

## DIAPHRAGM SEALS INTRODUCTION TO DIAPHRAGM SEALS

The diaphragm seal is designed to measure the process fluid pressure when the process fluid temperature is non-compatible to the instrument sensing element; when the process fluid may corrode the inner parts of the measuring instrument in contact with the fluid; when the fluid is highly viscous or it contains solid suspensions; when it solidifies at temperature changes.

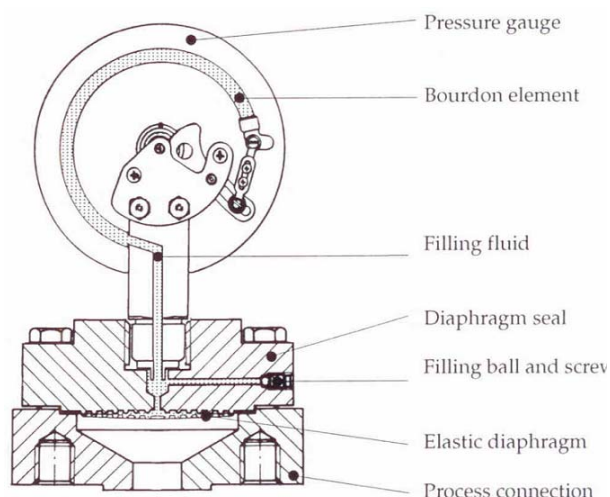
It is also used for long-distance pressure fluid transmission and measurement allowing to isolate dangerous fluids from the operating areas. It can be directly connected to the indicating instrument or through a capillary.

### OPERATING PRINCIPLE

The diaphragm seal operating principle is based on fluids non-compressibility (see drawing).

The separation from the process fluid is obtained from an elastic diaphragm sealed to the diaphragm seal body. The inner chamber between the diaphragm and the Bourdon tube is at first evacuated than filled with properly degassed fill fluid. At this point the system is able to transmit the mechanical stress produced by the process fluid on the diaphragm to the Bourdon tube.

Any bubble in the circuit must be avoided as it could affect the right system operation.



### RECOMMENDATIONS

The diaphragm and the body are in contact with the process fluid, therefore they must withstand the temperature and the possible fluid chemical aggression. A guide to the choice of the materials to use depending on the process medium is available under section "CORROSION / MATERIALS".

The filling fluid must be selected depending on the pressure fluid nature and temperature as well since any diaphragm fail may contaminate the process fluid and damage the whole process plant.

A guide for a filling-fluid selection is available under section "FILLING FLUID"

TAB. 1 – FILLING LIQUIDS

Liquid type	Limits of process temperature
Silicone oil type "A"	-45...+150°C
Silicone oil type "B"	-20...+250°C
Silicone oil type "C"	+20...+340°C
"Fluorolube"	-60...+150°C
Food oil	-20...+200°C

**Glycerine or silicone should not be used with highly oxidizing agents such as oxygen, chlorine, nitric acid or hydrogen peroxide, because of spontaneous chemical reaction, inflammability or explosion. The use of fluorinated fluid is recommended in these cases.**

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## FUNCTIONAL CHARACTERISTICS

**Accuracy:** at 20° +0.5%...1% depending on the diaphragm seal type. This accuracy value must be added to the pressure gauge accuracy.

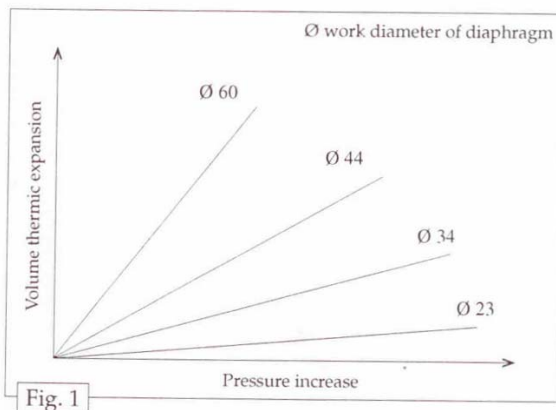
**Process fluid temperature:** Minimum -45°C, maximum 340°C, depending on the filling fluid, on the diaphragm material and on the process connection.

For temperature higher than the indicated limits please contact the Technical Service Department.

## TEMPERATURE INFLUENCE

The complete seal system composed by the diaphragm seal (with or without capillary) and the measuring instrument, is filled with a fixed amount of liquid at a fixed room temperature (generally +20°C +-2°C), called temperature of reference. Any ambient of fluid process temperature change produces a proportional variation of the filling fluid volume causing an inner pressure change that makes zero off at the indicating instrument. In order to minimize such an error it is necessary to compensate the volume modified by temperature variation.

