Corrosion Guide

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corrosion_br1.0, 07/120

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WARNING

This Guide is the only document to be used in making recommendations for corrosive service for Ashcroft, Inc. products. Call Customer Service for questions on unlisted chemicals or chemical concentrations.

The information provided here is for general information only. The end user is responsible for the choice of product(s) in his own application, based upon his own determination of the materials, chemical, and corrosion factors involved. THIS GUIDE AND ITS CONTENT ARE PROVIDED ON AN "AS IS" BASIS WITHOUT WARRANTY OF ANY KIND. THERE ARE NO WARRANTIES EXPRESS OR IMPLIED, INCLUDING THE WARANTY OF MERCHANTABILITY AND THE WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE. WITHOUT LIMITING THE FOREGOING, ASHCROFT, INC., ITS DISTRIBUTORS AND SUPPLIERS MAKE NO REPRESENTATIONS OR WARRANTIES ABOUT THE ACCURACY, RELIABILITY, COMPLETENESS, OR CURRENTNESS OF THIS GUIDE AND ITS CONTENT. IN NO EVENT SHALL ASHCROFT, INC., ITS DISTRIBUTORS AND SUPPLIERS, OR ANY THIRD PARTIES MENTIONED IN THIS GUIDE BE LIABLE ANY DAMAGES (INCLUDING, WITHOUT LIMITATION, INCIDENTAL AND CONSEQUENTIAL DAMAGES, PERSONAL INJURY/WRONGFUL DEATH, LOST PROFITS, OR BUSINESS LOSSES) RESULTING FROM THE USE OF OR INABILITY TO USE THIS GUIDE OR ITS CONTENT, WHETHER BASED ON WARRANTY, CONTRACT, TORT, OR ANY OTHER LEGAL THEORY, AND WHETHER OR NOT ASHCROFT, INC., ITS DISTRIBUTORS AND SUPPLIERS, OR ANY THIRD PARTIES MENTIONED IN THIS GUIDE ARE ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. ANY LIABILITY OF ASHCROFT, INC., ITS DISTRIBUTORS AND SUPPLIERS, OR ANY THIRD PARTIES MENTIONED IN THIS GUIDE SHALL BE LIMITED TO ASHCROFT, INC.'S STANDARD TERMS OF SALE, WARRANTY, AND LIMITATION OF LIABILITY SHALL APPLY TO ALL SUCH SALES OR PROVISIONS OF SERVICE. PRODUCTS AND SERVICES ARE GUARANTEED TO BE FREE FROM DEFECTS IN WORKMANSHIP AND MATERIALS FOR A PERIOD OF ONE YEAR FROM THE DATE OF DELIVERY THEREOF. ASHCROFT, INC., ITS DISTRIBUTORS AND SUPPLIERS, OR ANY THIRD PARTIES MENTIONED IN THIS GUIDE ARE NOT LIABLE FOR ANY PERSONAL INJURY, INCLUDING DEATH, CAUSED BY YOUR USE OR MISUSE OF THIS GUIDE OR ITS CONTENT. ANY CLAIMS ARISING IN CONNECTION WITH YOUR USE OF THIS GUIDE AND ITS CONTENT MUST BE BROUGHT WITHIN ONE (1) YEAR OF THE DATE OF THE EVENT GIVING RISE TO SUCH ACTION OCCURRED. REMEDIES UNDER THESE TERMS AND CONDITIONS ARE EXCLUSIVE AND ARE LIMITED TO THOSE EXPRESSLY PROVIDED FOR IN THESE TERMS AND CONDITIONS.

Careless use of this table could result in an accident endangering life and property. Most process plants or refineries have chemical or corrosion engineers, who are better able to specify instrument materials, since they are familiar with the details and past history of their own applications. This Guide should be used only when the end user has no such resource or additional sources of information. Consult the Stratford Customer Service Department about chemicals or conditions not covered in the Guide: Don't guess!

The table is intended to serve solely as a general guide in the recommendation of materials for corrosive services and must be regarded as indicative only and not as any guarantee for a specific service. There are many conditions which cannot be covered by a simple tabulation such as this, which is based on uncontaminated chemicals, not mixtures.

Many of the chemicals listed are dangerous or toxic. No material recommendation should be made when there is insufficient information, a high degree of risk, or an extremely dangerous chemical. The end user is responsible for testing materials in his own application, or for securing the services of a qualified engineer to recommend materials.

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Factory Questions

The Stratford Engineering or Customer Service Departments will provide assistance when necessary, but the end users' engineers should always be consulted first. If Ashcroft, Inc. is to be questioned, please be prepared with the following information:

Mandatory Information	Desired Information
• Temperature • Pressure • Concentration % of each constituent	• Impurities • Inhibitors used • Adjacent piping material • Hazardous location

Also, the name and phone number of the facility engineer or technical contact.

Be sure of the chemical name of the corrodent; seemingly minor differences in name can mean entirely different substances. For example, sodium *nitrite* is quite different from sodium *nitrate*, and *cupric* chloride has corrosion properties different from *cuprous* chloride.

