

CHEMICAL RESISTANCE OF PLASTIC PIPING MATERIALS

TR-19
2023



Foreword

This technical report was developed and published with the technical help and financial support of the members of the Plastics Pipe Institute (PPI). These members have shown their commitment to developing and improving quality products by assisting standards development organizations in the development of standards, and also by developing design aids and reports to help engineers, code officials, specifying groups, contractors and users.

The purpose of this technical report is to provide information on the transport of various chemicals using plastic piping materials.

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The Plastics Pipe Institute, Inc.

<https://www.plasticpipe.org/>

This Technical Report, TR-19, was first issued in 1973 and was updated in 1983, 1991, 1999, 2000, 2007, 2020 and April 2023.

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CHEMICAL RESISTANCE OF PLASTIC PIPING MATERIALS

1.0 INTRODUCTION

This technical report has been developed as an informative guide on the resistance of plastic piping and fitting materials to chemical attack.

It is divided into several sections:

- Section 2: How to Interpret the chemical resistance rating provided in Table 3
- Section 3: Chemical resistance in general, and considerations for end use applications
- Section 4: Types of chemical attack on plastics
- Section 5: Other considerations
- Section 6: Chemical Resistance Data for Plastic Piping in Non-Pressure Applications and Data Table
- Section 7: Additional resources

Listings of chemical resistance data are presented in Table 3 for common plastic piping materials applicable to **non-pressure applications**.

Determination of suitability for specific applications under stress (e.g., pressurized service) is beyond the scope of this report. Users should contact the specific pipe or fitting manufacturer for recommendations on pressurized applications.

Note 1: Safety Consideration: Additional engineering and safety considerations exist when transporting liquids above their atmospheric boiling temperature and gases. Both situations constitute piping under pressure and, due to the stored energy of compressed gases, pose a significant danger potentially leading to injury or death.

Note 2: Drinking water, also known as potable water, is water that is safe to drink or to use for food preparation. Across North America, the majority of the drinking water that is provided in public water systems is treated with a disinfectant to control the growth of harmful microorganisms. Potable water disinfectants include chlorine, chloramines, and rarely, chlorine dioxide. Piping materials intended for treated water must be resistant to such disinfectants at various levels, as described in product standards.

For specific information about the resistance of crosslinked polyethylene (PEX) to disinfectants, please see:

- PPI TN-53 *Guide to Chlorine Resistance Ratings of PEX Pipes and Tubing for Potable Water Applications*,
- PPI TN-67 *Chlorine Dioxide and Plastic Hot- And Cold- Water Plumbing Distribution Pipes*, and

- PPI Statement A - *Relative Oxidative Aggressiveness of Chloramines and Free Chlorine Disinfectants on Crosslinked Polyethylene (PEX) Pipes used in Treated Potable Water*

For specific information about the resistance of high-density polyethylene (HDPE) to disinfectants, please see:

- PPI TN-44 *Long Term Resistance of AWWA C906 Polyethylene (PE) Pipe to Potable Water Disinfectants* and
- PPI TN-49 *Recommendations for AWWA C901 Service Tubes in Potable Water Applications*

For specific information about the resistance of chlorinated polyvinyl chloride (CPVC) to disinfectants, please see *Section 4: Effects of Potable Water Disinfectants on CPVC* of PPI TN-62 *Suitability and Fitness of CPVC Piping Systems for Commercial Building Applications*.

2.0 HOW TO INTERPRET THE RATINGS SHOWN IN TABLE 3

The chemical resistance ratings for the pipe and fitting materials and chemicals provided in Table 3 are neither authoritative nor exhaustive. They are only intended as starting point for a proper engineering evaluation. The suitability of a pipe or fitting material in a given application must include the appropriate engineering evaluation of the application including the factors (e.g., temperatures, pressure, chemical concentrations, material stress and expected service life) as discussed in other sections of this document.