Diaphragm of small diameter can compensate only little volumes changes (see fig 1). It is recommended to use, in line with process requirements, diaphragm seals with large size diameter. In order to prevent the effects of temperature conduction between the diaphragm seal and the instrument, when the process temperature exceeds 100°C, it is required to fit the instrument with:



**Cooling element:** The purpose of the cooling element is to protect the instrument from high temperatures. It reduces the filling fluid temperature inside the instrument to approximately the room temperature. The cooling element is recommended for instruments direct mounting when the process temperature is exceeding +100°C but is not higher than +250°C.

**When a diaphragm seal provided with cooling element is installed on an insulated pipe, it is fundamental that the insulating coat is not covering the element radiant surface in order to assure the system proper working..**

**Remote mounting with capillary:** The capillary allows the instrument reading when it is far from the process connection. The capillary avoids the fluid process temperature effect on the instrument accuracy.

A 500mm capillary is generally long enough to reduce the indicating instrument temperature to the ambient temperature. The capillary length must be as short as possible and it should not exceed 6mt because any ambient temperature variation could affect the instrument accuracy and response time (see fig 2).

The remote mounting requires instruments for wall or panel mounting. If the level difference is known, it must be indicated in order. If not a field adjustment of the micromatic pointer in order to compensate the effect of extreme temperature variation, will be necessary.

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## MAINTENANCE

Periodically it may be necessary to remove sediments from the diaphragm and to check the corrosion or wear condition of the entire system. This operation must be carried out by specially trained staff. The diaphragm seal and its pressure gauge must be removed from process and inspected then the diaphragm must be cleaned without using any tool that could damage it but with a solvent properly chosen according to the sediment to be removed.

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**MEI Manometría e Instrumentación, s.l.**  
**Pol. Ind. "El Pla" C/ Comerç, 2-22 nave 13 E-08980 Sant Feliu de Llobregat Barcelona Spain**  
**Tf. +34 934 403 939 Fax. +34 934 483 986 www.mei.es e-mail: info@mei.es**

Tab. 5 - 150 psi

°F	°C	C.st.	AISI 304	AISI 316	AISI 316L	Monel	Hast. B	Hast. C
-20	-28,9	275	275	275	275	195	350	345
100	37,8	275	275	275	275	180	345	335
150	65,6	255	255	255	255	175	335	320
200	93,3	240	240	240	240	165	330	310
250	121,1	225	225	225	225	160	320	300
300	148,9	210	210	210	210	155	315	290
350	176,7	195	195	195	195	155	305	285
400	204,4	180	180	180	180	155	295	280
450	232,2	165	165	165	165	155	285	275
500	260	150	150	150	150	155	280	265
550	287,8	140	140	140	140	145	275	260
600	315,6	130	130	130	130	145	265	260
650	343,3	120	120	120	120	145	260	260
700	371,1	110	110	110	110	145	260	260
750	398,9	100	100	100	100	145	260	260
800	426,7	92	92	92	92	145	260	260
850	454,4	82	82	82	82	145	260	260
875	468,3	75	75	75	75	120	260	260
900	482,2	70	70	70	70	105	260	260
925	496,1	60	60	60	60	60	260	260
950	510	55	55	55	55	55	260	260
975	523,9	50	50	50	50	50	260	260
1000	537,8	40	40	40	40	40	260	260

Tab. 5 - 300 psi

°F	°C	C.st.	AISI 304	AISI 316	AISI 316L	Monel	Hast. B	Hast. C
-20	-28,9	720	615	720	515	515	910	900
100	37,8	720	615	720	515	574	900	875
150	65,6	710	585	710	515	455	880	845
200	93,3	700	550	700	515	435	865	815
250	121,1	690	520	690	495	420	845	790
300	148,9	680	495	680	475	410	825	765
350	176,7	675	470	675	435	410	800	740
400	204,4	665	450	665	395	405	770	725
450	232,2	650	430	650	380	405	745	715
500	260	625	410	625	360	405	725	695
550	287,8	590	395	590	350	405	715	680
600	315,6	555	380	555	335	405	700	680
650	343,3	515	370	515	325	405	680	680
700	371,1	470	355	495	310	405	680	680
750	398,9	425	340	470	300	405	680	680
800	426,7	365	330	450	290	405	680	680
850	454,4	300	320	425	280	405	680	680
875	468,3	260	315	415	275	375	680	680
900	482,2	225	310	400	275	310	680	680
925	496,1	190	305	390	275	275	680	680
950	510	155	305	380	275	275	680	680
975	523,9	120	300	370	275	275	680	680
1000	537,8	85	300	355	275	275	680	680