Other Gauge Selection Guidelines

Since a bourdon tube is a spring, it may encounter corrosion fatigue. Minimize stresses by selecting a gauge with a pressure range twice the maximum operating pressure. Specify a liquid filled gauge with a throttle plug if there is pulsation or vibration.

To repeat ANSI B40.1 in part:

> 4.3.1 Operating pressure. The pressure gauge selected should have a range such that the operating pressure occurs in the middle half … of the scale. A good rule of thumb is to select a gauge with a full scale pressure two times the intended operating pressure.

Do not use a steel Bourdon tube if the adjacent piping is a more corrosion resistant material; avoid mixing dissimilar metal alloys.

A diaphragm seal made of suitably corrosion resistant materials should be used where there is potential for corrosion of pressure elements; for clogging by solids, or abnormal temperature.

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Corrosion Guide Legend Details	
O	An open circle means the material is OK for the service. The uniform corrosion rate is less than .002 per year and there is no tendency for pitting or stress corrosion. A Bourdon tube, bellows, diaphragm, or lower housing of this material may be used. An "O" under the "R" column indicates an "R" gauge system (carbon steel socket, 316 SS Bourdon tube) is permissible if the adjacent piping is iron or steel. There may be some rusting.
L	The letter "L" indicates the uniform corrosion rate is less than .020 inches per year and the material is suitable only for a diaphragm seal lower housing. It is **NOT** suitable for a Bourdon tube, bellows, or diaphragm.
X	Cross in box: material is not recommended, there is insufficient information, or there are complex restrictions that cannot be addressed in this simple table. The Stratford Engineering Department has access to more detailed corrosion information and may be consulted if there are questions and there is no facility engineer available.
★	See special note in left column of this line.

Observe the temperature limitations in the table for rubber and plastic components. These may be lower than temperature listed for the corrodent.

Oxidizing Agent Warning

The ***PLUS!***® (XLL) variation may be used for a gauge intended for service on oxygen or an oxidizing chemical.

Liquid Fill for Gauges and Diaphragm Seals Used With Oxidizing Agents

Halocarbon® gauge or diaphragm seal fill is required for use with media which are strong oxidizing agents. Leakage of strong oxidizing agents may cause fires or violent reactions if mixed with glycerin, silicone or oil, instrument fills. To specify Halocarbon®, add variation XGX to the product code for gauges, or variation XCF for diaphragm seals. Any liquid may be used to fill a gauge on a diaphragm seal.

Halocarbon® is mandatory for use with

- dry or moist **Chlorine, Oxygen, or ETO** (Ehylene Oxide)
- concentrated **Sulfuric acid or Nitric acid**
- concentrated **Sodium Hypochlorite, Sodium Chlorate, Sodium Chlorite, Chlorine Dioxide or Hydrogen Peroxide**

Less common chemicals requiring Halocarbon®include aqueous solutions, with over 10% of chemical compounds, whose name ends in the following

- Bromate
- Chlorate & Chlorite
- Chromate
- Hypochlorate incl. Sodium Hypochlorate
- Dichromate
- Nitrate & Nitrite
- Perborate
- Perchlorate
- Permanganate
- Persulfate
- Perodate
- Peroxide, incl. Hyrdogen Peroxide
- Perselenate

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Oxidizing Agent Warning (cont.)

Halocarbon® is a trademark for chlorotrifluoroethylene (CTFE) oils and greases made by Halocarbon® Products Corporation, River Edge, NJ. Occidental Chemical's Fluorolube®, has the same non-reactive chemical, both carry the CAS number 9002-83-9. CAS (Chemical Abstracts Service) is a division of the American Chemical Society that assigns a unique identifying number for each chemical compound and its structure. Dilute water solutions (over 90% water) of these chemicals do not normally behave as oxidizing agents.

The customer's facility engineer is responsible for deciding whether a solution could be hazardous.

In the following corrosion chart, chemical names with a 💣 (bomb symbol) are oxidizing agents and Halocarbon® fill should be used for solutions with over 10% of the chemical.

If in doubt whether a material is an oxidant, consult the facility engineer, Stratford Engineering, or a reference such as Dangerous Properties of Industrial Materials, N.I. Sax, Van Nostrand Reinhold, or the U.S. Department of Trasportation Hazardous Materials Table in 49CFR 172.101 the Merck Index, or other publications.

Hydrogen Warning

Please note that for systems over 1,000 psi the entire wetted system must be Type 316 stainless steel.

Sour Gas/Oil Warning

NACE Gauges and Pressure Products for Sour Gas or Oil Service

Please see ASH/PI-60 for oilfield or refinery applications requiring instruments meeting MRO175/ISO 15156 OR NACE MRO0103. Non-metals are not yet covered by the NACE standard. Teflon PTFE has a good rating but it is permeable. Viton is not recommended and the Kalrez compound 2037 used for Ashcroft diaphragms, has poor resistance to the amine inhibitors frequently used to reduce corrosion of metals in sour oil fields.

