泵与介质接触的主要零件材料耐腐蚀性能选择 Corrosion resistance option of materials for pump's main parts touching medium

金属材料耐腐蚀性能通常用腐蚀深度（又称腐蚀速度）作为评定金属材料耐腐蚀性能的一项主要指标。

腐蚀深度是指金属材料在单位时间内腐蚀的金属深度，单位用“毫米/年”(mm/a)表示。

按照腐蚀程度的不同，通常分为：腐蚀深度小于0.1mm/a的材料，称为耐腐蚀性能材料；腐蚀深度为0.1~1mm/a，称为尚耐腐蚀材料；腐蚀深度大于1mm/a，称为耐腐蚀性不好的材料。

一般泵与介质接触的主要零件的材料选用在指定介质情况中，尚耐腐蚀性材料就可以。

为便于用户选用泵时，根据所输送介质条件，选择适宜泵的主要零件材料耐腐蚀性能，本说明书汇编了：ZG1Cr18Ni9(302),ZG1Cr18Ni9Ti(321),ZG0Cr18Ni12Mo2Ti(316Ti),ZG1Cr18Ni12Mo2Ti(307),ZG00Cr17Ni14Mo2(316L),ZG1Cr18Mn13Mo2CuN(402)等材料耐腐蚀性能表供选泵时参考。

Generally the corrosion depth (also called corrosion velo-city) is used as a primary index to evaluate the corrosion resistance of metal materials.

The corrosion depth refers to the corrosive metal depth of metal materials in unit time, expressed in "millimeter annually" (mm/a).

By different degrees of corrosion, it is usually divided into: corrosion resistance material with a corrosion depth less than 0.1mm/a; passable corrosion resistance material with a corrosion depth between 0.1–1mm/a; and weak corrosion resistance material with a corrosion depth larger than 1mm/a.

Generally the passable corrosion resistance material can be adopted for main parts of pump contacting medium on the condition of specified medium.

To facilitate the user to select the proper corrosion resist-ance of materials of main pump parts in accordance with conditions of transporting medium during the pump selection, the instructions are provided with the compilation of corrosion resistance tables of such materials as ZG1Cr18Ni9(302), ZG1Cr18Ni9Ti(321), ZG0Cr18Ni12Mo2Ti(316Ti), ZG1Cr18Ni12Mo2Ti(307), ZG00Cr17Ni14Mo2(316L) and ZG1Cr18Mn13Mo2CuN(402) for reference.

ZG1Cr18Ni9(302)钢的耐腐蚀性能表 ZG1Cr18Ni9(302) Comparison table of corrosion resistance of steel

介质条件 Medium condition			腐蚀深度 Corrosion depth (mm/a)
介质 Medium	浓度(%) Concentration	温度(℃) Temperature	
硝 酸 Nitric acid	0.5~99	20	<0.1
	7~37	沸 Boiling	0.1~1
	65	沸 Boiling	<1
	93	37	0.01
	93	55	0.21
	97	55	0.76
	99	55	1.25
	99	沸 Boilingv	<10
醋 酸 Acetic acid	10	沸 Boiling	<0.1
	50	沸 Boiling	<1
	80	沸 Boiling	<3
硫 酸 Sulphuric acid	0.5	190	0.06~0.14

介质条件 Medium condition			腐蚀深度 Corrosion depth (mm/a)
介质 Medium	浓度(%) Concentration	温度(℃) Temperature	
硫 酸 Sulphuric acid	1	20~90	0.002
	5	20	0.6
	5	40	<3
	5	50	3~4.5
	5	100~105	3.3~15
	10~50	20	2~5
	80	20	0.46
	90~95	20	0.0006~0.008
柠檬酸 Citric acid	1~50	20	<0.1
	5	140	<1
	50	沸 Boiling	<10
	95	20~140	<0.1

ZG1Cr18Ni9Ti(321)钢的耐腐蚀性能表 ZG1Cr18Ni9Ti(321) Comparison table of corrosion resistance of steel