Tab. 5 - 600 psi

°F	°C	C.st.	AISI 304	AISI 316	AISI 316L	Monel	Hast. B	Hast. C
-20	-28,9	1440	1235	1440	1030	1030	1825	1805
100	37,8	1440	1235	1440	1030	945	1805	1750
150	65,6	1420	1165	1420	1030	905	1765	1685
200	93,3	1400	1095	1400	1030	870	1730	1625
250	121,1	1380	1040	1380	990	845	1685	1575
300	148,9	1365	985	1365	955	825	1645	1530
350	176,7	1350	945	1350	870	815	1605	1480
400	204,4	1330	900	1330	790	810	1545	1435
450	232,2	1305	860	1305	755	805	1490	1435
500	260	1250	825	1250	725	805	1455	1390
550	287,8	1180	795	1180	695	805	1435	1365
600	315,6	1110	765	1110	670	805	1400	1360
650	343,3	1030	735	1030	645	805	1360	1360
700	371,1	940	710	985	620	805	1360	1360
750	398,9	850	685	940	600	805	1360	1360
800	426,7	730	660	895	580	755	1360	1360
850	454,4	600	640	850	560	615	1360	1360
875	468,3	525	630	825	550	550	1360	1360
900	482,2	445	620	805	550	550	1360	1360
925	496,1	375	615	780	550	550	1360	1360
950	510	310	610	760	550	550	1360	1360
975	523,9	240	605	735	550	550	1360	1360
1000	537,8	170	600	715	550	550	1360	1360

Tab. 5 - 900 psi

°F	°C	C.st.	AISI 304	AISI 316	AISI 316L	Monel	Hast. B	Hast. C
-20	-28,9	2160	1850	2160	1545	1545	2735	2705
100	37,8	2160	1850	2160	1545	1420	2705	2625
150	65,6	2130	1750	2130	1545	1360	2645	2530
200	93,3	2100	1645	2100	1545	1305	2590	2440
250	121,1	2070	1565	2070	1490	1265	2530	2365
300	148,9	2050	1480	2050	1430	1235	2470	2295
350	176,7	2025	1415	2025	1310	1225	2405	2220
400	204,4	2000	1350	2000	1185	1215	2315	2180
450	232,2	1955	1290	1955	1135	1210	2230	2130
500	260	1875	1235	1875	1085	1210	2180	2090
550	287,8	1775	1190	1775	1045	1210	2150	2045
600	315,6	1660	1145	1660	1005	1210	2095	2035
650	343,3	1550	1105	1550	970	1210	2035	2035
700	371,1	1410	1065	1480	935	1210	2035	2035
750	398,9	1275	1025	1410	900	1210	2035	2035
800	426,7	1100	985	1345	870	1210	2035	2035
850	454,4	900	960	1275	840	1130	2035	2035
875	468,3	785	945	1240	825	925	2035	2035
900	482,2	670	930	1205	825	825	2035	2035
925	496,1	565	920	1175	825	825	2035	2035
950	510	460	915	1140	825	825	2035	2035
975	523,9	355	905	1105	825	825	2035	2035
1000	537,8	250	900	1070	825	825	2035	2035

Tab. 5 - 1500 psi

°F	°C	C.st.	AISI 304	AISI 316	AISI 316L	Monel	Hast. B	Hast. C
-20	-28,9	3600	3085	3600	2570	2570	4560	4510
100	37,8	3600	3085	3600	2570	2365	4510	4370
150	65,6	3550	2915	3550	2570	2265	4405	4215
200	93,3	3500	2740	3500	2570	2175	4320	4065
250	121,1	3450	2605	3450	2480	2110	4215	3945
300	148,9	3415	2470	3415	2385	2055	4115	3825
350	176,7	3375	2360	3375	2180	2040	4010	3705
400	204,4	3330	2245	3330	1975	2025	3855	3635
450	232,2	3255	2150	3255	1895	2015	3720	3585
500	260	3125	2055	3125	1810	2015	3635	3480
550	287,8	2955	1985	2955	1740	2015	3585	3410
600	315,6	2770	1910	2770	1670	2015	3495	3395
650	343,3	2580	1845	2580	1615	2015	3395	3395
700	371,1	2350	1775	2465	1555	2015	3295	3395
750	398,9	2125	1710	2355	1550	2015	3395	3395
800	426,7	1830	1645	2240	1450	2015	3395	3395
850	454,4	1500	1595	2125	1400	1885	3395	3395
875	468,3	1305	1570	2070	1345	1545	3395	3395
900	482,2	1115	1545	2010	1370	1370	3395	3395
925	496,1	945	1535	1955	1370	1370	3395	3395
950	510	770	1525	1900	1370	1370	3395	3395
975	523,9	600	1510	1840	1370	1370	3395	3395
1000	537,8	430	1500	1785	1370	1370	3395	3395