Dry Chlorine/Titanium Warning

Please note that **Titanium** is **not suitable** when exposed to **dry chlorine** (either vapor or liquid). In the absence of water, Titanium can burn and possibly explode, even at room temperature.

Do not confuse Titanium with Tantalum.
Tantalum is fully resistant to dry or wet chlorine and is the most frequently used diaphragm material when combined with a Hastelloy C lower housing.

Do not confuse liquid chlorine with "wet" chlorine.
Wet means there is water mixed with the chlorine, which can form hydrochloric acid. Chlorine gas liquefies at about 120 psi and is normally shipped as a liquid in pressurized containers.

Chlorine is the highest volume chemical produced in the USA and is used extensively in treating both potable water and sewage treatment.

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				Metals														Plastics				Elastomers			
Corrodent	Common Names & Formulas	Corrodent Temp. °F MAX	Concentration % in H_2O	403/410 SS [SE]	Carbon Steel [B]	17-4 PH, 304 SS	316, 316L SS [S]	Carp. 20 Cb 3 [D]	Phos. Bronze or Brass [A]	Monel [P OR M]	Nickel [N]	Inconel 600,718 [W],[WW]	Hastelloy B2 [G]	Hastelloy C276 [H]	Tantalum [U]	Titanium [TI] (<160°F)	"R" Systems	PVC (-40/140°F) [V]	Kynar (PVDF) (180°F) [KY]	Halar (ECTFE) (250°F)	Teflon (PTFE) (400°F) [T]	EPDM (175°F)	Viton (FKM) (300°F) [Y]	Buna "N" (NBR) (150°F)	Kalrez 2037 (FFKM) (200°F)
ACETIC ACID (EPDM <140°F)		200	<40	X	X	O	O	O	X	X	X	X	X	O	O	O	X	X	O	O	O	O	X	X	O
ACETIC ANHYDRIDE		200	–	X	X	O	X	X	X	X	X	X	X	O	O	O	X	X	X	X	O	O	X	X	O
ACETONE		150	–	X	X	O	O	O	O	O	O	O	O	O	O	O	O	X	X	X	O	O	X	X	O
ACETYLENE, DRY (Explosive in Cu)		200	100	O	O	L	O	O	X	X	O	O	O	O	O	O	O	X	X	X	O	O	X	X	O
ACROLEIN		200	100	X	X	X	L	L	X	L	L	L	L	L	O	O	X	X	X	X	O	O	X	X	O
ALUMINUM CHLORIDE	$AlCl_3$, Polyaluminum Chloride	150	–	X	X	X	X	X	X	X	X	X	X	O	X	X	X	L	O	O	O	O	O	O	O
ALUMINUM SULFATE	Alum. $Al_2(SO_4)_3$	150	<50	X	X	X	L	L	X	X	X	X	O	O	O	O	X	L	O	O	O	O	O	O	O
AMMONIA ANHYDROUS (Wet, see Ammonium Hydroxide)	DOT Quality NH_3	300	100	O	O	O	O	O	X	X	X	X	L	L	X	X	O	X	X	O	O	O	X	X	X
AMMONIUM CHLORIDE	Sal Ammoniac NH_4Cl	200	<40	X	X	X	X	X	X	X	X	X	X	O	O	O	X	X	O	O	O	O	O	X	O
AMMONIUM HYDROXIDE	Ammonia Water NH_3 in Water	120	<30	X	X	L	O	L	X	X	X	X	L	L	X	O	X	O	O	O	O	O	X	O	O
AMMONIUM NITRATE	Norway Saltpeter NH_4NO_3	200	<50	L	X	X	O	O	X	X	X	X	X	L	O	O	O	O	O	X	O	X	X	O	O
AMMONIUM SULFATE	$(NH_4)_2SO_4$	200	<60	X	X	X	L	L	X	X	L	X	X	L	O	O	X	O	O	O	O	O	X	O	O
AMYL ACETATE		250	–	X	L	L	O	O	X	X	X	X	O	O	O	O	O	X	X	X	O	X	X	X	O
ANILINE		200	>99	X	X	L	O	O	X	L	L	L	X	X	O	O	X	X	X	X	O	X	X	X	O
BEER		200	–	X	X	O	O	O	X	X	X	X	X	X	X	X	X	O	O	X	O	O	X	O	X

