concentration (%)	Temperature (°C and °F) for HETRON Resin 922 °C / °F	980 °C / °F	980/35 °C / °F	FR 992 °C / °F	FR 998/35 °C / °F	800 °C / °F	197 °C / °F
Aluminum Chlorohydrate	21	All	100/210	100/210	-	100/210	100/210	-	75/165
Aluminum Chlorohydroxide	-	50	100/210	100/210	-	100/210	100/210	-	-
Aluminum Citrate	-	Sat'd	95/200	95/200	95/200	95/200	95/200	-	-
Aluminum Fluoride	1, 21	All	30/90	30/90	30/90	30/90	30/90	105/225	30/90
Aluminum Nitrate	21	All	80/180	80/180	80/180	80/180	80/180	-	-
Aluminum Potassium Sulfate	-	Sat'd	100/210	105/220	120/250	100/210	120/250	-	100/210
Aluminum Sulfate	21	All	100/210	105/220	105/220	100/210	105/220	-	120/250
Aluminum Sulfate	-	Sat'd	100/210	120/250	120/250	100/210	120/250	120/250	120/250
Amine salts	21	All	50/125	50/125	65/150	50/125	65/150	-	50/125
Aminoethanol, (2-) (See Ethanolamine)	-	-	-	-	-	-	-	-	-
Aminoethoxy Ethanol (See Diglycolamine)	-	-	-	-	-	-	-	-	-
Aminoethyl Piperazine	-	100	NR	-	-	NR	-	45/110	NR
Ammonia, Dry Vapors	-	-	40/100	80/180	40/100	40/100	40/100	40/100	30/90
Ammonia, Wet Vapors	-	-	40/100	65/150	NR	40/100	NR	-	NR
Ammonium Acetate	21	All	45/110	45/110	-	45/110	-	-	-
Ammonium Acid Sulfite, Ammonium Sulfite, Ammonium Sulfate	-	up to 25 / up to 8 / up to 5	-	-	-	-	-	-	45/115
Ammonium Benzoate	-	100	80/180	80/180	-	80/180	-	-	-
Ammonium Bicarbonate	-	up to 20	70/160	70/160	70/160	70/160	70/160	-	55/130
Ammonium Bicarbonate	-	21% to saturation	65/150	65/150	65/150	65/150	65/150	-	-
Ammonium Bisulfite Liquor (black liquor)	-	-	80/180	80/180	80/180	80/180	80/180	-	90/195
Ammonium Bromide	-	Sat'd	-	-	-	-	-	105/225	-
Ammonium Carbonate	21	All	65/150	65/150	65/150	65/150	65/150	80/180	-
Ammonium Chloride	21	All	100/210	100/210	100/210	100/210	100/210	105/220	95/200
Ammonium Citrate	21	All	65/150	65/150	65/150	65/150	65/150	-	-
Ammonium Fluoride	1, 21	All	65/150	65/150	65/150	65/150	65/150	105/225	65/150
Ammonium Hydroxide	21	0.5 to 1 (as NH3)	**95/200**	95/200	-	95/200	-	65/150	NR
Ammonium Hydroxide	-	2 to 5 (as NH3)	**80/180**	80/180	-	80/180	-	40/100	NR
Ammonium Hydroxide	-	6 to 10 (as NH3)	**70/160**	70/160	-	70/160	-	40/100	NR
Ammonium Hydroxide	-	11 to 20 (as NH3)	**65/150**	50/125	-	65/150	-	NR	NR
Ammonium Hydroxide	-	21 to 28 (as NH3)	**50/125**	50/125	-	50/125	-	NR	NR
Ammonium Hydroxide	-	29 to 30 (as NH3)	**25/75**	25/75	-	-	-	NR	NR
Ammonium Lauryl Sulfate (also Ammonium dodecyl sulfate)	21	All	55/130	55/130	-	55/130	-	-	55/130
Ammonium Metatungstate (AMT) (pH 3.3)	-	50	LS80/LS180	-	-	LS80/LS180	-	-	LS80/LS180
Ammonium Nitrate	-	Sat'd	100/210	105/220	120/250	100/210	120/250	105/220	95/200
Ammonium Nitrate, Urea, Water (fertilizer)	-	up to 40 / up to 50 / balance	50/120	-	-	50/120	-	-	30/90

See pages 50 and 51 for notes

In bold: preferred resin

Chemical Environment	Notes	Concen-tration	Temperature (°C and °F) for HETRON Resin						
			922	980	980/35	FR 992	FR 998/35	800	197
		(%)	°C / °F	°C / °F	°C / °F	°C / °F	°C / °F	°C / °F	°C / °F
Ammonium Orthophosphate (di-H) (See Ammonium Phosphate Monobasic)	-	-	-	-	-	-	-	-	-
Ammonium Persulfate	21	All	80/180	80/180	80/180	80/180	80/180	80/180	65/150
Ammonium Phosphate (monobasic)	21	All	100/210	100/210	100/210	100/210	100/210	80/180	-
Ammonium Phosphate, dibasic	21	All	100/210	100/210	100/210	100/210	100/210	80/180	-
Ammonium Sulfate	-	Sat'd	100/210	105/220	105/220	100/210	105/220	105/220	105/220
Ammonium Sulfate, Ammonium Acid Sulfite, Ammonium Sulfite	-	up to 5 / up to 25 / up to 8	-	-	-	-	-	-	45/115
Ammonium Sulfate, Ferric Sulfate	-	10.5 / 20	-	-	-	-	-	-	80/180
Ammonium Sulfate, Manganous Sulfate, Sulfuric Acid (concentrations in g/l)	-	up to 150 / up to 15 / up to 40	50/125	50/125	50/125	50/125	-	-	50/125
Ammonium Sulfide	-	Sat'd	50/120	50/120	50/120	50/120	50/120	120/250	50/120
Ammonium Sulfite	-	10	40/100	40/100	40/100	40/100	40/100	-	-
Ammonium Sulfite, Ammonium Sulfate, Ammonium Acid Sulfite	-	up to 8 / up to 5 / up to 25	-	-	-	-	-	-	45/115
Ammonium Thiocyanate	21	0.5 to 20	100/210	100/210	100/210	100/210	100/210	-	95/200
Ammonium Thiocyanate	-	Sat'd	50/120	50/120	50/120	50/120	50/120	-	80/180
Ammonium Thiosulfate	-	60	40/100	40/100	40/100	40/100	40/100	-	80/180
Ammonium Tungstate	-	Sat'd	-	-	-	-	-	120/250	-
Amyl Acetate	-	100	NR	40/100	50/120	NR	50/120	95/200	30/90
Amyl Acetate, Xylene	-	30 / 70	-	50/120	-	-	-	50/120	NR
Amyl Alcohol	-	100	50/120	95/200	95/200	50/120	95/200	95/200	95/200
Amyl Chloride	-	100	NR	50/120	50/120	NR	50/120	-	LS50/LS120
Anaerobic Sewage	21	All	30/85	30/85	30/85	30/85	30/85	-	30/85
Aniline	-	100	NR	NR	NR	NR	NR	120/250	NR
Aniline Hydrochloride	21	All	65/150	80/180	80/180	65/150	80/180	105/225	-
Aniline Sulfate	21	All	100/210	105/220	100/210	100/210	100/210	-	95/200
Anionic Surfactant	21	All	-	-	-	-	-	-	50/120
Anthraquinone Disulfonic Acid	-	1	65/150	65/150	-	65/150	-	-	65/150
Antimony Oxychloride	-	100	-	-	-	-	-	105/225	-
Antimony Pentachloride,(for aqueous solutions See Hydrochlorid Acid)	-	100	30/90	30/90	-	30/90	-	-	30/90
Antimony Trichloride	-	100	95/200	105/220	105/220	95/200	105/220	105/225	95/200
Apple Acid (See Malic acid)	-	-	-	-	-	-	-	-	-
Aqua Regia (concentrated hydrochloric acid and nitric acid, 3 : 1)	2,6,9	100	NR	NR	NR	NR	NR	NR	55/130
Asphalt	6		-	-	-	-	-	-	-
Azelaic Acid	-	100	-	-	-	-	-	-	30/90
Barium Acetate	21	All	90/190	90/190	80/180	90/190	80/180	-	80/180
Barium Carbonate (slurry)	-	-	100/210	105/220	120/250	100/210	120/250	-	95/200

See pages 50 and 51 for notes

Chemical Environment	Notes	Concen-tration	Temperature (°C and °F) for HETRON Resin						
			922	980	980/35	FR 992	FR 998/35	800	197
		(%)	°C / °F	°C / °F	°C / °F	°C / °F	°C / °F	°C / °F	°C / °F
Barium Chloride	21	All	100/210	100/210	100/210	100/210	100/210	95/200	95/200
Barium Hydroxide	21	0.5 to 10	65/150	70/160	70/160	65/150	70/160	-	-
Barium Hydroxide	-	10% to saturation	65/150	65/150	65/150	65/150	65/150	95/200	-
Barium Sulfate	-	100	100/210	105/220	120/250	100/210	120/250	120/250	80/180
Barium Sulfide	-	Sat'd	80/180	80/180	80/180	80/180	80/180	65/150	-
Beet Sugar Liquor	-	-	80/180	80/180	80/180	80/180	80/180	-	-
Benzal Chloride (Benzyl Dichloride)	-	100	NR	-	-	NR	-	120/250	-
Benzaldehyde	-	100	NR	-	-	NR	NR	95/200	NR
Benzene	-	100	NR	40/100	40/100	NR	40/100	65/150	30/90
Benzene Disulfonic Acid	-	100	-	-	-	-	-	-	90/195
Benzene, 120°F	6	-	-	-	-	-	-	-	-
Benzenesulfonic Acid	-	30	100/210	105/220	105/220	100/210	105/220	95/200	95/200
Benzenesulfonic Acid	-	Sat'd	100/210	105/220	105/220	100/210	105/220	95/200	40/100
Benzenesulfonic Acid, Sulfuric Acid, balance water	-	88 / 7	60/140	60/140	-	60/140	-	60/140	60/140
Benzoic Acid	-	100	100/210	100/210	100/210	100/210	100/210	120/250	120/250
Benzoic Anhydride	-	100	-	-	-	-	-	-	30/90
Benzotrichloride	-	100	NR	-	-	NR	-	120/250	-
Benzoyl Chloride	-	100	NR	-	-	NR	-	40/100	NR
Benzoylbenzoic Acid (o-)	-	100	100/210	100/210	100/210	100/210	100/210	-	-
Benzyl Alcohol	-	100	NR	40/100	40/100	NR	25/80	95/200	-
Benzyl Benzoate	-	100	-	-	-	-	-	50/120	-
Benzyl Chloride	2	100	NR	25/80	25/80	NR	25/80	65/150	NR
Biocide Chlorphenate (organic sulfur type, blend)	-	100	50/125	50/125	-	50/125	-	-	50/125
Black Liquor (pH >7)	2	-	80/180	80/180	80/180	80/180	80/180	-	-
Black Liquor (recovery furnace gases)	-	-	NR	115/240	115/240	NR	115/240	-	115/240
Bleach (please check the composition of the product and refer to the type of bleaching agent used like hydrogen peroxide, sodium hypochlorite…)	14	-	-	-	-	-	-	-	-
Borax	-	Sat'd	100/210	100/210	100/210	100/210	100/210	60/140	80/180
Boric Acid	-	Sat'd	100/210	105/220	105/220	100/210	105/220	95/200	95/200
Brake Fluid	-	100	NR	50/120	50/120	NR	50/120	-	-
Brass Metal Plating (See Metal plating)	-	-	-	-	-	-	-	-	-
Brine, Salt	-	Sat'd	100/210	105/220	105/220	100/210	105/220	105/220	105/220
Bromine Water, laboratory reagent.	-	3.2g in 100g water	80/180	95/200	-	80/180	-	-	-
Bromine, Dry Gas	-	100	30/90	40/100	40/100	30/90	40/100	-	60/140
Bromine, Wet Gas	-	100	30/90	30/90	30/90	30/90	30/90	-	30/90
Bronze Plating (See Metal plating)	-	-	-	-	-	-	-	-	-