As the ratings which are presented are a consolidation of laboratory and field experience from over 50 years of plastic industry experience and not the result of a systematic study, inconsistencies in results may appear in Table 3. It is important to note that a rating (e.g., “R- Resistance”) to a certain temperature or concentration does not imply a lack of resistance above that temperature or concentration. The literature and manufacturers may have other data or experience that supports the use of the material at higher temperatures and this evidence should be considered as part of the engineering analysis.

It is strongly recommended that each user satisfy themselves by means of appropriate tests or from previous experience before a particular plastic piping system is used to transport a specific chemical under the particular conditions of interest. The information in this report is intended to give general guidance only in making tests, and then assessing the results of such tests and experiences.

3.0 CHEMICAL RESISTANCE IN GENERAL

Plastic pipe and fitting materials are generally resistant to attack from many chemicals. This inherent property makes them suitable for use in numerous fluid and gas transport applications.

However, there are certain chemicals that may damage plastic pipes, either through exposure on the outside of the pipe to chemicals, on the internal surface of the pipe during the transport of such chemicals, or with exposure to inert fluids containing chemicals in various concentrations.

Each material has unique resistance to chemicals in various situations. The suitability of a pipe or fitting system for use in a particular fluid or gas application is a function of several factors, described below:

3.1. Pipe and Fitting Materials

The specific plastic material used in pipe and fittings impacts its chemical resistance. This report includes the materials listed in Table 1.

Table 1: Plastic Materials Identification

ABS	acrylonitrile-butadiene-styrene
CPVC	chlorinated polyvinyl chloride
PP	polypropylene
PP-R ¹	polypropylene random copolymer
PP-RCT ¹	polypropylene random copolymer with modified crystallinity and temperature resistance
PVC	polyvinyl chloride
PE	polyethylene (representative of medium density polyethylene [MDPE] and high density polyethylene [HDPE]; not representative of low density polyethylene [LDPE])
PE-RT ²	polyethylene of raised temperature resistance
PB	polybutylene
PVDF	polyvinylidene fluoride
PEX	crosslinked polyethylene
PA11/ PA12	polyamide 11 / polyamide 12
PA66	polyamide 66
PSU	polysulfone
PPSU	polyphenylsulfone

¹ PP-R and PP-RCT are chemically similar to PP and are grouped together in Table 3; they may be assumed to have similar chemical resistance

² PE-RT is chemically similar to MDPE and HDPE and are grouped together in Table 3; they may be assumed to have similar chemical resistance

3.2. Product Design and Joining Systems

Piping dimensions, including wall thickness, construction, and composition (layers, fillers, etc.), can affect chemical resistance.

The type of joining system can also affect the performance of the system in chemical handling applications. Heat fusion and solvent cementing do not introduce different materials into the system. The resistance of solvent cement to certain chemicals can vary from grade to grade.

Other components and appurtenances in the piping system can have different chemical resistances. Certain types of mechanical joints include gaskets using elastomers with their own unique resistances. Some piping systems include other plastic or non-plastic materials used as mechanical fitting components which can have different chemical resistance.

3.3. Operating Conditions - Internal and External

- o Chemicals or mixtures of chemicals, and their concentrations.
- o Operating temperature — maximum, minimum, and cyclical variations.
- o Operating pressure or applied stress — maximum, minimum and cyclical variations.

4.0 TYPES OF CHEMICAL ATTACK ON PLASTICS

In general, chemicals that affect plastics do so in several ways, including solvation, chemical attack, and environmental stress cracking.

4.1. Permeation, Swelling, Plasticization, Solvation, and Extraction

Permeation is the transport of chemicals through the pipe wall via diffusion through the free volume of the polymer matrix without significant change in the material properties. Permeability may be of interest in situations where the pipe is to function as a liner pipe for a less resistant material (e.g., fiberglass or steel), where the pipe is transporting particularly hazardous substances, or where the pipe is installed in contaminated soil.