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				Metals														Plastics				Elastomers			
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BENZENE	C_6H_6	200	<50	L	L	L	O	O	L	O	O	O	X	X	O	O	O	X	X	X	O	X	X	X	O
BENZIDINE		200	<99	L	L	L	L	L	L	L	L	L	L	L	O	O	X	X	X	X	X	X	X	X	O
BENZOIC ACID		200	<70	L	X	L	L	L	X	L	L	X	O	O	O	O	X	X	O	L	O	X	X	X	O
BLACK LIQUOR	Sulfate Liquor	200	–	X	X	X	X	L	X	X	X	X	X	X	X	X	X	X	X	L	O	X	O	X	X
BLEACH	<5% NaOCl	120	<5	X	X	X	X	X	X	X	X	X	X	O	O	O	X	O	O	O	O	O	O	X	O
BORIC ACID	H_3BO_4	150	<25	X	X	O	O	O	L	L	L	L	O	O	O	O	X	O	O	O	O	O	O	O	O
BROMINE, DRY (<57 PPM H_2O)	Br	140	>99	X	X	X	X	X	X	L	L	O	L	L	O	X	X	X	O	O	X	X	O	X	O
BROMOBENZENE		200	>99	X	X	X	O	O	X	L	L	L	L	O	O	O	O	X	X	X	O	X	O	X	O
BUTADIENE (BUTYLENE)		200	>99	O	O	O	O	O	O	O	O	O	O	O	O	O	O	X	O	X	O	X	X	X	O
BUTANE	C_4H_{10}	200	–	O	O	O	O	O	O	O	O	O	O	O	O	O	O	X	O	O	O	X	O	O	O
BUTYL ALCOHOL	Butanol	200	–	O	X	O	O	O	O	O	O	O	O	O	O	O	X	X	O	O	O	X	O	O	O
BUTYRIC ACID		200	<10	X	X	X	L	L	X	X	X	X	O	O	O	O	X	X	O	O	O	X	X	X	O
CALCIUM BISULFATE	$Ca(HSO_3)_2$	250	>90	X	X	X	O	X	X	X	X	X	X	X	X	O	X	O	O	O	O	X	O	X	O
CALCIUM CHLORIDE	$CaCl_2$	200	<80	X	X	X	X	X	X	X	X	O	O	O	O	O	X	O	O	O	O	O	O	O	O
CALCIUM HYDROXIDE	Slaked Lime $Ca(OH)_2$	200	<50	X	X	X	L	X	X	X	X	X	X	O	O	O	X	O	O	O	O	O	O	O	O
CALCIUM HYPOCHLORITE	$Ca(OCl)_2$	75<	<10	X	X	X	X	X	X	X	X	X	X	L	O	O	X	O	O	O	O	O	O	X	O
CARBON DIOXIDE, WET	CO_2	150	>50 ppm	X	X	O	O	O	X	O	X	O	O	O	O	O	X	O	O	O	O	O	O	O	O
CARBON MONOXIDE	CO	200	>99	O	O	O	O	O	O	O	X	O	O	O	O	O	O	X	O	X	O	O	O	O	O

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CHLORINATED WATER (<10ppm Chlorine)		70	<10 ppm	X	X	O	O	O	O	O	X	X	L	O	O	O	X	O	O	O	O	X	O	X	O
CHLORINATED WATER (To Saturation)		120	–	X	X	X	X	O	X	X	X	X	L	O	O	O	X	O	O	O	X	X	X	X	O
CHLORINE, DRY (*SEE PAGE 5) (<50PPM H_2O)	Cl_2	200	>99	X	X	X	X	L	X	X	L	X	X	L	O	X*	X	X	L	X	X	X	O	X	O
CHLORINE, MOIST		160	>90	X	X	X	X	X	X	X	X	X	X	L	O	X	X	X	L	X	X	X	X	X	X
CHLOROACETIC ACID		150	<30	X	X	X	X	X	X	L	X	X	L	L	O	L	X	X	X	O	X	X	X	X	O
CHLOROFORM, DRY	Trichloromethane $CHCl_3$	100	>99	X	X	X	O	O	X	O	O	O	X	X	O	O	X	X	O	O	O	X	X	X	O
CHROMIC ACID	Chromium Trioxide H_2CrO_4"	200	<30	X	X	X	X	X	X	X	X	X	X	X	O	O	X	X	O	O	O	X	O	X	O
CITRIC ACID		200	>10 <50	X	X	X	O	O	X	L	L	L	O	O	O	O	X	O	O	O	O	O	O	O	O
COPPER NITRATE	Cupric Nitrate $Cu(NO_3)_2$	200	<10	X	X	O	O	O	X	X	X	X	X	X	O	O	X	X	O	O	O	X	O	O	O
COPPER SULFATE	Cupric Sulfate $CuSO_4$	200	<30	X	X	X	L	O	X	X	X	X	X	O	O	O	X	O	O	O	O	O	O	O	O
CREOSOTE	Coal-Tar	200	–	X	L	L	L	L	L	L	L	L	L	O	O	X	X	X	X	X	O	X	O	X	O
CRESOL		200	>99	O	X	X	O	O	L	O	O	O	O	O	O	L	X	X	O	X	O	X	X	X	O
CRUDE OIL - SOUR (SEE WARNING PG. 5)		<200	<5	X	X	X	X	X	X	O	X	X	X	O	O	X	X	X	O	O	O	X	X	X	X
CRUDE OIL - SWEET, LOW SULFUR		200	–	X	L	O	O	O	X	O	O	O	O	O	O	O	O	O	O	O	O	X	O	X	O
CUPRIC CHLORIDE	Copper Chloride	200	<40	X	X	X	X	X	X	X	X	X	X	X	O	O	X	O	O	O	O	O	O	O	O
DIESEL FUEL		140	–	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	X	O	O	O
DOWTHERM A		300	–	O	O	O	O	O	X	O	O	O	O	O	O	O	O	X	X	X	O	X	X	X	O
ETHANOL	Ethyl Alcohol C_2H_5OH	200	–	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O

