

Special Alloy Steel (Cast) Valves



Approach to Corrosive Environment

KITZ High Corrosion Resistant Material *Special Alloy Steel*

Customers with corrosion concern might be looking for following material.

Higher corrosion resistant material than current valve material at lower cost.

Valve material with longer valve replacement period to reduce maintenance cost.

KITZ can supply customers with high corrosion resistant material to fit their corrosive environments by material selection based on own corrosion test data from wide range of lineups from stainless steel casting to high nickel alloy steel casting.

KITZ can meet customers' requirements with producing even 1piece of high nickel alloy valve at own casting facilities.

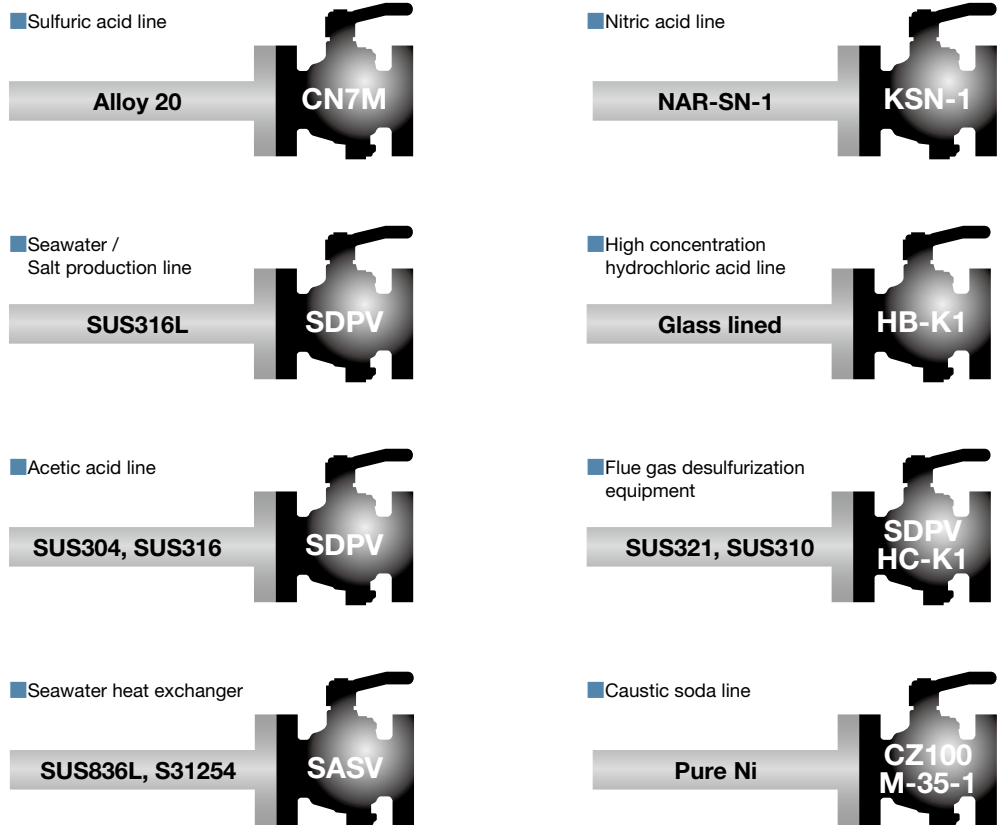
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1. KITZ Selects Proper Valve Material from Piping Material and Operating Environment.

Valve Material Selection Example



Point in selecting valve material



- Valves have more gaps than pipes.
- Valves have higher crevice corrosion risk than pipes.

It is required to select higher corrosion resistant valves than pipes depending on operating environment.

2. Is Cost Too High with the Valve Material Selection ?

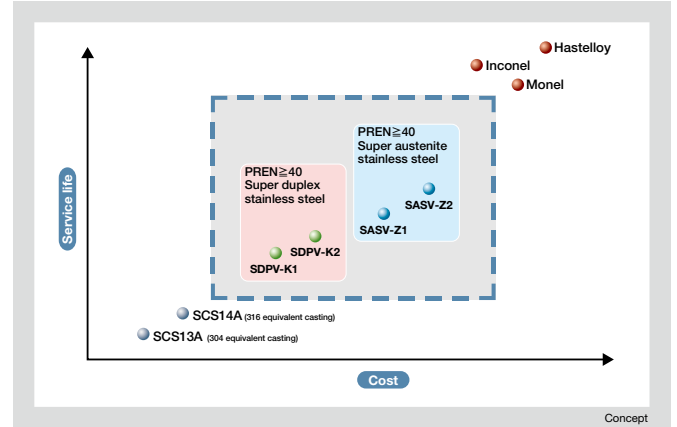
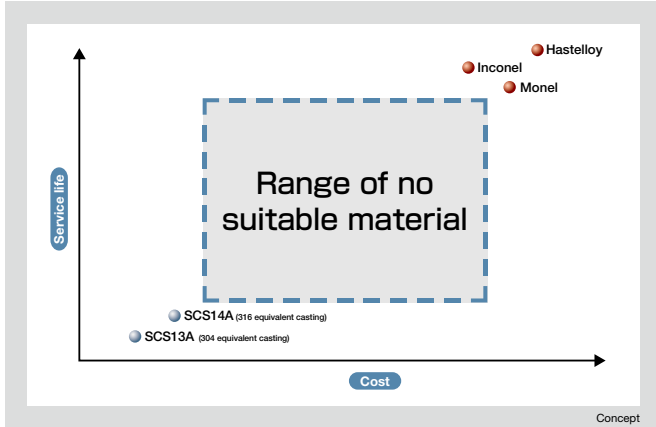
When you select valve material until now ...?

You had to select much higher cost material than SCS13A or SCS14A.

KITZ has wide variety of material to be selected.

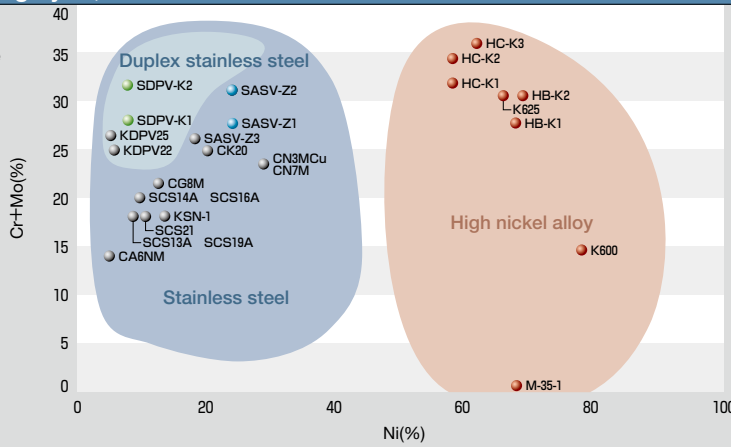
KITZ collected wide variety of valve material.

You can select material with high corrosion resistance at reasonable cost.



Material positioning by Ni, Cr and Mo contents

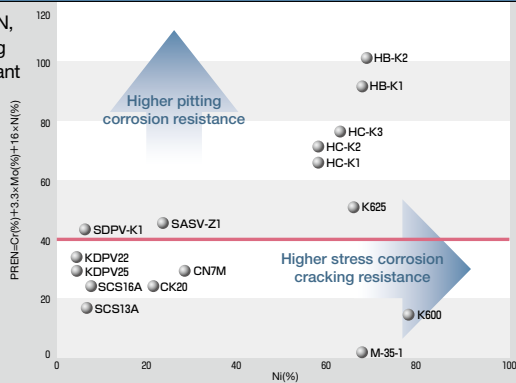
The more Ni, Cr and Mo contents, the more expensive material



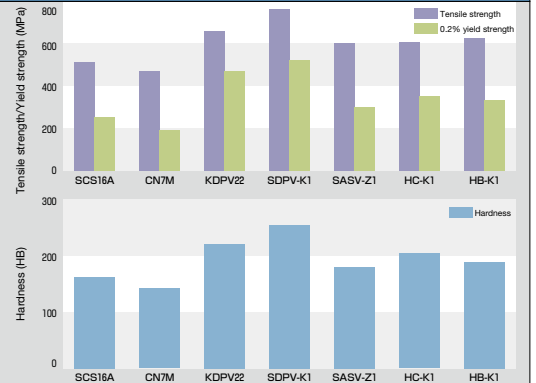
3. Material Positioning by Characteristics

Positioning by pitting corrosion resistance

The higher PREN, the higher pitting corrosion resistant material



Mechanical properties of stainless steel and high nickel alloy casting



PREN : Pitting Resistance Equivalent Number

$$PREN = Cr(\%) + 3.3 \times Mo(\%) + 16 \times N(\%)$$

PREN is digitized pitting corrosion resistance.

● The higher PREN, the higher pitting corrosion resistant material. ● Material with PREN ≥ 40 has "Super" as capital letter.