Tab. 5 - 2500 psi

°F	°C	C.st.	AISI 304	AISI 316	AISI 316L	Monel	Hast. B	Hast. C
-20	-28,9	6000	5145	6000	4285	4285	7600	7510
100	37,8	6000	5145	6000	4285	3945	7515	7285
150	65,6	5915	4855	5915	4285	3770	7345	7025
200	93,3	5830	4565	5830	4285	3630	7200	6775
250	121,1	5750	4340	5750	4135	3430	7025	6570
300	148,9	5690	4115	5690	3980	3430	6860	6370
350	176,7	5625	3930	5625	3635	3400	6685	6175
400	204,4	5550	3745	5550	3295	3380	6425	6060
450	232,2	5430	3585	5430	3155	3360	6200	5970
500	260	5210	3430	5210	3020	3360	6060	5800
550	287,8	4925	3305	4925	2900	3360	5970	5685
600	315,6	4620	3180	4620	2785	3360	5825	5655
650	343,3	4300	3070	4300	2690	3360	5655	5655
700	371,1	3920	2960	4110	2595	3360	5655	5655
750	398,9	3550	2850	3920	2500	3360	5655	5655
800	426,7	3050	2745	3730	2415	3360	5655	5655
850	454,4	2500	2660	3540	2335	3360	5655	5655
875	468,3	2180	2620	3445	2345	3145	5655	5655
900	482,2							