Permeability of specific plastic piping materials is not addressed in this document. PPI Statement N - *Barrier Properties of Plastic Pipe Used for Potable Water Service*, states “In areas of known or suspected contamination, the design of the distribution system should be based on a careful analysis of the situation.

Appropriate technical data and individual manufacturers' recommendations should be consulted on the overall design of a pipe system for these systems."

Note 3: See also *PPI Comments on Permeation of Water Pipes and on the AWWA-RF Report on Hydrocarbons* at [link](#)

Absorption occurs when a chemical diffuses into the free volume of the polymer matrix and accumulates there. This may result in one or more of the following effects: swelling, plasticization, or solvation. In the case of absorption, physical properties may be affected, but the polymer molecule itself is not chemically changed, degraded or destroyed.

Swelling is an increase in the bulk volume of a material caused by the absorption of liquids or vapors from the environment. It may or may not be accompanied by plasticization, which results in softening and loss of strength in the material.

In extreme cases, the solvating compound can fully dissolve the plastic material.

Sometimes the polymer itself may not be soluble, but it may contain a soluble formulary ingredient that may be extracted from the polymer compound. This is more common in plasticized materials where loss of plasticizer may result in embrittlement. It is not common in plastic materials used for pipes and fittings and is not addressed in this document.

In gas or vapor transmission service, there may be a very slight loss of contents through the pipe wall.

Lastly, a solvating or permeating chemical entrained in the material may be released when heat fusion or solvent cement joining is performed. Thus, heat fusion (e.g., welding) or solvent cement joining may be unreliable if performed on permeated pipes. Caution should be used in performing these processes if solvation or permeation are suspected.

4.2. Direct Chemical Attack

Direct chemical attack occurs when exposure to a chemical causes a chemical alteration of the polymer molecules by chain scission, crosslinking, oxidation, or substitution reactions.

Direct chemical attack frequently causes a severe reduction of mechanical physical properties such as tensile strength, ductility, burst pressure, and impact resistance.

Chemical resistance may vary greatly from one plastic material to another (i.e., PVC, ABS, PE, etc.), and also among different cell classifications of the same plastic type (e.g., PVC 1120 to PVC 2110, PE 3608 to PE 4710, etc.). There may also be slight variations among commercial products having the same cell classification, based on compound ingredients known as stabilizers or “additive packages”.

The chemical resistance of plastic piping and fittings is basically a function of the chemical resistance of the plastic material, including additives and other ingredients in the final compound. In general, the fewer filler ingredients used, the better the chemical resistance.

Plastic pipes with significant filler percentages may be susceptible to chemical attack whereas an unfilled material may be affected to a lesser degree or not at all.

4.3. Environmental Stress Cracking

Environmental stress cracking (ESC) is defined as the “development of cracks in a material that is subjected to stress or strain in the presence of specific chemicals”, as per ASTM F412 *Standard Terminology for Plastic Piping Systems*.

Environmental stress cracking is a fundamentally different phenomenon than chemical attack, even though they may present similarly (e.g., crazing or whitening of parts, sloughing of material, minor crack formation). ESC does not result in chemical alteration of the polymer molecule. ESC is caused by a chemical agent in combination with inherent and applied stresses. It can often be minimized with proper installation. Direct chemical attack does not require any stress or strain on the material for it to occur, although it may be accelerated in conditions of high stress or strain.

5.0 OTHER CONSIDERATIONS

5.1. Chemical Families

While the effect of each individual chemical is specific, some chemicals can be grouped into general categories based on similarities in chemical characteristics (acids, bases, alcohols, etc.). For example, water-based (aqueous) solutions of neutral inorganic salts generally have the same effect on plastic piping materials as water alone; thus, sodium chloride, potassium alum, calcium

chloride, copper sulfate, potassium sulfate and zinc chloride solutions have the same effect as water.

However, at elevated temperatures or high concentrations, some salt solutions may attack some plastic materials through either oxidation or chemical substitution when they would be benign at lower temperatures and concentrations.