介质条件 Medium condition			腐蚀深度 Corrosion depth (mm/a)
介质 Medium	浓度(%) Concentration	温度(℃) Temperature	
硝 酸 Nitric acid	30	20	0.007
	50~56	20	0
	93	43	0.05
	95	37~55	0.03
	97	55	0.76
	99	55	1.25
	99.67	55	<10
硫 酸 Sulphuric acid	2	50	0.016
	2	100	3~6.5
	5	50	3~4.5
	5	100~105	3.3~15
	80	20	0.46
醋 酸 Acetic acid	1~浓 Concentrated	20~40	<0.1
	10		<0.1
	50		<0.1
	80		<0.3
磷 酸 Phosphoric acid	10	80	0.01
	28		0.67
	45		0.1~1
	60	60	1.7
	80	110	腐蚀深度过大 Excessive corrosion depth
柠檬酸 Citric acid	1~50	20	<0.1
	5	140	<1
	50		<0.1
	95	20~140	<0.1
硫 Sulfur	熔化的 Melted	130	<0.1
	熔化的 Melted	445	<0.3

介质条件 Medium condition			腐蚀深度 Corrosion depth (mm/a)
介质 Medium	浓度(%) Concentration	温度(℃) Temperature	
混合酸 Mixed acid	$H_2SO_4$78 $HNO_3$0.5	20	0.003
	$H_2SO_4$78 $HNO_3$0.5	90	0.05
	$H_2SO_4$78 $HNO_3$1	20	0.0018
	$H_2SO_4$78 $HNO_3$1	90	0.0251
氢氧化钾 Potassium hydroxide	20	20~沸 Boiling	<0.1
	50	20	<0.1
	50	沸 Boiling	<0.1
	熔化的 Melted		>10
氢氧化钠 Sodium hydroxide	~12	100	0.0044
	~35	100	0.008
重铬酸钾 Potassium dichromate	25	20~沸 Boiling	<0.1
氯化锰 Manganese chloride	10~50	100	<0.1
过氧化钠 Sodium peroxide	10	20~沸 Boiling	<0.1
亚硫酸钠 Sodium sulfite	25~50	沸 Boiling	<0.1
硫酸钠 Sodium sulfate	5~饱和 Saturated	100	<0.1
	熔化的 Melted	900	>10
硝酸银 Silver nitrate	10	沸 Boiling	<0.1
氯 Chlorine	干燥的 Dry	20	<0.1
	干燥的 Dry	100	>10
漂白粉 Bleaching powder	潮湿的 Moist	40	0.48
氯化氢 Chlorine hydride	干燥的 Dry	20~100	<0.1
	干燥的 Dry	100~500	<0.1

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ZG0Cr18Ni12Mo2Ti(316Ti)钢的耐腐蚀性能表 ZG0Cr18Ni12Mo2Ti(316Ti) Comparison table of corrosion resistance of steel

介质条件 Medium condition			腐蚀深度 Corrosion depth (mm/a)
介质 Medium	浓度(%) Concentration	温度(℃) Temperature	
硝 酸 Nitric acid	1~5	20	<0.1
	1~5	80	<0.1
	5	沸腾 Boiling	<0.1
	20	20~80	<0.1
	50	20~50	<0.1
	50	80	<0.1
	50	沸 Boiling	<0.1
	60	20~60	<0.1
	60	沸 Boiling	0.1~1
	65	20	<0.1
	65	85	<0.1
	65	沸 Boiling	0.1~1
	90	20	<0.1
	90	70	0.1~1
	90	沸 Boiling	1~3
	99	20	0.1~3
	99	沸 Boiling	3~10
硫 酸 Sulphuric acid	0.5	20	<0.1
	1	20	<0.1
	3	20	<0.1
	40	20	<0.1
	80	20	0.1~1
	98	20	<0.1
亚硫酸 Sulfurous acid	2	20	<0.1
	20	20	<0.1