4. KITZ Valve Advantages

1 Quality

Integrated production from casting (material) with own casting facilities.

2 Variety

Wide range of material lineups from stainless steel to high nickel alloy casting.

3 Flexibility

Flexibility to produce even 1 piece of special stainless steel and high nickel alloy valve.

4 Economy

The most suitable material valve can be offered for specific operating environment based on our internal corrosion test data.

5. Production Location

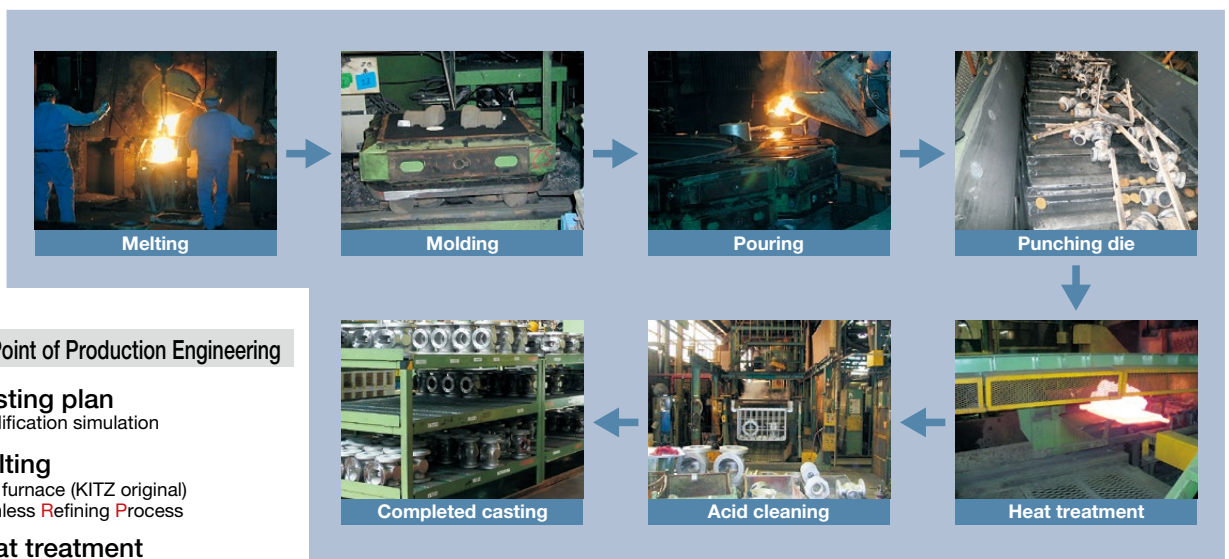
Nagasaki Plant

Manufacturing plant exclusively for stainless steel to high nickel alloy casting valves.



6. Production Engineering

1 Melting/Casting Process



2 Point of Production Engineering

Casting plan
Solidification simulation

Melting
SRP furnace (KITZ original)
Stainless Refining Process

Heat treatment
EMF (Furnace exclusive for special stainless steel and high nickel alloy casting)
Exotic Material Furnace

7. Material List of KITZ Stainless Steel and High Nickel Alloy Steel Casting

Classification	KITZ material		Major components	Standard															
				Casting			Equivalent other than casting and forging			Chemical components (Wt%)									
	General	KITZ		Name	Symbol	JIS	ASTM	UNS-No.	JIS	ASTM	UNS-No.	C	Si	Mn	P	S	Ni	Cr	Mo
Standard material	Austenitic stainless steel casting																		
	SCS13		18Cr-8Ni	SCS13A	-	-	SUS 304	-	-	-	~0.08	~2.00	~1.50	~0.040	~0.040	8.00~11.00	18.00~21.00	-	
				-	A351 Gr.CF8	J92600		A312 304	S30400		~0.08	~2.00	~1.50	~0.040	~0.040	8.0~11.0	18.0~21.0	~0.50	
	SCS19	V	18Cr-8Ni-LC ⁽¹⁾	SCS19A	-	-	SUS 304L	-	-	-	~0.03	~2.00	~1.50	~0.040	~0.040	8.00~12.00	17.00~21.00	-	
				-	A351 Gr.CF3	J92500		A312 304L	S30403		~0.03	~2.00	~1.50	~0.040	~0.040	8.0~12.0	17.0~21.0	~0.50	
	SCS14	M	18Cr-9Ni-2Mo	SCS14A	-	-	SUS 316	-	-	-	~0.08	~1.50	~1.50	~0.040	~0.040	9.00~12.00	18.00~21.00	2.00~3.00	
				-	A351 Gr.CF8M	J92900		A312 316	S31600		~0.08	~1.50	~1.50	~0.040	~0.040	9.0~12.0	18.0~21.0	2.0~3.0	
	SCS16	O	18Cr-9Ni-2Mo-LC ⁽¹⁾	SCS16A	-	-	SUS 316L	-	-	-	~0.03	~1.50	~1.50	~0.040	~0.040	9.00~13.00	17.00~21.00	2.00~3.00	
				-	A351 Gr.CF3M	J92800		A312 316L	S31603		~0.03	~1.50	~1.50	~0.040	~0.040	9.0~13.0	17.0~21.0	2.0~3.0	
	SCS21	CB	18Cr-10Ni-Nb	SCS21	-	-	SUS 347	-	-	-	~0.08	~2.00	~2.00	~0.040	~0.040	9.00~12.00	18.00~21.00	-	
				-	A351 Gr.CF8C	J92710		A312 347	S34700		~0.08	~2.00	~1.50	~0.040	~0.040	9.0~12.0	18.0~21.0	~0.50	
	CG8M	CG	18Cr-12Ni-3.5Mo	-	A351 Gr.CG8M	J93000	SUS 317	A312 317	S31700		~0.08	~1.50	~1.50	~0.040	~0.040	9.0~13.0	18.0~21.0	3.0~4.0	
	CG3M	GM	18Cr-12Ni-3.5Mo-LC ⁽¹⁾	-	A351 Gr.CG3M	J92999	SUS 317L	A312 317L	S31703		~0.03	~1.50	~1.50	~0.040	~0.040	9.0~13.0	18.0~21.0	3.0~4.0	
	KSN-1	SN	18Cr-13Ni-4.5Si	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
																KITZ original material (no public standard)			
	CN7M	CN	21Cr-29Ni-2.5Mo-3.5Cu	SCS23	-	-	-	-	-	-	~0.07	~2.00	~2.00	~0.040	~0.040	27.50~30.00	19.00~19.9	2.00~3.00	
				-	A351 Gr.CN7M	J95150	-	B474 N08020	N08020		~0.07	~1.50	~1.50	~0.040	~0.040	27.5~30.5	19.0~19.9	2.0~3.0	
	CN3MCu	3M	21Cr-29Ni-2.7Mo-3.2Cu-LC ⁽¹⁾	SCS23 equiv.	A990 Gr.CN3MCu	-	-	-	-	-	~0.03	~1.00	~1.50	~0.030	~0.015	27.5~30.5	19.0~22.0	2.0~3.0	
	CK20	CK	25Cr-20Ni	SCS18	-	-	SUS 310S	-	-	-	~0.20	~2.00	~2.00	~0.040	~0.040	19.00~22.00	23.00~27.00	-	
				-	A351 Gr.CK20	J94202	-	A312 310S	S31008		0.04~0.20	~1.75	~1.50	~0.040	~0.040	19.0~22.0	23.0~27.0	~0.50	
Special material	Super austenitic stainless steel casting High corrosion resistance with PREN ≥ 40																		
	SASV-Z1	SA	21Cr-24Ni-6.5Mo-N	-	A351 Gr.CN3MN	-	SUS 836L	B690 N08367	N08367		~0.03	~1.00	~2.00	~0.040	~0.010	23.5~25.5	20.0~22.0	6.0~7.0	
	SASV-Z2	SA	25Cr-24Ni-6.5Mo-N	-	A351 Gr.CN3MN mod.	-	-	-	-	-	-	-	-	-	-	KITZ original material (no public standard)			
	SASV-Z3	SA	20Cr-18Ni-6.5Mo-N-Cu	-	A351 Gr.CK3MCuN	J93254	-	A312 S31254	S31254		~0.025	~1.00	~1.20	~0.045	~0.010	17.5~19.5	19.5~20.5	6.0~7.0	
	Duplex stainless steel casting High hardness and high corrosion resistance with PREN=30~40, ferrite ≅ 50% and austenite ≅ 50																		
	KDPV22	4A	22Cr-5Ni-3Mo-N	-	A995 Gr.4A, CD3MN	J92205	SUS 329J3L	A790 S31803	S31803		~0.03	~1.00	~1.50	~0.040	~0.020	4.5~6.5	21.0~23.5	2.5~3.5	
	KDPV25	1B	25Cr-5Ni-2Mo-3Cu-N	-	A995 Gr.1B, CD4MCuN	J93372	-	-	-	-	~0.040	~1.00	~1.00	~0.040	~0.040	4.7~6.0	24.5~26.5	1.70~2.30	
	Super duplex stainless steel casting High hardness and high corrosion resistance with PREN ≥ 30~40, ferrite ≅ 50% and austenite ≅ 50																		
	SDPV-K1	SD	25Cr-7Ni-3Mo-N	SCS10 equiv.	-	-	SUS 329J4L	A790 S32750	S32750		~0.03	~1.50	~1.50	~0.040	~0.030	4.50~8.50	21.00~26.00	2.50~4.00	
	SDPV-K2	SD	28Cr-7Ni-4Mo-N	SCS10 mod.	-	-	-	-	-	-	-	-	-	-	-	KITZ original material (no public standard)			
SDPV-K3	SD	25Cr-7Ni-3Mo-Cu-N-W	-	A890(995)Gr.6A, CD3MWCuN	J93380	-	A790 S32750	S32750		~0.030	~1.00	~1.00	~0.030	~0.025	6.5~8.5	24.0~26.0	3.0~4.0		
SDPV-K4	SD	25Cr-7Ni-4Mo-N	-	A890(995)Gr.5A, CE3MN	J93404	SUS 327L1	A790 S32750	S32750		~0.030	~1.00	~1.50	~0.040	~0.040	6.0~8.0	24.0~26.0	4.0~5.0		
Nickel-based alloy	Ni-Cu alloy casting Ni casting with 30% Cu																		
	M-35-1	NC	67Ni-30Cu	NCuC	A494 Gr.M-35-1	N24135	-	B163 N04400	N04400		~0.35	~1.25	~1.50	~0.030	~0.030	Balance	-	-	
	Ni-Cr alloy casting Ni casting with 15% Cr																		
	K600	CY	78Ni-15Cr-5Fe	NCr/C	A494 Gr.CY40	N06040	-	B166 N06600	N06600		~0.40	~3.00	~1.50	~0.030	~0.020	Balance	14.0~17.0	-	
	Ni-Mo alloy casting Ni casting with Mo with high corrosion resistance to reducing acid																		
	HB-K1	HB	67Ni-28Mo-5Fe	NMC	A494 Gr.N12MV	N30012	-	B335 N10001	N10001		~0.12	~1.00	~1.00	~0.040	~0.030	Balance	~1.00	26.0~30.0	
	HB-K2	HB	68Ni-31Mo-1Fe	-	A494 Gr.N7M	N30007	-	B335 N10665	N10665		~0.07	~1.00	~1.00	~0.040	~0.030	Balance	~1.00	30.0~33.0	
	Ni-Cr-Mo alloy casting Ni casting with Cr and Mo with high corrosion resistance to oxidizing acid and reducing acid																		
	HC-K1	HC	58Ni-16Cr-16Mo-6Fe-4W	NMCrC	A494 Gr.CW12MW	N30002	-	B574 N10276	N10276		~0.12	~1.00	~1.00	~0.040	~0.030	Balance	15.5~17.5	16.0~18.0	
	HC-K2	HC	58Ni-21Cr-14Mo-4Fe-3W	-	A494 Gr.CX2MW	N26022	-	B574 N06022	N06022		~0.02	~0.80	~1.00	~0.025	~0.025	Balance	20.0~22.5	12.5~14.5	
	HC-K3	HC	62Ni-17Cr-17Mo-2Fe	-	A494 Gr.CW6M	N10002	-	-	-		~0.07	~1.00	~1.00	~0.040	~0.030	Balance	17.0~20.0	17.0~20.0	
	HC-K4	HC	64Ni-16Cr-16Mo-1Fe	-	A494 Gr.CW2M	N26455	-	B574 N06455	N06455		~0.02	~0.08	~1.00	~0.030	~0.020	Balance	15.0~17.5	15.0~17.5	
	K625	CW	65Ni-22Cr-9Mo-3.5Nb	-	A494 Gr.CW6MC	N26625	-	B446 N06625	N06625		~0.06	~1.00	~1.00	~0.015	~0.015	Balance	20.0~23.0	8.0~10.0	
	K825	CU	43Ni-22Cr-3Mo-30Fe-Nb	-	A494 Gr.CU5MCuC	N08826	-	B425 N08825	N08825		~0.050	~1.00	~1.00	~0.030	~0.030	38.0~44.0	19.5~23.5	2.5~3.5	
	Ni casting																		
CZ-100	CZ	97Ni	-	A494 Gr.CZ100	N02100	-	B160 N02200	N02200		~1.00	~2.00	~1.50	~0.030	~0.030	95.0~	-	-		

