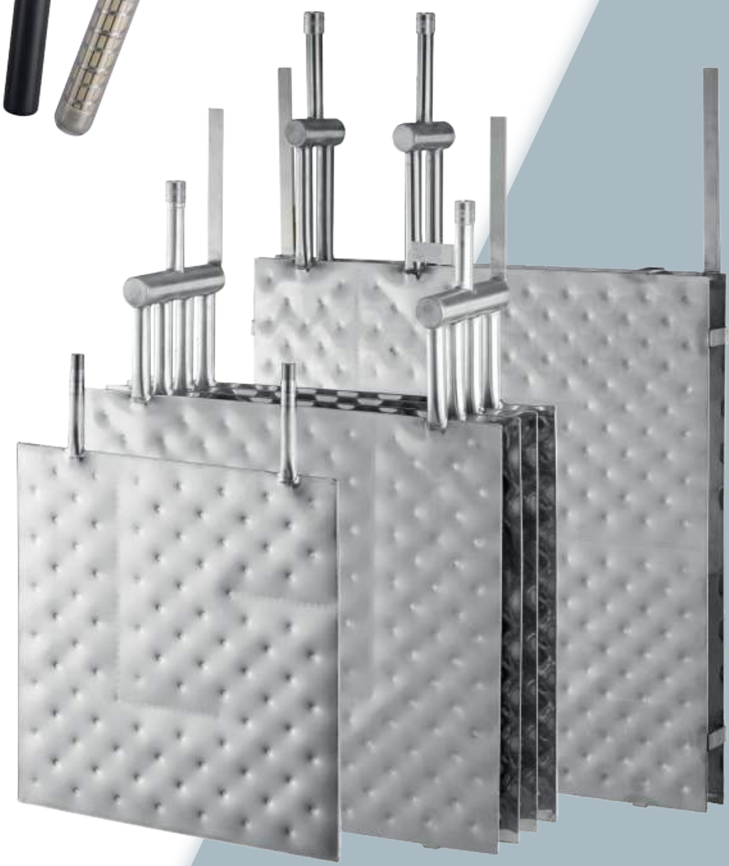
MAZURCZAK
Heating Cooling Controlling

Resistance List

Recommendations for Usage of Materials in Process Liquids

Electric Heaters

Sensors for Temperature and Level Measurement



Heat Exchanger SYNOTHERM®

Recommendations for use

The chemicals in your process liquids demand various properties regarding the chemical resistance of the materials we use. Also, we have to take into consideration the physical processes, for example, possible encrustment and thermal limits like the maximum permissible surface loading according to your choice of suitable material. We hope our overview of the advantages and disadvantages of the individual materials and the resistance list will make your choice more easy.

We are always willing to help with planning and with general advice.

	Acid Resistance	Alkaline Resistance	Thermal Resistance	Breakage Resistance	For	Against
Stainless Steel	fairly good	good	high	very high	individually processable	/
Titanium	good	good	high	very high	individually processable	/
Porcelain	very good	moderate	good	moderate	good heat transfer	/
Technical glass	very good	moderate	good	low	/	liable to break
Quartz glass	very good	moderate	good	low	thermoshock resistant	thermal radiation
PTFE, pure white	very good	very good	low	low	clean room application	low surface loading
PFA-Compound	very good	very good	low	low	highest chemical resistance	low surface loading
PFA	very good	very good	low	low	highest chemical resistance	low surface loading
FEP	very good	very good	low	low	highest chemical resistance	low surface loading
PVDF	very good	moderate	up to 140°C	high	/	/
PP	good	very good	up to 90°C	high	/	/

Acids, Alkaline Solutions and Water


Immersion Heaters


Heating Rods


Galmatherm


Temperature Probes


Float Switches


Level Probes

(Symbols in the chart below: rec. = recommended (blue +), res. = resistant (green +), mod. = moderate, n.s. = not suitable, i = general evaluation not possible, please enquire)

