Technical Information

Magnetic Flowmeter
Material Selection Guide

TI 1E6A0-06E

1. INTRODUCTION

This is the selection guide of the wetted part materials of ADMAG series magnetic flowmeters. This selection guide is composed of data based on field experience and published data. However, the data doesn't always apply the actual process conditions. For suitable selection of the materials, careful consideration of the process fluid is required; conditions such as temperature, pressure, consistency, corrosiveness, abrasiveness and/or adhesiveness are possible to affect the corrosion rate.

2. DISCLAIMER

Final responsibility for material selection remains with the customer (end-user) who knows the actual process conditions best. Yokogawa does not guarantee any data shown in this guide.

YOKOGAWA
Yokogawa Electric Corporation

TI 1E6A0-06E
1st Edition: Apr. 1990 (YK)
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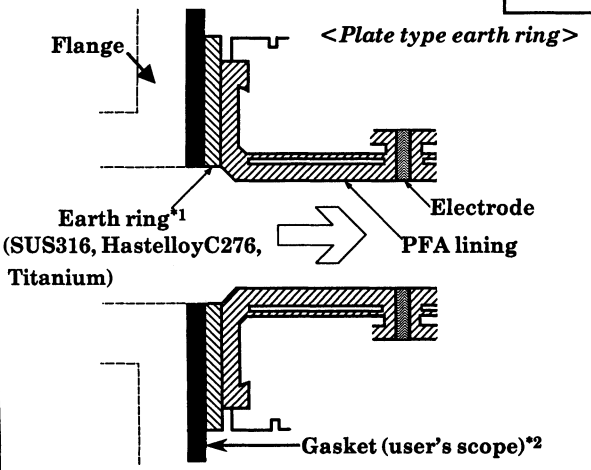
3. MAGNETIC FLOWMETER WETTED PARTS

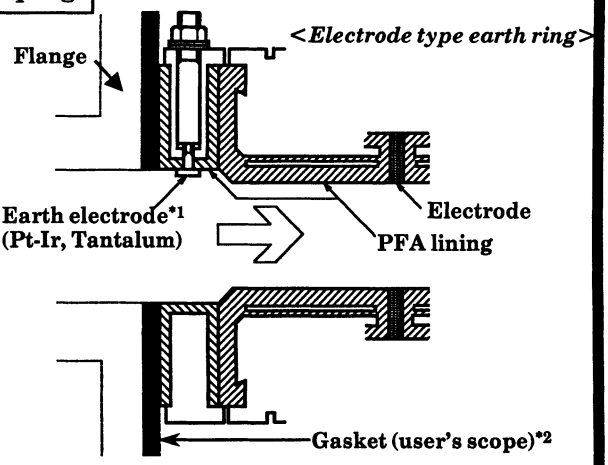
■ Fluorocarbon PFA Lining

For metal piping



Model : AM/AE 102 ~ 340 □□-A□□-□ S/H/V

For low corrosive liquids which not require platinum (P) or tantalum (T) electrodes

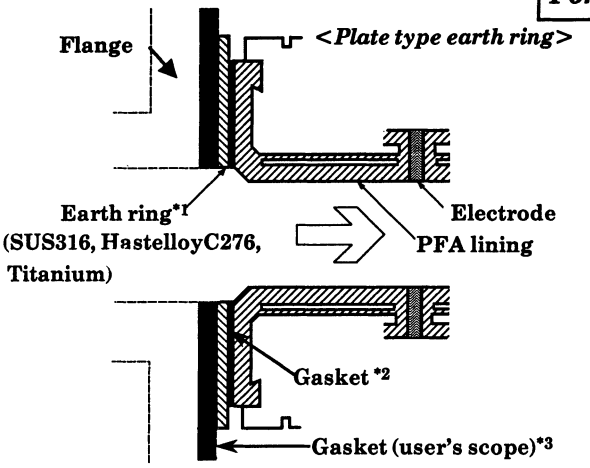


Model : AM/AE 102 ~ 340 □□-A□□-□ P/T

For strong corrosive liquids.