See pages 50 and 51 for notes

Chemical Environment	Notes	Concen-tration	Temperature (°C and °F) for HETRON Resin						
			922	980	980/35	FR 992	FR 998/35	800	197
		(%)	°C / °F	°C / °F	°C / °F	°C / °F	°C / °F	°C / °F	°C / °F
Brown Stock (Pulp Mill, pH<12)	6	100	65/150	80/180	-	65/150	-	65/150	-
Butyl Acetate	-	100	NR	30/90	30/90	NR	30/90	105/220	30/90
Butyl Alcohol (includes normal, secondary and tertiary)	-	100	25/80	50/120	50/120	25/80	50/120	50/120	40/100
Butyl Ether (See Dibutyl Ether (-n))	-	-	-	-	-	-	-	-	-
Butylene Glycol	-	100	70/160	80/180	80/180	70/160	80/180	-	70/160
Butyric Acid	21	0.5 to 25	80/180	80/180	100/210	80/180	100/210	65/150	50/120
Butyric Acid	-	26 to 50	70/160	70/160	100/210	70/160	100/210	65/150	30/90
Butyric Acid	-	51 to 70	50/120	50/120	50/120	50/120	50/120	65/150	30/90
Butyric Acid	-	71 to 100	NR	40/100	50/120	NR	50/120	50/120	30/90
Cadmium Cyanide (See Metal plating)	-	-	100/210	105/220	-	100/210	-	-	NR
Calcium Bisulfite (also calcium hydrogen sulfite)	-	Sat'd	80/180	80/180	80/180	80/180	80/180	105/225	-
Calcium Carbonate (slurry)	-	-	80/180	80/180	80/180	80/180	80/180	-	-
Calcium Chlorate	-	Sat'd	100/210	105/220	120/250	100/210	120/250	-	120/250
Calcium Chloride	-	Sat'd	100/210	105/220	120/250	100/210	120/250	120/250	120/250
Calcium Hydroxide (slurry)	-	All	**80/180**	40/100	40/100	80/180	40/100	105/225	40/100
Calcium Hypochlorite	2,3, 17	Sat'd	70/160	70/160	70/160	70/160	70/160	NR	50/120
Calcium Nitrate	-	Sat'd	100/210	105/220	105/220	100/210	105/220	105/220	-
Calcium Sulfate (slurry)	-	-	100/210	105/220	120/250	100/210	120/250	120/250	120/250
Carbon Dioxide gas (wet, acidic)	-	100	100/210	120/250	120/250	100/210	120/250	-	120/250
Carbon Disulfide	-	100	NR	NR	NR	NR	NR	30/90	NR
Carbon Disulfide, Fumes no condensation, or coalescence	-	-	40/100	40/100	65/150	40/100	65/150	-	-
Carbon Monoxide Gas	-	100	100/210	120/250	-	100/210	175/350	70/160	120/250
Carbon Tetrachloride	-	100	LS30/LS90	65/150	80/180	65/150	80/180	105/225	50/125
Carbon Tetrachloride, Vapor	-	-	30/90	65/150	95/200	65/150	95/200	105/225	60/140
Carbonic Acid	21	All	70/160	70/160	-	70/160	-	-	70/160
Carbonic acid, magnesium salt	21	All	80/180	80/180	80/180	80/180	80/180	-	80/180
Carboxymethylcellulose	-	10	65/150	80/180	65/150	65/150	65/150	-	-
Castor Oil	-	100	25/75	50/120	50/120	25/75	50/120	-	-
Cerous Nitrate	-	Sat'd	30/90	30/90	30/90	30/90	30/90	30/90	30/90
Chloral	-	Sat'd	-	-	-	-	-	105/225	-
Chlorinated brine 2.5 < pH < 9	-	Sat'd Cl2	40/100	40/100	40/100	40/100	40/100	-	40/100
Chlorinated brine pH < 2.5	-	Sat'd Cl2	80/180	80/180	80/180	80/180	80/180	-	95/200
Chlorinated brine pH > 9 (hypochlorite)	1,2,3	Sat'd Cl2	80/180	65/150	-	80/180	-	-	NR
Chlorinated Paraffin Wax	-	100	80/180	95/200	80/180	80/180	80/180	-	-
Chlorinated Pulp Stock	6	-	-	-	95/200	-	95/200	-	30/90
Chlorine Dioxide (<1 g/l)	6	-	60/140	80/180	80/180	60/140	80/180	NR	60/140
Chlorine Dioxide (chilled liquid)	6	-	7/45	7/45	-	7/45	-	NR	7/45

See pages 50 and 51 for notes

In bold: preferred resin

Chemical Environment	Notes	Concen-tration	Temperature (°C and °F) for HETRON Resin						
			922	980	980/35	FR 992	FR 998/35	800	197
		(%)	°C / °F	°C / °F	°C / °F	°C / °F	°C / °F	°C / °F	°C / °F
Chlorine Dioxide Generator (effluent R-2 system)	6	-	65/150	80/180	-	65/150	-	-	80/180
Chlorine Gas, Dry	2,8	100	80/180	120/250	120/250	80/180	120/250	105/225	150/300
Chlorine Gas, Wet	2,8	100	80/180	80/180	80/180	80/180	80/180	LS65/LS150	105/220
Chlorine Water (See Chlorinated brine)	-	-	-	-	-	-	-	-	-
Chloroacetic Acid (also Monochloroacetic acid)	-	1	50/120	50/120	50/120	50/120	50/120	-	30/90
Chloroacetic Acid (also Monochloroacetic acid)	-	25	40/100	40/100	40/100	40/100	40/100	-	30/90
Chloroacetic Acid (also Monochloroacetic acid)	-	50	40/100	40/100	40/100	40/100	40/100	-	30/90
Chlorobenzene	-	1	NR	25/80	25/80	NR	25/80	120/250	-
Chlorobenzene	-	100	NR	25/80	25/80	NR	25/80	65/150	-
Chlorodifluoromethane	-	100	25/75	25/75	-	25/75	-	40/100	-
Chloroform, Liquid (trichloromethane)	-	100	NR	NR	NR	NR	NR	60/140	NR
Chloroform, Vapor	-	100	NR	-	-	NR	-	120/250	NR
Chlorosulfonic Acid	-	100	NR	NR	NR	NR	NR	25/80	NR
Chlorotoluene (o) and (m)	-	100	NR	-	-	NR	-	30/90	NR
Chrome Metal Plating (See Metal plating)	-	-	-	-	-	-	-	-	-
Chromic Acid	2	1	40/100	65/150	65/150	40/100	65/150	NR	95/200
Chromic Acid	2	5	40/100	65/150	65/150	40/100	65/150	NR	80/180
Chromic Acid	2	10	40/100	65/150	65/150	40/100	65/150	NR	80/180
Chromic Acid	2	20	40/100	50/120	50/120	40/100	50/120	NR	65/150
Chromic Acid	2	30	NR	NR	NR	NR	NR	NR	50/120
Chromic Acid	2	40	NR	NR	NR	NR	NR	NR	30/90
Chromic Acid	6	50	-	-	-	-	-	-	-
Chromic Acid, Sulfuric Acid	2	3 / 16	NR	-	-	NR	-	-	70/160
Chromic Acid, Sulfuric Acid	2	12.5 / 16	-	-	-	-	-	-	70/160
Chromic Acid, Sulfuric Acid	2	20 / 20	NR	-	-	NR	-	-	60/140
Chromic Acid, Sulfuric Acid	2	20 / 32	-	-	-	-	-	-	30/90
Chromic Chloride	-	Sat'd	-	-	-	-	-	105/220	-
Chromic Sulfate	-	100	65/150	65/150	65/150	65/150	65/150	-	-
Chromium Potassium Sulfate	-	Sat'd	-	-	-	-	-	105/225	-
Chromous Sulfate	-	Sat'd	65/150	65/150	-	65/150	-	-	65/150
Citric Acid	-	Sat'd	100/210	105/220	105/220	100/210	105/220	-	95/200
Cleaner (heavy-duty phenolic based desinfectant cleaner)	14	100	40/100	40/100	-	40/100	-	40/100	40/100
Cleaner, Liquid (biodegradable, all purpose)	14	-	40/100	40/100	-	40/100	-	-	40/100
Cocamidopropyl Betaine	-	100	50/120	50/120	-	50/120	-	-	50/120
Cocamidopropyl Dimethylamine	-	100	50/120	50/120	-	50/120	-	-	50/120
Coconut Fatty Acid (coconut diethanolamide)	-	100	-	-	-	-	-	-	40/100
Coconut Oil	-	100	80/175	80/175	80/175	80/175	80/175	-	-

See pages 50 and 51 for notes

Chemical Environment	Notes	Concentration (%)	Temperature (°C and °F) for HETRON Resin 922 °C / °F	980 °C / °F	980/35 °C / °F	FR 992 °C / °F	FR 998/35 °C / °F	800 °C / °F	197 °C / °F
Cod Liver Oil	-	100	-	-	-	-	40/100	-	-
Copper Acetate	-	Sat'd	70/160	80/180	-	70/160	-	105/225	-
Copper Chloride	-	Sat'd	100/210	105/220	120/250	100/210	120/250	120/250	120/250
Copper Cyanide	-	Sat'd	100/210	105/220	100/210	100/210	100/210	-	95/200
Copper Cyanide Plating (See Metal plating)	-	-	-	-	-	-	-	-	-
Copper Matte (See Metal plating)	-	-	-	-	-	-	-	-	-
Copper Nitrate	-	Sat'd	100/210	105/220	105/220	100/210	105/220	-	60/140
Copper Sulfate	-	Sat'd	100/210	105/220	120/250	100/210	120/250	120/250	120/250
Copper Sulfate, ammoniated	21	All	90/195	90/195	90/195	90/195	90/195	-	LS90/LS195
Copper, Metal Plating (See Metal plating)	-	-	-	-	-	-	-	-	-
Corn Oil	-	100	65/150	95/200	100/210	65/150	100/210	-	-
Corn Starch	-	100	100/210	105/220	100/210	100/210	100/210	-	-
Corn Sugar (See Glucose)	-	-	-	-	-	-	-	-	-
Cotton Seed Oil	-	100	65/150	95/200	100/210	65/150	100/210	-	40/100
Cresols, Mixture	-	100	-	-	-	-	-	65/150	-
Cresylic Acid, Fumes	-	100	-	-	-	-	-	-	25/80
Crude Oil (See Oil, Crude)	-	-	-	-	-	-	-	-	-
Cyclohexane	-	100	50/120	65/150	65/150	50/120	65/150	65/150	60/140
Cyclohexane, Vapor (no condensation, no coalescence)	-	-	80/180	80/180	-	80/180	-	-	80/175
Cyclohexanone	-	100	-	-	-	-	-	40/100	-
Cyclooctadiene	-	100	-	-	-	-	-	-	40/100
Detergent, Dishwashing Liquid (biodegradable)	14	100	40/100	40/100	-	40/100	-	-	40/100
Detergents, Germicidal (conc.)	14	-	-	-	-	-	-	40/100	40/100
Detergents, Sulfated	21	1 to 50	100/210	105/220	80/180	100/210	80/180	-	95/200
Detergents, Sulfonated	-	100	100/210	105/220	-	100/210	-	-	90/190
Deionized or Demineralized Water (See Water)	-	-	-	-	-	-	-	-	-
Di (2-Ethylhexyl) Phosphoric Acid (DEHPA) in Kerosene	-	20	50/120	65/150	-	50/120	80/180	-	-
Diallylphthalate	-	100	80/180	100/210	100/210	80/180	100/210	100/210	-
Diammonium Phosphate (See Ammonium Phosphate, Dibasic)	-	-	-	-	-	-	-	-	-
Dibromopropanol (2, 3-)	-	100	NR	NR	-	NR	-	40/105	-
Dibromopropanol (2, 3-)	-	100	NR	NR	-	NR	-	40/105	-
Dibromopropyl Phosphate	-	100	-	-	-	-	-	40/105	-
Dibutyl Ether (-n)	-	100	25/80	50/120	50/120	25/80	50/120	140/285	25/80
Dibutyl Phthalate	-	100	65/150	95/200	95/200	65/150	95/200	95/200	40/100
Dibutyl Sebacate	-	100	100/210	100/210	-	100/210	65/150	-	-
Dichloro-(2)-Propyl Phosphate	-	100	-	-	-	-	-	40/105	-