5.2. Accelerating factors (concentration, temperature, stress)

Generally, the resistance of a particular plastic to a specific chemical will decrease with an increase in concentration. For example, for some materials, dilute sulfuric acid may be acceptable, whereas 95% sulfuric acid may not.

The resistance of a particular plastic to a specific chemical generally decreases as temperature increases because the rate of chemical phenomenon (i.e., reactivity, permeation rate, solvation) tends to increase. This rate increase is logarithmic with respect to temperature over most plastic functional temperatures and generally follows to the Arrhenius equation.

The chemical resistance of a particular plastic generally decreases with increasing applied stress. This is commonly seen when the presence of certain chemicals causes environmental stress cracking where unstressed parts exhibit good chemical resistance.

The chemical resistance of a particular plastic generally decreases where temperature or applied stress are varied or cycled. These effects can be greater overall in combination. Testing should be conducted if the system is expected to perform across a wide range of temperatures and stresses to determine the overall combined effect.

5.3. Combinations of Chemicals

In some cases, combinations of chemicals may have a synergistic effect on damaging a plastic material, and a mixture may cause damage where the individual chemicals do not. It cannot be assumed that an individual chemical's lack of effect would apply for combinations that include several chemicals. When the possible combined effect of several chemicals is unknown, the material should be tested in the complete chemical mixture(s) in question.

5.4. Multi-Layered (Composite) Piping

Some piping products utilize a multi-layered (composite) construction, in which the pipe wall is constructed of layers of different materials. The layers may consist of both plastic and non-plastic.

For example, PE/AL/PE and PEX/AL/PEX pipes contain mid-wall aluminum layers. Examples of all-plastic composite pipes include PVC/ABS/PVC and fiber-core PP-R or PP-RCT pipes. Layered composite material pipes may have chemical resistance that differs from the chemical resistance of the individual materials.

5.5. Rate of Chemical Attack

Chemicals that attack plastics do so at a certain rate, some slowly and some more quickly. But usually, any chemical attack is increased when temperature or stress are increased, or when temperature or stress are varied. The particular rate of chemical attack must be taken into consideration in the life-cycle evaluation for a particular application. Each combination of material cost, installation cost and service life must be evaluated and judged on its own merits.

In certain cases involving a slow rate of chemical attack, particularly when the application will be pressurized, simple immersion data, like that represented in Table 3, may not adequately characterize performance throughout the intended design life. Longer-term testing to replicate service conditions is advisable to fully measure the effects of these chemicals.

6.0 CHEMICAL RESISTANCE DATA FOR PLASTIC PIPING IN NON-PRESSURE APPLICATIONS AND DATA TABLE

When plastic pipes come into contact with chemical agents it is important to know how the pipe may be affected. For non-pressure applications, where the pipe is not subject to continuous internal pressure or stress, chemical immersion test data may provide suitable information. The pipe manufacturer may have additional data from similar tests, or information on previous installations under similar field conditions.

The following cautions apply to Table 3 *List of Chemical Resistances*:

- **Data Sources.** The information in Table 3 has been obtained from numerous sources. The data are based primarily on plastic material test specimens that have been immersed in the chemical and evaluated, and to a lesser degree, on field-experience. In most cases, detailed information on the test conditions (e.g., exposure time), and on test results (e.g., change in weight, change in volume, and change in

strength) was not available. Therefore, this information is best used only for comparison of different plastic materials.

- *Combinations of Chemicals.* Chemicals that individually do not have an effect may affect the pipe if combined with certain other chemicals. The list of possible combinations of chemicals is endless. Table 3 does not address chemical combinations.
- *Composite Piping.* Layered composite piping may have chemical resistance that differs from that of the individual materials in the layers. Table 3 is not applicable to layered composite piping products.
- *Applicability to fiberglass and filled materials.* Table 3 is not applicable to reinforced epoxy resin (fiberglass) pipes, and to plastic pipes containing significant percentages of filler materials.
- *Concentrations.* Where no concentrations are given (indicated as 'P'), the commercially pure material is indicated, except in the case of solids where saturated aqueous solutions are indicated.