Remarks

1. Materials mentioned above are applicable to cast body, bonnet, cover and body cap only.

2. (1) C ≤ 0.03 mass%.

3. (2) PREN is digitized pitting corrosion resistance (PREN = Cr% + 3.3xMo% + 16xN%). The higher PREN, the higher pitting corrosion resistant material. Material with PREN ≥ 40 has "Super" as capital letter.

4. SDPV/SASV/KSN are KITZ' trademarks.

5. NAR is Nippon Steel's trademark. 254SMO is Avesta Sheffield's trademark. SAF 2205/2507 are Sandvik's trademarks. Monel/Inconel/Incoloy/Nickel 200 are Special Metals' trademarks. Hastelloy is Haynes International's trademark.

						(2) PREN	Mechanical properties			Characteristics	Application	Equivalent (Trademark)
Cu	Fe	V	W	N	Tensile strength (N/mm ²)		Yield strength (N/mm ²)	Elongation (%)				
-	Balance	-	-	-	-	480~	205~	33~	High corrosion resistance to nitric acid, phosphoric acid and organic acid. Less corrosion resistance to sulfuric acid.	For corrosion resistance required process at various plants	-	
-	Balance	-	-	-	-	485~	205~	35~				
-	Balance	-	-	-	-	480~	205~	33~	Upgraded intergranular corrosion resistance type of SCS13A.	For intergranular corrosion resistance process of SCS13A	-	
-	Balance	-	-	-	-	485~	205~	35~				
-	Balance	-	-	-	-	480~	205~	33~	High corrosion resistance to environments other than hydrochloric acid, hydrofluoric acid, high temperature and high concentration of sulfuric acid and phosphoric acid.	For severer environments than SCS13A process	-	
-	Balance	-	-	-	-	485~	205~	30~				
-	Balance	-	-	-	-	480~	205~	33~	Upgraded intergranular corrosion resistance type of SCS14A.	For intergranular corrosion resistance process of SCS14A	-	
-	Balance	-	-	-	-	485~	205~	30~				
-	Balance	(Nb=10×C%~1.35)			-	480~	205~	28~	Higher intergranular corrosion resistance than SCS13A with stabilized carbide by adding Nb.	For hydrogenation desulfurizing equipment	-	
-	Balance	(Nb= 8×C%~1.00)			-	485~	205~	30~				
-	Balance	-	-	-	-	515~	240~	25~	Upgraded pitting corrosion resistance and crevice corrosion resistance type of SCS14A.	For acetic acid process	-	
-	Balance	-	-	-	-	515~	240~	25~	Upgraded intergranular corrosion resistance type of CG8M.	For intergranular corrosion resistance process of CG8M	-	
						480~	230~	10~	High corrosion resistance to total concentration of nitric acid and fuming nitric acid environments.	For nitric acid process	NAR®-SN-1	
3.00~ 4.00	Balance	-	-	-	-	390~	165~	30~	High corrosion resistance to all concentration of sulfuric acid below 60 degree C and heated solution of dilute oxide.	For sulfuric acid (the most common)	-	
3.0~ 4.0	Balance	-	-	-	-	425~	170~	35~				
3.0~ 3.5	Balance	-	-	-	-	425~	170~	35~	Higher sulfuric acid corrosion resistance than CN7M with 95% or more of refined material such as AOD and VOD.	Longer life type of CN7M	-	
-	Balance	-	-	-	-	450~	195~	28~	Higher Cr and Ni than SCS13A and used in environments such as sulfurous acid solution and nitric acid at room temperature.	For low concentration of alkali and nitric acid process	-	
-	Balance	-	-	-	-	450~	195~	30~				
~0.75	Balance	-	-	-	0.18~ 0.26	45~	550~	260~	35~	The highest acid resistance and alkali resistance among general austenitic stainless steel. High pitting corrosion resistance and crevice corrosion resistance to chloride solution such as seawater.	Higher grade than SDPV (less hardness)	-
						50~	550~	260~	20~	Higher pitting factor than SASV-Z1 with high Cr and suitable for seawater resistant environments at high temperature.	Higher grade than SDPV (the highest grade SASV)	-
0.50~ 1.00	Balance	-	-	-	0.18~ 0.24	40~	550~	260~	35~	Steel corresponding to AVESTA 254SMO which is commonly used in the world.	Higher grade than SDPV (less hardness)	254SMO®
~1.00	Balance	-	-	-	0.10~ 0.30	-	620~	415~	25~	Higher SCC resistance and pitting corrosion resistance in intermediate concentration of chloride environments. Higher general corrosion resistance to environments such as dilute sulfuric acid and phosphoric acid.	For seawater environments and oil well (mild environments such as North Sea oil well)	SAF 2205®
2.7~ 3.3	Balance	-	-	-	0.10~ 0.25	-	690~	485~	16~	Suitable for nitric acid in oxidizing environments and sulfuric acid in reducing environments with higher addition of Cr and Cu than KDPV22.	For seawater environments and oil well sulfuric acid process	-
-	Balance	-	-	-	0.08~ 0.30	40~	620~	390~	15~	Higher SCC resistance than austenitic stainless steel and higher weldability than ferritic stainless steel. High mechanical strength and higher acid resistance, pitting corrosion resistance and crevice corrosion resistance than SCS16A.	For seawater environments, oil well and seawater desalination process (domestic)	-
						45~	620~	390~	15~	KITZ originally developed, the highest pitting factor among SDPV series and suitable for high temperature seawater environments. Suitable for methionine process in oxidizing environments with high Cr.	For seawater desalination process (the highest grade duplex stainless steel)	-
0.5~ 1.0	Balance	-	0.5~ 1.0	0.20~ 0.30	40~	700~	450~	25~	Used for overseas seawater desalination process.	For seawater environments, oil well and seawater desalination process (overseas)	-	
-	Balance	-	-	0.10~ 0.30	40~	690~	515~	18~	Higher PREN than SDPV-K1 and K3 with high mechanical strength.	For seawater environments, oil well and seawater desalination process (overseas) (higher grade than SDPV-K3)	SAF 2507®	
26.0~ 33.0	~3.5	(Nb= ~0.5)			-	450~	170~	25~	High corrosion resistance in reducing environments without local corrosion and insensitive to SCC by Cl ⁻ .	For intermediate concentration of alkali and pure oxygen	Monel®400	