See pages 50 and 51 for notes

Chemical Environment	Notes	Concen-tration	Temperature (°C and °F) for HETRON Resin						
			922	980	980/35	FR 992	FR 998/35	800	197
		(%)	°C / °F	°C / °F	°C / °F	°C / °F	°C / °F	°C / °F	°C / °F
Dichlorobenzene (o-)	-	100	NR	40/100	-	NR	-	-	LS50/LS120
Dichloroethane (1,2-) (See Ethylene Chloride)	-	-	-	-	-	-	-	-	-
Dichloronitrobenzene (2,4-)	-	100	-	-	-	-	-	110/230	-
Dichlorophenol (DCP)	-	100	NR	-	-	NR	-	60/140	NR
Dichloropropane-dichloropropene mixture	-	-	NR	NR	NR	NR	-	-	NR
Dichloropropene	-	100	NR	NR	NR	NR	NR	-	NR
Dichloropropene-dichloropropane mixture	-	-	NR	NR	NR	NR	-	-	NR
Dichloropropionic Acid (2,2-)	-	100	NR	NR	NR	NR	NR	-	-
Dicoco Dimethyl Ammonium Chloride	21	All	50/120	50/120	-	50/120	-	50/120	50/120
Dicyclopentadiene	-	100	-	-	-	-	-	-	40/100
Diesel Fuel	-	100	80/175	95/200	95/200	80/175	95/200	-	80/175
Diethanolamine (DEA)	-	100	25/80	50/120	50/120	25/80	50/120	65/150	45/110
Diethyl Carbonate	-	100	NR	NR	-	NR	25/80	140/280	-
Diethyl Ketone	-	100	NR	NR	25/80	NR	25/80	100/215	-
Diethyl Sulfate	-	100	NR	40/100	40/100	NR	40/100	-	40/100
Diethylamine	-	100	NR	NR	-	NR	-	105/225	-
Diethylbenzene	-	100	25/80	50/120	65/150	25/80	65/150	65/150	50/120
Diethylene Glycol	-	100	100/210	100/210	100/210	100/210	100/210	105/225	120/250
Diethylene Glycol Monoethyl Ether	-	100	-	-	-	-	-	105/225	-
Diethylene Glycol N-Butyl Ether	-	100	-	30/90	40/100	-	40/100	-	30/90
Diethylenetriamine	2	100	-	-	-	-	-	40/100	NR
Diglycolamine	-	100	NR	-	-	NR	-	LS130/LS270	NR
Diisobutyl Phthalate	-	100	40/100	65/150	65/150	40/100	65/150	-	30/90
Diisobutylene	-	100	30/90	40/100	40/100	30/90	40/100	-	40/100
Diisopropanolamine	-	100	25/80	50/120	50/120	25/80	50/120	-	-
Dimethyl Formamide	-	up to 30	NR	-	-	NR	-	30/90	30/90
Dimethyl Formamide	-	100	NR	NR	NR	NR	NR	LS30/LS90	NR
Dimethyl Morpholine (2,6-)	-	100	NR	40/100	-	NR	25/80	-	LS50/LS120
Dimethyl Phthalate	-	100	50/120	65/150	-	50/120	80/180	105/225	-
Dimethyl Sulfate	-	100	-	-	-	-	-	95/200	-
Dimethylacetamide	-	70	-	-	-	-	-	-	65/150
Dimethylaniline (N,N)	-	100	-	-	-	-	-	105/225	-
Dimethyltin Dichloride	-	50	-	-	-	-	-	25/80	25/80
Dioctyl Phthalate	-	100	50/120	65/150	65/150	50/120	65/150	-	-
Dioxane	-	up to 100	NR	NR	-	NR	-	50/125	-
Diphenyl Oxide	-	100	25/80	50/120	50/120	25/80	50/120	95/200	-
Dipropylene Glycol	-	100	80/180	100/210	100/210	80/180	100/210	-	-

See pages 50 and 51 for notes

Chemical Environment	Notes	Concentration (%)	Temperature (°C and °F) for HETRON Resin 922 °C / °F	980 °C / °F	980/35 °C / °F	FR 992 °C / °F	FR 998/35 °C / °F	800 °C / °F	197 °C / °F
Dipropylene Glycol Dibenzoate	-	100	50/120	50/120	-	50/120	-	50/120	50/120
Disodium Phosphate	21	All	-	-	-	-	-	-	95/200
Dispersant, Anionic (blend)	-	100	-	-	-	-	-	40/100	50/125
Dispersant, Nonionic (blend)	-	100	-	-	-	-	-	-	50/125
Dispersing Agents	-	100	-	-	-	-	-	-	50/125
Divinyl Benzene	-	100	NR	50/120	-	NR	50/120	-	30/90
Dodecane	-	100	25/80	50/120	50/120	25/80	50/120	-	-
Dodecene	-	100	-	-	80/180	-	80/180	-	30/90
Dodecyl Alcohol (Also lauryl alcohol, n-dodecanol)	-	100	65/150	80/180	80/180	65/150	80/180	-	50/120
Dodecylbenzene Sulfonic Acid	-	100	100/210	105/220	-	100/210	95/200	-	-
Epichlorohydrin	-	100	NR	NR	NR	NR	-	-	-
Esters, Fatty Acid	-	100	80/180	80/180	80/180	80/180	80/180	-	50/120
Ethanol (See Ethyl Alcohol)	-	-	-	-	-	-	-	-	-
Ethanolamine	-	100	NR	30/90	25/80	NR	25/80	65/150	30/90
Ethanolamine, Ethylene glycol monobutyl ether (Alkaline Film Stripper)	-	30 / 57	NR	-	-	NR	-	60/140	NR
Ethoxylated Alcohol (pH 8.5, C(12)-C(15))	-	100	-	-	-	-	-	-	50/120
Ethoxylated Nonyl Phenol	-	100	-	-	-	-	-	-	40/100
Ethyl Acetate	-	1	NR	NR	NR	NR	NR	50/125	NR
Ethyl Acetate	-	100	NR	NR	NR	NR	NR	50/125	NR
Ethyl Acetoacetate	-	Sat'd	-	-	-	-	-	-	25/80
Ethyl Acrylate	-	100	NR	NR	NR	NR	NR	25/80	-
Ethyl Alcohol	-	up to 15	65/150	65/150	65/150	65/150	65/150	65/150	-
Ethyl Alcohol	-	50	40/100	65/150	65/150	40/100	65/150	40/100	65/150
Ethyl Alcohol	-	100	NR	40/100	40/100	NR	40/100	40/100	40/100
Ethyl Benzene, Benzene	-	2:3 / 1:3 vol	-	-	-	-	25/80	-	40/100
Ethyl Bromide	-	100	NR	NR	NR	NR	NR	95/200	NR
Ethyl Chloride	-	100	NR	NR	25/80	NR	25/80	105/220	30/90
Ethyl Chloroformate	-	100	-	-	-	-	-	-	25/80
Ethyl Ether	-	100	NR	-	-	NR	NR	30/90	NR
Ethyl Silicate	-	100	-	-	-	-	-	-	40/100
Ethyl Sulfate	-	100	25/80	40/100	40/100	25/80	40/100	105/225	40/100
Ethylamine	-	100	-	-	-	-	-	95/200	-
Ethylbenzene	-	100	NR	40/100	50/120	NR	40/100	-	NR
Ethylene Chloride	-	100	NR	NR	NR	NR	NR	40/100	NR
Ethylene Chlorohydrin	-	100	NR	40/100	40/100	NR	40/100	-	95/200
Ethylene Dibromide	-	100	NR	-	-	NR	NR	30/85	NR

See pages 50 and 51 for notes

Chemical Environment	Notes	Concen-tration	Temperature (°C and °F) for HETRON Resin						
			922	980	980/35	FR 992	FR 998/35	800	197
		(%)	°C / °F	°C / °F	°C / °F	°C / °F	°C / °F	°C / °F	°C / °F
Ethylene Glycol	-	100	100/210	100/210	100/210	100/210	100/210	120/250	120/250
Ethylene Glycol Monobutyl Ether	-	100	40/100	40/100	40/100	40/100	40/100	-	30/90
Ethylene Glycol Monobutyl Ether, Ethanolamine (Alkaline Film Stripper)	-	57 / 30	NR	-	-	NR	-	60/140	NR
Ethylene Oxide	-	100	-	-	-	-	NR	120/250	-
Ethylene Tetrachloride (See Perchloroethylene)	-	-	-	-	-	-	-	-	-
Ethylenediamine	-	100	-	-	-	-	-	40/100	-
Ethylenediaminetetraacetic acid, tetrasodium salt (EDTA)	-	100	25/80	30/90	40/100	25/80	40/100	-	30/90
Ethyl-N,N-di-n-propylthiolcarbamate (herbicide)	15	100	-	-	-	-	-	50/120	50/120
Fatty Acid, Alkanolamide	-	100	-	-	-	-	-	-	40/100
Fatty Acids	-	Sat'd	100/210	105/220	120/250	100/210	120/250	120/250	120/250
Ferric Acetate	-	Sat'd	80/180	80/180	-	80/180	80/180	-	-
Ferric Chloride	-	Sat'd	100/210	100/210	100/210	100/210	100/210	120/250	100/210
Ferric Chloride, Hydrochloric Acid	-	29 / 18.5	80/180	-	-	80/180	-	-	80/180
Ferric Nitrate	-	Sat'd	100/210	105/220	105/220	100/210	105/220	100/210	120/250
Ferric Sulfate	-	Sat'd	100/210	105/220	105/220	100/210	105/220	105/225	95/200
Ferric Sulfate, Ammonium Sulfate	-	20 / 10.5	-	-	-	-	-	-	80/180
Ferrous Chloride	-	Sat'd	100/210	105/220	105/220	100/210	105/220	-	105/220
Ferrous Nitrate	-	Sat'd	100/210	105/220	105/220	100/210	105/220	-	105/220
Ferrous Sulfate	-	Sat'd	100/210	105/220	105/220	100/210	105/220	-	105/220
Fertilizer Solution, Grades N-P-K: 8-8-8	-	100	65/150	65/150	-	65/150	65/150	-	-
Fertilizer Solution, Grades N-P-K:10-34-0	-	100	65/150	65/150	-	65/150	-	-	-
Flue Gas (Dry)	16	-	165/330	175/350	175/350	-	-	-	175/350
Flue Gas (Wet)	-	-	80/180	100/210	100/210	-	-	-	-
Fluoboric Acid	1,2	10	100/210	105/220	105/220	100/210	105/220	-	130/265
Fluoboric Acid	1,2	All	80/180	95/200	95/200	80/180	95/200	95/200	-
Fluorine Gas	1	100	120/250	120/250	-	120/250	25/80	LS130/LS265	-
Fluorosilicic Acid	1	1	65/150	70/160	80/180	65/150	80/180	95/200	80/180
Fluorosilicic Acid	1,2	10	65/150	70/160	80/180	65/150	80/180	95/200	80/180
Fluorosilicic Acid	1,2	25	40/100	40/100	50/120	40/100	50/120	95/200	80/180
Fluorosilicic Acid	1,2	35	40/100	40/100	40/100	40/100	40/100	95/200	70/160
Fluorosilicic Acid	1,2	Sat'd	40/100	40/100	40/100	40/100	40/100	95/200	40/100
Fluorosilicic Acid, Chromic Acid, Sulfuric Acid (concentrations in oz/gal and g/L, chrome plating)	1, 2	0.5/45/0.3 oz/gal or 8/23/338 g/L	-	-	-	-	-	-	45/115
Fly Ash Slurry	-	-	-	-	65/150	-	65/150	-	30/90
Formaldehyde	-	25	65/150	65/150	65/150	65/150	65/150	105/225	95/200
Formaldehyde	-	37	65/150	65/150	65/150	65/150	65/150	105/225	65/150