See Table 2 for the **Resistance Codes** which are used throughout Table 3.

Table 2: Resistance Codes

Code	Meaning	Typical Result
R to xx°F	Plastic material is generally Resistant up to the temperature (°F) indicated by code and may have limited resistance at higher temperatures	Swelling < 3% or weight loss < 0.5% and elongation at break not significantly changed Typical performance properties not significantly affected
L to xx°F	Plastic material has Limited resistance at the temperature (°F) indicated by code. Compatibility at lower temperatures should not be assumed	Material may experience swelling in the range of 3 - 8% or weight loss of 0.5 - 5% and/or reduction in elongation at break by < 50% Some effect on performance properties
N	Plastic material is Not resistant.	Material may experience swelling > 8% or weight loss > 5% and/or reduction in elongation at break by > 50%
P	Pure Concentration	
—	Data not available Check with piping manufacturer	

Chemicals that do not normally affect the properties of an unstressed plastic may cause completely different behavior (such as stress cracking) when under mechanical stress, such as constant internal pressure or mechanical stress cycles.

Unstressed immersion test chemical resistance information is applicable only when the plastic pipe will not be subject to mechanical load or stress that is constant, or cycles frequently.

When the pipe will be subject to a continuous applied mechanical stress or to combinations of chemicals, testing that duplicates the expected field conditions, as closely as possible, should be performed on representative samples of the pipe product to properly evaluate that plastic pipe for use in this application.

7.0 OTHER RESOURCES

The following references provide additional information on chemical compatibility of plastic piping and may provide useful guidance:

- [PPI Comments on Permeation of Water Pipes and on the AWWA-RF Report on Hydrocarbons](#)
- [PPI Statement A – Relative Oxidative Aggressiveness of Chloramines and Free Chlorine Disinfectants on Crosslinked Polyethylene \(PEX\) Pipes used in Treated Potable Water](#)
- [PPI Statement N – Barrier Properties of Plastic Pipe Used for Potable Water Service](#)
- [PPI TN-11 – Suggested Temperature Limits for Thermoplastic Pipe Installation and for Non-Pressure Pipe Operation](#)
- [PPI TN-44 – Long Term Resistance of AWWA C906 Polyethylene \(PE\) Pipe to Potable Water Disinfectants](#)
- [PPI TN-49 – Recommendations for AWWA C901 Service Tubes in Potable Water Applications](#)
- [PPI TN-52 – Guide to High-Temperature Applications of Non-Potable PEX Pipe and Tubing Systems](#)
- [PPI TN-53 – Guide to Chlorine Resistance Ratings of PEX Pipes and Tubing for Potable Water Applications](#)
- [PPI TN-67 – Chlorine Dioxide and Plastic Hot- And Cold- Water Plumbing Distribution Pipes](#)
- [ISO TR 10358 Plastics pipes and fittings for industrial applications — Collection of data on combined chemical-resistance](#)

May not be fully applicable to pressurized applications

Table 3: List of Chemical Resistances (°F)