介质条件 Medium condition			腐蚀深度 Corrosion depth (mm/a)
介质 Medium	浓度(%) Concentration	温度(℃) Temperature	
氢氟酸 Hydrofluoric acid	10	20	<0.1
	10	100	1~3
氢氧化钠 Sodium hydroxide	10~20	沸 Boiling	<0.1
	30	100	<0.1
	40	90	<0.1
	50	90	<0.1
	50	100	<0.1
	60	90	<0.1
	70	90	<0.1
草 酸 Oxalic acid	2.5	20	<0.1
	2.5	60	<0.1
	2.5	沸 Boiling	<0.1
	10	20	<0.1
	10	沸 Boiling	1~3
	50	沸 Boiling	0.1~1
氢氧化钾 Potassium hydroxide	25	沸 Boiling	<0.1
	50	20	<0.1
	50	沸 Boiling	<0.1
	68	120	<0.1
高锰酸钾 Potassium permanganate	5~10	20	<0.1
	10	沸 Boiling	<0.1
盐 酸 Hydrochloric acid	0.5		1~3
	3		<0.1
	5		<0.1
	10		0.1~1
	30		3~10

ZG1Cr18Ni12Mo2Ti(307)钢的耐腐蚀性能表 ZG1Cr18Ni12Mo2Ti(307) Comparison table of corrosion resistance of steel

介质条件 Medium condition			腐蚀深度 Corrosion depth (mm/a)
介质 Medium	浓度(%) Concentration	温度(℃) Temperature	
硫 酸 Sulphuric acid	1	85	<1
	3	80	<3
	5	20	<0.1
	5	80	1~3
	10	20	<0.1
	10	80	1~3
	20	20	<0.1
	20	60	<0.3
	40	20	<0.1
	40	60	>10
	80	20	<1
	80	60	3~10
亚硫酸 Sulfurous acid	20	20	<0.1
	饱和溶液 Saturated solution	20	<0.1
	潮湿气体 Humid gas	20	<0.1
	饱和溶液 Saturated solution	160~200 (0.8~2MPa)	<0.1
磷 酸 Phosphoric acid	1~80	20	<0.1
	1~45	沸腾 Boiling	<0.1
	1	140(0.3MPa)	<0.1
	80	60	<0.1
	80	110~沸腾 Boiling	1~3
盐 酸 Hydrochloric acid	0.5	20	<0.1
	0.5	沸腾 Boiling	<3
	1	20	<0.1
	1	50	<3
	5	20	<0.1
	5	60	<3
	10	20	<1
	10	60	3~10
	20	20	<3
	20	60	>10
	30	60	3~10
铬 酸 Chromic acid	10	20	<0.1

介质条件 Medium condition			腐蚀深度 Corrosion depth (mm/a)
介质 Medium	浓度(%) Concentration	温度(℃) Temperature	
铬 酸 Chromic acid	10	沸腾 Boiling	<1
	50	20	<0.1
	50	沸腾 Boiling	<0.3
氢氧化钠 Sodium hydroxide	10~30	20~沸腾 Boiling	<0.1
	40~60	120	<0.1
	60	160	<3
	78	120	<0.1
	熔体 Fusant	318	1~3
氢氧化钾 Potassium hydroxide	25~50	20~沸腾 Boiling	<0.1
	68	120	<0.1
	熔体 Fusant	300	1~3
氯 Chlorine	干燥的 Dry	20	<0.1
	潮湿的 Moist	20	<10
	潮湿的 Moist	100	>10
	氯水 Chlorine water	20	<1
氯 苯 Chlorobenzene	钝的 Blunt	沸腾 Boiling	<1
漂白粉 Bleaching powder	干燥中溶液 Solution in drying	20	<0.1
	溶液+25%C1 Solution+25C1	20	<0.1
氯化氢 Chlorine hydride	干燥的气体 Dry gas	20~100	<1
	干燥的气体 Dry gas	200	<10
氯化铁 Iron chloride	30~50	20	3
氯化铵 Ammonium chloride	28~饱和溶液 Saturated solution	100	<0.1
氯化钙 Calcium chloride	饱和溶液 Saturated solution	100	<0.1
碘 Iodine	溶液 Solution	20	>10
碘 仿 Triiodomethane	蒸汽 Steam	60	<0.1
溴化钾 Potassium bromide	溶液 Solution	20	<0.1
亚硫酸酐 Sulfurous acid anhydride	潮湿的 Moist	20	<0.1
	潮湿的 Moist	300	<0.1
	潮湿的 Moist	500	<1
	潮湿的 Moist	900	<3
亚硫酸钠 Sodium sulfite	50	沸腾 Boiling	<0.1
亚硫酸氢钠 Sodium bisulfite	50	沸腾 Boiling	<0.1
纤维素 Cellulose	纤维素蒸煮时 Cellulose in boiling	沸腾 Boiling	0(190h)
尿 素 Urea	溶液 Solution	20	<0.1