	Immersion Heaters						Heating Rods	Galmatherm		Temperature Probes					Float Switches			Level Probes		
Alkaline Solutions	PS	TG	QS	KB	TI	FC	FP	FEP	PFA	F	L	B	G	M	F	L	B	B	K	T
Ammonium hydroxide (NH_4OH)	n.s.	n.s.	n.s.	rec.	res.	rec.	res.	rec.	rec.	rec.	n.s.	rec.	res.	rec.	res.	n.s.	res.	rec.	res.	res.
Potassium hydroxide, with water (KOH)	n.s.	n.s.	n.s.	rec.	res.	res.	res.	res.	res.	rec.	n.s.	rec.	res.	rec.	res.	n.s.	res.	rec.	res.	mod.
Sodium hydroxide, with water (NaOH)	n.s.	n.s.	n.s.	rec.	res.	res.	res.	res.	res.	rec.	n.s.	rec.	res.	rec.	res.	n.s.	res.	rec.	res.	mod.
Inorganic Acids	PS	TG	QS	KB	TI	FC	FP	FEP	PFA	F	L	B	G	M	F	L	B	B	K	T
Hydrofluoric acid (HF)	n.s.	n.s.	n.s.	n.s.	n.s.	res. / mod.	res. / mod.	rec.	rec.	n.s.	res.	n.s.	res.	rec.	n.s.	rec.	n.s.	n.s.	rec.	n.s.
Aqua Regia ($3HCl + HNO_3$) 3)	res.	rec.	rec.	n.s.	mod.	mod.	mod.	res.	res.	n.s.	mod.	n.s.	rec.	rec.	n.s.	mod.	n.s.	n.s.	mod.	mod.
Mixed acid ($HNO_3/H_2SO_4/H_2O$)	res.	rec.	rec.	n.s.	n.s.	res.	res.	res.	res.	n.s.	mod.	n.s.	rec.	rec.	n.s.	mod.	n.s.	n.s.	rec.	mod.
Oleum (concentrated sulphuric acid) 3)	mod.	res.	res.	n.s.	n.s.	mod.	mod.	mod.	mod.	n.s.	n.s.	n.s.	n.s.	rec.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Phosphoric acid (H_3PO_4)	n.s.	n.s.	rec.	mod.	n.s.	rec.	res.	rec.	rec.	rec.	res.	mod.	res.	rec.	rec.	res.	mod.	mod.	rec.	n.s.
Nitric acid (HNO_3) 3)	n.s.	rec.	rec.	mod.	res.	res.	res.	rec.	rec.	n.s.	rec.	mod.	res.	rec.	n.s.	rec.	mod.	mod.	res.	rec.
Hydrochlorid acid (HCl); <10%	rec.	rec.	res.	n.s.	n.s.	res.	res.	rec.	rec.	rec.	res.	n.s.	res.	rec.	rec.	res.	n.s.	n.s.	res.	n.s.
Hydrochlorid acid (HCl); >10%	res.	res.	rec.	n.s.	n.s.	mod.	mod.	mod.	mod.	n.s.	rec.	n.s.	mod.	mod.	n.s.	rec.	n.s.	n.s.	mod.	n.s.
Sulphuric acid (H_2SO_4)	res. / mod.	rec.	rec.	n.s.	n.s.	res.	res.	rec.	rec.	n.s.	rec.	n.s.	res.	rec.	n.s.	rec.	n.s.	n.s.	res.	n.s.
Organic Acids	PS	TG	QS	KB	TI	FC	FP	FEP	PFA	F	L	B	G	M	F	L	B	B	K	T
Formic acid	rec.	mod.	res.	n.s.	n.s.	res. / mod.	res. / mod.	res. / mod.	res. / mod.	n.s.	rec.	n.s.	res.	rec.	n.s.	rec.	n.s.	n.s.	res. / mod.	n.s.
Benzoic acid	rec.	res.	res.	rec.	res.	res.	res.	rec.	rec.	res.	res.	res.	res.	rec.	rec.	res.	rec.	rec.	res.	res.
Acetic acid	rec.	rec.	res.	res.	rec.	res.	res.	rec.	rec.	res. / mod.	res. / mod.	rec.	res.	res.	res. / mod.	res. / mod.	rec.	res.	rec.	res.
Lactic acid	rec.	rec.	res.	mod.	rec.	res.	res.	rec.	rec.	rec.	mod.	mod.	res.	rec.	rec.	mod.	mod.	mod.	res.	rec.
Oxalic acid	rec.	rec.	res.	n.s.	n.s.	res.	res.	rec.	rec.	rec.	mod.	n.s.	res.	rec.	rec.	mod.	n.s.	n.s.	res. / mod.	n.s.
Tartaric acid	rec.	rec.	res.	mod.	rec.	res.	res.	rec.	rec.	rec.	res.	mod.	res.	rec.	rec.	res.	mod.	mod.	res.	rec.
Citric acid	rec.	rec.	res.	rec.	mod.	res.	res.	rec.	rec.	rec.	res.	res.	res.	rec.	rec.	res.	res.	rec.	res.	mod.
Water	PS	TG	QS	KB	TI	FC	FP	FEP	PFA	F	L	B	G	M	F	L	B	B	K	T
Tap-water	rec.	rec.	res.	rec.	res.	res.	res.	res.	res.	rec.	res.	res.	res.	rec.	rec.	res.	res.	res.	res.	res.
Seawater	rec.	rec.	res.	n.s.	rec.	res.	res.	res.	res.	rec.	res.	n.s.	res.	rec.	rec.	res.	n.s.	n.s.	res.	rec.
Distilled water, deionized (H_2O)	rec.	rec.	res.	mod.	res.	res.	res.	rec.	rec.	rec.	res.	mod.	res.	rec.	rec.	res.	mod.	i	i	i