Tab. 11 - CORROSION vs. MATERIAL

Corrosive Substance	Temp. °F	Temp. °C	Concentration	Material													
				C.Steel	AISI 304 st.st.	AISI 316 st.st.	Bronze	Brass	Monel 400	Nickel	Hastelloy B	Hastelloy C	Tantalum	PVC	Halar	Teflon	VITON
Acetic Acid	200	93,3	All	D	C	B	C	D	C	D	C	A	A	C	A	A	C
Acetic Anhydride	175	79,4	All	D	D	B	D	D	C	C	B	A	A	D	A	A	C
Acetone	100	37,8	All	B	B	B	A	A	A	A	A	A	A	D	A	A	C
Acetylene, Dry	400	204,4	100	A	A	A	D	D	B	B	A	A	A	A	A	A	A
Alcohols	212	100	All	B	B	A	A	A	A	A	A	A	A	A	A	A	A
Alkali Cleaners	212	100	All	C	B	A	B	D	A	A	B	B	A	A	A	A	A
Aluminium Chloride	212	100	All	D	D	D	D	D	D	D	A	B	A	A	A	A	A
Aluminium Hydroxide	212	100	All	B	B	B	B	B	B	C	B	A	A	A	A	A	B
Aluminium Sulphate	212	100	All	D	D	A	C	D	D	D	A	A	A	A	A	A	A
Amil Acetate	250	121,1	All	B	B	A	A	A	A	A	A	A	A	D	C	A	C
Ammonium Chloride	212	100	<40	D	D	C	C	D	B	B	B	A	A	A	A	A	A
Ammonium, Dry	600	315,6	100	A	A	A	D	D	A	A	A	A	C	A	A	A	C
Ammonium Hydroxide	212	100	All	B	B	B	D	D	D	D	B	B	D	A	A	A	B
Ammonium Nitrate	212	100	All	D	C	B	D	D	D	D	C	B	A	A	A	A	C
Ammonium Sulphate	212	100	<50	D	D	B	C	D	B	B	C	B	A	A	A	A	C
Aniline	250	121,1	100	A	A	A	D	D	B	B	B	B	A	D	C	A	C
Argon	300	148,9	100	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Asphalt	250	121,1		B	B	A	B	B	A	A	B	A	A	B	A	A	A
Atmosphere, Ind. & Marine				B	A	A	A	B	A	A	A	A	A	A	A	A	A
Atmosphere, Rural				B	A	A	A	A	A	A	A	A	A	A	A	A	A
Bauxite & Water	212	100	All	B	B	A	B	B	B	B	B	B	A	A	A	A	A
Benzene	212	100	All	B	B	B	A	B	A	A	B	B	A	C	C	A	B
Benzidine				B	B	B	B	B	B	B	B	B	A	C	A	A	B
Benzoic Acid				D	D	B	C	C	B	B	A	A	A	A	A	A	A
Bier	70	21,1		C	C	A	A	B	A	A	A	A	A	A	A	A	A
Borax (sodium borate)	212	100	<50	B	B	C	A	A	A	A	A	B	A	A	A	A	A
Boric Acid	212	100	All	D	D	B	B	B	B	B	A	A	A	A	A	A	A
Bromine, Dry	125	51,7	100	D	D	D	D	D	A	A	A	A	D	A	A	A	A
Bromobenzene	212	100	100	C	B	B	B	B	B	B	B	B	A	C	B	A	B
Butane	212	100		A	A	A	A	A	A	A	A	A	A	B	A	A	A
Butyl Alcohol	212	100		B	A	A	A	A	A	A	A	A	A	A	A	A	A
Butyric Acid	212	100	All	D	C	B	C	D	B	C	B	A	A	C	A	A	C
Calcium Bisulphite	212	100	All	D	C	B	D	D	D	D	D	C	A	A	A	A	A