Chemical Formula	Concentration	ABS	CPVC	PP (PP-R, PP-RCT)	PVC	PE (MDPE, HDPE, PE-RT)	PB	PVDF	PEX	PA11, PA12	PA66	PSU	PPSU
Acetaldehyde CAS# 75-07-0 CH ₃ CHO	40%	---	N	---	L to 73	R to 73	---	N	R to 73	---	---	---	---
	Pure	---	N	R to 140	N	L to 73	L to 73	---	L to 140	L to 176	---	R to 73	---
Acetamide CAS# 60-35-5 CH ₃ CONH ₂	5%	R to 120	---	R to 140	---	R to 140	---	R to 75	R to 140	---	---	---	---
Acetic Acid CAS# 64-19-7 CH ₃ COOH	vapor	R to 120	R to 180	R to 180	R to 140	R to 140	R to 140	---	R to 140	---	---	---	---
	10%	---	R to 180	---	---	---	---	R to 248	R to 180	R to 176	---	---	---
	25%	N	N	R to 180	R to 140	R to 140	R to 140	---	R to 140	---	---	---	---
	40%	---	---	---	---	---	---	R to 140	---	---	---	---	---
	50%	---	---	---	---	---	---	R to 140	---	L to 68	---	---	---
	60%	N	N	R to 180	R to 73	R to 73	R to 73	R to 104	---	---	---	---	---
	85%	N	N	R to 120	R to 73	R to 73	R to 73	---	---	---	---	R to 167	R to 167
	glacial	N	N	R to 120	R to 73	R to 73	R to 73	R to 104	R to 68	---	---	R to 167	R to 167
Acetic Anhydride CAS# 108-24-7 (CH ₃ CO) ₂ O	---	N	N	R to 73	N	R to 73	R to 140	N	R to 73	L to 68	---	---	---
Acetone CAS# 67-64-1 CH ₃ COCH ₃	5%	N	R to 180	R to 73	N	L to 73	R to 140	R to 212	L to 73	L to 140	---	N	---
	10%	---	L to 180	---	---	---	---	R to 122	---	---	---	---	---
	100%	---	N	---	---	---	---	---	---	---	---	---	---
Acetophenone CAS# 98-86-2 C ₆ H ₅ COCH ₃	---	N	N	R to 120	--	R to 73	---	R to 68	R to 73	---	---	---	---
Acetyl Chloride CAS# 75-36-5 CH ₃ COCl	---	N	N	---	N	---	---	R to 125	---	---	---	---	---
Acetylene CAS# 74-86-2 HC≡CH	gas 100%	R to 73	N	R to 73	N	R to 73	L to 73	R to 250	R to 73	R to 140	---	---	---
Acetylnitrile CAS 75-05-8 CH ₃ C≡N	---	---	N	---	N	---	---	---	---	---	---	---	---

May not be fully applicable to pressurized applications

Chemical Formula	Concentration	ABS	CPVC	PP (PP-R, PP-RCT)	PVC	PE (MDPE, HDPE, PE-RT)	PB	PVDF	PEX	PA11, PA12	PA66	PSU	PPSU
Acrylic Acid CAS# 79-10-7 $\text{H}_2\text{C}=\text{CHCOOH}$	97%	---	N	---	N	R to 140	---	---	R to 140	---	---	---	---
Acrylonitrile CAS# 107-13-1 $\text{H}_2\text{C}=\text{CHC}\equiv\text{N}$	---	---	N	---	N	R to 140	---	R to 75	R to 140	---	---	---	---
Adipic Acid CAS#124-04-9 $\text{COOH}(\text{CH}_2)_4\text{COOH}$	Saturated	---	R to 180	R to 140	R to 140	R to 140	R to 73	R to 176	R to 140	---	---	---	---
Allyl Alcohol CAS# 107-18-6 $\text{CH}_2 = \text{CHCH}_2 \text{ OH}$	96%	---	L to 73	R to 140	R to 73	N	R to 140	R to 125	L to 100	---	---	---	---
Allyl Chloride CAS# 107-05-1 $\text{CH}_2=\text{CHCH}_2\text{Cl}$	--	---	N	---	N	L to 73	---	R to 140	L to 73	---	---	---	---
	Liquid	---	---	---	---	---	---	R to 68	---	---	---	---	---
Aluminum Ammonium Sulfate (Alum) CAS# 7784-25-0 $\text{AlNH}_4 (\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$	Saturated	---	R to 180	R to 140	R to 140	R to 140	---	---	R to 140	---	---	---	---
Aluminum Chloride CAS# 7446-70-0 AlCl_3	Saturated	R to 160	R to 180	R to 180	R to 140	R to 140	R to 140	R to 212	R to 140	---	---	---	---
Aluminum Fluoride Anhydrous CAS# 7764-18-1 AlF_3	Saturated	R to 160	R to 180	R to 180	R to 73	R to 140	R to 140	R to 212	R to 140	---	---	---	---
Aluminum Hydroxide CAS# 21645-51-2 $\text{Al}(\text{OH})_3$	Saturated	R to 160	R to 180	R to 180	R to 140	R to 140	R to 140	R to 212	R to 140	---	---	---	---
Aluminum Nitrate CAS# 13473-90-0 $\text{Al}(\text{NO}_3)_3 \cdot 9\text{H}_2\text{O}$	Saturated	---	R to 180	R to 180	R to 140	R to 140	R to 140	R to 212	R to 140	---	---	---	---
Aluminum Oxychloride CAS# 1327-41-9	--	---	R to 180	R to 180	R to 140	---	R to 140	R to 125	---	---	---	---	---
Aluminum Potassium Sulfate (Alum) CAS# 10043-67-1 $\text{AlK}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$	Saturated	R to 160	R to 180	R to 140	R to 140	R to 140	---	R to 212	R to 140	---	---	---	---
Aluminum Sulfate CAS# 10043-01-3 $\text{Al}_2(\text{SO}_4)_3$	Saturated	R to 160	R to 180	R to 140	R to 140	R to 140	C to 73	R to 212	R to 140	R to 194	---	---	---