Key

1) When using metallic materials (KB, TI), a faulty current circuit breaker with capacitor in the earth connection is recommended in order to prevent DC current escaping.

2) When using metallic materials (KB, TI), a protective potential must be applied to the immersion tube or the metallic surface has to be passivated (i.e. with HNO3). Autocatalytic functioning electrolytes (without current) tend to cause metal separation on the hot surface of the immersion tube. Therefore the specific surface loading should not exceed 2.5 w / cm^2.

3) Terminal casing made from PVDF recommended (BC/L and LC/L)

Immersion Heaters Materials Legend

PS Special hard porcelain, glazed
TG Technical glass (hydrolytic class 1, acid class 1, alkaline class 2 according to DIN 12111, 12116 & 52322)
QS Quartz glass (hydrolytic class 1, acid class 1, alkaline class 1, according to DIN 12111, 12116 & 52322)
KB Stainless steel (material no. 316 TI)
TI Titanium (material no. 3.7035)
FC Fluoropolymer (PFA-Compound)

Heating Rods / Galmatherm Legend

FP Fluoropolymer (PFA-Compound)
FEP Fluorinated etylene propylene
PFA Perfluoroalkoxy

Temperature Probes Legend

F Polypropylene (PP)
L Polyvinylidenfluoride (PVDF)
B Stainless steel (material no. 316 TI)
G Polytetrafluorethylene (PTFE)
M Perfluoroalkoxy (PFA)

Float Switches / Level Probes

F Polypropylene (PP)
L Polyvinylidenfluoride (PVDF)
B Stainless steel (material no. 316 TI)
K Polytetrafluorethylene (PTFE) - compound
T Titanium (material no. 3.7035, PTFE)

Symbols

+ (blue) recommended
+ (green) resistant
◑ moderate
✗ not suitable
i general evaluation not possible, please enquire