Calcium Chloride	212	100	All	C	C	C	B	C	B	A	B	A	A	A	A	A	A
Calcium Hydroxide	212	100	10	B	B	B	B	B	B	B	B	A	C	A	A	A	A
Calcium Hypochlorite	212	100	All	D	D	D	C	C	D	D	C	B	A	A	A	A	B
Carbon Dioxide, Dry	100	37,8		A	A	A	A	A	A	A	A	A	A	A	A	A	A
Carbon Sulphide	125	51,7		B	B	A	B	A	B	B	A	A	A	D	A	A	A
Carbon Tetrachloride, Dry	212	100	100	C	A	A	A	C	A	A	D	B	A	D	C	A	A
Carbon Tetrachloride, Moist	212	100		D	D	C	D	D	A	A	D	B	A	D	C	A	A
Carbonated Water	212	100	All	D	A	B	B	D	C	C	A	A	A	A	A	A	A
Carbonic Oxide	300	148,9		A	A	A	A	B	A	A	A	A	A	A	A	A	A
Caustic Potassium	212	100	<50	D	B	B	D	D	A	A	B	C	D	A	A	A	C
Caustic Soda	212	100	All	C	C	C	D	D	B	B	B	C	D	A	A	A	C
Caustic Soda	212	100	<40	C	B	A	B	D	A	A	A	B	D	A	A	A	C
Cement Slurry	212	100	All	B	A	A	B	B	B	B	B	C	A	A	A	A	C
Chloride	500	260		B	A	A	D	D	B	C	B	A	A	A	A	A	C
Chlorine Dioxide	150	65,6		D	D	D	D	D	D	D	B	B	A	D	B	A	B
Chlorine, Dry	200	93,3	100	B	B	C	B	C	B	B	C	A	A	C	A	A	A
Chlorine, Moist	200	93,3	All	D	D	D	D	D	D	D	D	A	A	C	A	A	A
Chloroacetic Acid	212	100	All	D	D	D	D	D	C	C	B	A	A	C	A	A	C
Chlorobenzene	150	65,6	100	C	B	B	B	C	B	B	B	B	A	D	B	A	A
Chloroform, Dry	150	65,6	100	A	B	C	B	B	A	A	B	B	A	C	B	A	A
Chromic Acid	212	100	All	C	D	D	D	D	D	D	D	D	A	C	A	A	A
Chromium Plating Solution	212	100	All	C	D	D	D	D	D	D	D	D	A	C	A	A	A
Citric Acid	212	100	All	D	C	A	C	D	C	C	A	A	A	A	A	A	A
Coffee	212	100	All	D	B	A	A	C	B	B	B	A	A	A	A	A	A
Copper Chloride	212	100	All	D	D	D	C	D	D	D	D	D	A	A	A	A	A
Copper Nitrate	212	100	All	D	B	B	D	D	D	D	D	D	A	A	A	A	A
Copper Plating Solutions (Acid)	212	100	All	D	C	B	D	D	B	B	C	C	A	A	A	A	A

A = Recommended Best service life Attack < 0,05 mm/year  
 B = Suitable Good service life Attack 0,05...0,5 mm/year  
 C = Not recommended Fair service life Attack 0,5...1,27 mm/year  
 D = Unsuitable No service life Attack > 1,27 mm/year

This tab is a guide. The purchaser will directly choose the most suitable material for the process conditions. (The diaphragm thickness goes from 0,05 mm to 0,15mm according to the material and the diaphragm type chosen.) For further information please contact our Service Technical Department.