-	~11.0	-	-	-	-	485~	195~	30~	High oxidation resistance at high temperature to oxidizing acid such as nitric acid. High SCC resistance by Cr and high corrosion resistance to high pure water and alkali.	For high temperature process and intermediate concentration of alkali	Inconel®600	
-	4.0~6.0	0.20~ 0.60	-	-	-	525~	275~	6~	Corrosion resistant to hydrochloric acid at all concentrations to boiling point. Corrosion resistant to reducing acid such as sulfuric acid up to 60%, phosphoric acid and cupric chloride. High temperature resistant but not suitable for strong oxidizing environments such as nitric acid.	For high concentration of hydrochloric acid process (not suitable for nitric acid)	Hastelloy®B	
-	~3.0	-	-	-	-	525~	275~	20~	High corrosion resistance at welded part with high weldability.	Higher grade type of HB	Hastelloy®B2	
-	4.5~7.5	0.20~ 0.40	3.75~ 5.25	-	-	495~	275~	4~	High corrosion resistance in oxidizing environments such as wet chlorine gas and chlorine dioxide. High corrosion resistance to organic acid and salt such as acetic acid and seawater.	For seawater environments, oil well (high concentration of H ₂ S) and flue gas desulfurization process (not suitable for nitric acid)	Hastelloy®C276	
-	2.0~6.0	~0.35	2.5~ 3.5	-	-	550~	310~	30~	High corrosion resistance in oxidizing environments by high Cr and low Mo with improved mechanical properties.	For mixed acid (sulfuric acid and nitric acid) Improved type of HC-K1	Hastelloy®C22	
-	~3.00	-	-	-	-	495~	275~	25~	High corrosion resistance in oxidizing environments and reducing environments by high Cr and low Mo. Commonly used overseas.	Intermediate material between HC-K1 and HC-K2	-	
-	~2.0	-	~1.0	-	-	495~	275~	20~	Equivalent material to HC-K1 and commonly used overseas.	Inexpensive type of HC-K1	Hastelloy®C4	
-	~5.0	(Nb=3.15~4.50)			-	485~	275~	25~	High corrosion resistance in oxidizing environments at high temperature. High corrosion resistance in erosive environments.	For high temperature process, seawater environments and oil well (high concentration of H ₂ S)	Inconel®625	
1.5~ 3.5	Balance	(Nb=0.60~1.20)			-	520~	240~	20~	High SCC resistance and crevice corrosion resistance to sulfuric acid and phosphoric acid.	For high temperature process, seawater environments and oil well	Incoloy®825	
~1.25	~3.00	-	-	-	-	345~	125~	10~	High corrosion resistance to alkali hydroxide solution and fused alkali such as sodium hydroxide and potassium hydroxide.	For high concentration of alkali (for caustic soda)	Nickel 200®	

8. Corrosion Resistance Evaluation of Material under Corrosive Environment

These evaluations are average values of laboratory test data and do not guarantee any maximum or minimum values and corrosion resistance in the actual environment.

- Corrosion rate < 0.127mm/year (5mpy)
- Corrosion rate < 0.508mm/year (20mpy)
- ▲ Corrosion rate ≥ 0.508mm/year

Ferric Chloride Crevice Corrosion Test (12.7% FeCl₃·6H₂O:Temperature 30°C)

Corrosion evaluation	SCS14A	SCS16A	CN7M	SASV-Z1	SDPV-K1	SDPV-K2	HC-K1
Corrosion rate	▲	▲	▲	●	●	●	●
Number of crevice corrosion	40/40	40/40	39/40	0/40	14/40	2/40	0/40

Hydrochloric Acid

Concentration	Temperature	SCS13A	SCS16A	CN7M	SASV-Z1	SDPV-K1	HB-K1	HC-K1
5%	Boiling	▲	—	—	▲	●	—	—
10%	Boiling	—	—	—	▲	—	●	●
20%	40	—	●	●	●	●	●	●
	80°C	▲	▲	▲	●	●	●	●
40%	40°C	—	●	●	●	●	●	●
	80°C	▲	▲	●	▲	▲	●	●
60%	40°C	—	▲	●	●	●	●	●
	60°C	▲	—	●	●	▲	—	—
60%	80°C	—	▲	●	●	▲	●	●
	80°C	—	▲	●	●	▲	●	●
80%	40°C	▲	▲	●	●	▲	●	●
	80°C	—	▲	▲	▲	▲	●	●
98%	40°C	●	●	●	●	●	—	—
	80°C	▲	▲	▲	▲	▲	●	●

Caustic Soda

Concentration	Temperature	M-35-1
20%	Boiling	●
40%	100°C	●
	Boiling	●
60%	100°C	●
	Boiling	●
80%	100°C	●
	150°C	●
	Boiling	●

Chlorine Dioxide

Concentration	Temperature	SCS14A	SASV-Z1	SDPV-K1	HB-K1	HC-K1	TI
2000ppm	95°C	●	●	●	▲	●	●

Sulfuric Acid

Concentration	Temperature	SCS13A	SASV-Z1	SDPV-K1	HB-K1	HC-K1	K625
0.5%	Boiling	▲	●	●	—	—	—
1.0%	60°C	—	—	●	—	—	—
	Boiling	▲	—	▲	●	●	▲
1.5%	60°C	—	●	●	—	—	—
	80°C	▲	—	▲	—	●	●
	Boiling	—	▲	▲	●	—	—

Formic Acid

Concentration	Temperature	SCS14A	CN7M	SASV-Z1	SDPV-K1
40%	Boiling	▲	●	●	●
60%		▲	●	▲	●
80%		●	●	▲	▲

Acetic Acid

Concentration	Temperature	SCS14A	CN7M	SASV-Z1	SDPV-K1	HC-K1	HC-K2
10%	Boiling	—	●	●	●	—	●
20%		●	●	—	●	●	—
40%		●	●	—	●	●	—
50%		—	●	—	●	—	●
60%		●	●	—	●	●	—
80%		●	●	—	●	●	—
99.5%		—	●	●	●	●	—

Lactic Acid

Concentration	Temperature	SCS16A	SASV-Z1	SDPV-K1	HC-K1
90%	150°C	▲	●	●	●
	200°C	▲	▲	●	●

Acetic Acid with Hydrogen Bromide (HBr:1000ppm)

Concentration	Temperature	SCS16A	CN7M	SDPV-K1	M-35-1	HB-K1	HC-K2	K625
99.5%	120°C	▲	▲	▲	▲	●	●	●
	150°C	▲	▲	▲	▲	●	●	●
	183°C	▲	▲	▲	▲	●	▲	▲

Test condition	Test solution	Concentration	Temperature	Permeation period
A	H ₂ SO ₄	40%	80°C	24hr
B		60%		

General Corrosion Test Example

KITZ material name	SCS16A	SDPV-K1	SASV-Z1	CN7M	HC-K1	HB-K1
Standards	JIS G5121 SCS 16A	JIS G5121 SCS 10	—	JIS G5121 SCS 23	JIS H5701 NMCrC	JIS H5701 NMC
	ASTM A351 CF3M	—	ASTM A351 CN3MN	ASTM A351 CN7M	ASTM A494 CW-12MW	ASTM A494 N-12MV
	UNS J92800	—	—	UNS J95150	UNS N30002	UNS N30012
Test condition						
	<p>A H₂SO₄:40%, 80°C</p> <p>B H₂SO₄:60%, 80°C</p>					

9. KITZ Special Alloy Steel Valve Production Range

Actual production record and available.
 No actual production record and will be available upon advanced consultation.
 A series are available.
 C series will be available upon advanced consultation.
 No casting pattern and new pattern production is required.