Degreasing Solutions and Electrolytes

	Immersion Heaters						Heating Rods	Galmatherm		Temperature Probes					Float Switches			Level Probes		
Degreasing Solutions	PS	TG	QS	KB	TI	FC	FP	FEP	PFA	F	L	B	G	M	F	L	B	B	K	T
Acid (fluoride-free)	+ (blue)	+ (blue)	+ (green)	✕	✕	+ (blue)	+ (green)	+ (blue)	+ (blue)	+ (green)	+ (green)	✕	+ (green)	+ (blue)	◐	◐	◐	✕	+ (green)	✕
Alkaline (halogen-free)	✕	✕	✕	+ (blue)	+ (green)	+ (blue)	+ (green)	+ (blue)	+ (blue)	+ (blue)	✕	+ (green)	+ (green)	+ (blue)	◐	✕	+ (green)	+ (green)	+ (green)	+ (green)
Electrolytes	PS	TG	QS	KB	TI	FC	FP	FEP	PFA	F	L	B	G	M	F	L	B	B	K	T
Lead bath (fluorborate)	✕	✕	✕	✕	✕	+ (blue)	+ (blue)	+ (blue)	+ (blue)	+ (blue)	+ (green)	✕	+ (green)	+ (blue)	+ (blue)	+ (green)	✕	✕	+ (blue)	✕
Chromium bath (H_2SO_4) [1,3]	+ (blue)	+ (blue)	+ (green)	✕	+ (green)	+ (blue)	+ (blue)	+ (blue)	+ (blue)	✕	+ (blue)	✕	+ (green)	+ (blue)	✕	+ (blue)	✕	✕	+ (green)	◐
Chromium bath (mixed acids, cont. fluoride) [3]	✕	✕	✕	✕	✕	+ (blue)	+ (blue)	+ (blue)	+ (blue)	✕	+ (blue)	✕	+ (green)	+ (blue)	✕	+ (blue)	✕	✕	+ (green)	✕
Iron bath ($FeCl_2 \cdot 4\,H_2O$) [1]	+ (blue)	+ (blue)	+ (green)	✕	◐	+ (blue)	+ (blue)	+ (blue)	+ (blue)	+ (blue)	+ (green)	✕	+ (green)	+ (blue)	ⓘ	ⓘ	✕	✕	+ (green)	+ (blue)
Iron bath ($FeSO_4$ or $Fe(BF_2)$) [1]	◐	◐	◐	✕	✕	+ (blue)	+ (blue)	+ (blue)	+ (blue)	+ (green)	+ (blue)	✕	+ (green)	+ (blue)	ⓘ	ⓘ	✕	✕	+ (blue)	✕
Gold bath, cyanide [1]	◐	◐	◐	+ (blue)	◐	+ (blue)	+ (blue)	+ (blue)	+ (blue)	+ (blue)	◐	+ (green)	+ (green)	+ (blue)	+ (blue)	◐	+ (blue)	+ (blue)	+ (green)	◐
Gold bath, acid	+ (blue)	+ (blue)	+ (green)	✕	✕	+ (blue)	+ (blue)	+ (blue)	+ (blue)	+ (blue)	+ (green)	✕	+ (green)	+ (blue)	+ (blue)	+ (green)	✕	✕	+ (green)	✕
Copper bath, cyanide [1]	◐	◐	◐	+ (blue)	◐	+ (blue)	+ (green)	+ (blue)	+ (blue)	+ (blue)	✕	+ (green)	+ (green)	+ (blue)	ⓘ	✕	+ (blue)	+ (blue)	+ (green)	◐
Copper bath, acid	+ (blue)	+ (blue)	+ (green)	✕	✕	+ (green)	+ (green)	+ (blue)	+ (blue)	+ (blue)	+ (green)	✕	+ (green)	+ (blue)	+ (green)	+ (green)	✕	✕	+ (blue)	◐
Copper bath (fluorborate)	✕	✕	✕	✕	✕	+ (blue)	+ (green)	+ (blue)	+ (blue)	✕	+ (green)	✕	+ (green)	+ (blue)	ⓘ	ⓘ	✕	✕	+ (blue)	✕
Brass bath, cyanide [1]	◐	◐	◐	+ (blue)	◐	+ (green)	+ (blue)	+ (blue)	+ (blue)	+ (blue)	✕	+ (green)	+ (green)	+ (blue)	+ (green)	✕	+ (blue)	+ (blue)	+ (green)	◐