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ETHANOL AMINES	MEA, DEA, TEA	120	100	X	L	O	O	O	X	O	L	L	O	O	O	O	X	X	X	X	O	O	X	X	X
ETHYL ACETATE		<200	–	X	L	O	O	O	O	O	O	O	O	O	O	O	O	X	X	X	O	X	X	X	O
ETHYL CHLORIDE, DRY	Chloroethane	<200	>99	O	O	O	X	O	O	O	O	O	O	O	O	O	O	X	O	O	O	X	O	O	O
ETHYLENE	Ethene	200	–	O	O	O	O	O	O	O	X	O	O	O	O	X	O	X	X	X	O	X	X	X	O
ETHYLENE GLYCOL	Glycol	200	>40	X	X	O	O	O	L	L	L	L	O	O	O	O	X	O	O	O	O	O	O	O	O
ETHYLENE OXIDE	ETO	100	>99	X	O	O	O	O	O	O	O	O	X	X	O	X	O	X	O	O	O	X	X	X	O
FERRIC CHLORIDE (*VITON <170°F)	$FeCl_3$	200	<40	X	X	X	X	X	X	X	X	X	X	X	O	O	X	O	O	O	O	O	O*	O	O
FERRIC SULFATE (*VITON <170°F)	$Fe_2(SO_4)_3$	150	<10	X	X	X	O	O	X	X	X	O	X	O	O	O	X	O	O	O	O	O	O*	O	O
FERROUS CHLORIDE (*VITON <170°F)	$FeCl_2$	200	<30	X	X	X	X	X	X	X	X	X	X	L	O	O	X	O	O	O	O	O	O*	O	O
FERROUS SULFATE (*VITON <170°F)	$FeSO_4$	200	<50	X	X	X	X	L	X	X	X	X	L	L	O	O	X	O	O	O	O	O	O*	O	O
FLUORINE, GAS DRY No Air or O_2	F_2	200	>99	X	X	X	X	X	X	O	O	O	X	X	X	X	X	X	X	X	X	X	X	X	X
FLUOROSILICIC ACID	Hydrofluosilicic Acid - H_2SiF_6	140	<30	X	X	X	X	X	X	X	X	X	X	X	X	X	X	O	O	O	X	X	O	O	O
FORMALDEHYDE		200	–	X	X	O	O	O	X	O	O	O	L	X	O	O	X	X	X	X	O	O	X	X	O
FORMIC ACID		<150	–	X	X	X	X	X	X	X	X	X	L	L	O	X	X	X	O	O	O	O	X	X	O
FUEL OIL, LIGHT	Diesel, No. 2, Heating Oil	140	–	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	X	O	O	O
FUEL OIL, HEAVY	Bunker, Resid, No. 6, Heavy Gas Oil	300	–	X	X	X	L	O	X	X	X	X	X	O	O	O	X	X	X	X	O	X	O	O	O
FURFURAL		200	<10	X	X	O	X	O	L	L	L	X	L	O	O	L	X	X	X	O	O	X	X	X	O
GASOLINE (*FLOWING-PHOS BRONZE)		200	–	X	X	O	O	X	L*	X	X	L	O	O	O	X	X	X	O	O	O	X	O	O	O
GLUCOSE		300	–	X	X	O	O	O	O	O	O	O	O	O	O	O	X	O	O	O	O	O	O	O	O