KITZ material	Standard			Type	Size	A	Class																							
	Name	Symbol	JIS				ASTM	15	20	25	32	40	50	65	80	100	125	150	200	250	300	350	400	450	500	600				
								1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4	5	6	8	10	12	14	16	18	20	24				
SCS21	CB	G5121 SCS21	A351 Gr.CF8C	Gate valve	10K/Class150																									
				Globe valve	20K/Class300																									
				Check valve	600																									
				Ball valve	10K/Class150																									
CG8M CG3M SCS13 SCS14	CG GM 13 M	G5121 SCS13A G5121 SCS14A	A351 Gr.CG8M A351 Gr.CG3M A351 Gr.CF8 A351 Gr.CF8M	Gate valve	10K/Class150																									
				Globe valve	20K/Class300																									
				Check valve	600																									
				Ball valve	10K/Class150																									
KSN-1	SN	-	-	Gate valve	10K/Class150																									
				Globe valve	20K/Class300																									
				Check valve	600																									
				Ball valve	10K/Class150																									
CN7M CN3MCu	CN 3M	G5121 SCS23	A351 Gr.CN7M A990 Gr.CN3MCu	Gate valve	10K/Class150																									
				Globe valve	20K/Class300																									
				Check valve	600																									
				Ball valve	10K/Class150																									
CK20	CK	G5121 SCS18	A351 Gr.CK20	Gate valve	10K/Class150																									
				Globe valve	20K/Class300																									
				Check valve	6010																									
				Ball valve	10K/Class150																									
SDPV-K1 SDPV-K2 SDPV-K3 SDPV-K4	SD SD SD SD	G5121 SCS10 G5121 SCS10 mod.	A995 Gr.6A, CD3MWCuN A995 Gr.5A, CE3MN	Gate valve	10K/Class150																									
				Globe valve	20K/Class300																									
				Check valve	600																									
				Ball valve	10K/Class150																									
SASV-Z1 SASV-Z2 SASV-Z3	SA SA SA	-	A351 Gr.CN3MN A351 Gr.CN3MN mod. A351 Gr.CK3MCuN	Gate valve	10K/Class150																									
				Globe valve	20K/Class300																									
				Check valve	600																									
				Ball valve	10K/Class150																									
HB-K1	HB	H5701 NMC	A494 Gr.N12MV	Gate valve	10K/Class150																									
				Globe valve	20K/Class300																									
				Check valve	600																									
				Ball valve	10K/Class150																									
HC-K1 HC-K2	HC HC	H5701 NMCrC	A494 Gr.CW12MW A494 Gr.CX2MW	Gate valve	10K/Class150																									
				Globe valve	20K/Class300																									
				Check valve	600																									
				Ball valve	10K/Class150																									

Notes
 1. Applicable valve types are A series and C series stainless steel valves as gate, globe and check valves and floating flanged valves as ball valves. Consult KITZ for trunnion mounted flanged ball valves individually. Consult KITZ for production range of other type valves such as butterfly valves individually. Consult KITZ for production range of other materials of the above individually.
 2. Consult KITZ for production range of SDPV-K2 and SDPV-K4 individually.
 3. SDPV, SASV and KSN are KITZ trademark.

Memo

10. KITZ Special Alloy Steel Valve Range of Use

Pressure/Temperature Rating (P/T Rating)

The valve material strength changes by the temperature, which determines maximum allowable pressure of the valve. Pressure/temperature rating shows relationship between valve temperature and maximum allowable pressure to be used. The relationship is established in JIS B2220 (Steel pipe flanges) and JIS B2071 (Steel flanged valves) by material and structure. The rating is defined in ANSI/ASME B16.34 (Valves-Flanged, Threaded and Welding End) as PRESSURE-TEMPERATURE RATING in USA. It is also defined in JPI 7S-65 as steel valve pressure-temperature standard. These standards categorize many materials to be used by their properties and define maximum allowable pressure from ambient to high temperature. It is required to select valves which meet operating conditions from the pressure/temperature rating with economical efficiency.

10-1. Pressure/Temperature Rating (JIS 10K/20K)

Size					10K								20K								
Material					Operating temperature																
Type	KITZ		JIS	ASTM	℃	-120	220	260	300	350	400	425	-120	220	260	300	316	325	350	400	425
	Name	Symbol																			
Iron-based alloy	Austenitic stainless steel casting																				
	SCS21	CB	SCS21	A351 Gr.CF8C	MPa	1.4	1.2		1.0	—	—	—	3.4	3.1		2.9			2.6	2.3	2.0
	CG8M	CG	—	A351 Gr.CG8M	MPa	1.4	1.2		1.0	—	—	—	3.4	3.1		2.9			2.6	2.3	2.0
	CG3M	GM	—	A351 Gr.CG3M	MPa	1.4	1.2		1.0	—	—	—	3.4	3.1		2.9			2.6	2.3	2.0
	KSN-1	SN	—	—	MPa	1.4	1.2		1.0	—	—	—	3.4	3.1		2.9			2.6	2.3	2.0
	CN7M	CN	SCS23	A351 Gr.CN7M	MPa	1.4	1.2		1.0	—	—	—	3.4	3.1		2.9		2.8	—	—	—
	CN3MCu	3M	SCS23 equiv.	A990 Gr.CN3MCu	MPa	1.4	1.2		1.0	—	—	—	3.4	3.1		2.9		2.8	—	—	—
	CK20	CK	SCS18	A351 CK20	MPa	1.4	1.2		1.0	—	—	—	3.4	3.1		2.9			2.6	2.3	2.0
	Super austenitic/duplex/super duplex stainless steel casting																				
	SASV-Z1	SA	—	A351 Gr.CN3MN	MPa	1.4	1.2		1.0	—	—	—	3.4	3.1		2.9			2.6	2.3	2.0
	KDPV22	4A	—	A995 Gr.4A, CD3MN	MPa	1.4	1.2		1.0	—	—	—	3.4	3.1		2.9			2.6	—	—
	SASV-Z2	SA	—	—	MPa	1.4	1.2		1.0	—	—	—	3.4	3.1		2.9	2.8	—	—	—	—
	SDPV-K1	SD	SCS10 equiv.	—																	
	SDPV-K2	SD	SCS10 mod.	—																	
	SDPV-K4	SD	—	A995 Gr.5A, CE3MN																	
	SASV-Z3	SA	—	A351 Gr.CK3MCuN	MPa	1.4	1.2		1.0	—	—	—	3.4	3.1		2.9			2.6	2.3	—
	KDPV 25	1B	—	A995 Gr.1B, CD4MCuN																	
	SDPV-K3	SD	—	A995 Gr.6A, CD3MWCuN																	
Ni-Cu/Ni-Cr/Ni-Mo/Ni-Cr-Mo alloy casting																					
M-35-1	NC	NCuC	A494 Gr.M35-1	MPa	1.4	1.2		1.0	—	—	—	3.4	3.1		2.9			2.6	2.3	2.0	
K600	CY	NCrFC	A494 Gr.CY40	MPa	1.4	1.2		1.0	—	—	—	3.4	3.1		2.9			2.6	2.3	2.0	
K625	CW	—	A494 Gr.CW6MC																		
HB-K1	HB	NMCN	A494 Gr.N12MV	MPa	1.4	1.2		1.0	—	—	—	3.4	3.1		2.9			2.6	2.3	2.0	
HC-K1	HC	MCrC	A494 Gr.CW12MW																		
HB-K2	HB	—	A494 Gr.N7M	MPa	1.4	1.2		1.0	—	—	—	3.4	3.1		2.9			2.6	2.3	2.0	
HC-K3	HC	—	A494 Gr.CW6M																		
HC-K2	HC	—	A494 Gr.CX2MW	MPa	1.4	1.2	1.1	—	—	—	—	3.4	3.1	3.0	—	—	—	—	—	—	
HC-K4	HC	—	A494 Gr.CW2M																		
K825	CU	—	A494 Gr.CU5MCuC	MPa	1.4	1.2		1.0	—	—	—	3.4	3.1		2.9			2.6	2.3	2.0	
Ni casting																					
					℃	-29 ~ 38	93	149	204	260	300	316	-29 ~ 38	93	149	204	260	316			
CZ-100	CZ	—	A494 Gr.CZ100	MPa	1.13	1.10	1.03	1.03	0.99	0.97	—	2.99	2.89	2.75	2.75	2.62	2.55				

Notes
 1. The above chart does not indicate JIS/ASME standards the latest values.
 2. The range of use may be limited by valve structures and specifications.
 It is required to consider operating temperature of packing and gasket and seat rating of ball seat.