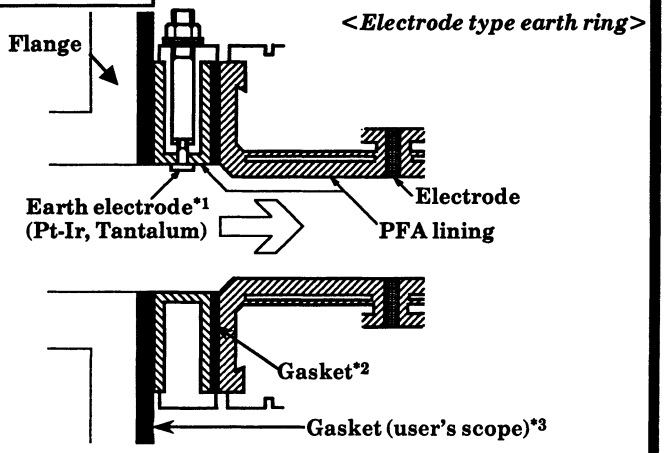
*1: To select a material equivalent to the electrode material for the earth ring/earth electrode material.
*2: To use compressed non-asbestos fiber gasket, PTFE gasket or the gasket which has equal elasticity for metal piping.

For PVC piping



Model : AM/AE 102 ~ 340 □□-A□□-□ S/H/V... /FRG

For low corrosive liquids which not require platinum (P) or tantalum (T) electrodes



Model : AM/AE 102 ~ 340 □□-A□□-□ P/T... /FRG

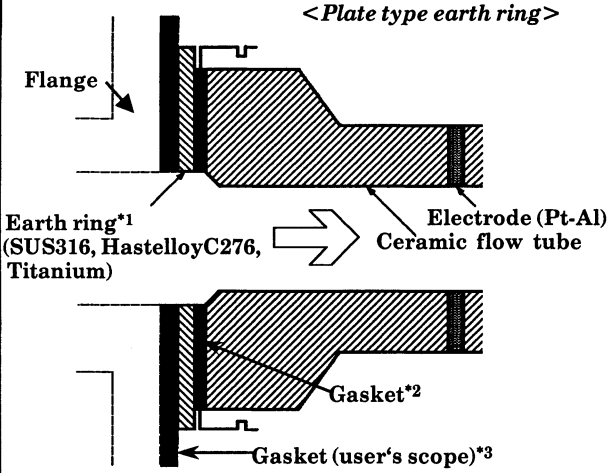
For strong corrosive liquids.

*1: To select a material equivalent to the electrode material for the earth ring/earth electrode material.
*2: To select the optional code /FRG (fluoro rubber gasket) between the lining and the earth ring /earth electrode. VALQUA#4010 gasket is also available. (See "4.3 Gasket Material".)
*3: To use rubber gasket or others which has equal elasticity for PVC piping.

■ Ceramic Lining

For metal piping / PVC piping

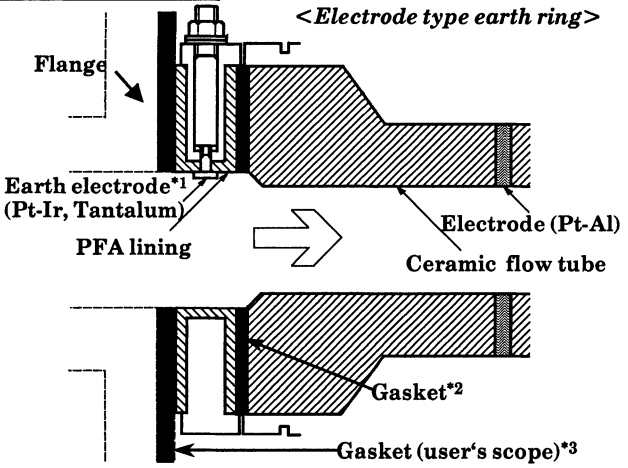
<Plate type earth ring>



Model : AM / AE 115 ≀ 220 □□-C□□-E S / H / V

For low corrosive liquids which not require platinum (P) or tantalum (T) electrodes

<Electrode type earth ring>

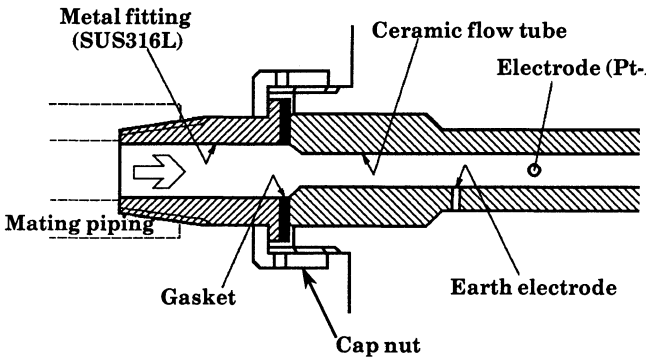


Model : AM / AE 115 ≀ 220 □□-C□□-E P / T

For strong corrosive liquids.