May not be fully applicable to pressurized applications

Chemical Formula	Concentration	ABS	CPVC	PP (PP-R, PP-RCT)	PVC	PE (MDPE, HDPE, PE-RT)	PB	PVDF	PEX	PA11, PA12	PA66	PSU	PPSU
Ammonia Gas CAS# 7664-41-7 NH ₃	100%	N	N	R to 140	R to 140	R to 140	R to 140	---	R to 140	R to 140	---	---	---
Ammonium Acetate CAS# 631-61-8 CH ₃ COONH ₄	Saturated	R to 120	R to 180	R to 73	R to 140	R to 140	---	R to 212	R to 140	---	---	---	---
Ammonium Bifluoride CAS# 1341-49-7 NH ₄ HF ₂	Saturated	---	R to 180	R to 180	R to 140	---	R to 140	R to 150	R to 140	---	---	---	---
Ammonium Bisulfide CAS# 12124-99-1 (NH ₄)HS	---	---	---	---	R to 140	---	---	---	---	---	---	---	---
Ammonium Carbonate CAS# 506-87-6 (NH ₄) ₂ CO ₃	Saturated	---	R to 180	R to 212	R to 140	R to 140	R to 140	R to 248	R to 140	---	---	---	---
Ammonium Chloride CAS# 12125-02-9 NH ₄ Cl	Saturated	R to 120	R to 180	R to 212	R to 140	R to 140	R to 140	R to 212	R to 140	---	---	---	---
Ammonium Dichromate CAS# 7789-09-5 (NH ₄) ₂ Cr ₂ O ₇	--	---	R to 73	---	R to 73	---	---	R to 250	---	---	---	---	---
Ammonium Fluoride CAS# 12125-01-8 NH ₄ F	10%	R to 120	R to 180	R to 212	R to 140	R to 140	---	R to 212	R to 140	---	---	---	---
	25%	R to 120	R to 180	R to 212	L to 140	R to 140	R to 73	---	R to 140	---	---	---	---
Ammonium Hydroxide CAS# 1336-21-6 NH ₄ OH	10%	R to 120	N	R to 212	R to 140	R to 140	R to 140	---	R to 140	---	---	---	---
	30%	---	---	---	---	R to 140	---	---	R to 140	---	---	---	---
	Saturated	---	---	---	---	---	---	---	R to 194	---	---	---	---
Ammonium Metaphosphate CAS# 13446-46-3 NH ₃ HPO ₃	Saturated	--	--	R to 212	R to 140	R to 140	R to 140	R to 248	R to 140	---	---	---	---
Ammonium Nitrate CAS# 6484-52-2 NH ₄ NO ₃	Saturated	R to 120	R to 180	R to 212	R to 140	R to 140	R to 140	R to 212	R to 140	---	---	---	---
Ammonium Persulfate CAS# 7727-54-0 (NH ₄) ₂ S ₂ O ₈	---	---	R to 180	R to 140	R to 140	R to 140	R to 140	R to 212	R to 140	---	---	---	---
Ammonium Phosphate (Monobasic) CAS# 7722-76-1 NH ₄ H ₂ PO ₄	---	R to 120	L to 73	R to 212	R to 140	R to 140	R to 140	R to 248	R to 140	---	---	R to 199	R to 199