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GLYCERIN	Glycerol	200	–	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
HEXANE, DRY		200	>99	O	O	O	O	O	O	O	O	O	O	O	O	O	O	X	O	O	O	X	O	O	O
HYDRAZINE		100	–	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	O	X	O	O	X	X	O
HYDROBROMIC ACID	HBr	140	–	X	X	X	X	X	X	X	X	X	X	X	O	O	X	X	L	O	X	O	O	X	O
HYDROCHLORIC ACID	HCl, Muriatic Acid	100	<38	X	X	X	X	X	X	X	X	X	L	X	O	X	X	X	O	O	X	X	O	X	O
HYDROFLUORIC ACID (NO AIR)	HF	120	<50	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	O	O	X	X	X	X	X
HYDROFLUOSILIC ACID	Fluosilicic Acid	140	<30	X	X	X	X	X	X	X	X	X	X	X	X	X	X	O	O	O	X	X	O	O	O
HYDROGEN (SEE WARNING PG. 5)	H2	200	–	X	X	X	O	X	O	X	X	X	X	X	X	X	X	X	O	X	X	O	O	O	O
HYDROGEN PEROXIDE	H_2O_2	100	<30	X	X	O	O	X	X	X	X	X	X	X	O	X	X	X	O	O	O	X	X	X	O
HYDROGEN SULFIDE (SEE WARNING PG. 5)	H_2S	140	–	X	X	X	X	X	X	X	X	X	X	O	O	X	X	X	O	O	X	X	X	X	X
KEROSENE	Kerosine	200	>99	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	X	O	O	O
LACTIC ACID		<100	<70	X	X	O	O	O	X	X	X	X	L	L	O	O	X	X	O	O	O	O	O	X	O
MAGNESIUM CHLORIDE	$MgCl_2$	200	<40	X	X	X	X	X	X	X	X	X	X	O	O	O	X	O	O	O	O	O	O	O	O
MAGNESIUM SULFATE	Epsom Salts $MgSO_4$	200	<40	X	X	O	O	O	O	O	O	X	O	X	O	O	O	O	O	O	O	O	O	O	O
MERCURIC CHLORIDE	$HgCl_2$	200	<60	X	X	X	X	X	X	X	X	X	X	X	O	O	X	O	O	O	O	O	O	O	O
MERCURY	Quicksilver Hg	200	>99	O	O	X	O	O	X	X	O	X	X	O	X	X	O	O	O	O	O	O	O	O	O
METHANE DRY, NO H_2S	CH_4	200	–	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	X	O	O	O
METHANOL	Wood Alcohol	100	>99	X	O	X	O	O	X	O	O	L	O	O	O	X	O	O	O	O	O	O	X	X	O
METHYL ETHYL KETONE	M.E.K.	120	>99	X	L	X	O	O	X	X	X	X	X	X	X	X	O	X	X	X	O	O	X	X	O
MILK		–	–	X	X	X	O	X	X	X	X	O	X	O	X	X	X	O	O	O	O	O	O	O	X
MORPHOLINE		200	>99	O	O	X	O	O	O	O	O	O	O	O	X	O	O	X	X	X	O	X	X	X	O

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NAPHTHA	Benzin	200	>99	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	X	O	O	O
NAPHTHALENE	Tar Camphor $C_{10}H_8$	150	>99	O	O	X	O	O	L	O	O	O	X	X	L	O	O	X	O	X	O	X	O	X	O
NATURAL GAS, DOT QUALITY (*Cu alloy <100PSI)		150	–	X	L	O	O	X	O*	L	X	X	X	O	O	X	O	X	O	X	O	X	O	O	O
NICKEL CHLORIDE	$NiCl_2$	200	<80	X	X	X	X	X	X	X	X	X	O	O	O	O	X	O	O	O	O	O	O	O	O
NICKEL SULFATE	$NiSO_4$	200	–	X	X	X	O	L	X	X	X	X	X	X	X	O	X	L	O	O	O	O	O	O	O
NITRIC ACID	HNO_3	<100	<95	X	X	O	O	O	X	X	X	X	X	X	O	X	X	X	O	O	O	X	X	X	X
NITROUS OXIDE (DRY)	Laughing Gas N_2O	<100	>99	X	X	X	L	L	X	X	X	X	X	L	O	X	X	X	X	O	O	O	X	X	O
N-METHYLPYRROLIDONE	NMP	70	>99	X	X	X	L	O	X	X	O	O	O	O	X	X	X	X	X	X	O	O	O	X	O
OLEIC ACID		200	–	X	X	X	L	O	L	L	L	O	L	L	O	L	X	X	O	O	O	X	X	X	O
OXALIC ACID		140	<50	X	X	X	X	X	X	X	X	X	X	L	O	X	X	L	O	O	O	O	O	X	O
OXYGEN GAS ("X6B")	O_2	120	–	X	X	O	O	O	O	O	X	O	O	O	O	X	X	O	O	O	O	X	X	X	X
OZONE	O_3	120	<8	X	X	O	O	O	X	X	X	X	X	X	X	X	X	X	O	O	O	X	X	X	O
PALMITIC ACID		160	>99	X	X	O	O	X	X	X	X	X	X	O	X	X	X	X	O	O	O	X	O	O	O
PHENOL		120	>90	X	X	O	O	O	X	L	O	O	X	O	O	X	X	X	O	X	O	X	O	X	O
PHOSPHORIC ACID	H_3PO_4	100	<60	X	X	X	O	O	X	X	X	L	O	O	O	X	X	O	O	O	O	O	O	X	O
PHTHALIC ANHYDRIDE		200	>99	X	O	X	O	O	X	O	O	O	O	O	O	X	O	X	X	X	O	O	X	X	O
PICRIC ACID		200	<10	X	X	X	O	X	X	X	X	X	X	L	O	X	X	X	X	X	O	O	O	X	O
POTASSIUM CHLORIDE	KCl	150	<30	X	X	X	X	X	X	L	L	X	L	O	O	O	X	X	O	O	O	O	O	O	O
POTASSIUM HYDROXIDE	KOH	160	<50	X	L	X	L	L	X	O	O	L	L	L	X	X	X	O	X	O	O	O	X	X	O
POTASSIUM NITRATE	Saltpeter KNO_3	200	<50	L	L	X	L	X	L	L	L	L	X	L	O	O	X	O	O	O	O	O	O	O	O
POTASSIUM NITRITE	KNO_2	200	<50	L	L	X	L	L	L	L	L	L	L	L	X	X	X	O	X	X	O	O	X	X	O