See pages 50 and 51 for notes

Chemical Environment	Notes	Concentration (%)	Temperature (°C and °F) for HETRON Resin 922 °C / °F	980 °C / °F	980/35 °C / °F	FR 992 °C / °F	FR 998/35 °C / °F	800 °C / °F	197 °C / °F
Formaldehyde	-	44	30/90	30/90	65/150	30/90	65/150	105/225	65/150
Formaldehyde	-	52	30/90	30/90	65/150	30/90	65/150	65/150	65/150
Formamide	-	100	LS40/LS100	LS40/LS100	40/100	LS40/LS100	40/100	LS40/LS100	40/100
Formic Acid	-	Up to 10	80/180	80/180	80/180	80/180	80/180	105/225	95/200
Formic Acid	-	25	50/120	50/120	50/120	50/120	50/120	70/160	60/140
Formic Acid	-	50	50/120	50/120	50/120	50/120	50/120	50/120	40/100
Formic Acid	2	85	-	50/120	50/120	-	50/120	40/100	40/100
Formic Acid	2	100	-	-	40/100	-	40/100	40/100	40/100
Fuel Oil, No.1 (See Kerosene) and No.2 (See Diesel)	-	-	-	-	-	-	-	-	-
Furfural	-	5	50/120	65/150	65/150	50/120	65/150	105/225	30/90
Furfural	-	100	NR	NR	NR	NR	NR	105/225	-
Furfural in organic solvent	4,6	-	-	-	-	-	-	-	-
Furfuryl Alcohol	2	100	-	-	-	-	NR	105/225	40/100
Gallic Acid	-	Sat'd	-	-	-	-	-	120/250	25/80
Gallotannin (See Tannic acid)	-	-	-	-	-	-	-	-	-
Gas oil (See Kerosene)	-	-	-	-	-	-	-	-	-
Gasohol (contact Ashland for a specific recommendation)	6	-	-	-	-	-	-	-	-
Gasoline (contact Ashland for a specific recommendation)	6	-	-	-	-	-	-	-	-
Gluconic Acid	-	50	40/100	50/125	-	40/100	-	-	50/125
Glucose	-	100	100/210	105/220	120/250	100/210	120/250	-	80/180
Glycerin (Also Glycerol)	-	100	100/210	105/220	100/210	100/210	100/210	120/250	95/200
Glycerol Dibromohydrin (See Dibromopropanol)	-	-	-	-	-	-	-	-	-
Glycerol Dichlorohydrin	-	100	-	-	-	-	-	50/125	-
Glycerol Monochlorohydrin	21	All	-	-	-	-	-	50/125	-
Glycolic acid (also Hydroxyacetic Acid)	-	35	80/180	95/200	95/200	80/180	95/200	95/200	60/140
Glycolic acid (also Hydroxyacetic Acid)	-	70	40/100	40/100	40/100	40/100	40/100	95/200	40/100
Glyoxal	-	40	25/80	25/80	-	25/80	40/100	-	-
Glyoxylic Acid (or oxoacetic acid)	-	25	NR	NR	NR	NR	NR	NR	LS100/LS210
Gold Metal Plating (See Metal plating)	-	-	-	-	-	-	-	-	-
Green Liquor (Pulp Mill)	2	-	80/180	80/180	80/180	80/180	80/180	-	NR
Groundnut Oil (See Peanut Oil)	-	-	-	-	-	-	-	-	-
Gypsum slurry (See Calcium sulfate)	-	-	-	-	-	-	-	-	-
Heating Oil (See Diesel)	-	-	-	-	-	-	-	-	-
Heptane, n-	-	100	95/200	95/200	95/200	95/200	95/200	120/250	95/200
Herbicide (Please contact Ashand)	14	-	-	-	-	-	-	-	-
Hexachlorocyclopentadiene	-	100	80/180	80/180	-	80/180	-	95/200	95/200
Hexamethylenetetramine	-	28	-	-	-	-	-	-	25/80

See pages 50 and 51 for notes

Chemical Environment	Notes	Concen-tration	Temperature (°C and °F) for HETRON Resin						
			922	980	980/35	FR 992	FR 998/35	800	197
		(%)	°C / °F	°C / °F	°C / °F	°C / °F	°C / °F	°C / °F	°C / °F
Hexane (n-)	-	100	70/160	70/160	70/160	70/160	70/160	70/160	70/160
Humid Air, Trace Sulfur Fumes	-	-	95/200	95/200	95/200	95/200	-	-	95/200
Hydraulic fluid (Glycols)	14	100	80/180	80/180	80/180	80/180	80/180	-	80/180
Hydrazine	-	10	-	-	-	-	-	-	40/100
Hydrazine	-	70	NR	NR	NR	NR	NR	LS40/LS100	NR
Hydrazine Sulfate	-	Sat'd	-	-	-	-	-	105/225	-
Hydriodic Acid	-	57% Hydrogen iodide	-	-	-	-	-	120/250	-
Hydrobromic Acid	-	1	100/210	105/220	105/220	100/210	105/220	-	95/200
Hydrobromic Acid	-	18	95/200	95/200	95/200	95/200	95/200	-	95/200
Hydrobromic Acid	-	up to 48	70/160	70/160	70/160	70/160	70/160	NR	70/160
Hydrobromic Acid, Fumes (See Hydrogen Bromide)	-	-	-	-	-	-	-	-	-
Hydrochloric Acid (contact Ashland for a specific recommendation for application above 180°F or 80°C)	9, 12,21	up to 5	100/210	105/220	**105/220**	100/210	105/220	110/230	110/230
Hydrochloric Acid (contact Ashland for a specific recommendation for application above 180°F or 80°C)	9,12	10	100/210	105/220	**105/220**	100/210	105/220	110/230	110/230
Hydrochloric Acid (contact Ashland for a specific recommendation for application above 180°F or 80°C)	9,12	15	100/210	105/220	**105/220**	100/210	105/220	110/230	110/230
Hydrochloric Acid (contact Ashland for a specific recommendation for application above 180°F or 80°C)	9,12	20	80/180	95/200	**95/200**	80/180	95/200	80/180	95/200
Hydrochloric Acid (contact Ashland for a specific recommendation for application above 180°F or 80°C)	9,12	25	80/180	80/180	**80/180**	80/180	80/180	65/150	80/180
Hydrochloric Acid (contact Ashland for a specific recommendation for application above 180°F or 80°C)	2,8,9,13	32	65/150	65/150	**65/150**	65/150	65/150	65/150	65/150
Hydrochloric Acid (contact Ashland for a specific recommendation for application above 180°F or 80°C)	2,8,9,13	36	50/125	50/125	**50/125**	50/125	50/125	50/125	50/125
Hydrochloric Acid (contact Ashland for a specific recommendation for application above 180°F or 80°C)	2,8,9,13	37	40/100	40/100	**40/100**	40/100	40/100	NR	40/100
Hydrochloric Acid, Ferric Chloride	9,12	18.5 / 29	80/180	-	-	80/180	-	-	80/180
Hydrochloric acid, Organics	6	-	-	-	-	-	-	-	-
Hydrochloric Acid, Phosphorus Acid	9,12	2 / 70	80/180	80/180	80/180	80/180	80/180	-	80/180
Hydrochloric Acid, Sodium Chloride	9,12	5 / NaCl Sat'd	100/210	100/210	100/210	100/210	100/210	-	-
Hydrochloric Acid, Sulfuric Acid	9,12	14 / 45	-	-	-	-	-	-	60/140
Hydrochloric Acid, Sulfuric Acid (iron and steel cleaning bath)	9,12	9 / 23	95/200	95/200	100/210	95/200	100/210	-	80/180
Hydrochloric Acid, Vapor (See Hydrogen Chloride)	-	-	-	-	-	-	-	-	-
Hydrocyanic Acid	-	Sat'd	65/150	65/150	65/150	65/150	65/150	-	95/200
Hydrofluoric Acid	1,2,19	1	65/150	65/150	65/150	65/150	65/150	NR	65/150

See pages 50 and 51 for notes

In bold: preferred resin

Chemical Environment	Notes	Concen-tration	Temperature (°C and °F) for HETRON Resin						
			922	980	980/35	FR 992	FR 998/35	800	197
		(%)	°C / °F	°C / °F	°C / °F	°C / °F	°C / °F	°C / °F	°C / °F
Hydrofluoric Acid	1,2,19	5	50/120	50/120	50/120	50/120	50/120	NR	50/120
Hydrofluoric Acid	1,2,19	10	40/100	40/100	40/100	40/100	40/100	NR	40/100
Hydrofluoric Acid	1,2,19	15	30/90	30/90	30/90	30/90	30/90	NR	30/90
Hydrofluoric Acid	1,2,19	20	LS25/LS80	LS30/LS90	LS30/LS90	LS25/LS80	LS30/LS90	NR	30/90
Hydrofluoric Acid	6	above 20%. contact technical service	-	-	-	-	-	-	-
Hydrofluoric Acid, Nitric Acid	1, 2	up to 5 / up to 15	-	-	-	-	-	-	75/165
Hydrofluosilicic Acid (See fluosilicic acid)	-	-	-	-	-	-	-	-	-
Hydrogen Bromide, Dry	-	100	80/180	80/180	80/180	80/180	80/180	-	95/200
Hydrogen Bromide, Wet	-	100	80/180	80/180	80/180	80/180	80/180	-	80/180
Hydrogen Chloride Gas, Dry Fumes	6,16	100	100/210	105/220	120/250	100/210	120/250	-	175/350
Hydrogen Chloride Gas, Wet (See also Hydrochloric acid)	-	100	100/210	105/220	105/220	100/210	105/220	-	110/230
Hydrogen Iodide, Iodine, all vapors	-	-	-	-	-	-	-	-	65/150
Hydrogen Peroxide	2,3,6,18	5	65/150	65/150	65/150	65/150	65/150	-	100/210
Hydrogen Peroxide	2,3,6,18	30	40/100	40/100	65/150	40/100	65/150	-	-
Hydrogen Peroxide	2,3,6,18	35	40/100	-	-	40/100	-	NR	40/105
Hydrogen Peroxide	2,3,6,18	50	-	-	-	-	-	NR	25/80
Hydrogen Sulfide (dry gas)	-	100	100/210	100/210	100/210	100/210	100/210	120/250	120/250
Hydrogen Sulfide (sewer gas)	-	-	30/90	30/90	-	30/90	-	30/90	30/90
Hydroxyacetic Acid (See Glycolic acid)	-	-	-	-	-	-	-	-	-
Hypochlorous Acid	2,3	10	65/150	65/150	-	65/150	-	NR	40/105
Hypophosphorous Acid (also phosphinic acid)	-	50	30/90	30/90	30/90	30/90	30/90	45/115	45/115
Incinerator, Flue Gas Fumes	6	-	-	-	-	-	-	-	-
Iodine Vapor	-	100	-	-	-	-	65/150	-	80/175
Iodine, Vapor, Hydrogen Iodide, Vapor	-	-	-	-	-	-	-	-	65/150
Iron Metal Plating (See Metal plating)	-	-	-	-	-	-	-	-	-
Iron perchloride (See ferric chloride)	-	-	-	-	-	-	-	-	-
Isoamyl Alcohol	-	100	40/100	50/120	50/120	40/100	50/120	130/265	-
Isodecanol	-	100	80/180	80/180	80/180	80/180	50/120	80/180	65/150
Isopropyl Alcohol	-	10	25/80	40/100	50/120	25/80	50/120	65/150	70/160
Isopropyl Alcohol	-	100	25/80	40/100	50/120	25/80	50/120	65/150	30/90
Isopropyl Palmitate	-	100	100/210	105/220	-	100/210	110/230	-	-
Itaconic Acid	-	8	50/120	100/210	100/210	50/120	100/210	-	40/100
Jet Fuel (contact Ashland for a specific recommendation)	6	-	-	-	-	-	-	-	-
Kaolin Slurry	-	-	-	-	-	-	-	-	25/80
Kerosene (also Paraffin)	-	100	80/175	80/175	80/180	80/175	80/180	-	80/180
Kerosene, Vapor and Condensate	-	100	-	-	-	-	-	-	50/120