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Tab. 11 - CORROSION/MATERIAL

Corrosive substance	Temp. °F	Temp. °C	Concentration	C.Steel	AISI 304 st.st.	AISI 316 st.st	Bronze	Brass	Monel 400	Nickel	Hastelloy B	Hastelloy C	Tantalum	PVC	Halar	Teflon	VITON	Fluorotube
Copper Plating Solutions (cyanide)	212	100	All	B	A	A	D	D	B	B	B	A	A	A	A	A	A	A
Copper Sulphate	212	100	<40	D	C	B	C	D	D	D	C	A	A	A	A	A	A	A
Corn Oil	500	260	All	D	B	A	A	C	B	B	A	A	A	A	A	A	A	A
Creosol	212	100	All	B	A	A	B	C	B	B	B	A	A	D	A	A	A	A
Creosote	212	100		B	B	B	C	B	B	B	B	A	A	D	A	A	A	A
Crude Oil	300	148,9	All	B	B	B	B	C	A	B	B	C	A	B	A	A	A	A
Ethanol	212	100	All	B	A	A	A	A	A	A	B	A	A	A	A	A	A	A
Ethyl Acetate	212	100	100	D	B	B	B	B	B	C	C	B	A	D	C	A	C	C
Ethyl Chloride, Dry	212	100		B	C	A	A	A	B	A	B	B	A	D	A	A	A	A
Ethylene Glycol	212	100	All	C	B	B	B	B	B	B	A	A	A	A	A	A	A	A
Ethylene Oxide	75	23,9	100	B	A	B	D	D	B	B	A	A	A	C	B	A	C	C
Fatty Acids	500	260	100	D	C	A	C	C	B	A	A	A	A	A	A	A	A	A
Ferric Chloride	150	65,6	<50	D	D	D	D	D	D	D	D	B	A	A	A	A	A	A
Ferric Sulphate	150	65,6	10	D	B	A	D	D	D	B	B	A	A	A	A	A	A	A
Ferrous Chloride	212	100	<50	D	D	D	C	D	D	D	B	B	A	A	A	A	A	A
Ferrous Sulphate	212	100	All	D	C	B	C	D	C	D	B	B	A	A	A	A	A	A
Fluorine, Gas	300	148,9	100	D	A	A	C	C	A	A	C	B	D	B	A	A	C	C
Fluorine, Liquid	75	23,9	100	D	A	A	B	C	A	A	C	B	C	B	B	A	C	C
Fluorosilicic Acid	75	23,9	10	D	B	B	C	C	A	B	B	A	C	A	A	A	B	B
Formaldehyde	212	100	<50	D	B	A	B	B	B	B	B	A	A	B	B	A	B	B
Formic Acid	212	100	All	D	B	D	B	C	B	B	A	A	A	B	B	A	A	B
Gasoline	200	93,3		A	A	A	A	A	C	A	A	A	A	B	A	A	A	A
Glucose	300	148,9	All	B	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Glue	300	148,9	All	C	A	A	A	B	A	A	A	A	A	A	A	A	A	A
Glycerine	212	100	All	B	A	A	B	B	A	A	A	A	A	A	A	A	A	A
Hexane, Dry	212	100		A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Hydrobromic Acid	212	100	All	D	D	D	D	D	D	D	B	D	A	B	A	A	A	A
Hydrochloridric Acid	212	100	All	D	D	D	D	D	D	D	D	B	C	A	B	A	A	A
Hydrofluoric Acid	212	100	All	D	D	D	C	D	B	D	B	B	D	C	A	A	C	C
Hydrogen	500	260		B	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Hydrogen Chloride	400	204,4		D	C	C	D	D	A	A	A	A	A	A	A	A	A	A
Hydrogen Fluoride, Dry	200	93,3	100	C	B	B	C	C	B	B	C	B	C	A	A	A	C	C
Hydrogen Peroxide	212	100	30	D	C	B	D	D	C	C	C	C	A	A	A	A	A	A
Hydrogen Peroxide	212	100	100	D	C	C	D	D	C	C	D	C	A	A	A	A	A	A
Kerosene	300	148,9		A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Lacquers & Thinners	200	93,3	All	B	A	A	A	B	A	A	A	A	A	D	C	A	C	C
Lactic Acid	212	100	All	D	C	B	D	D	D	D	B	B	A	A	C	A	A	A
Lime	212	100	All	B	B	B	B	B	B	B	B	A	A	A	A	A	A	A
Linseed Oil	75	23,9		A	A	A	B	C	B	B	B	B	A	A	A	A	A	A
Magnesium Chloride	212	100	<40	D	D	C	B	C	B	A	A	A	B	A	A	A	A	A
Magnesium Oxide	212	100	All	B	B	B	A	B	B	A	B	B	D	A	A	A	A	A
Magnesium Sulphate	212	100	<50	B	A	A	A	B	A	A	C	A	A	A	A	A	A	A
Mercuric Chloride	75	23,9	10	D	D	D	D	D	D	C	C	B	A	A	A	A	A	A
Mercury				A	A	A	D	D	C	B	B	B	A	A	A	A	A	A
Methyl Chloride, Dry	212	100	100	A	B	A	A	B	B	B	B	B	A	D	A	A	A	A
Methylene Chloride	212	100	100	C	C	C	C	B	B	C	A	A	A	D	C	A	B	B
Milk				D	A	A	B	C	C	A	B	B	A	A	A	A	A	A
Naphta	75	23,9	100	B	A	A	A	A	A	A	B	A	B	A	A	A	A	A
Naphtaline	212	100	100	A	A	A	B	B	B	B	B	B	A	C	A	A	A	A
Nickel Chloride	212	100	<40	D	D	C	D	D	B	C	A	B	A	A	A	A	A	A
Nickel Sulphate	212	100		D	C	B	B	C	B	B	B	B	A	A	A	A	A	A
Nitric Acid	75	23,9	All	D	A	A	D	D	D	D	D	B	A	A	A	A	A	A
Nitric Acid	212	100	All	D	C	C	D	D	D	D	D	D	A	C	B	A	C	C
Oxalic Acid	212	100	All	D	D	D	B	C	B	C	B	B	A	A	A	A	A	A
Oxygen	300	148,9	All	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Perchloric Acid	120	48,9	All	D	D	D	D	D	D	D	C	D	A	D	A	A	A	A
Phenol	175	79,4	100	B	B	A	A	B	A	A	A	A	A	C	A	A	A	A
Phosphoric Acid	212	100	All	D	C	C	D	D	D	D	B	C	A	A	A	A	A	A
Phthalic Anhydride	250	121,1	100	B	A	A	C	C	A	A	B	A	A	C	B	A	B	B
Picric Acid	212	100	All	D	B	B	D	D	D	D	D	B	A	C	A	A	A	A