*1: To select a material equivalent to the electrode material for the earth ring/earth electrode material.
*2: For metal piping, VALQUA#7020 gasket is supplied as standard for insertion between the ceramic tube and the earth ring. VALQUA#7026 gasket is also available. (See "4.3 Gasket Material".)
For PVC piping, to select the optional code /FRG (fluoro rubber gasket) between the lining and the earth ring /earth electrode. VALQUA#4010 gasket is also available. (See "4.3 Gasket Material".)
*3: For metal piping, to use compressed non-asbestos fiber gasket, PTFE gasket or the gasket which has equal elasticity.
For PVC piping, to use rubber gasket or others which has equal elasticity.

Union joint



Model : AM / AE 102 / 105 / 110 □□-C

The standard metal fitting material is stainless steel JIS SUS316L. If the mating piping is made of PVC, we can also provide PVC fitting *.
For the gasket, VALQUA #7020 is used as standard. VALQUA #7026 is also available. (See "4.3 Gasket Material".)
*Even in case of PVC fitting, the standard gasket is available (no need /FRG) because the cap nut is made of metal.

4. MATERIAL FEATURES

4.1 Lining Material

	Abrasion resistance	Heat resistance	Pressure tightness Note 4)	Corrosion resistance	Adhesion resistance
Fluorocarbon PFA	Not applicable	160°C max.	4MPa max.	Suitable Note 1)	Normally
Ceramic	Suitable	180°C max.	4MPa max.	Suitable Note 2)	Suitable Note 3)
Polyurethane	Normally applicable	40°C max.	2MPa max.	Not applicable	Normally

Note 1) This cannot be used for potassium hydroxide and is also a vulnerable to nitric acid, hydrofluoric acid, and fluorides.
Note 2) This is vulnerable to hydrofluoric acid, phosphoric acid, and strong alkalis.
Note 3) The inner surface must be mirror-finished.
Note 4) Maximum pressure depends on sizes and models.

4.2 Electrode Material

	Applications
Stainless Steel JIS SUS316L	Suitable for filtrated water and sewage Cannot be used for organic and inorganic acids and chlorides
Hastelloy C-276	Meets the abrasive liquid requirements Vulnerable to chlorides and sulfuric acids
Titanium	Usable for chlorides, sulfides, sulfuric acid compounds, and alkali solutions Unusable for hydrochloric acids, sulfuric acids, nitric acids, etc.
Platinum-iridium	Not chemically attacked by almost any chemical. Not applicable to aqua regia, ammonium salt, etc.
Tantalum	Not chemically attacked by almost any chemical Vulnerable to HF, strong NaOH, and fuming nitric acid

4.3 Gasket Material

	Product name	Applications
Standard gasket for ceramic lining	VALQUA #7020 (ceramic particles are filled in PTFE)	Applicable to high concentration sulfuric acid or nitric acid
Alkali-resistant gasket for ceramic lining*	VALQUA #7026 (carbon particles are filled in PTFE)	Applicable to high concentration alkalis such as potassium hydroxide and sodium hydroxide, and acids such as hydrochloric acid and hydrofluoric acid
Gasket for PVC piping	Rubber containing fluorine (Viton) Optional code /FRG	For PVC piping to which sufficient axial fastening force cannot be applied.
Acid-resisting gasket for PVC piping*	Rubber containing fluorine (VALQUA #4010) Mixing No.: RCD470	For PVC piping to which sufficient axial fastening force cannot be applied. Applicable to strong acidic liquids.
Alkali-resisting gasket for PVC piping*	Rubber containing fluorine (VALQUA #4010) Mixing No.: RCD970	For PVC piping to which sufficient axial fastening force cannot be applied. Applicable to strong alkaline liquids.

* Special spec. ; Contact Yokogawa.