See pages 50 and 51 for notes

Chemical Environment	Notes	Concen-tration	Temperature (°C and °F) for HETRON Resin						
			922	980	980/35	FR 992	FR 998/35	800	197
		(%)	°C / °F	°C / °F	°C / °F	°C / °F	°C / °F	°C / °F	°C / °F
Lactic Acid	-	100	100/210	105/220	100/210	100/210	100/210	105/225	95/200
Latex paint, Acrylic binders	-	100	40/100	40/100	50/120	40/100	50/120	-	-
Latex paint, Dispersion in Water	-	100	40/100	40/100	50/120	40/100	50/120	40/100	40/100
Latex paint, Vinyl binders	-	100	40/100	40/100	50/120	40/100	50/120	-	-
Lauric Acid	-	Sat'd	100/210	105/220	-	100/210	-	-	-
Lauryl Chloride	-	100	-	-	-	-	100/210	-	100/210
Lauryl Mercaptan	-	100	-	-	-	-	65/150	-	50/120
Lauryl Pyridinium Chloride (also LPC)	-	10	-	-	-	-	-	-	70/155
Lead (II) Acetate	-	Sat'd	100/210	105/220	110/230	100/210	110/230	-	70/160
Lead (II) Nitrate	-	Sat'd	100/210	105/220	105/220	100/210	105/220	105/225	-
Lead Metal Plating (See Metal plating)	-	-	-	-	-	-	-	-	-
Levulinic Acid (also 4-oxopentanoic acid)	-	Sat'd	100/210	105/220	105/220	100/210	105/220	105/225	-
Lime Slurry (See Calcium Hydroxide)	-	-	-	-	-	-	-	-	-
Lin Seed Oil	-	100	100/210	105/220	105/220	100/210	105/220	-	95/200
Lithium Bromide	-	100	100/210	105/220	105/220	100/210	105/220	-	80/180
Lithium Chloride	-	up to 45	100/210	105/220	105/220	100/210	105/220	-	120/250
Lithium Chloride	-	Sat'd	100/210	105/220	105/220	100/210	105/220	-	70/160
Lithium Chloride, Methyl Alcohol	-	25 / 75	-	-	-	-	-	-	40/100
Lithium Hydroxide	-	Sat'd	65/150	65/150	-	65/150	80/180	-	NR
Lithium Sulfate	-	100	100/210	105/220	105/220	100/210	105/220	-	95/200
Magnesium Bisulfite (also Sulfurous acid, magnesium salt)	-	100	80/180	80/180	80/180	80/180	80/180	-	80/180
Magnesium Chloride	-	Sat'd	100/210	105/220	120/250	100/210	120/250	105/220	105/220
Magnesium Nitrate	-	Sat'd	70/160	70/160	100/210	70/160	100/210	-	-
Magnesium Sulfate	-	Sat'd	100/210	105/220	120/250	100/210	120/250	120/250	95/200
Maleic Acid	-	5	100/210	105/220	-	100/210	-	-	-
Maleic Acid	-	Sat'd	80/180	80/180	120/250	80/180	120/250	95/200	95/200
Maleic Anhydride	-	100	65/150	65/150	-	65/150	-	-	-
Malic Acid (Also Apple acid)	-	10	-	-	120/250	-	120/250	-	35/95
Manganous chloride	-	Sat'd	-	-	-	-	100/210	105/225	-
Manganous sulfate	-	Sat'd	100/210	105/220	105/220	100/210	105/220	105/225	-
Manganous Sulfate, Ammonium Sulfate, Sulfuric Acid (concentrations in g/l)	-	up to 15 / up to 150 / up to 40	50/125	50/125	50/125	50/125	-	-	50/125
Melamine Resin	-	100	-	-	-	-	-	-	25/80
Mercaptoethanol	-	100	-	-	-	-	-	25/80	25/80
Mercaptopropionic (3-) Acid	-	100	NR	-	-	NR	-	95/200	NR
Mercuric Chloride (also Mercury (II) chloride)	-	Sat'd	100/210	105/220	100/210	100/210	100/210	105/220	100/210
Mercury	-	100	100/210	105/220	-	100/210	120/250	-	120/250

See pages 50 and 51 for notes

Chemical Environment	Notes	Concentration (%)	Temperature (°C and °F) for HETRON Resin 922 °C / °F	980 °C / °F	980/35 °C / °F	FR 992 °C / °F	FR 998/35 °C / °F	800 °C / °F	197 °C / °F
Metal Plating, Brass (3% copper, 1% zinc, 5.6% sodium cyanides, 3% sodium carbonate)	-	-	80/180	80/180	80/180	80/180	80/180	-	80/180
Metal Plating, Bronze (4% copper, 5% sodium cyanides, 3% sodium carbonate, 4.5% rochelle salts)	-	-	80/180	80/180	80/180	80/180	80/180	-	-
Metal Plating, Cadmium Cyanide (3% cadmium oxide, 10% sodium cyanide, 1.2% sodium hydroxide)	-	-	100/210	105/220	-	100/210	-	-	NR
Metal Plating, Chrome (19% chromic acid with sodium fluosilicate and sulfate)	1	-	40/100	40/100	-	40/100	50/120	-	95/200
Metal Plating Copper (45% copper fluoboric Acid, 9% copper sulfate, 8% sulfuric Acid)	1	-	80/180	80/180	80/180	80/180	80/180	-	80/180
Metal Plating, Copper Cyanide(10.5% copper, 14% sodium cyanide, 6% rochelle salts)	-	-	80/180	80/180	80/180	80/180	80/180	-	NR
Metal Plating, Copper Matte (dipping bath, 30% iron chlorate, 19% hydrochloric Acid)	-	-	95/200	95/200	95/200	95/200	-	-	80/180
Metal Plating, Gold (23% potassium ferrocyanide with potassium gold cyanide and sodium cyanide)	-	-	95/200	95/200	95/200	95/200	95/200	-	95/200
Metal Plating, Iron (45% iron chloride, 15% calcium chloride, 20% iron sulfate, 11% ammonia sulfate)	-	-	80/180	80/180	80/180	80/180	80/180	-	80/180
Metal Plating, Lead (acidic process, 8% lead, with fluoboric acid and boric acid)	1	-	95/200	95/200	-	95/200	-	-	95/200
Metal Plating, Lead (alkaline process, 8% lead acetate, 20% sodium hydroxide)	-	-	80/180	80/180	-	80/180	-	-	NR
Metal Plating, Nickel (44% nickel sulfate, 4% ammonium chloride, 4% boric acid)	-	-	95/200	95/200	95/200	95/200	95/200	-	95/200
Metal Plating, Silver (4% silver, 7% potassium cyanide, 5% sodium cyanide, 2% potassium carbonate)	-	-	95/200	95/200	80/180	95/200	80/180	-	NR
Metal Plating, Tin Fluoroborate (18% stannous fluoroborate, 7% tin, 9% fluoroboric acid, 2% boric acid)	1	-	95/200	95/200	100/210	95/200	100/210	-	95/200
Metal plating, Zinc chloride: concentration in oz/gal and g/L, pH 4.8-5.2; Zinc Chloride, Sodium Chloride, Ammonium Chloride	-	18/31/3 oz/gal or (135/233/23 g/L)	-	-	-	-	-	-	30/90
Metal Plating, Zinc Cyanides (9% zinc cyanide, 4% sodium cyanide, 9% sodium hydroxide)	-	180	70/160	70/160	-	70/160	-	-	NR
Metaphosphoric Acid	-	100	-	-	-	-	-	105/225	-
Methacrylic Acid	7	10	-	-	-	-	-	-	40/100
Methacrylic Acid, Glacial	-	100	-	-	-	-	-	-	30/90
Methanamide (See formamide)	-	-	-	-	-	-	-	-	-
Methanesulfonic Acid	-	100	-	-	-	-	-	95/200	-
Methanol (See Methyl Alcohol)	-	-	-	-	-	-	-	-	-
Methyl Acetate	-	100	-	-	-	-	-	55/130	-
Methyl Alcohol	-	up to 100	NR	40/100	40/100	NR	40/100	65/150	40/100

See pages 50 and 51 for notes

Chemical Environment	Notes	Concen-tration	Temperature (°C and °F) for HETRON Resin						
			922	980	980/35	FR 992	FR 998/35	800	197
		(%)	°C / °F	°C / °F	°C / °F	°C / °F	°C / °F	°C / °F	°C / °F
Methyl Alcohol, Lithium Chloride	-	75 / 25	-	-	-	-	-	-	40/100
Methyl Chloride	2	100	NR	NR	NR	NR	NR	NR	4/40
Methyl chloroform (See Trichloroethane(-1,1,1))	-	-	-	-	-	-	-	-	-
Methyl Ethyl Ketone	-	100	NR	NR	NR	NR	NR	65/150	NR
Methyl Isobutyl Ketone	-	100	NR	NR	NR	NR	NR	65/150	NR
Methyl Sulfate (See dimethyl sulfate)	-	-	-	-	-	-	-	-	-
Methylcyclohexanol	-	100	-	-	-	-	-	95/200	-
Methylene Chloride (also Dichloromethane)	-	100	NR	-	NR	NR	NR	LS30/LS90	NR
Methylphenol (See cresol)	-	-	-	-	-	-	-	-	-
Methylstyrene (Alpha- or p-)	-	100	NR	NR	NR	NR	NR	-	NR
Methyl-Tert-Butyl Ether (MTBE)	-	100	-	25/80	-	-	-	25/80	-
Metolachlor	-	100	-	40/100	-	-	-	-	-
Mineral Oil (See Olis, Mineral)	-	-	-	-	-	-	-	-	-
Mineral Spirits	-	100	105/220	105/220	120/250	105/220	120/250	120/250	140/280
Monochlorobenzene (See Chlorobenzene)	-	-	-	-	-	-	-	-	-
Monoethanolamine (See Ethanolamine)	-	-	-	-	-	-	-	-	-
Monohydroxysuccinic Acid (See Malic Acid)	-	-	-	-	-	-	-	-	-
Morpholine	2	10	-	-	-	-	-	65/150	40/100
Motor Oil (Lubricating Oil)	-	100	100/210	105/220	105/220	100/210	105/220	-	-
Muriatic Acid (See Hydrochloric Acid)	-	-	-	-	-	-	-	-	-
Myristic Acid (tetradecanoic acid)	-	100	100/210	105/220	120/250	100/210	120/250	-	-
Naphtha	-	100	80/180	95/200	100/210	80/180	100/210	-	95/200
Naphthalene	-	100	80/180	95/200	100/210	80/180	100/210	100/210	30/90
Naphthalenesulfonic Acid	-	100	-	-	-	-	-	105/225	-
Neopentyl Glycol	-	90	-	-	-	-	-	-	65/150
Nickel Chloride	-	Sat'd	100/210	105/220	105/220	100/210	105/220	105/220	105/220
Nickel Metal Plating (See Metal plating)	-	-	-	-	-	-	-	-	-
Nickel Nitrate	-	Sat'd	100/210	105/220	105/220	100/210	105/220	105/220	105/220
Nickel Sulfate	-	Sat'd	100/210	105/220	100/210	100/210	100/210	110/230	105/220
Nitric Acid	-	1	100/210	105/220	80/180	100/210	80/180	-	-
Nitric Acid	-	5	70/160	70/160	80/180	70/160	80/180	30/90	100/210
Nitric Acid	-	10	50/120	60/140	65/150	50/120	65/150	30/90	95/200
Nitric Acid	-	20	50/120	65/150	65/150	50/120	65/150	NR	60/140
Nitric Acid	2	28	40/100	55/130	65/150	40/100	-	NR	60/140
Nitric Acid	2	35	40/100	50/120	-	40/100	-	NR	60/140
Nitric Acid	2	40	NR	NR	NR	NR	NR	NR	50/120
Nitric Acid	2	50	NR	NR	NR	NR	NR	NR	45/110