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POTASSIUM PERMANGANATE	$KMnO_4$	140	<30	X	X	X	X	X	X	X	X	X	X	X	O	O	X	X	O	O	O	O	X	X	O
PROPANE	C_3H_8	200	>99	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	X	O	O	O
PROPYLENE		200	>99	O	O	O	O	O	O	O	O	O	O	O	O	X	O	X	O	X	O	X	O	X	O
ROSIN		200	–	X	X	O	O	O	L	O	O	X	X	O	X	X	O	X	X	X	O	X	X	O	O
SEA WATER (*Monel not for Diaphragms)	Ocean Water	200	–	X	X	X	X	X	X	O*	X	O	X	O	O	O	X	O	O	O	O	O	O	O	O
SEWAGE, RAW		100	–	X	X	X	L	L	L	L	X	X	X	O	O	X	X	O	O	O	O	X	O	O	O
SILICONE OIL	PDMS	140	–	O	O	O	O	O	O	O	O	O	O	O	O	O	O	L	O	O	O	O	O	O	O
SILVER NITRATE (Acid free)	$AgNO_3$	200	<50	L	X	X	L	O	X	X	X	X	X	X	O	X	X	O	O	O	O	O	O	X	O
SKYDROL		200	100	X	X	O	O	O	X	O	O	O	O	O	O	X	X	X	X	X	O	O	X	X	O
SODIUM BICARBONATE	Baking Soda $NaHCO_3$	<200	<20	O	L	O	O	O	L	O	O	O	L	L	X	O	O	O	O	O	O	O	O	O	O
SODIUM BISULFATE	$NaHSO_4$	<200	<30	X	X	X	X	O	L	L	L	X	L	L	O	X	X	O	O	O	O	O	O	X	O
SODIUM BISULFITE	$NaHSO_3$	<150	<40	X	X	X	X	L	X	L	X	X	L	L	O	O	X	O	O	O	O	O	O	O	O
SODIUM CARBONATE	Soda Ash Na_2CO_3	<200	<40	O	L	O	O	O	X	O	O	O	O	O	O	O	X	O	O	O	O	O	O	O	O
SODIUM CHLORIDE	Table Salt NaCl	<200	<30	X	X	X	X	X	X	O	L	O	X	O	O	O	X	O	O	O	O	O	O	O	O
SODIUM CHROMATE	Na_2CrO_4	<200	<60	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	X	O	O	X	O	O
SODIUM CYANIDE	NaCN	<140	–	X	O	O	O	O	X	X	X	X	X	X	O	O	O	O	O	O	O	O	O	O	O
SODIUM DICHROMATE	S. Bichromate $Na_2Cr_2O_7$	<140	<20	O	L	O	O	O	X	X	X	X	X	X	X	O	O	O	O	O	O	O	O	X	O
SODIUM HYDROXIDE	Caustic Soda NaOH	<150	<40	X	X	O	O	O	L	O	O	O	O	O	X	O	O	O	X	O	O	O	X	O	O
SODIUM HYDROXIDE	Caustic Soda NaOH	<200	<70	X	X	X	X	O	X	O	O	O	O	L	X	X	X	X	X	X	O	O	X	X	O

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SODIUM HYPOCHLORITE (*Kynar 15% max. conc.)	NaOCl, Bleach	120	<40	X	X	X	X	X	X	X	X	X	X	X	O	O	X	O	O*	O	X	O	X	X	O
SODIUM NITRATE	Chile Saltpeter $NaNO_3$	<200	–	O	L	O	O	O	X	X	O	X	X	X	O	O	O	O	O	O	O	O	X	X	O
SODIUM NITRITE	$NaNO_2$	<200	<60	O	O	O	O	O	X	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	X
SODIUM PERMANGANATE (pH >6, no chlorides)	$NaMnO_4$	<120	<50	X	X	X	O	O	X	X	O	X	X	O	O	O	X	X	O	X	O	O	O	X	O
SODIUM PEROXIDE	Na_2O_2	<200	<10	O	L	O	O	O	X	L	L	L	L	L	X	X	O	L	O	O	O	O	O	X	O
SODIUM PHOSPHATE (TRIBASIC)	TSP Na_3PO_4	<200	<60	O	O	O	O	O	O	O	O	O	L	O	O	X	O	X	O	O	O	O	O	X	O
SODIUM SILICATE	Water Glass	<200	–	O	O	O	O	O	X	O	O	O	X	L	O	O	O	O	O	O	O	O	O	O	O
SODIUM SULFATE	Na_2SO_4	<200	<30	O	X	O	O	O	L	L	L	L	L	L	O	O	O	O	O	O	O	O	O	O	O
SODIUM SULFIDE	Na_2S	<200	<30	X	X	X	L	O	X	L	L	L	X	L	O	X	X	O	O	O	O	O	X	O	O
SODIUM SULFITE (*Viton<140°F)	Na_2SO_3	<200	<30	X	X	X	O	O	X	X	X	X	X	O	O	O	X	O	O	O	O	O	O*	X	O
SODIUM THIOSULFATE	$Na_2S_2O_3$	<200	–	X	X	X	O	O	X	O	L	L	L	L	O	X	X	O	O	O	O	O	O	X	O
SOUR GAS / OIL (SEE WARNING PG. 5)		<200	<5	X	X	X	X	X	X	O	X	X	X	O	O	X	X	X	O	O	O	X	X	X	X
STANNOUS CHLORIDE	Tin Dichloride $SnCl_2$	<200	<50	X	X	X	X	L	X	X	X	X	X	X	O	X	X	X	O	X	O	O	O	O	O
STEAM (WITH SIPHON)		<300	–	O	O	O	O	O	O	O	O	O	O	O	O	O	O	X	X	O	O	O	X	X	X