Nickel bath (fluorborate) [1]	✕	✕	✕	✕	✕	+ (blue)	+ (blue)	+ (blue)	+ (blue)	+ (blue)	+ (green)	✕	+ (green)	+ (blue)	ⓘ	ⓘ	✕	✕	+ (blue)	✕
Nickel bath (nickel-chloride / nickel-sulphate) [1]	+ (blue)	+ (blue)	+ (green)	✕	+ (blue)	+ (green)	+ (green)	+ (blue)	+ (blue)	+ (blue)	+ (green)	✕	+ (green)	+ (blue)	ⓘ	ⓘ	✕	✕	+ (blue)	◐
Platinum bath / Palladium, acid	+ (blue)	+ (blue)	+ (green)	✕	✕	+ (blue)	+ (blue)	+ (blue)	+ (blue)	+ (green)	+ (blue)	✕	+ (green)	+ (blue)	+ (green)	+ (blue)	✕	✕	+ (green)	◐
Rhodium bath (H_2SO_4)	+ (blue)	+ (blue)	+ (green)	✕	✕	+ (blue)	+ (blue)	+ (blue)	+ (blue)	+ (green)	+ (blue)	✕	+ (green)	+ (blue)	+ (green)	+ (blue)	✕	✕	+ (green)	✕
Silver bath, cyanide [1]	◐	◐	◐	+ (blue)	◐	+ (green)	+ (blue)	+ (blue)	+ (blue)	+ (blue)	✕	+ (green)	+ (green)	+ (blue)	ⓘ	ⓘ	+ (blue)	+ (blue)	+ (green)	✕
Zinc bath, alkaline, cyanide [1]	◐	◐	◐	+ (blue)	◐	+ (green)	+ (blue)	+ (blue)	+ (blue)	+ (blue)	✕	+ (green)	+ (green)	+ (blue)	ⓘ	ⓘ	+ (green)	+ (blue)	+ (green)	◐
Zinc bath, acid	+ (blue)	+ (blue)	+ (green)	✕	✕	+ (blue)	+ (green)	+ (blue)	+ (blue)	+ (blue)	+ (green)	✕	+ (green)	+ (blue)	ⓘ	ⓘ	✕	✕	+ (blue)	✕
Tin bath, alkaline [1]	✕	✕	✕	+ (blue)	◐	+ (green)	+ (green)	+ (blue)	+ (blue)	+ (blue)	✕	+ (green)	+ (green)	+ (blue)	ⓘ	ⓘ	+ (blue)	+ (blue)	+ (green)	+ (green)
Tin bath (fluorborate)	✕	✕	✕	✕	✕	+ (blue)	+ (green)	+ (blue)	+ (blue)	+ (blue)	+ (green)	✕	+ (green)	+ (blue)	ⓘ	ⓘ	✕	✕	+ (blue)	✕
Tin bath (H_2SO_4)	+ (blue)	+ (blue)	+ (green)	✕	✕	+ (green)	+ (green)	+ (blue)	+ (blue)	+ (blue)	+ (green)	✕	+ (green)	+ (blue)	ⓘ	ⓘ	✕	✕	+ (blue)	◐
Autocatalytic Electrolytes [2]	PS	TG	QS	KB	TI	FC	FP	FEP	PFA	F	L	B	G	M	F	L	B	B	K	T
Copper bath (without current), alkaline [1]	◐	✕	✕	+ (green)	◐	+ (green)	+ (green)	+ (blue)	+ (blue)	◐	◐	✕	+ (blue)	+ (blue)	◐	+ (blue)	+ (blue)	ⓘ	+ (blue)	ⓘ
Copper bath (without current), acid	+ (blue)	+ (blue)	+ (green)	✕	✕	+ (green)	+ (green)	+ (blue)	+ (blue)	◐	+ (blue)	✕	+ (green)	+ (blue)	◐	+ (blue)	✕	ⓘ	+ (blue)	ⓘ
Nickel bath (without current), alkaline [1]	◐	✕	✕	+ (green)	◐	+ (green)	+ (green)	ⓘ	ⓘ	◐	+ (blue)	✕	+ (green)	+ (blue)	◐	+ (blue)	+ (blue)	ⓘ	+ (blue)	ⓘ
Nickel bath (without current), acid [1]	+ (blue)	+ (blue)	+ (green)	+ (green)	◐	+ (green)	+ (green)	ⓘ	ⓘ	◐	+ (blue)	✕	+ (green)	+ (blue)	◐	+ (blue)	+ (blue)	ⓘ	+ (blue)	ⓘ