See pages 50 and 51 for notes

Chemical Environment	Notes	Concentration (%)	Temperature (°C and °F) for HETRON Resin 922 °C / °F	980 °C / °F	980/35 °C / °F	FR 992 °C / °F	FR 998/35 °C / °F	800 °C / °F	197 °C / °F
Nitric Acid, Copper Salts ((concentration in oz/gal and g/L)	-	2.7/25.6 oz/gal or 20/190 g/L	-	-	-	-	-	-	80/180
Nitric Acid, Hydrofluoric Acid	1, 2	up to 15 / up to 5	-	-	-	-	-	-	75/165
Nitric Acid, Phosphoric Acid	2	4 / 80	-	-	-	-	-	-	95/200
Nitric Acid, Phosphoric Acid, all vapors	2	5 / 95	-	-	-	-	-	-	95/200
Nitric Acid, Sulfuric Acid	2	15 / 15	-	-	-	-	-	-	80/180
Nitric Acid, Sulfuric Acid	2	5 / 20	-	-	-	-	-	-	100/210
Nitrobenzene	-	100	NR	NR	NR	NR	NR	105/225	-
Nitromethane	-	100	-	-	-	-	-	-	30/90
Nitromethane (tris, hydroxymethyl), Traces of Formaldehyde, pH3	-	51	50/120	50/120	-	50/120	-	-	50/120
Nitrophenol	-	100	-	-	-	-	-	105/225	-
Nitrotoluene (4-) Sulfonic Acid (2-)	-	24	-	-	-	-	-	-	95/200
Nitrous Acid	-	10	-	-	-	-	-	-	30/90
Nitrous Acid	6	100	-	-	-	-	-	-	-
Nonanedioic Acid (1,9-) (See Azelaic acid)	-	-	-	-	-	-	-	-	-
Nonyl Phenol (monononyl phenol)	-	100	45/110	45/110	45/110	45/110	-	45/110	45/110
Nonyl(phenoxypoly(ethyleneoxy)ethanol, branched. (also nonoxynol-9)	-	100	-	-	-	-	-	-	40/105
Nuclear Waste applications (contact Ashland Technical Service)	6	-	-	-	-	-	-	-	-
Octanoic Acid	-	100	80/180	95/200	95/200	80/180	100/210	-	60/140
Oil Crude (Heavy, Medium, Light, Sweet and Sour)	-	100	-	100/210	100/210	100/210	100/210	-	100/210
Oil, Lubricating (See Motor Oil)	-	-	-	-	-	-	-	-	-
Oil, Organic (animal, plants). See also the specific oil name like for example Peanut oil	-	100	95/200	95/200	95/200	95/200	95/200	120/250	-
Oil, Transformer	-	100	100/210	100/210	100/210	100/210	100/210	-	105/220
Oils, Mineral (aliphatic)	-	100	95/200	100/210	120/250	95/200	120/250	80/180	105/220
Oleic Acid	-	100	95/200	100/210	100/210	95/200	100/210	105/225	95/200
Oxalic Acid	-	100	100/210	105/220	105/220	100/210	105/220	95/200	105/220
Ozone (gas or dissolved in solution), contact Ashland Technical service	6	-	-	-	-	-	-	-	-
Palmitic Acid (also n-hexadecanoic acid)	-	Sat'd	100/210	105/220	120/250	100/210	120/250	-	-
Paraffin Wax	-	100	-	-	-	-	-	105/220	-
Peanut Oil (also Groundnut Oil)	-	100	80/180	80/180	80/180	80/180	80/180	-	-
Pentachloroethane	-	100	-	-	-	-	-	105/225	-
Peracetic acid	6	-	-	-	-	-	-	-	-
Perchloric Acid	-	5	80/180	80/180	80/180	80/180	80/180	-	30/85
Perchloric Acid	-	10	65/150	65/150	-	65/150	65/150	-	30/85
Perchloric Acid	-	30	25/80	25/80	-	25/80	40/100	-	30/85

See pages 50 and 51 for notes

Chemical Environment	Notes	Concentration (%)	Temperature (°C and °F) for HETRON Resin 922 °C / °F	980 °C / °F	980/35 °C / °F	FR 992 °C / °F	FR 998/35 °C / °F	800 °C / °F	197 °C / °F
Perchloric Acid	-	70	-	-	-	-	-	-	30/85
Perchloroethylene	-	100	25/80	40/100	40/100	25/80	40/100	120/250	40/100
Petroleum (See Oil, Crude)	-	-	-	-	-	-	-	-	-
Petroleum Ether (See specific alkane hydrocarbon, like for example: Hexane)	-	-	-	-	-	-	-	-	-
Phenol (also called carbolic acid)	2	2	25/80	40/100	40/100	25/80	40/100	80/180	80/180
Phenol	2	5	NR	25/80	25/80	NR	25/80	80/180	80/180
Phenol	2	10	-	-	-	-	-	80/180	40/100
Phenol	2	15	NR	NR	NR	NR	NR	50/120	LS30/LS90
Phenol	2	85	NR	-	-	NR	-	30/90	NR
Phenol	2	100	NR	NR	NR	NR	NR	30/90	NR
Phenolsulfonic Acid	-	Sat'd	NR	NR	NR	NR	-	105/220	45/110
Phenyl Carbinol (See Benzyl alcohol)	-	100	-	-	-	-	-	50/120	-
Phosphoric Acid	-	85	100/210	105/220	100/210	100/210	100/210	120/250	120/250
Phosphoric Acid	-	100	100/210	105/220	100/210	100/210	100/210	-	120/250
Phosphoric Acid (with phosphoric anhydride 76% P2O5)	-	105	100/210	105/220	100/210	100/210	100/210	-	120/250
Phosphoric Acid, Hydrochloric Acid (saturated with chlorine)	-	15 / 9	-	-	100/210	-	100/210	-	105/220
Phosphoric Acid, Nitric Acid	2	80 / 4	-	-	-	-	-	-	95/200
Phosphoric Acid, Nitric Acid, all vapors	-	95 / 5	-	-	-	-	-	-	95/200
Phosphoric Acid, Polyvinyl Alcohol	-	8 / 92	-	-	-	-	-	-	30/90
Phosphoric Acid, Sulfuric Acid	-	20 / 10	-	-	-	-	-	-	70/160
Phosphoric Acid, Vapor, Nitric Acid, Vapor	-	95 / 5	-	-	-	-	-	-	95/200
Phosphorous Acid, ortho-	-	70	40/100	40/100	40/100	40/100	40/100	-	-
Phosphorus Acid (conc.)	-	-	-	-	-	-	-	105/225	-
Phosphorus Acid, Hydrochloric Acid	-	70 / 2	80/180	80/180	80/180	80/180	80/180	-	80/180
Phosphorus Oxychloride	15	100	NR	NR	NR	NR	NR	NR	25/80
Phosphorus Sesquisulfide	-	100	-	-	-	-	-	-	70/160
Phosphorus Trichloride	15	100	NR	NR	NR	NR	NR	40/100	NR
Phthalic Acid	-	100	100/210	105/220	100/210	100/210	100/210	105/225	-
Phthalic Anhydride	-	Sat'd	100/210	105/220	-	100/210	-	-	40/100
Picric Acid	-	Sat'd	-	-	-	-	-	75/165	-
Polyacrylamide (pH 12)	-	40	-	-	-	-	-	-	NR
Polyelectrolytes, Anionic	-	100	55/130	55/130	55/130	55/130	55/130	-	55/130
Polyethylene glycols and methoxypolyethylene glycols	-	100	40/100	50/120	-	40/100	-	-	-
Polyvinyl Acetate Emulsion	-	-	100/210	100/210	-	100/210	-	-	40/100
Polyvinyl Alcohol	-	10	80/180	80/180	80/180	80/180	80/180	-	-
Polyvinyl Alcohol	-	100	50/120	50/120	50/120	50/120	50/120	-	25/80

See pages 50 and 51 for notes

Chemical Environment	Notes	Concen-tration	Temperature (°C and °F) for HETRON Resin						
			922	980	980/35	FR 992	FR 998/35	800	197
		(%)	°C / °F	°C / °F	°C / °F	°C / °F	°C / °F	°C / °F	°C / °F
Polyvinyl Alcohol, Phosphoric Acid	-	92 / 8	-	-	-	-	-	-	30/90
Polyvinyl Chloride (PVC) Latex (with 35 parts DOP (Dioctyl phthalate, plasticizer))	6	-	50/120	50/120	50/120	50/120	50/120	-	45/110
Polyvinylidiene Chloride (PVDC) Latex	6	-	-	-	-	-	-	-	-
Potassium Aluminum Sulfate	-	Sat'd	100/210	105/220	105/220	100/210	105/220	-	80/180
Potassium Bicarbonate	-	10	70/160	70/160	65/150	70/160	65/150	-	30/90
Potassium Bicarbonate	-	Sat'd	70/160	70/160	-	70/160	-	-	-
Potassium Bromate	-	10% in hot water	-	-	-	-	-	65/150	-
Potassium Bromide	-	Sat'd	70/160	70/160	70/160	70/160	70/160	95/200	-
Potassium Carbonate	-	10	**80/180**	80/180	80/180	80/180	80/180	95/200	45/110
Potassium Carbonate	-	25	**80/180**	80/180	80/180	80/180	80/180	95/200	45/110
Potassium Carbonate	-	Sat'd	**30/90**	30/90	-	30/90	-	95/200	45/110
Potassium Chloride	-	100	100/210	105/220	100/210	100/210	100/210	120/250	120/250
Potassium Cyanide	-	Sat'd	-	-	-	-	-	25/80	-
Potassium Dichromate	-	100	100/210	105/220	-	100/210	100/210	-	95/200
Potassium Ferricyanide	-	Sat'd	100/210	105/220	100/210	100/210	100/210	80/180	-
Potassium Ferrocyanide	-	Sat'd	100/210	105/220	100/210	100/210	100/210	95/200	95/200
Potassium Fluoride	1	Sat'd	65/150	65/150	-	65/150	-	-	65/150
Potassium Hydroxide	2	10	**65/150**	65/150	NR	65/150	NR	65/150	NR
Potassium Hydroxide	2	25	**65/150**	65/150	NR	65/150	NR	65/150	NR
Potassium Hydroxide	2	45	**65/150**	65/150	NR	65/150	NR	65/150	NR
Potassium Hydroxide	2	50	**65/150**	65/150	NR	65/150	NR	65/150	NR
Potassium Nitrate	-	100	100/210	105/220	105/220	100/210	105/220	120/250	105/220
Potassium Oxalate	-	Sat'd	-	-	-	-	-	105/225	-
Potassium Permanganate	-	100	100/210	105/220	105/220	100/210	105/220	-	65/150
Potassium Persulfate	-	100	100/210	105/220	100/210	100/210	100/210	105/225	30/90
Potassium Pyrophosphate	-	100	40/100	40/100	65/150	40/100	65/150	-	50/125
Potassium Sulfate	-	100	100/210	105/220	100/210	100/210	100/210	120/250	105/220
Propenoic Acid (See acrylic acid)	-	-	-	-	-	-	-	-	-
Propionic Acid	-	20	95/200	95/200	95/200	95/200	95/200	-	-
Propionic Acid	-	50	80/180	80/180	80/180	80/180	80/180	-	25/80
Propionic Acid	-	100	NR	-	-	NR	25/80	40/100	NR
Propylene dichloride	-	100	NR	NR	NR	NR	NR	-	NR
Propylene Glycol	-	100	100/210	105/220	100/210	100/210	100/210	-	80/180
Pulp Stock (chlorinated, pH 4.5)	6	-	-	-	-	-	-	-	90/190
Pulp Stock, Fumes	6	-	-	-	-	-	-	-	-
Pulp, Bleached	6	-	-	-	-	-	-	-	90/190