5. MATERIAL CORROSION RESISTANCE

Wetted material / Liquid name (Liquid temperature is assumed as max. 100degC when it is not specified.)	Lining		Electrode/Earth ring					Gasket				
								For metal piping		For PVC piping		
	PFA	Ceramic	SUS 316	Pt-Ir	Hastelloy C	Tantalum	Titanium	Standard	Alkali-resistant	/FRG	Acid-resistant	Alkali-resistant
Acetaldehyde CH_3CHO(100%)	A	A	A	A	A	A	A	A	A	N	N	N
Acetic acid CH_3COOH(50%)	A	A	B	A	A	A	A	A	A	N	N	N
Acetic acid (75%)	A	A	N	A	A	A	A	A	A	N	N	N
Alum (100%)	A	A	N	A	N	A		B	A	A	A	A
Aluminum chloride $AlCl_3$(100%)	A	A	N	A	A	B	A	A	A	A	A	A
Aluminum fluoride (100%)	A	A	N	A	N	N	B	B	A	A	A	A
Aluminum hydroxide $Al(OH)_3$(100%)	A	A	B	A	N	A		B	A			
Aluminum nitrate (100%)	A	A	N	A	N	N	B	N	N			
Aluminum sulfate $Al_2(SO_4)_3$(100%)	A	A	N	A	B	A	B	A	A	A	A	A
Aluminum potassium sulfate (100%)	A	A	N	A	B	A	A	B	A			
Amidosulfonic acid (100%)	A	A	N	A	N	A		A	A			
Ammonium carbonate $(NH_4)_2CO_3 \cdot H_2O$(50%)	A	A	B	A	B	A	B	B	A	A	A	
Ammonium chloride NH_4Cl(30%)	A	A	N	A	A	A	B	A	A			
Ammonium fluoride NH_4F(100%)	A	A	N	A	B	N	A	B	A			
Ammonium hydrogencarbonate (50%)	A	A	N	A	N	A		B	A			A
Ammonium hydrogenfluoride (50%)	A	A	N	A	B	N	N	N	A			N
Ammonium hydroxide (100%)	A	A	A	A	A	A	A	B	A		B	B
Ammonium nitrate (100%)	A	A	B (120°C)	B	N	B	B	A	N			
Ammonium persulfate (100%)	A	A	B	A	B	A	N	A	N			A
Ammonium phosphate $(NH_4)_3PO_4$(100%)	A	A	A	A	A	A		B	A			
Ammonium sulfate $(NH_4)_2SO_4$(20%)	A	B	B	A	B	A	B	A	A	N	N	N

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Note 2) Assessment is shown in the case of containing no mixture in the liquids.

Note 3) Corrosion-resistance assessment for ceramics lining is that containing electrodes (platinum-alumina cermet)

Note 4) Shaded parts show the products handled as semi-standard.

A	Usable
B	Usable term may be short.
N	Unusable due to permeation, corrosion,
No symbol	No data

Wetted material / Liquid name (Liquid temperature is assumed as max. 100degC when it is not specified.)	Lining		Electrode/Earth ring					Gasket				
								For metal piping		For PVC piping		
	PFA	Ceramic	SUS 316	Pt-Ir	Hastelloy C	Tantalum	Titanium	Standard	Alkali-resistant	/FRG	Acid-resistnt	Alkali-resistant
Ammonium sulfide $(NH_4)_3S$(100%)	A	A		B		B		A	A	N		
Antimony pentachloride (100%)	A	A	N	A	B	A		A	A			
Antimony trichloride (100%)	A	A	N	A	N	A		A	A			
Aqua regia (100%)		N	N	N	N	A	B	B	N		A	B
Arsenic acid (100%)	A	A	N	A	N	A		B		A	A	A
Arsenous acid (100%)	A	A	N	A	N	A		A	A			
Barium carbonate (100%)	A	A	N	A	N	A		A	A			A
Barium chloride $BaCl_2$(30%)	A	A	N	A	A	A	B	A	A	A	A	A
Barium hydroxide $Ba(OH)_2$(50%)	A	A	B	A	B	B	B	B	A	A	A	A
Barium sulfate $BaSO_4$(100%)	A	A	N	A	N	A	B	A	A	A	A	A
Barium sulfide BaS(100%)	A	A	N	A	A	A	A	B	A	A	A	A
Benzenesulfonic acid (100%)		A	N	A	B	A	N	A	A		A	N
Boron Fluoride (100%)	B		A	A	B	A	N	N	A			
Cadmium chloride $CdCl_2$(100%)	A	A	N	B	N	A		A	A			
Calcium carbonate $CaCO_3$(100%)	A	A	B	A	B	A	A	A	A	A	A	A
Calcium chlorate $CaClO_3$(30%)	A	A	N	A	B	A	B	B	N			A
Calcium chloride $CaCl_2$(40%)	A	A	N	A	B	A	B	A	A	A	A	A
Calcium hydroxide $Ca(OH)_2$(50%)	A	A	B	A	A	A	A	B	A	A	A	A
Calcium hypochlorite $Ca(ClO)_2$(100%)	A	A	N	A	B	A	A	A	N	A	A	A
Calcium nitrate $Ca(NO_3)_2$(10%)	A	A	N	A	N	A	A	A	N	A	A	A
Calcium sulfate $CaSO_4$(100%)	A	A	N	A	B	A		A	A	A	A	A
Chloroacetic acid (100%)	A	A	N	A	B	A		B	B			B
Chlorosulfuric acid $ClSO_3H$(100%)	B	A	N	A	B	A		B				
Chromic acid H_2CrO_4(100%)	A	A	N	A	N	A		A	N			