10-2. Pressure/Temperature Rating (ASME Class 150/300)

Class	Type	Material			Operating temperature																			
		KITZ		ASTM	°C																			
		Name	Symbol		-29-38	-20.2-100.4	-28.9-37.8	-20-100	122	174	174	158	138	121	102	93	84	74	65	5.5				
150	Iron-based alloy	Austenitic stainless steel casting				bar	19.0		18.7	17.4		15.8	13.8	12.1	10.2	9.3	8.4	7.4	6.5	5.5				
		300	Nickel-based alloy	Austenitic stainless steel casting				bar	49.6		48.8	45.3		42.5	39.9	37.8	36.1	35.4	34.8	34.2	33.9	33.6		

Notes
 1. The above chart does not indicate ASME standards the latest values.
 2. The range of use may be limited by valve structures and specifications. It is required to consider operating temperature of packing and gasket and seat rating of ball seat.
 3. *1 Mpa is equivalent value. 4. *2 Psi is specified value of ASME B16.34 Table III-2. 5. *3 KITZ original is material not specified in ASME B16.34. 6. *4 Maximum temperature of flanged valve is up to 538°C.

427	450	455	475	482	500	538	550	575	600	625	650	675	700	725	750	775	800	816	Applicable standards											
800	842	850	887	900	932	950	1000	1022	1050	1067	1100	1112	1150	1157	1200	1202	1247	1250	1292	1300	1337	1350	1382	1400	1427	1450	1472	1500		
	4.6		3.7		2.8		1.4		1.4		1.4		1.4		1.4		1.4		1.4		1.4		1.2		0.9		0.8	0.7	ASME B16.34 Table 2-2.11A	
80	0.46		0.37		0.28		0.14		0.14		0.14		0.14		0.14		0.14		0.14		0.14		0.12		0.09		0.08	0.07	ASME B16.34 Table 2-2.2A	
80	4.6		3.7		2.8		1.4		1.4		1.4		1.4		1.4		1.4		1.4		1.4		1.2		0.9		0.8	0.7	ASME B16.34 Table 2-2.2A	
80	0.46		0.37		0.28		0.14		0.14		0.14		0.14		0.14		0.14		0.14		0.14		0.12		0.09		0.08	0.07	KITZ original [®] 3 (ASME B16.34 Table 2-2.1A conformity)	
80	4.6		3.7		2.8		1.4		1.4		1.4		1.4		1.4		1.4		1.4		1.4		1.2		0.9		0.8	0.7	ASME B16.34 Table 2-3.17A	
80	0.46		0.37		0.28		0.14		0.14		0.14		0.14		0.14		0.14		0.14		0.14		0.12		0.09		0.08	0.07	KITZ original [®] 3	
80	4.6		3.7		2.8		1.4		1.4		1.4		1.4		1.4		1.4		1.4		1.4		1.2		0.9		0.8	0.7	ASME B16.34 Table 2-2.12A	
80	0.46		0.37		0.28		0.14		0.14		0.14		0.14		0.14		0.14		0.14		0.14		0.12		0.09		0.08	0.07	ASME B16.34 Table 2-2.12A	
																													ASME B16.34 Table 2-3.12A	
																														KITZ original [®] 3 (ASME B16.34 Table 2-2.8A conformity)
																														KITZ original [®] 3 (ASME B16.34 Table 2-2.8A conformity)
																														ASME B16.34 Table 2-2.8A
																														ASME B16.34 Table 2-3.4A
																														KITZ original [®] 3 (ASME B16.34 Table 2-3.15A conformity)
																														ASME B16.34 Table 2-3.15A
																														KITZ original [®] 3 (ASME B16.34 Table 2-3.15A conformity)
																														KITZ original [®] 3 (ASME B16.34 Table 2-3.15A conformity)
																														KITZ original [®] 3 (ASME B16.34 Table 2-3.8A conformity)
																														KITZ original [®] 3
																														ASME B16.34 Table 2-2.11A
																														ASME B16.34 Table 2-2.2A
																														ASME B16.34 Table 2-2.2A
																														KITZ original [®] 3 (ASME B16.34 Table 2-2.1A conformity)
																														ASME B16.34 Table 2-3.17A
																														KITZ original [®] 3
																														ASME B16.34 Table 2-2.12A
																														ASME B16.34 Table 2-3.12A
																														KITZ original [®] 3 (ASME B16.34 Table 2-2.8A conformity)
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																														ASME B16.34 Table 2-2.8A
																														ASME B16.34 Table 2-3.4A
																														KITZ original [®] 3 (ASME B16.34 Table 2-3.15A conformity)
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																														KITZ original [®] 3 (ASME B16.34 Table 2-3.8A conformity)
																														KITZ original [®] 3

10-3. Pressure/Temperature Rating (ASME Class 600/900)