See pages 50 and 51 for notes

In bold: preferred resin

Chemical Environment	Notes	Concen-tration	Temperature (°C and °F) for HETRON Resin						
			922	980	980/35	FR 992	FR 998/35	800	197
		(%)	°C / °F	°C / °F	°C / °F	°C / °F	°C / °F	°C / °F	°C / °F
Quaternary Ammonium Salts	21	All	80/180	80/180	80/180	80/180	80/180	-	80/180
Red Liquor (ammonium bisulfite based)	-	-	65/150	75/165	80/180	65/150	80/180	-	65/150
Resorcinol	-	100	-	-	-	-	-	120/250	-
Salicylic Acid	-	Sat'd	70/160	70/160	-	70/160	60/140	120/250	-
Sea Water	-	100	100/210	100/210	95/200	100/210	95/200	-	80/180
Selenious Acid	21	All	100/210	100/210	50/120	100/210	50/120	-	-
Sewage Gas, Hydrogen Sulfide (See Hydrogen sulfide)	-	-	-	-	-	-	-	-	-
Silicone Tetrachloride	-	100	-	-	-	-	-	60/140	-
Silver Cyanide	-	100	100/210	100/210	-	100/210	-	-	-
Silver Nitrate	21	All	100/210	100/210	100/210	100/210	100/210	-	105/220
Silver, Metal Plating (See Metal plating)	-	-	-	-	-	-	-	-	-
Sodium Acetate	-	100	100/210	105/220	100/210	100/210	100/210	105/225	95/200
Sodium Acid Sulfite (See Sodium bisulfite)	-	-	-	-	-	-	-	-	-
Sodium Alkyl Xanthate	21	All	65/150	65/150	-	65/150	-	-	-
Sodium alpha-Olefin Sulfonate	21	All	-	-	-	-	-	-	50/120
Sodium Aluminate	-	Sat'd	**70/160**	70/160	-	70/160	-	65/150	NR
Sodium Ammonium Phosphate	21	All	-	-	-	-	-	-	95/200
Sodium Arsenite	-	50	-	-	-	-	-	-	55/130
Sodium Benzoate	-	Sat'd	100/210	105/220	-	100/210	-	100/210	80/175
Sodium Bicarbonate	-	10	80/180	80/180	80/180	80/180	80/180	105/225	60/140
Sodium Bicarbonate	-	Sat'd	70/160	70/160	80/180	70/160	80/180	105/225	60/140
Sodium Bichromate (See sodium dichromate)	-	-	-	-	-	-	-	-	-
Sodium Bichromate (See sodium dichromate)	-	-	-	-	-	-	-	-	-
Sodium Biphosphate (pH 1-3)	-	10	-	-	-	-	-	-	95/200
Sodium Bisulfate	-	100	100/210	105/220	100/210	100/210	100/210	105/225	95/200
Sodium bisulfide (See sodium hydrosulfide)	-	-	-	-	-	-	-	-	-
Sodium Bisulfite	-	Sat'd	100/210	105/220	105/220	100/210	105/220	105/225	95/200
Sodium Borate	-	Sat'd	100/210	105/220	105/220	100/210	105/220	60/140	75/170
Sodium Bromate	-	20	-	-	-	-	-	65/150	-
Sodium Bromide	-	100	100/210	105/220	105/220	100/210	105/220	-	120/250
Sodium Carbonate	-	10	**80/180**	80/180	80/180	80/180	80/180	70/160	70/160
Sodium Carbonate	-	Sat'd	**70/160**	70/160	80/180	70/160	80/180	70/160	30/90
Sodium Chlorate, stable	-	Sat'd	100/210	105/220	105/220	100/210	105/220	-	95/200
Sodium Chlorate, Sodium Chloride	-	34 / 20	100/210	100/210	100/210	-	100/210	-	80/180
Sodium Chloride	-	Sat'd	100/210	105/220	105/220	100/210	105/220	120/250	105/220
Sodium Chloride with saturated chlorine, 2.5 <pH < 9. See Chlorinated brine.	-	-	-	-	-	-	-	-	-

See pages 50 and 51 for notes

In bold: preferred resin

Chemical Environment	Notes	Concentration (%)	Temperature (°C and °F) for HETRON Resin 922 °C / °F	980 °C / °F	980/35 °C / °F	FR 992 °C / °F	FR 998/35 °C / °F	800 °C / °F	197 °C / °F
Sodium Chloride with saturated chlorine, pH <2.5 See Chlorinated brine	-	-	-	-	-	-	-	-	-
Sodium Chloride with saturated chlorine, pH > 9. See Chlorinated brine	-	-	-	-	-	-	-	-	-
Sodium Chloride, Hydrochloric Acid	2	NaCl Sat'd / 5	100/210	100/210	100/210	100/210	100/210	-	-
Sodium Chlorite, (pH<6) (See Chlorine Dioxide)	-	-	-	-	-	-	-	-	-
Sodium Chlorite, stable (pH>6).	5	2	100/210	105/220	105/220	100/210	105/220	-	100/210
Sodium Chlorite, stable.	5	25	100/210	105/220	105/220	100/210	105/220	-	80/175
Sodium Chlorite, stable.	5	Sat'd	100/210	105/220	-	100/210	-	-	65/150
Sodium Chromate	-	Sat'd	100/210	105/220	105/220	100/210	105/220	-	80/180
Sodium Cumenesulfonate	-	43	-	-	-	-	-	-	50/120
Sodium Cyanide	21	All	100/210	-	-	100/210	100/210	105/220	-
Sodium Dichromate	-	Sat'd	100/210	100/210	100/210	100/210	100/210	-	-
Sodium Dichromate, Acetic Acid	-	30 / 70	-	-	-	-	-	-	LS65/LS 150
Sodium Dichromate, Sulfuric Acid	-	up to 3 / up to 30	NR	-	-	NR	-	NR	70/160
Sodium diphosphate (See Tetrasodium pyrophosphate)	-	-	-	-	-	-	-	-	-
Sodium Dodecylbenzenesulfonate (pH 8)	-	40	-	-	-	-	-	-	50/120
Sodium Ferricyanide	-	Sat'd	100/210	105/220	-	100/210	-	-	120/250
Sodium Ferrocyanide	-	Sat'd	100/210	105/220	-	100/210	-	-	80/180
Sodium Fluoride	1	100	80/180	80/180	80/180	80/180	80/180	-	-
Sodium Fluorosilicate	1	100	65/150	65/150	-	65/150	-	-	-
Sodium Hexametaphosphate	-	Sat'd	65/150	65/150	65/150	65/150	65/150	65/150	65/150
Sodium Hydrosulfide	-	15	60/140	60/140	60/140	60/140	60/140	60/140	70/160
Sodium Hydrosulfide	-	45	60/140	60/140	60/140	60/140	60/140	60/140	70/160
Sodium Hydrosulfide	-	65	60/140	60/140	-	60/140	-	60/140	70/160
Sodium Hydrosulfide, Sodium Hydroxide	-	15 / 15	60/140	60/140	-	60/140	-	60/140	-
Sodium Hydroxide	2,7,20, 21	0.5	**80/180**	80/180	80/180	80/180	80/180	80/180	NR
Sodium Hydroxide	2,7,20	1	**80/180**	80/180	70/160	80/180	70/160	80/180	NR
Sodium Hydroxide	2,20	5	**70/160**	70/160	-	70/160	-	70/160	NR
Sodium Hydroxide	2,20	10	**65/150**	60/140	-	70/160	-	70/160	NR
Sodium Hydroxide	2,20	25	**65/150**	50/120	-	65/150	-	65/150	NR
Sodium Hydroxide	2,20	50	**80/180**	65/150	-	80/180	-	80/180	NR
Sodium Hydroxide, Sodium Hydrosulfide	-	15 / 15	60/140	60/140	-	60/140	-	60/140	-
Sodium Hypochlorite (stable, alkaline pH above 11)	2,3,17	2	65/150	65/150	50/120	**65/150**	50/120	NR	50/125
Sodium Hypochlorite (stable, alkaline pH above 11)	2,3,17	5.25	65/150	65/150	50/120	**65/150**	50/120	NR	50/125
Sodium Hypochlorite Vapors (concentration above 5.25%)	2,3,17	-	65/150	65/150	-	**65/150**	-	-	-
Sodium Hypochlorite(stable, alkaline pH above 11)	2,3,17	10	65/150	65/150	50/120	**65/150**	50/120	NR	50/120

See pages 50 and 51 for notes

In bold: preferred resin

Chemical Environment	Notes	Concen-tration	Temperature (°C and °F) for HETRON Resin						
			922	980	980/35	FR 992	FR 998/35	800	197
		(%)	°C / °F	°C / °F	°C / °F	°C / °F	°C / °F	°C / °F	°C / °F
Sodium Hypochlorite(stable, alkaline pH above 11)	2,3,17	15	65/150	65/150	NR	**65/150**	NR	NR	45/110
Sodium Lauryl Sulfate	-	100	80/180	80/180	70/160	80/180	70/160	-	40/100
Sodium Methacrylate (pH 10-10.5)	-	25	-	-	-	-	-	-	80/180
Sodium Monophosphate	-	Sat'd	100/210	105/220	100/210	100/210	100/210	-	-
Sodium Nitrate	-	Sat'd	100/210	105/220	100/210	100/210	100/210	-	120/250
Sodium Nitrite	-	Sat'd	100/210	105/220	-	100/210	-	-	80/180
Sodium Oxalate	-	Sat'd	-	-	-	-	-	105/225	-
Sodium Persulfate	-	20	50/120	50/120	-	50/120	-	-	-
Sodium Polyacrylate (pH 9-10.5)	-	25	65/150	65/150	80/180	65/150	80/180	-	80/180
Sodium Silicate	1	6	100/210	105/220	100/210	100/210	100/210	70/160	70/160
Sodium Sulfate	-	Sat'd	100/210	105/220	100/210	100/210	100/210	120/250	105/220
Sodium Sulfhydrate (See sodium hydrosulfide)	-	-	-	-	-	-	-	-	-
Sodium Sulfhydrate (See sodium hydrosulfide)	-	-	-	-	-	-	-	-	-
Sodium Sulfide	-	10	100/210	105/220	100/210	100/210	-	105/220	60/140
Sodium Sulfide	-	Sat'd	100/210	105/220	-	100/210	-	105/220	NR
Sodium Sulfite	-	100	100/210	105/220	100/210	100/210	100/210	-	105/220
Sodium Sulfite (All) / Bisulfite (Sat'd)	-	50 / 50 vol	-	-	-	-	-	-	65/150
Sodium Tartrate	-	Sat'd	-	-	-	-	-	105/225	-
Sodium Tetraborate (See Sodium borate)	-	-	-	-	-	-	-	-	-
Sodium Tetrachlorophenate	-	13	-	-	-	-	-	-	30/90
Sodium Thiocyanate	-	100	95/200	95/200	95/200	95/200	95/200	-	-
Sodium Thiosulfate	-	100	50/120	50/120	80/180	50/120	80/180	105/220	-
Sodium Tridecylbenzene Sulfonate	21	All	50/120	50/120	-	50/120	-	-	50/120
Sodium Tripolyphosphate	-	Sat'd	100/210	100/210	100/210	100/210	100/210	-	50/125
Sodium Xylene Sulfonate	-	40	100/210	105/220	-	100/210	-	-	65/150
Sodium Xylene Sulfonate, Sodium Sulfate	-	40 / 2	-	-	-	-	-	-	65/150
Soil	-	-	30/90	30/90	-	30/90	-	-	30/90
Sorbitol	21	All	65/150	65/150	65/150	65/150	65/150	-	-
Soybean Oil	-	100	80/180	80/180	100/210	80/180	100/210	-	-
Soybean Oil, epoxidized, also called ESO.	-	100	50/120	65/150	100/210	50/120	65/150	-	50/125
Stannic Chloride	-	100	80/180	80/180	80/180	80/180	80/180	105/225	80/180
Stannous Chloride	-	100	100/210	100/210	100/210	100/210	100/210	-	120/250
Starch	-	100	-	-	-	-	-	-	80/180
Steam	-	-	100/210	105/220	105/220	100/210	105/220	-	105/220
Stearic Acid	-	100	100/210	105/220	100/210	100/210	100/210	120/250	120/250
Styrene	-	100	NR	25/80	25/80	NR	25/80	-	NR
Succinonitrile	-	100	40/100	40/100	40/100	40/100	40/100	-	-