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Wetted material / Liquid name (Liquid temperature is assumed as max. 100degC when it is not specified.)		Lining		Ectrode/Earth ring					Gasket				
									For metal piping		For PVC piping		
		PFA	Ceramic	SUS 316	Pt-Ir	Hastelloy C	Tantalum	Titanium	Standard	Alkali-resistant	/FRG	Acid-resistant	Alkali-resistant
Chrome fluoride	(100%)	A	A						B	A			
Chromic acid	H_2CrO_4(50%)	A	A	N	A	N	A	A	A	N	A	A	A
Chromium sulfate	(100%)	A	A	N	A	B	A		A	A			
Copper(II) chloride	$CuCl_2$(50%)	A	A	N	N	N	A	N	A	A	A	A	A
Copper(II) cyanide	(100%)	A	A	B	A	B	A		A	A		A	
Copper fluoride	CuF_2(100%)	A		N	A	N	N		N	A			
Copper(II) nitrate	(50%)	A	A	N	A	B	A	B	A	N			
Copper oxychloride	(100%)	A	A	N	A	N	N	N	A	N			B
Copper sulfate	(40%)		A	N		B	A	B	A	A	A	A	A
Copper sulfide	(100%)	A	A	B	A	B	A		B	A			
Fluorosilicic acid	(35%)	A	A	N	A	B	N		B	A			
Fluorosilicic acid	(40%)	B		N	A	B	N	N	N	A			
Fluorosilicic acid	(100%)	B (35°C)	A	N	A	B	N		B	A			
Formaldehyde	HCHO(100%)	A	A	N	A	B	A		A				N
Formic acid	HCOOH(80%)	A	A	N	A	B	A	B	N	B	N	N	B
Glycerin	(100%)	A	A	A	A	A	A	A	A	B	A	A	A
Hydrobromic acid	(50%)	A	A	N	N	N	A		A	A	A	A	A
Hydrochloric acid	HCl(10%, 180°C)	A	B	N	B	N	A	N	N	A		A	A
Hydrochloric acid	HCl(100%, 20°C)	A	B	N	B	N	A	N	B	A			B
Hydrochloric acid	HCl(10%, 60°C)	A	A	N	B	N	A	B	A	A	A	A	A
Hydrochloric acid	HCl(38%, 60°C)	A	A	N	B	N	A	N	A	A	A	A	A
Hydrofluoric acid	$HF.H_2O$(98%, 20°C)	B	A	N	A	B	N	B	N	A		A	
Hydrogen cyanide	HCN(100%)	A	A	B	A	B	A		A	A			

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Note 3) Corrosion-resistance assessment for ceramics lining is that containing electrodes (platinum-alumina cermet)

Note 4) Shaded parts show the products handled as semi-standard.