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ZG00Cr17Ni14Mo2(316L)钢耐腐蚀性能表 ZG00Cr17Ni14Mo2(316L) Comparison table of corrosion resistance of steel

介质条件 Medium condition			腐蚀深度 Corrosion depth (mm/a)
介质 Medium	浓度(%) Concentration	温度(℃) Temperature	
硫 酸 Sulphuric acid	0~30	25	<0.3
	10	0≤	<0.3
	40	25	>0.3
	85	25	<0.3
	98	25~50	<0.3
磷 酸 Phosphoric acid	40	70~100	<0.3
	40	沸腾 Boiling	<0.3
	50~60	70~100	<0.3
	50~60	沸腾 Boiling	<0.3
	70	70~90	<0.3
	70	100	>0.3
	80	70~80	<0.3
	80	>80	>0.3
粗醋酸 Coarse acetic acid	浓 Concentrated	81	2.2
		190	14
		沸腾 Boiling	<0.0005
甲酸+醋酸 Methanoic acid+ acetic acid	20	沸腾 Boiling	0.26
	70	沸腾 Boiling	0.26

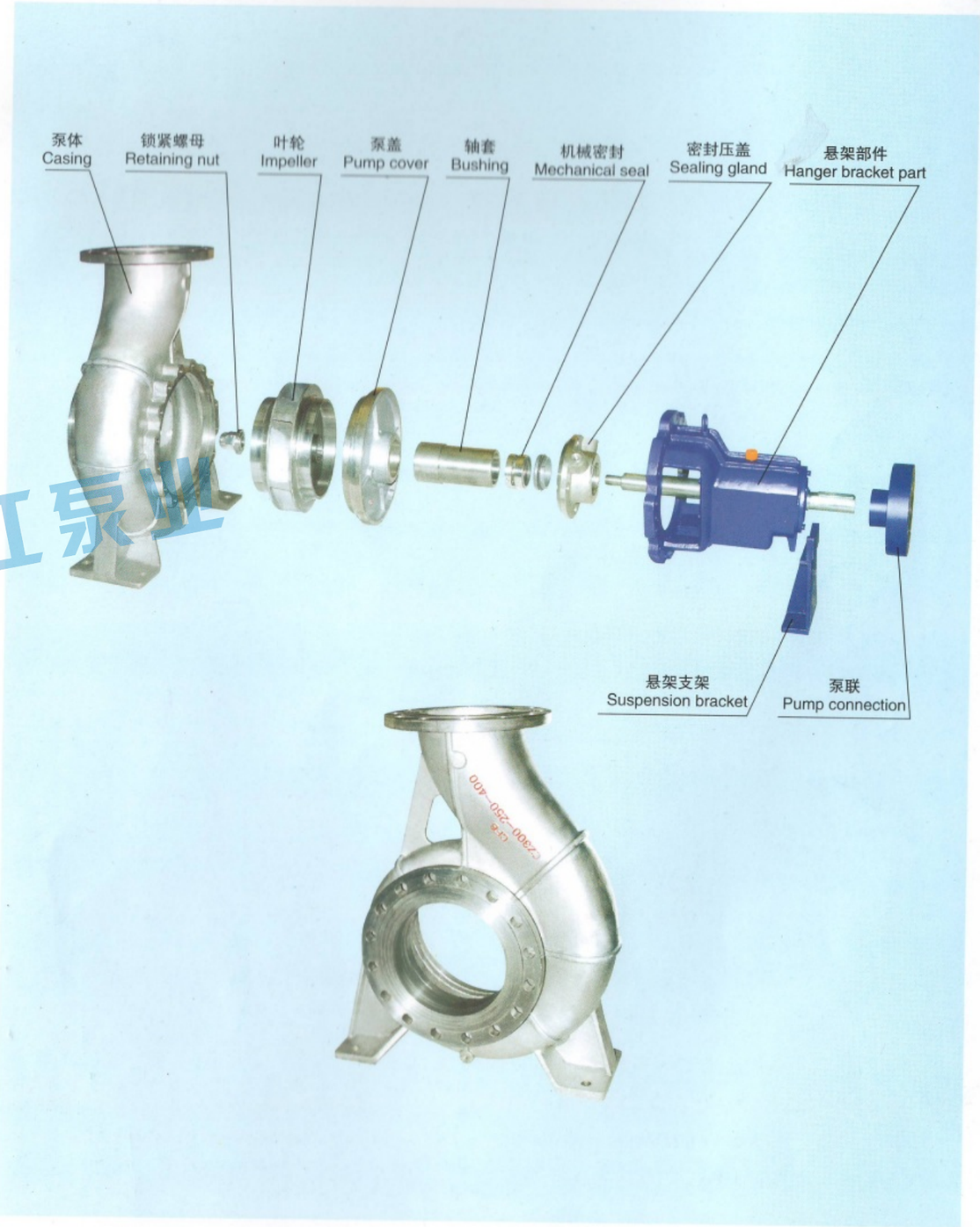
介质条件 Medium condition			腐蚀深度 Corrosion depth (mm/a)
介质 Medium	浓度(%) Concentration	温度(℃) Temperature	
甲酸+醋酸 Methanoic acid+ acetic acid	20	沸腾 Boiling	0.401
	45		
醋 酸 Acetic acid	30	沸腾 Boiling	0
	50	沸腾 Boiling	0.005
	70	沸腾 Boiling	0.018
	99	沸腾 Boiling	0.035
熔融尿素 Melted urea	尿素32~34 Urea	190~150	0.065