See pages 50 and 51 for notes

In bold: preferred resin

Chemical Environment	Notes	Concen-tration	Temperature (°C and °F) for HETRON Resin						
			922	980	980/35	FR 992	FR 998/35	800	197
		(%)	°C / °F	°C / °F	°C / °F	°C / °F	°C / °F	°C / °F	°C / °F
Sugar Beet, Liquor	-	100	80/180	80/180	80/180	80/180	80/180	-	-
Sugar Cane, Liquor	-	100	80/180	80/180	80/180	80/180	80/180	-	-
Sulfamic Acid	-	15	100/210	100/210	100/210	100/210	100/210	-	70/160
Sulfanilic Acid	-	100	100/210	100/210	100/210	100/210	100/210	-	-
Sulfide Anolyte, Nickel Sulfate, Nickel Chloride (pH 1.5)	-	-	-	-	-	-	-	-	75/170
Sulfite Liquors	-	-	100/210	105/220	105/220	100/210	105/220	-	70/160
Sulfophtalic Acid (4-)	-	25	-	-	-	-	-	-	50/120
Sulfophthalic Acid (4-), Sulfuric Acid	-	50 / 1.6	-	-	-	-	-	-	30/90
Sulfur Chloride	-	100	NR	NR	NR	NR	NR	105/225	NR
Sulfur Chloride, Vapors	-	-	NR	-	-	NR	-	-	-
Sulfur Dichloride	-	100	-	-	-	-	-	40/100	NR
Sulfur Dichloride, Vapors	-	-	NR	NR	NR	NR	NR	25/80	-
Sulfur Dioxide (dry or wet)	-	100	100/210	120/250	120/250	100/210	120/250	120/250	120/250
Sulfur Trioxide, Dry gas	6	100	100/210	105/220	-	100/210	-	-	30/90
Sulfur Trioxide, wet (See sulfuric acid)	6	-	-	-	-	-	-	-	-
Sulfur, Molten (traces of hydrogen sulfide, sulfur dioxide, sulfur trioxide and water)	-	100	NR	-	-	NR	-	125/260	125/260
Sulfur, Molten, Vapors	-	100	-	-	-	-	-	-	150/300
Sulfuric Acid	-	Up to 5	100/210	105/220	105/220	100/210	105/220	100/210	105/220
Sulfuric Acid	-	25	100/210	105/220	105/220	100/210	105/220	100/210	105/220
Sulfuric Acid	-	50	95/200	95/200	95/200	95/200	95/200	95/200	95/200
Sulfuric Acid	15	70	80/180	80/180	80/180	80/180	80/180	90/190	90/190
Sulfuric Acid	2,15	75	40/100	50/120	50/120	40/100	50/120	65/150	80/175
Sulfuric Acid	2,15	80	NR	NR	NR	NR	NR	40/100	65/150
Sulfuric Acid Vapor (See Sulfuric acid)	-	-	-	-	-	-	-	-	-
Sulfuric Acid, 4-Sulfo-phthalic Acid	-	1.6 / 50	-	-	-	-	-	-	30/90
Sulfuric Acid, Ammonium Sulfate, Manganous Sulfate (concentrations in g/l)	-	up to 40 / up to 150 / up to 15	50/125	50/125	50/125	50/125	-	-	50/125
Sulfuric Acid, Benzenesulfonic Acid, balance water	-	7 / 88	60/140	60/140	-	60/140	-	60/140	60/140
Sulfuric Acid, Chromic Acid	2	16 / 12.5	-	-	-	-	-	-	70/160
Sulfuric Acid, Chromic Acid	2	20 / 20	NR	-	-	NR	-	-	60/140
Sulfuric Acid, Chromic Acid	2	32 / 20	-	-	-	-	-	-	30/90
Sulfuric acid, copper salts (See sulfuric acid)		-	-	-	-	-	-	-	-
Sulfuric Acid, Hydrochloric Acid (iron and steel cleaning bath)	2,9,12	23 / 9	95/200	95/200	100/210	95/200	100/210	-	80/180
Sulfuric Acid, Hydrochloric Acid	2,9,12	45 / 14	-	-	-	-	-	-	60/140
Sulfuric Acid, Nitric Acid	2	20 / 5	-	-	-	-	-	-	100/210
Sulfuric Acid, Phosphoric Acid		10 / 20	-	-	-	-	-	-	70/160
Sulfurous Acid	-	10	40/100	40/100	40/100	40/100	40/100	95/200	65/150

See pages 50 and 51 for notes

Chemical Environment	Notes	Concen-tration	Temperature (°C and °F) for HETRON Resin						
			922	980	980/35	FR 992	FR 998/35	800	197
		(%)	°C / °F	°C / °F	°C / °F	°C / °F	°C / °F	°C / °F	°C / °F
Surfactant (please check under the chemical name).	6,14	-	-	-	-	-	-	-	-
Tall Oil	6	-	65/150	65/150	65/150	65/150	65/150	-	95/200
Tannic Acid	-	Sat'd	100/210	100/210	-	100/210	-	-	120/250
Tar Camphor (See naphtalene)	-	-	-	-	-	-	-	-	-
Tartaric Acid	-	Sat'd	100/210	100/210	100/210	100/210	100/210	120/250	120/250
Tetrachloroethylene (See Perchloroethylene)	-	-	-	-	-	-	-	-	-
Tetrachloropyridine	-	100	50/120	50/120	-	50/120	-	-	50/120
Tetrahydrofuran THF	-	100	-	-	-	-	-	40/100	-
Tetrahydrofuryl Alcohol	-	100	-	-	-	-	-	105/225	-
Tetrakis (Hydroxymethyl) Phosphonium Chloride	-	100	-	-	-	-	-	-	75/170
Tetrapotassium Pyrophosphate (See potassium pyrophosphate)	-	-	-	-	-	-	-	-	-
Tetrasodium Ethylenediamine Tetracetate (See Ethylenediaminetetraacetic acid, tetrasodium salt, CAS Number 64-02-8)	-	-	-	-	-	-	-	-	-
Tetrasodium Pyrophosphate	-	5	65/150	65/150	-	65/150	-	-	50/125
Tetrasodium Pyrophosphate	-	Sat'd	40/100	40/100	-	40/100	-	-	-
Thioglycolic Acid	-	10	40/100	40/100	-	40/100	-	-	-
Thionyl Chloride, Vapor	-	100	-	-	-	-	-	-	65/150
Tin Fluoborate Plating Bath; 18% Stannous Fluoborate; 7% Tin; 9% Fluoboric Acid; 2% Boric Acid	1	-	95/200	95/200	100/210	95/200	100/210	-	95/200
Titanium Chloride or titanium tetrachloride	-	Sat'd	-	-	-	-	-	105/225	-
Titanium Sulfate	-	Sat'd	-	-	-	-	-	105/225	25/80
Tobias Acid	-	100	100/210	100/210	100/210	100/210	-	-	-
Toluene	-	100	NR	50/120	40/100	NR	50/120	105/225	30/90
Toluene Diisocyanate	2	100	25/80	25/80	-	25/80	-	-	65/150
Toluene, Acetone	2	50 / 50	NR	NR	NR	NR	-	30/90	-
Toluene, Xylene	-	90 / 10 vol	-	-	-	-	-	50/120	30/90
Toluenesulfonic Acid, solid.	-	100	100/210	100/210	100/210	100/210	100/210	105/220	-
Toluenesulfonic Acid, solution.	-	65	100/210	100/210	100/210	100/210	-	40/100	40/100
Tributyl Phosphate	-	100	-	65/150	65/150	-	65/150	-	-
Trichloroacetic Acid	-	50	100/210	100/210	100/210	100/210	100/210	-	95/200
Trichloroacetonitrile, Trace Acetonitrile and HCl	-	100	-	-	-	-	-	30/85	30/85
Trichlorobenzene	-	100	NR	-	-	NR	-	105/225	NR
Trichloroethane (1,1,1-) (or methyl chloroform)	-	100	-	25/80	25/80	-	-	50/120	25/80
Trichloroethane (1,1,2-) (or vinyl trichloride)	-	100	-	25/80	25/80	-	-	50/120	25/80
Trichloroethylene	15	100	NR	NR	NR	NR	-	80/180	NR
Tricresyl Phosphate	-	100	25/80	50/120	50/120	25/80	50/120	70/160	-

See pages 50 and 51 for notes

Chemical Environment	Notes	Concen-tration	Temperature (°C and °F) for HETRON Resin						
			922	980	980/35	FR 992	FR 998/35	800	197
		(%)	°C / °F	°C / °F	°C / °F	°C / °F	°C / °F	°C / °F	°C / °F
Triethanolamine	-	100	65/150	65/150	65/150	65/150	65/150	-	-
Triethylamine	-	100	65/150	65/150	50/120	65/150	50/120	65/150	-
Triethylene Glycol	-	100	-	-	-	-	-	-	80/180
Trihydroxybenzoic Acid (See Gallic Acid)	-	-	-	-	-	-	-	-	-
Trimethyl Borate in Methyl Alcohol	2	98	-	-	-	-	-	-	65/150
Trimethyl Carbinol (See Butyl Alcohol)		-	-	-	-	-	-	-	-
Trimethylamine Hydrochloride (pH 3-4)	-	100	55/130	55/130	-	55/130	-	-	55/130
Triphenyl Phosphite	-	100	40/100	40/100	40/100	40/100	40/100	-	50/120
Trisodium Phosphate	21	All	100/210	80/180	80/180	80/180	80/180	-	30/90
Turpentine, Crude Sulfate	-	100	40/100	40/100	-	40/100	-	NR	LS40/LS100
Turpentine, Pure Gum	-	100	30/90	40/100	80/180	30/90	-	-	50/120
Uranium, Contact Technical service.	6	-	-	-	-	-	-	-	-
Urea	21	up to 50	80/180	80/180	80/180	80/180	80/180	70/160	60/140
Urea, Ammonium Nitrate, Water (fertilizer)	-	up to 40 / up to 45 / balance	50/120	-	-	50/120	-	-	30/90
Urea-Formaldehyde Resin	-	100	-	-	-	-	-	-	25/80
Urotropine (See Hexamethylenetetramine)	-	-	-	-	-	-	-	-	-
Vinegar (contains up to 4 - 8% of acetic acid, See Acetic Acid)	-	-	-	-	-	-	-	-	-
Vinyl Toluene (also Methyl Styrene)	-	100	NR	25/80	25/80	NR	25/80	-	25/80
Vinylidene Chloride, Acrylic Acid Dispersion	-	2 / 98	-	-	-	-	-	-	30/90
Water, cooling tower, please contact Technical service.	6	-	-	-	-	-	-	-	-
Water, Deionized	2, 6, 22	100	80/180	95/200	80/180	80/180	80/180	-	80/180
Water, Distilled or demineralized	2, 22	100	80/180	95/200	80/180	80/180	80/180	-	80/180
Water, Steam Condensate (See Water, distilled or demineralized)	-	-	-	-	-	-	-	-	-
Water, Tap, hard	2, 22	100	80/180	105/220	105/220	80/180	105/220	-	80/180
Water, Tap, soft	2, 22	100	80/180	95/200	80/180	80/180	80/180	-	80/180
Water, Urea, Ammonium Nitrate, (fertilizer)	-	up to 40 / up to 30 / balance	50/120	-	-	50/120	-	-	50/120
White Liquor (Pulp Mill)	2	-	65/150	65/150	80/180	65/150	80/180	-	-
White Spirit (See Mineral Spirit)	-	-	-	-	-	-	-	-	-
Xylene	-	100	NR	50/120	40/100	NR	-	105/225	40/100
Xylene, Amyl Acetate	-	70 / 30	-	50/120	-	-	-	50/120	NR
Zinc Chloride	-	Sat'd	100/210	100/210	100/210	100/210	100/210	-	130/265
Zinc Fluoborate	1	50	100/210	100/210	100/210	100/210	100/210	-	-
Zinc Hydrosulfite		Sat'd	-	-	-	-	-	-	70/160
Zinc Nitrate	-	Sat'd	100/210	100/210	100/210	100/210	100/210	-	80/180
Zinc Phosphate	-	100	-	-	-	-	-	-	95/200

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		(%)	°C / °F	°C / °F	°C / °F	°C / °F	°C / °F	°C / °F	°C / °F
Zinc Sulfate	-	100	100/210	100/210	100/210	100/210	-	120/250	120/250
Zinc Sulfite	-	100	80/180	80/180	80/180	80/180	80/180	-	-
Zinc, Metal plating (See Metal plating)	-	-	-	-	-	-	-	-	-

Concentration chart		
ppm	=	%
10,000		1.0
1,000		0.1
100		0.01

Baumé concentration chart at 25°C, 77°F					
Baumé (°B,°Be or °Bé)	Hydrochloric acid %	Nitric acid %	Phosphoric acid %	Sulfuric acid %	Ammonia
5	7.15		7.01	5.28	
10	14.83	12.86	13.70	10.77	0.
16	24.57	20.69	21.30	17.53	10.28
19	29.65	24.83	25.80	21.07	15.28
22	35.21	29.07	30.00	24.61	21.60
24	39.41	31.94	34.00	27.10	25.50
30		41.30	40.20	34.60	
35		50.32	49.50	41.30	
40		61.38	55.00	48.10	
46		81.10	64.60	56.50	
48		91.35	66.00	59.20	
62			90.00	81.30	
62.5			96.00	90.60	
66				94	

Notes

See pages 50 and 51 for notes

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