A	Usable
B	Usable term may be short.
N	Unusable due to permeation, corrosion,
No symbol	No data

Wetted material / Liquid name (Liquid temperature is assumed as max. 100degC when it is not specified.)		Lining		Electrode/Earth ring					Gasket				
									For metal piping		For PVC piping		
		PFA	Ceramic	SUS 316	Pt-Ir	Hastelloy C	Tantalum	Titanium	Standard	Alkali-resistant	/FRG	Acid-resistant	Alkali-resistant
Hydrogen peroxide	H_2O_2(50%)	A		A	B	B	B	B	N	N		A	B
Hydroxy acetic acid	(35%)	B	A	B	A	B	A		B	A			
Hydroxy acetic acid	(70%)	B		B	A	B	A		B	A			
Hypochlorous acid	(20%)	A	A	N	N	B	A	N	A	N	A	A	A
Iron(II) chloride	$FeCl_2$(100%)	A	A	N	A	B	A	A	A	A		A	A
Iron(III) chloride	$FeCl_3$(100%)	A	A	N	A	B	A	A	A	A	A	A	A
Iron(II) nitrate	(100%)	A	A	N	A	B	A		A	N	A	A	A
Iron(III) nitrate	(100%)	A	A	N	A	B	A		A	N			
Iron nitrate	(100%)	A	A	N	A	B	A		A	N	A	A	A
Iron(II) sulfate	$FeSO_4$(100%)	A	A	N	A	B	A		A	A			
Lead acetate	$Pb(CH3COO)_2.3H_2O$(100%)	A	A	N	N	N	A		A	A	N	N	N
Lithium chloride	LiCl(100%)	A	A	N	A	A	A	A	A	A			A
Magnesium carbonate	$MgCO_3$(10%)	A	A	B	A	B	A		A	A			A
Magnesium chloride	$MgCl_2$(40%)	A	A	N	A	A	A	B	A	A	A	A	A
Magnesium hydrogensulfate	(100%)	A		B		B			N	A			
Magnesium hydroxide	(100%)	A	A	N	A	N	N		B	A	A	A	A
Magnesium nitrate	(100%)	A	A	N	A	N	A	B	A	N			
Magnesium sulfate	$MgSO_4$(100%)	A	A	B	A	B	A	B	A	A	A	A	A
Mercury(II) chloride	Hg_2Cl_2(60%)	A	A	N	A	B	A	B	A	A	A	A	A
Nickel chloride	$NiCl_2$(20%)	A	A	N	A	B	A	A	A	A	A	A	A
Nickel nitrate	(10%)	A	A		A	B	A		A	N			
Nickel sulfate	$NiSO_4$(100%)	A	A	N	A	B	A		A	A	A	A	A
Nitric acid	HNO_3(10%, 100°C)	B	A	B	A	B	A	A	A	N	B	A	A
Nitric acid	HNO_3(60%, 100°C)	B	A	N	A	B	A	A	B	N	N	N	N

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Liquid name (Liquid temperature is assumed as max. 100degC when it is not specified.) \ Wetted material	Lining		Electrode/Earth ring					Gasket				
								For metal piping		For PVC piping		
	PFA	Ceramic	SUS 316	Pt-Ir	Hastelloy C	Tantalum	Titanium	Standard	Alkali-resistant	/FRG	Acid-resistant	Alkali-resistant
Nitric acid (70%, 70°C)	B	A	N	A	N	A	A	B	N		A	
Nitric acid (98%, 30°C)	B	A	N	A	N	A	N	B	N		A	
Oxalic acid $C_2H_2SO_4$(100%)	A	A	N	A	N	A	N	A	A			
Perchloric acid $HClO_4$(50%)	A	A	N	A	N	A	B	A	B		A	B
Phenol (carbolic acid) (10%)		A	B	A	B	A		A	A	A	A	A
Phosphoric acid H_3PO_4(100%, 20°C)	A	A	N	A	B	A	N	A				
Phosphoric acid (25%, 180°C)	A	A	B	A	B	A	B	A		A	A	A
Phosphoric acid (50%, 180°C)	A	B	N	A	B	A	N	B				
Phosphoric acid (50%, 60°C)	A	A	B	A	B	A	B	A	A	A	A	A
Phosphoric acid (80%, 180°C)	A	B	N	A	B	A	N	B				
Phosphoric acid (80%, 60°C)	A	A	N	A	B	A	N	A				
Potassium carbonate $CaCO_3$(100%)	A	A	B	A	B	A	B	A				A
Potassium chloride KCl(50%)	A	A	B	A	A	A	A	A	A	A	A	A
Potassium dichromate (100%)	A	A	A	A	N	A		A	N			
Potassium ferricyanide (100%)	A	A	N	N	N	A		A	N			
Potassium ferrocyanide (100%)	A	A	N	N	N	A		A	N			
Potassium hydroxide KOH(25%, 180°C)	A	N	N	A	B	A	B	N	A		B	B
Potassium hydroxide (50%, 180°C)	A	N	N	A	B	B	N	N	A			
Potassium nitrate (80%)	A	A	N	A	B	B	A	A	N	A	A	A
Potassium permanganate $KMnO_4$(10%)	B	A	N	A	N	B	B	A	N			
Potassium persulfate (10%)	A	A	B	A	B	A	A	A	N			A
Potassium sulfate KNO_3(100%)	A	A	B	A	A	A	B	A	A	A	A	A
Sea water	A	A	N	A	B	A	A	A		A	A	A