Additional Treatment Liquids

	Immersion Heaters						Heating Rods	Galmatherm		Temperature Probes					Float Switches			Level Probes		
Additional Treatment Liquids	PS	TG	QS	KB	TI	FC	FP	FEP	PFA	F	L	B	G	M	F	L	B	B	K	T
ABS pickle (CrO_3 / H_2SO_4) [3]	◐	+ (blue)	+ (blue)	✕	✕	+ (green)	+ (green)	+ (blue)	+ (blue)	✕	+ (blue)	✕	+ (green)	+ (blue)	✕	+ (blue)	✕	✕	+ (green)	✕
Aluminium pickling bath, containing fluoride	✕	✕	✕	✕	✕	+ (blue)	+ (blue)	ⓘ	ⓘ	✕	+ (blue)	✕	+ (green)	+ (blue)	+ (green)	+ (green)	✕	✕	+ (blue)	✕
Ammonium fluoride (NH_4F)	✕	✕	✕	✕	✕	+ (blue)	+ (blue)	+ (blue)	+ (blue)	◐	+ (blue)	✕	+ (green)	+ (blue)	◐	+ (blue)	✕	✕	+ (green)	✕
Flux bath ($NH_4Cl + ZnCl_2$)	+ (blue)	+ (blue)	+ (green)	✕	+ (green)	+ (green)	+ (blue)	+ (blue)	+ (blue)	+ (blue)	+ (green)	✕	+ (green)	+ (blue)	+ (blue)	+ (green)	✕	✕	+ (blue)	✕
Borax bath ($Na_2B_4O_7 \cdot 10H_2O$)	◐	◐	+ (green)	+ (blue)	✕	+ (blue)	+ (green)	+ (blue)	+ (blue)	+ (blue)	+ (green)	+ (green)	+ (green)	+ (blue)	+ (green)	+ (green)	+ (blue)	+ (blue)	+ (green)	✕
Chromatizing bath (H_3PO_4 / CrO_3 / H_2SO_4), fluoride-free	◐	◐	+ (green)	✕	✕	+ (green)	+ (blue)	+ (blue)	+ (blue)	✕	+ (blue)	✕	+ (green)	+ (blue)	✕	+ (blue)	✕	✕	+ (blue)	✕
Pickling bath (HCl & / or H_2SO_4), fluoride-free	+ (blue)	+ (blue)	+ (green)	✕	◐	+ (green)	+ (blue)	+ (blue)	+ (blue)	+ (green)	+ (blue)	✕	+ (green)	+ (blue)	+ (green)	+ (blue)	✕	✕	+ (blue)	✕
Iron III chloride solution ($FeCl_3$)	+ (blue)	+ (blue)	+ (green)	✕	+ (blue)	+ (blue)	+ (green)	+ (blue)	+ (blue)	+ (blue)	+ (green)	✕	+ (green)	+ (blue)	+ (blue)	+ (green)	✕	✕	+ (green)	+ (blue)
Gloss bath, chemical ($H_3PO_4 + HNO_3$)	◐	◐	+ (blue)	◐	✕	+ (blue)	+ (green)	ⓘ	ⓘ	◐	+ (blue)	✕	+ (green)	+ (blue)	◐	+ (blue)	+ (green)	✕	+ (blue)	✕
Potassium permanganate, with water ($KMnO_4$)	+ (green)	+ (green)	+ (green)	+ (blue)	+ (blue)	+ (green)	+ (green)	◐	◐	◐	+ (green)	+ (blue)	+ (green)	+ (blue)	◐	+ (green)	+ (green)	+ (green)	+ (green)	+ (blue)
Sodium chloride solution (containing NaCl)	+ (blue)	+ (blue)	+ (green)	✕	+ (blue)	+ (blue)	+ (blue)	+ (blue)	+ (blue)	+ (blue)	+ (green)	✕	+ (green)	+ (blue)	+ (blue)	+ (green)	✕	✕	+ (green)	+ (blue)
Solder liquid, acidic (containing HCl)	+ (blue)	+ (blue)	+ (green)	✕	✕	+ (green)	+ (green)	+ (blue)	+ (blue)	+ (blue)	+ (green)	✕	+ (green)	+ (blue)	+ (blue)	+ (green)	✕	✕	+ (blue)	◐
Sodium hypochlorite (NaClO)	+ (blue)	+ (green)	+ (green)	✕	+ (blue)	ⓘ	ⓘ	+ (blue)	+ (blue)	✕	◐	✕	+ (blue)	+ (blue)	✕	◐	✕	✕	+ (blue)	+ (blue)
Sodium sulphate ($Na_2SO_4 \cdot 10H_2O$)	◐	◐	+ (green)	✕	+ (blue)	+ (green)	+ (blue)	+ (blue)	+ (blue)	+ (blue)	+ (green)	+ (green)	+ (green)	+ (blue)	+ (blue)	+ (green)	+ (blue)	+ (blue)	+ (green)	+ (green)
Phosphate bath (iron / zinc phosphate)	+ (green)	✕	✕	+ (green)	✕	ⓘ	ⓘ	ⓘ	ⓘ	+ (blue)	+ (green)	◐	+ (blue)	+ (blue)	ⓘ	ⓘ	◐	+ (blue)	+ (green)	✕
Black bath ($HNO_3 + FeCl_3$) [3]	◐	+ (blue)	+ (green)	✕	+ (blue)	+ (green)	+ (green)	+ (blue)	+ (blue)	✕	+ (blue)	✕	+ (green)	+ (blue)	✕	+ (blue)	✕	✕	+ (green)	+ (blue)
Sealing bath = desalinated water	◐	+ (blue)	+ (green)	+ (blue)	+ (green)	+ (green)	+ (blue)	ⓘ	ⓘ	+ (green)	+ (blue)	+ (green)	+ (green)	+ (blue)	+ (blue)	+ (green)	+ (blue)	ⓘ	ⓘ	ⓘ
Hydrogen peroxide (H_2O_2) [3]	+ (blue)	+ (blue)	+ (green)	◐	◐	+ (green)	ⓘ	ⓘ	ⓘ	◐	+ (blue)	◐	+ (green)	+ (blue)	◐	+ (blue)	◐	ⓘ	ⓘ	ⓘ