Class	Type	Material			Operating temperature																					
		Name	Symbol	ASTM	°C	29-38	28.9-37.8	100	93	100	149	150	200	204	250	260	300	316	325	350	375	400	425			
					F	-20.2-100.4	-20-100	122	200	212	300	302	392	400	482	500	572	600	617	650	700	750	752	797		
600	Iron-based alloy	Austenitic stainless steel casting				bar	99.3	97.5	90.6	84.9	79.9	75.6	72.2	60.7	69.5	68.4	67.8	67.2								
		SCS21 ^{1,4}	CB	A351 Gr.CF8C	MPa ^{1,1}	9.93	1,440	1,325	1,235	1,150	1,085	1,030	1,015	995	985	985	985	985	985							
		CG8M	CG	A351 Gr.CG8M	psi ^{1,2}	99.3	96.2	84.4	77.0	71.3	66.8	63.2	61.8	60.7	59.8	58.9	58.9	58.3								
		CG3M	GM	A351 Gr.CG3M	bar	99.3	96.2	84.4	77.0	71.3	66.8	63.2	61.8	60.7	59.8	58.9	58.3									
		KSN-1	SN	—	MPa ^{1,1}	9.93	95.6	81.7	74.0	69.0	65.0	61.8	60.4	59.3	58.1	56.9	56.0									
		CN7M	CN	A351 Gr.CN7M	psi ^{1,2}	99.3	96.2	84.4	77.0	71.3	66.8	63.2	61.8	60.7	59.8	58.9	58.3									
		CN3MCu	3M	A990 Gr.CN3MCu	bar	82.7	80.3	70.6	64.1	58.7	54.4	50.8	48.8	48.8	48.8	48.8	48.8	48.8	48.8	48.8	48.8	48.8	48.8	48.8	48.8	48.8
		CK20 ^{1,4}	CK	A351 CK20	MPa ^{1,1}	8.27	80.3	70.6	64.1	58.7	54.4	50.8	48.8	48.8	48.8	48.8	48.8	48.8	48.8	48.8	48.8	48.8	48.8	48.8	48.8	
		Super austenitic/duplex/super duplex stainless steel casting				bar	1199.2	1106.4	823.6	751.1	678.6	638.0	598.9	581.5	581.5	581.5	581.5	581.5	581.5	581.5	581.5	581.5	581.5	581.5	581.5	581.5
		SASV-Z1	SA	A351 Gr.CN3MN	psi ^{1,2}	92.7	91.1	85.1	80.3	74.6	69.8	66.2	64.6	63.2	62.0	60.8	59.7									
	KDPV22	4A	A995 Gr.4A, CD3MN	MPa ^{1,1}	103.4	103.4	101.3	91.9	85.3	80.9	77.7	76.3	75.3	74.7	73.3	73.3	73.3	73.3	73.3	73.3	73.3	73.3	73.3	73.3	73.3	
	SASV-Z2 SDPV-K1 SDPV-K2 SDPV-K4	SA SD SD SD	—	psi ^{1,2}	103.4	103.4	101.3	91.9	85.3	80.9	77.7	76.3	75.3	74.7	73.3	73.3	73.3	73.3	73.3	73.3	73.3	73.3	73.3	73.3		
	SASV-Z3 KDPV-K5 SDPV-K3	SA 1B SD	A995 Gr.5A, CE3MN A995 Gr.1B, CD4MCuN A995 Gr.6A, CD3MWCuN	MPa ^{1,1}	103.4	103.4	101.3	91.9	85.3	80.9	77.7	76.3	75.3	74.7	73.3	73.3	73.3	73.3	73.3	73.3	73.3	73.3	73.3	73.3		
	Nickel-based alloy	Ni-Cu/Ni-Cr/Ni-Mo/Ni-Cr-Mo alloy casting				bar	82.7	80.5	71.9	67.5	65.4	65.2	65.2	65.2	65.1	64.8	64.2	63.3								
		M-35-1	NC	A494 Gr.M35-1	MPa ^{1,1}	8.27	8.05	7.19	6.75	6.54	6.52	6.52	6.52	6.52	6.51	6.48	6.42	6.33								
		K600 K625	CY CW	A494 Gr.CY40 A494 Gr.CW6MC	psi ^{1,2}	82.7	81.3	75.6	71.7	67.9	64.5	61.5	60.1	58.8	57.4	56.5	55.3									
		HB-K1 HC-K1	HB HC	A494 Gr.N12MV A494 Gr.CW12MW	bar	82.7	81.3	75.6	71.7	67.9	64.5	61.5	60.1	58.8	57.4	56.5	55.3									
		HB-K2 HC-K2	HB HC	A494 Gr.N7M A494 Gr.CW6M	psi ^{1,2}	82.7	81.3	75.6	71.7	67.9	64.5	61.5	60.1	58.8	57.4	56.5	55.3									
		HC-K2 HC-K4	HC HC	A494 Gr.CX2MW A494 Gr.CW2M	MPa ^{1,1}	8.27	8.05	7.19	6.75	6.54	6.52	6.52	6.52	6.51	6.48	6.42	6.33									
		K825	CU	A494 Gr.CU5MCuC	psi ^{1,2}	103.4	103.4	103.0	100.3	96.7	92.7	89.7	86.6	84.4	82.6	80.4	77.6	73.3	70.0							
		Ni casting				bar	60.0	58.0	55.0	55.0	55.0	53.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0
CZ-100		CZ	A494 Gr.CZ100	Mpa	6.00	6.00	6.00	6.00	6.00	6.00	6.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00		
900		Iron-based alloy	Austenitic stainless steel casting				bar	148.9	146.3	135.9	127.4	119.8	113.4	108.3	106.1	104.3	102.6	101.7	100.8							
	SCS21 ^{1,4}		CB	A351 Gr.CF8C	MPa ^{1,1}	14.89	14.63	13.59	12.74	11.98	11.34	10.83	10.61	10.43	10.26	10.17	10.08									
	CG8M		CG	A351 Gr.CG8M	psi ^{1,2}	148.9	144.3	126.6	115.5	107.0	100.1	94.9	92.7	91.0	89.6	88.3	87.4									
	CG3M		GM	A351 Gr.CG3M	bar	148.9	144.3	126.6	115.5	107.0	100.1	94.9	92.7	91.0	89.6	88.3	87.4									
	KSN-1		SN	—	MPa ^{1,1}	14.89	14.35	12.26	11.10	10.34	97.5	92.7	90.7	88.9	87.1	85.3	84.0									
	CN7M		CN	A351 Gr.CN7M	psi ^{1,2}	148.9	144.3	126.6	115.5	107.0	100.1	94.9	92.7	91.0	89.6	88.3	87.4									
	CN3MCu		3M	A990 Gr.CN3MCu	bar	124.1	120.4	105.9	96.1	88.1	81.7	76.1	73.3	73.3	73.3	73.3	73.3	73.3	73.3	73.3	73.3	73.3	73.3	73.3	73.3	
	CK20 ^{1,4}		CK	A351 CK20	MPa ^{1,1}	12.41	12.04	10.59	9.61	8.81	8.17	7.61	7.33	7.33	7.33	7.33	7.33	7.33	7.33	7.33	7.33	7.33	7.33	7.33	7.33	
	Super austenitic/duplex/super duplex stainless steel casting				bar	2015	1,865	1,680	1,615	1,490	1,395	1,325	1,295	1,265	1,240	1,240	1,240	1,240	1,240	1,240	1,240	1,240	1,240	1,240	1,240	
	SASV-Z1		SA	A351 Gr.CN3MN	psi ^{1,2}	139.0	136.7	127.6	120.4	112.0	104.7	99.3	97.0	94.8	93.0	91.3	89.5									
	KDPV22	4A	A995 Gr.4A, CD3MN	MPa ^{1,1}	155.1	155.1	152.0	137.8	128.0	121.4	116.6	114.5	112.9	111.29	109.8	109.8	109.8	109.8	109.8	109.8	109.8	109.8	109.8	109.8		
	SASV-Z2 SDPV-K1 SDPV-K2 SDPV-K4	SA SD SD SD	—	psi ^{1,2}	155.1	155.1	152.0	137.8	128.0	121.4	116.6	114.5	112.9	111.29	109.8	109.8	109.8	109.8	109.8	109.8	109.8	109.8	109.8	109.8		
	SASV-Z3 KDPV-K5 SDPV-K3	SA 1B SD	A351 Gr.CK3MCuN A995 Gr.1B, CD4MCuN A995 Gr.6A, CD3MWCuN	MPa ^{1,1}	155.1	155.1	152.0	137.8	128.0	121.4	116.6	114.5	112.9	111.29	109.8	109.8	109.8	109.8	109.8	109.8	109.8	109.8	109.8	109.8		
	Nickel-based alloy	Ni-Cu/Ni-Cr/Ni-Mo/Ni-Cr-Mo alloy casting				bar	124.1	120.7	107.8	101.2	98.1	97.8	97.8	97.7	97.2	96.2	94.9									
		M-35-1	NC	A494 Gr.M35-1	MPa ^{1,1}	12.41	12.07	10.78	10.12	9.81	9.78	9.78	9.78	9.77	9.72	9.62	9.49									
		K600 K625	CY CW	A494 Gr.CY40 A494 Gr.CW6MC	psi ^{1,2}	124.1	121.9	113.4	107.6	101.8	96.8	92.2	90.2	88.3	86.2	84.8	83.0									
		HB-K1 HC-K1	HB HC	A494 Gr.N12MV A494 Gr.CW12MW	bar	124.1	121.9	113.4	107.6	101.8	96.8	92.2	90.2	88.3	86.2	84.8	83.0									
		HB-K2 HC-K2	HB HC	A494 Gr.N7M A494 Gr.CW6M	psi ^{1,2}	124.1	121.9	113.4	107.6	101.8	96.8	92.2	90.2	88.3	86.2	84.8	83.0									
		HC-K2 HC-K4	HC HC	A494 Gr.CX2MW A494 Gr.CW2M	MPa ^{1,1}	12.41	12.07	10.78	10.12	9.81	9.78	9.78	9.78	9.77	9.72	9.62	9.49									
		K825	CU	A494 Gr.CU5MCuC	psi ^{1,2}	155.1	155.1	154.6	150.6	145.0	139.0	128.6	124.0	120.7	116.5	109.8	105.1									

Notes:
1. The above chart does not indicate ASME standards the latest values.
2. The range of use may be limited by valve structures and specifications. It is required to consider operating temperature of packing and gasket and seat rating of ball seat.
3. * 1 Mpa is equivalent value.
4. * 2 Psi is specified value of ASME B16.34 Table VII-2.
5. * 3 KITZ original is material not specified in ASME B16.34.
6. * 4 Maximum temperature of flanged valve is up to 538°C.