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Liquid name (Liquid temperature is assumed as max. 100degC when it is not specified.) \ Wetted material	Lining		Electrode/Earth ring					Gasket				
								For metal piping		For PVC piping		
	PFA	Ceramic	SUS 316	Pt-Ir	Hastelloy C	Tantalum	Titanium	Standard	Alkali-resistant	/FRG	Acid-resistant	Alkali-resistant
Silver nitrate (50%)	A	A	N	A	B	B	B	A	N	A	A	A
Sodium acetate CH_3COONa(100%)	A	A	N	A	N	A	A	A	A	N	N	N
Sodium borate (100%)	A	A	N	A	N	A		A				
Sodium bromide (100%)	A	A	N	A	N	A		A	A			A
Sodium carbonate Na_2CO_3(100%)	A	A	B	A	B	B	A	A	A	A	A	A
Sodium chlorate (40%)	A	A	N	A	B	A	A	B	N			A
Sodium chloride (30%)	A	A	N	A	A	A	A	A	A	A	A	A
Sodium chlorite $NaClO_2$(40%)	A		N	B	N	A	A	N	N			A
Sodium chromate Na_2CrO_4(100%)	A	A	N	A	N	A	A	B	N			A
Sodium cyanide (100%)	A	A	N	N	B	A	A	A	A			
Sodium ferricyanide (100%)	A	A	N	N		A		A	N			
Sodium fluoride NaF(100%)	A		N	A	N	N		N	A			
Sodium hydrogencarbonate (30%)	A	A	B	A	B	A	A	B	A	A	A	A
Sodium hydrogensulfate (100%)	A	A	N	A	N	A	A	N	A	A	A	A
Sodium hydrogensulfide (100%)	A		B	A	N	A		N	A			
Sodium hydrogensulfite (100%)	A	A	N	A	B	A		A	A	A	A	A
Sodium hydrosulfite (100%)	A		B	A	B	A		N	A			
Sodium hydroxide (30%, 180°C)	A	B	N	A	B	N	B	B	B			A
Sodium hydroxide (40%, 70°C)	A	B	B	A	A	N	B	B	A		B	A
Sodium hydroxide (40%, 90°C)	A	B	B	A	A	N	B	B	B		N	A
Sodium hydroxide (50%, 180°C)	A	B	N	A	B	N	B	B	B			A
Sodium hypochlorite $Na(ClO)_2$(15%)	A	A	N	A	A	A	A	A	N	A	A	A
Sodium hypochlorite $Na(ClO)_2$(25%)	B (90°C)	A	N	A	B	B	B	A	N			

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Note 1) Assessment at a parenthesized concentration or temperature is shown.

Note 2) Assessment is shown in the case of containing no mixture in the liquids.

Note 3) Corrosion-resistance assessment for ceramics lining is that containing electrodes (platinum-alumina cermet)

Note 4) Shaded parts show the products handled as semi-standard.

A	Usable
B	Usable term may be short.
N	Unusable due to permeation, corrosion,
No symbol	No data