May not be fully applicable to pressurized applications

Chemical Formula	Concentration	ABS	CPVC	PP (PP-R, PP-RCT)	PVC	PE (MDPE, HDPE, PE-RT)	PB	PVDF	PEX	PA11, PA12	PA66	PSU	PPSU
Ammonium Sulfate CAS# 7783-20-2 (NH ₄) ₂ SO ₄	Saturated	R to 120	R to 180	R to 212	R to 140	R to 140	R to 140	R to 212	R to 140	---	---	---	---
Ammonium Sulfide CAS# 12135-76-1 (NH ₄) ₂ S	dilute	R to 120	R to 180	R to 212	R to 140	R to 140	R to 140	R to 200	R to 140	---	---	---	---
	Saturated	---	---	---	---	R to 140	---	R to 125	---	---	---	---	---
Ammonium Thiocyanate CAS# 1762-95-4 NH ₄ SCN	50-60%	R to 120	R to 180	R to 212	R to 140	R to 140	R to 140	R to 212	R to 73	---	---	---	---
Amyl Acetate CAS# 628-63-7 CH ₃ COOC ₅ H ₁₁	--	N	N	N	N	R to 73	---	R to 122	R to 73	C to 194	---	---	---
Amyl Alcohol CAS# 75-41-0 C ₅ H ₁₁ OH	--	---	N	---	N	R to 140	R to 140	R to 212	R to 140	---	R to 73	---	---
	100%	---	---	---	---	---	L to 140	---	---	---	---	---	---
n-Amyl Chloride CAS# 543-59-9 CH ₃ (CH ₂) ₃ CH ₂ Cl	--	N	N	N	N	L to 73	---	R to 285	L to 73	---	---	---	---
Aniline CAS# 62-53-3 C ₆ H ₅ NH ₂	--	N	N	---	N	R to 73	L to 140	R to 68	L to 140	---	---	---	---
Aniline Chlorohydrate	--	---	N	---	N	L to 73	N	---	L to 73	---	---	---	---
Aniline Hydrochloride CAS# 142-04-1 C ₆ H ₅ NH ₂ • HCl	Saturated	---	N	---	N	R to 140	N	R to 75	R to 140	---	---	---	---
Anthraquinone CAS# 84-65-2 C ₁₄ H ₈ O ₂	--	---	R to 180	---	R to 140	L to 73	L to 73	---	L to 73	---	---	---	---
Anthraquinone Sulfonic Acid CAS# 82-49-5 C ₁₄ H ₇ O ₂ • SO ₃ • H ₂ O	--	---	R to 180	R to 73	R to 140	R to 140	L to 73	---	L to 73	---	---	---	---
Antimony Trichloride CAS# 10025-91-9 SbCl ₃	Saturated	---	R to 180	R to 140	R to 140	R to 140	R to 140	R to 140	R to 140	---	---	---	---
Aqua Regia ` CAS# 8007-56-5 (Nitrohydrochloric Acid) HCl+HNO ₃	--	N	R to 73	N	L to 73	N	N	L to 194	N	---	---	N	---
Arsenic Acid CAS# 7778-39-4 H ₃ AsO ₄	80%	---	R to 180	R to 140	R to 140	R to 140	R to 140	R to 248	R to 140	---	---	---	---