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STEARIC ACID		<200	–	X	X	O	O	O	X	X	O	L	X	O	O	X	X	O	O	O	O	X	X	X	O
STODDARD SOLVENT		<150	–	O	O	O	O	O	O	O	O	O	O	O	O	O	O	X	O	O	O	X	O	O	O
SULFAMIC ACID		<150	<95	X	X	X	X	X	X	X	X	X	X	L	O	X	X	X	O	X	O	O	X	X	O
SULFUR	S	250	>95	X	X	X	X	X	X	X	X	O	L	O	O	O	X	X	X	X	O	O	O	X	O
SULFUR DIOXIDE, WET	SO_2	140	–	X	X	X	L	X	X	X	X	X	X	L	O	O	X	X	L	O	O	O	O	X	O
SULFUR HEXAFLUORIDE	SF_6	120	–	O	O	O	O	O	O	O	O	O	O	O	O	O	O	L	X	X	O	O	X	X	X
SULFUR TRIOXIDE, DRY	SO_3	140	>99	X	X	X	L	L	X	X	L	L	X	O	X	X	X	O	X	X	O	O	O	X	O
SULFURIC ACID <60%	H_2SO_4	200	<60	X	X	X	X	X	X	X	X	X	L	X	O	X	X	X	O	O	O	O	X	X	O
SULFURIC ACID 80-98%	H_2SO_4	200	<98	X	X	X	X	X	X	X	X	X	L	X	O	X	X	X	X	O	O	X	X	X	O
TANNIC ACID	Tannin	<150	–	X	O	O	O	O	X	O	X	L	X	X	O	O	O	O	O	O	O	O	O	O	O
TARTARIC ACID		<150	<50	X	X	X	O	X	X	O	X	O	X	X	O	X	X	X	O	O	O	O	O	O	O
TOLUENE	Toluol	<200	>99	O	O	O	O	O	O	O	O	O	O	O	O	O	O	X	X	X	O	X	X	X	O
TRICHLOROACETIC ACID		<200	<50	X	X	X	X	X	X	L	X	X	L	O	X	X	O	X	X	X	X	X	X	X	O
TRICHLOROETHANE 1,1,1, DRY (*Teflon<200°F)		<150	>98	O	O	O	O	O	O	O	O	O	O	O	O	O	O	X	X	X	O*	X	X	X	O
TRICHLOROETHYLENE, DRY		<200	>99	X	O	O	O	O	X	O	O	L	O	O	O	O	O	X	O	X	O	X	X	X	O
TURPENTINE		<200	>98	O	O	O	O	O	O	O	O	O	O	O	O	L	O	X	O	O	O	X	O	X	O
UREA	Carbamide, DEF	<200	<50	X	X	O	O	X	X	X	X	L	X	X	X	O	X	X	O	O	O	O	X	X	X
VINYL CHLORIDE		<100	>99	X	X	X	O	O	X	O	X	X	X	O	O	O	X	X	O	X	O	X	X	X	O

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This guide was developed for Ashcroft Inc. products from manufactuers' literature and standard references such as:

Corrosion Data Survey, Metals Section (1985) or Non-Metals Section (1975), available from NACE, National Association of Corrosion Engineers) P. O. Box 218340, Houston, TX 79231, Phone (713) 492-0535.

Chemical Resistance Guide for Metals and Alloys, ---Plastics, and --- for Elastomers, all published by Compass Publications, PO Box 2276, LaMesa CA 91943, Phone (619) 589-9636.

Chemical Resistance vol II Thermoplastic Elastomers, Thermosets and Rubbers 2nd ed. 1994, PDL, Plastics Design Library, Morris NY 13808.

To quote part of ASME B40.1 -2005 Gauges – Pressure Indicating Dial Type – Elastic Element Available from ASME, New York, NY; paragraphs 4.3.3 and 4.3.4:

> The elastic element is generally a thin walled member, which operates under high stress conditions and must be carefully selected for compatibility with the pressure medium being measured. None of the common element materials are impervious to every type of chemical attack. The potential for corrosive attack is established by many factors, including the concentration, temperature and contamination of the medium. In addition to the factors discussed above, the capability of the pressure element is influenced by the design, materials and fabrication of the joints between its parts.

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