Wetted material / Liquid name (Liquid temperature is assumed as max. 100degC when it is not specified.)	Lining		Electrode/Earth ring					Gasket				
								For metal piping		For PVC piping		
	PFA	Ceramic	SUS 316	Pt-Ir	Hastelloy C	Tantalum	Titanium	Standard	Alkali-resistant	/FRG	Acid-resistant	Alkali-resistant
Sodium metaphosphate (100%)	A	A						A	A			
Sodium nitrate (40%)	A	A	B	A	B	A	B	A	N	A	A	
Sodium nitrite $NaNO_2$(40%)	A	A	B	A	N	A	A	A	A			
Sodium silicate $Na_2O.xSiO_2$(100%)	A	A	A	A	B	A	A	B	A	A	A	A
Sodium sulfate Na_2SO_4(100%)	A	A	N	A	B	A		A	A	A	A	A
Sodium sulfide (100%)	A	A	N	A	B	A	B	B	A			
Sodium sulfite $NaSO_4$(30%)	A	A	B	A	A	A	A	A	A	A	A	A
Sodium tetraborate (100%)	A	A	B	A	B	A		A	B			
Sodium thiosulfate $Na_2S_2O_3$(100%)	A	A	N	A	B	N	B	A	A	A	A	A
Sulfuric acid H_2SO_4(100%, 60°C)	A	A	N	A	B	A	N	N			A	B
Sulfuric acid (30%, 180°C)	A	B	N	A	N	A	N	N			A	A
Sulfuric acid (30%, 60°C)	A	A	N	A	B	A	N	A			A	A
Sulfuric acid (70%, 100°C)	A	N	N	A	N	A	N	N			A	A
Sulfuric acid (70%, 60°C)	A	A	N	A	B	A	N	N			A	A
Sulfurous acid (10%)	A	A	B	A	A	A	B	A	A	A	A	A
Tin(II) chloride $SnCl_2$(100%)	A	A	N	A	N	A	B	A	A	A	A	A
Tin(IV) chloride $SnCl_4$(100%)	A	A	N	A	N	A	N	A	A	A	A	A
Trisodium phosphate $(NH_4)_3PO_4$(100%)	A	A	B	A	B	A		B	A			
Zinc chloride $ZnCl_2$(50%)	A	A	N	A	A	A	A	A	A			

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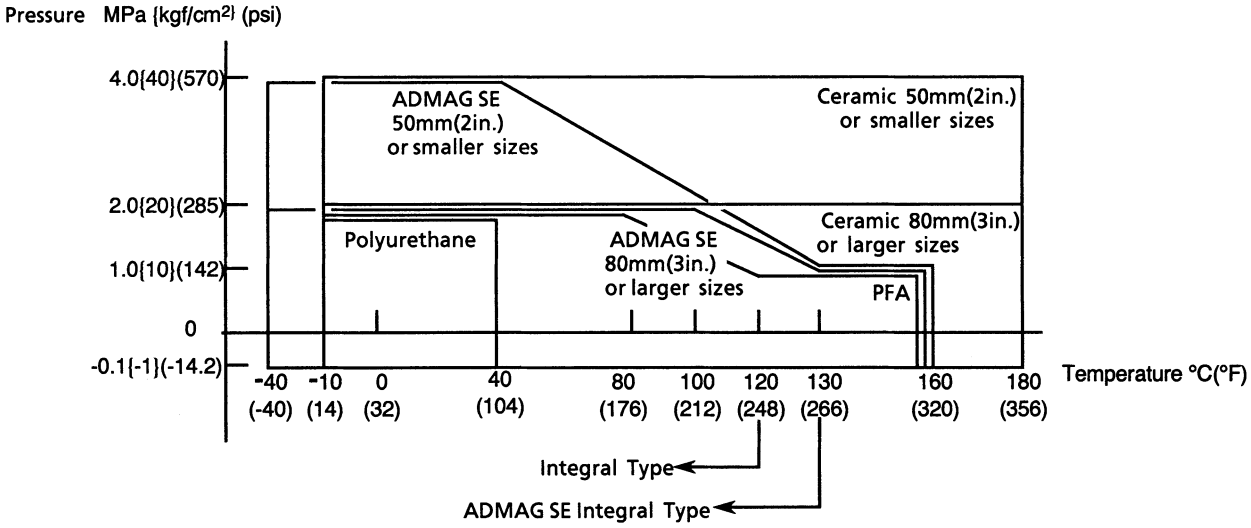
Note 3) Corrosion-resistance assessment for ceramics lining is that containing electrodes (platinum-alumina cermet)

Note 4) Shaded parts show the products handled as semi-standard.

A	Usable
B	Usable term may be short.
N	Unusable due to permeation, corrosion,
No symbol	No data

6. FLUID TEMPERATURE AND PRESSURE



7. THERMAL SHOCK LIMITS OF CERAMIC FLOW TUBE