	$CO_2$10~11		
	$NH_3$35~36		
	H_2O19~21		
熔融尿素 Melted urea	$CO_2$35	170~180	0.024
	$NH_3$54~55		
	H_2O10		
熔融尿素 Melted urea	尿液30 Urea solution	188	0.17
	甲铵30 Ammonium formate		
	$NH_3$20		
	H_2O20		

注：熔融尿素的压力=200
Note: melted urea's pressure=200

ZG1Cr18Mn13Mo2CuN(402)钢是无镍的不锈钢，在大多数化工介质中的耐腐蚀性相当或优于ZG1Cr18Ni9Ti(321)钢，尤其是在腐蚀性能与磨损并存的条件下比ZG1Cr18Ni9Ti更优，机械性能和铸造性能好，但气孔敏感性比ZG1Cr18Ni9Ti大，其耐腐蚀性能在此基础上可参照ZG1Cr18Ni9Ti耐腐蚀性能表。

ZG1Cr18Mn13Mo2CuN(402) is the nickel-free stain-less steel, which is equivalent or superior to the ZG1Cr18Ni9Ti(321) regarding its corrosion resistance in a majority of chemical media, especially in such a condition as both corrosion and abrasion coexist. Its mechanical and casting properties are better but its air hole sensibility is bigger than ZG1Cr18Ni9Ti. Based on that, its corrosion resistance can refer to the corrosion resistance table of ZG1Cr18Ni9Ti.

泵组装示意图 Schematic Diagram For Pump Assembling



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