A = Recommended Best service life Attack < 0,05 mm/year  
 B = Suitable Good service life Attack 0,05...0,5 mm/year  
 C = Not recommended Fair service life Attack 0,5...1,27 mm/year  
 D = Unsuitable No service life Attack > 1,27 mm/year

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Tab. 11 - CORROSION/MATERIALS

Corrosive substances	Temp. °F	Temp. °C	Concentrations	Carbon steel	AISI 304 st.st.	AISI 316 st.st.	Bronze	Brass	Monel 400	Nickel	Hastelloy B	Hastelloy C	Tantalum	PVC	Halar	Teflon	VITON	Fluorolube
Propan	300	148,9		A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Quinine	212	100	100	D	B	B	B	B	B	B	B	B	A	A	A	A	A	A
Resin Solution	150	65,6	All	D	B	A	B	B	B	B	B	A	A	D	A	A	C	
Rochelle Salt	212	100	100	D	B	B	B	C	B	B	B	B	A	A	A	A	A	A
Rosin	700	371,1	100	D	B	B	B	B	A	A	B	A	A	A	A	A	A	A
Sea Water	75	23,9		D	C	C	D	C	A	A	A	A	A	A	A	A	A	A
Silicate Solutions	212	100	All	B	A	A	B	B	A	A	A	A	A	A	A	A	A	A
Silicone Fluids	212	100	100	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Silver Nitrate	212	100	<60	D	B	B	D	D	D	D	B	C	A	A	A	A	A	A
Soap & Detergents	212	100	All	B	A	A	A	B	A	A	A	A	A	A	A	A	A	A
Sodium Bicarbonate	212	100	20	B	A	A	B	B	A	A	B	B	A	A	A	A	A	A
Sodium Bisulphate	212	100	<10	D	B	B	B	D	B	B	B	B	A	A	A	A	A	A
Sodium Bisulphite	212	100	<40	D	D	C	C	C	B	C	C	B	A	A	A	A	A	A
Sodium Carbonate	212	100	<40	B	B	B	B	C	B	B	B	B	A	A	A	A	A	A
Sodium Chloride	212	100	<40	C	C	C	B	B	B	B	B	B	A	A	A	A	A	A
Sodium Cyanide	212	100	10	B	A	A	D	D	D	D	B	C	A	A	A	A	A	A
Sodium Hydroxide	180	82,2	<60	C	B	A	B	C	A	A	A	B	D	A	A	A	C	
Sodium Hypochlorite	75	23,9	10	D	D	D	D	D	D	D	C	A	A	A	A	A	A	A
Sodium Nitrate	212	100	<50	B	A	A	C	C	B	B	C	B	A	A	A	A	B	A
Sodium Nitrate	212	100	60	B	C	B	B	B	B	B	B	B	A	A	A	A	B	A
Sodium Peroxide	212	100	10	B	B	B	C	D	B	B	B	B	A	A	A	A	A	A
Sodium Phosphate (Tribasic)	212	100	All	B	A	A	B	B	B	B	A	B	A	A	A	A	A	A
Sodium Silicate	212	100	All	B	A	A	B	B	B	B	B	B	A	A	A	A	A	A
Sodium Sulphate	212	100	<50	B	B	B	B	B	B	B	B	B	A	A	A	A	A	A
Sodium Sulphate	212	100	10	D	A	A	C	D	B	B	C	B	A	A	A	A	A	A
Sodium Sulphide	175	79,4	20	D	A	A	D	D	B	B	B	B	D	A	A	A	A	A
Steam	800	426,7		A	A	A	D	D	B	B	B	B	A	C	A	A	B	
Sulphur Chloride, Dry	212	100	100	D	B	C	C	C	C	B	C	B	A	A	A	A	A	A
Sulphur Dioxide, Dry	500	260	100	B	B	B	C	D	B	B	B	B	A	A	A	A	C	
Sulphur Trioxide, Dry	300	148,9		B	B	B	C	C	B	B	A	B	D	A	A	A	A	A
Sulphuric Acid	212	100	10	D	D	D	D	D	D	D	C	B	A	A	A	A	A	A
Sulphuric Acid	212	100	<30	D	D	D	D	D	D	D	B	C	A	B	A	A	A	A
Sulphuric Acid	212	100	100	D	D	D	D	D	D	D	B	B	A	C	A	A	A	A
Sulphuric Acid, Fuming	175	79,4	100	D	A	B	D	D	D	D	B	B	C	C	A	A	B	
Sulphurous Acid	212	100	All	D	C	C	C	C	C	C	B	B	A	A	A	A	A	A
Tannic Acid	212	100	All	C	B	B	B	C	B	B	B	B	A	A	A	A	A	A
Tartaric Acid	212	100		D	A	A	B	C	B	B	B	B	A	A	A	A	A	A
Tin Chloride	125	51,7	All	D	D	D	D	D	D	B	B	B	A	A	A	A	A	A
Titanium Tetrachloride, Dry	75	23,9	100	A	B	B	D	D	B	B	B	B	A	A	A	A	A	A
Toluene	212	100		A	A	A	A	A	A	A	A	A	A	D	A	A	B	
Trichloroacetic Acid	212	100	All	D	D	D	D	D	B	C	B	B	A	D	C	A	C	
Trichloroethane, Dry	125	51,7		A	A	A	A	A	A	A	A	A	A	D	C	A	B	
Trichloroethylene, Dry	300	148,9		B	B	B	B	B	A	A	A	B	A	D	D	A	A	A
Turpentine	75	23,9	100	B	A	A	A	B	A	B	A	A	A	C	A	A	A	A
Urea	100	37,8	50	C	A	A	B	B	B	B	B	B	A	A	A	A	A	A
Varnish	250	121,1		A	A	A	B	B	A	A	A	A	D	A	A	A	A	A
Vynil Chloride	150	65,6	100	C	B	B	C	C	A	A	B	A	A	D	A	A	A	A
Water (demimeralized)	212	100		C	A	A	A	B	A	A	A	A	A	A	A	A	A	A
Whiskey (hot mash)	212	100		C	A	A	B	B	A	B	A	A	A	B	A	A	A	A
Zinc Chloride	212	100	<40	D	D	D	C	D	B	B	B	B	A	A	A	A	A	A
Zinc Sulphate	212	100	<30	D	A	A	B	D	B	B	B	B	A	A	A	A	A	A

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