PP is, however, not chemically resistant enough for strongly oxidizing acids (i.e. HNO_3, CrO_3). In this case the white PVDF terminal casing is most suitable with its excellent acid resistance and its high thermal resistance. PVDF cannot be used with alkaline solutions.

The red terminal casing made of polypropylene (PP) is extremely chemically resistant and can be used with many acids and with nearly every alkaline solution.

SYNOTHERM® heat exchanger

When selecting appropriate heat exchanger materials, the following factors have to be considered:

- Inlet temperature of the heat transfer medium
- Chemical composition of the process liquid
- Concentration of process liquid components
- PH value
- Incrustation tendency of the process

Consequently, no general approval of the chemical resistance of heat exchanger materials in process liquids is possible.

Some recommendations for the use of heat exchangers in process liquids we would like to give you nevertheless.

The stainless steels (1.4301, 1.4404 and 1.4571) are suitable for alkaline degreasing agents, alkaline zinc-nickel electrolytes and cyanide copper electrolytes.

Titanium 3.7035 can be used in acidic zinc baths (fluoride-free), nickel baths (nickel sulphate / nickel chloride), nitric acid and fluoride-free chromium electrolytes.

Stainless steel 1.4539 is particularly suitable for solutions containing sulfuric acid, for example for cooling anodizing baths based on sulfuric acid, highly concentrated phosphoric acid, highly concentrated sodium hydroxide solution, mixed acids (sulphuric acid and nitric acid) and for cooling certain electropolishing baths (sulphuric acid and phosphoric acid).

Despite the variety of metals and their alloys, metallic materials are not chemically stable in some processes. Coated plate heat exchangers and plastic heat exchangers SYNOTHERM® can be used in process liquids that contain halogens and are highly acidic.

In process liquids such as used for zinc or manganese phosphating, incrustations form on the surface of the heaters. The anti-adhesive fluoropolymer coating of the coated heat exchangers reduces the tendency to form incrustations and reduces the cleaning effort. The non-stick effect makes it easy to remove and clean the heat exchangers.

The specification of the resistance of the individual materials to aggressive process liquids is to be regarded as a recommendation only and refers to aqueous solutions in a temperature range from 0°C to 100°C.

We draw your attention to the fact that all information is provided without guarantee.

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