427	450	455	475	482	500	538	550	675	600	625	650	675	700	725	750	775	800	816	Applicable standards									
800	842	850	887	900	932	950	1000	1022	1050	1067	1100	1112	1150	1157	1200	1202	1247	1250	1292	1300	1337	1350	1382	1400	1427	1450	1472	1500
66.9	63.4	56.5	50	49.8	47.9	39.6	27.7	20.6	15.9	11.2	8.0	6.2	4.9	4.0	3.8	ASME B16.34 Table 2-2.11A												
6.69	6.34	5.65	5	4.98	4.79	3.96	2.77	2.06	1.59	1.12	0.80	0.62	0.49	0.40	0.38	ASME B16.34 Table 2-2.2A												
975	970	900	775	725	720	625	420	300	225	150	105	80	60	55	ASME B16.34 Table 2-2.2A													
57.7	57.3	56.5	50.0	5.00	KITZ original ^{®3}										(ASME B16.34 Table 2-2.1A conformity)													
5.77	5.73	5.65	5.00	5.00	ASME B16.34 Table 2-3.17A																							
845	835	830	775	725	KITZ original ^{®3}																							
57.7	58.0	5.77	6.00	835	ASME B16.34 Table 2-3.17A																							
56.0	6.00	810	KITZ original ^{®3}																									
55.2	53.5	51.7	47	45.9	43.3	38.8	33.7	28.1	23.0	17.5	12.7	8.9	6.3	4.6	3.8	ASME B16.34 Table 2-2.12A												
5.52	5.35	5.17	5	4.59	4.33	3.88	3.37	2.81	2.30	1.75	1.27	0.89	0.63	0.46	0.38	ASME B16.34 Table 2-2.12A												
820	795	770	740	675	650	585	500	410	330	240	165	110	75	55	ASME B16.34 Table 2-3.12A													
865	KITZ original ^{®3}										(ASME B16.34 Table 2-2.8A conformity)																	
KITZ original ^{®3}										(ASME B16.34 Table 2-2.8A conformity)																		
ASME B16.34 Table 2-2.8A																												
53.8	41.5	ASME B16.34 Table 2-3.4A																										
5.38	4.15	KITZ original ^{®3}										(ASME B16.34 Table 2-3.15A conformity)																
915	755	550	52.6	50.0	ASME B16.34 Table 2-3.15A																							
54.4	53.5	52.6	50.0	5.00	KITZ original ^{®3}										(ASME B16.34 Table 2-3.15A conformity)													
5.44	5.35	5.26	5.00	5.00	ASME B16.34 Table 2-3.15A																							
800	785	775	760	725	KITZ original ^{®3}										(ASME B16.34 Table 2-3.15A conformity)													
54.4	53.5	52.6	50.0	5.00	ASME B16.34 Table 2-3.15A																							
5.44	5.35	5.26	5.00	5.00	KITZ original ^{®3}										(ASME B16.34 Table 2-3.15A conformity)													
800	785	775	760	725	ASME B16.34 Table 2-3.15A																							
54.4	53.5	53	5	KITZ original ^{®3}										(ASME B16.34 Table 2-3.15A conformity)														
5.44	5.35	5	775	ASME B16.34 Table 2-3.15A																								
67.7	63.4	56.5	50.0	KITZ original ^{®3}										(ASME B16.34 Table 2-3.8A conformity)														
6.77	6.34	5.65	5.00	ASME B16.34 Table 2-3.8A																								
1,015	975	900	775	725	KITZ original ^{®3}																							
100.4	95.1	84.7	75	74.8	71.8	59.4	41.6	30.9	23.9	16.8	11.9	9.3	7.4	6.1	5.7	ASME B16.34 Table 2-2.11A												
10.04	9.51	8.47	8	7.48	7.18	5.94	4.16	3.09	2.39	1.68	1.19	0.93	0.74	0.61	0.57	ASME B16.34 Table 2-2.2A												
1,460	1,455	1,350	1,160	1,090	1,080	935	625	455	340	225	155	125	95	80	ASME B16.34 Table 2-2.2A													
86.5	86.0	84.7	75.0	8.00	ASME B16.34 Table 2-2.2A																							
8.65	8.60	8.47	8.00	8.00	KITZ original ^{®3}										(ASME B16.34 Table 2-2.1A conformity)													
1,265	1,255	1,245	1,160	1,090	ASME B16.34 Table 2-2.2A																							
86.5	87.0	8.65	9.00	1,255	ASME B16.34 Table 2-2.2A																							
84.0	8.00	1,215	KITZ original ^{®3}										(ASME B16.34 Table 2-2.1A conformity)															
ASME B16.34 Table 2-3.17A																												
KITZ original ^{®3}																												
82.8	80.2	77.5	70	68.8	65.0	58.2	50.5	42.2	34.6	26.3	19.0	13.4	9.4	6.9	5.7	ASME B16.34 Table 2-2.12A												
8.28	8.02	7.75	7	6.88	6.50	5.82	5.05	4.22	3.46	2.63	1.90	1.34	0.94	0.69	0.57	ASME B16.34 Table 2-2.12A												
1,230	1,195	1,150	1,110	1,015	975	875	750	615	495	360	245	165	115	80	ASME B16.34 Table 2-3.12A													
1,295	KITZ original ^{®3}										(ASME B16.34 Table 2-2.8A conformity)																	
KITZ original ^{®3}										(ASME B16.34 Table 2-2.8A conformity)																		
ASME B16.34 Table 2-2.8A																												
80.7	62.3	ASME B16.34 Table 2-3.4A																										
8.07	6.23	KITZ original ^{®3}										(ASME B16.34 Table 2-3.15A conformity)																
1,375	1,130	825	79.0	75.0	ASME B16.34 Table 2-3.15A																							
81.7	80.3	79.0	7.90	8.00	KITZ original ^{®3}										(ASME B16.34 Table 2-3.15A conformity)													
8.17	8.03	8.03	8.00	8.00	ASME B16.34 Table 2-3.15A																							
1,200	1,180	1,160	1,140	1,090	KITZ original ^{®3}										(ASME B16.34 Table 2-3.15A conformity)													
81.7	80.3	79.0	7.90	8.00	ASME B16.34 Table 2-3.15A																							
8.17	8.03	8.03	8.00	8.00	KITZ original ^{®3}										(ASME B16.34 Table 2-3.15A conformity)													
1,200	1,180	1,160	1,140	1,090	ASME B16.34 Table 2-3.15A																							
81.7	80.3	80.0	8.00	KITZ original ^{®3}										(ASME B16.34 Table 2-3.15A conformity)														
8.17	8.03	8.00	1,160	ASME B16.34 Table 2-3.15A																								
101.4	95.1	84.7	75.0	KITZ original ^{®3}										(ASME B16.34 Table 2-3.8A conformity)														
10.14	9.51	8.47	8.00	ASME B16.34 Table 2-3.8A																								
1,525	1,460	1,350	1,160	1,090	KITZ original ^{®3}																							

10-4. Pressure/Temperature Rating (ASME Class 1500)

Class	Type	Material		ASTM	Operating temperature																						
		KITZ			°C	-29-38	-28.9-37.8	50	93	100	149	150	200	204	250	260	300	316	325	350	375	400	425				
		Name	Symbol																					F	-20.2-100.4	-20-100	122
1500	Iron-based alloy	Austenitic stainless steel casting				bar	248.2	243.8	226.5	212.4	199.7	189.1	180.4	176.8	173.8	171.0	169.5	168.1									
		MPa ^{*1}	24.82	24.38	22.65	21.24	19.97	18.91	18.04	17.68	17.38	17.10	16.95	16.81													
		psi ^{*2}																									
		CG8M	CG	A351 Gr.CG8M	bar	248.2	240.6	211.0	192.5	178.3	166.9	158.1	154.4	151.6	149.4	147.2	145.7										
		CG3M	GM	A351 Gr.CG3M	MPa ^{*1}	24.82	24.06	21.10	19.25	17.83	16.69	15.81	15.44	15.16	14.94	14.72	14.57										
		KSN-1	SN	—	bar	248.2	239.1	204.3	185.0	172.4	162.4	154.6	151.1	148.1	145.2	142.2	140.0										
		CN7M	CN	A351 Gr.CN7M	MPa ^{*1}	24.82	23.91	20.43	18.50	17.24	16.24	15.46	15.11	14.81	14.52	14.22	14.00										
		CN3MCu	3M	A990 Gr.CN3MCu	psi ^{*2}																						
		CK20 ^{*4}	CK	A351 CK20	bar	206.8	200.7	176.5	160.2	146.8	136.1	126.9	122.1	—	—	—	—	—	—	—	—	—	—	—	—	—	
					MPa ^{*1}	20.68	20.07	17.65	16.02	14.68	13.61	12.69	12.21	—	—	—	—	—	—	—	—	—	—	—	—	—	
					psi ^{*2}																						
					bar	206.8	190.9	142.1	129.6	117.1	110.0	103.3	100.3	—	—	—	—	—	—	—	—	—	—	—	—	—	
					MPa ^{*1}	20.68	19.09	14.21	12.96	11.71	11.00	10.33	10.03	—	—	—	—	—	—	—	—	—	—	—	—	—	
					psi ^{*2}																						
					bar	2998.6	2768.1	2060.5	1879.2	1698.0	1595.0	1497.9	1454.4	—	—	—	—	—	—	—	—	—	—	—	—	—	
				MPa ^{*1}	299.86	276.81	206.05	187.92	169.80	159.50	149.79	145.44	—	—	—	—	—	—	—	—	—	—	—	—	—		
				psi ^{*2}																							
				bar	231.7	222.4	187.7	174.4	167.7	163.1	158.6	156.1	—	—	—	—	—	—	—	—	—	—	—	—	—		
				MPa ^{*1}	23.17	22.24	18.77	17.44	16.77	16.31	15.86	15.61	—	—	—	—	—	—	—	—	—	—	—	—	—		
				psi ^{*2}																							
				bar	3,360	2,750	2,530	2,425	2,350	2,280	2,230	2,170	2,110	2,065	2,015	1,970	1,925	1,880	1,835	1,790	1,745	1,700	1,655	1,610	1,565		
				MPa ^{*1}	336	275	253	242.5	235	228	223	217	211	206.5	201.5	197	192.5	188	183.5	179	174.5	170	165.5	161	156.5		
				psi ^{*2}																							
				bar	231.7	227.8	212.7	200.7	186.6	174.5	165.5	161.6	158.1	155.1	152.1	149.1											
				MPa ^{*1}	23.17	22.78	21.27	20.07	18.66	17.45	16.55	16.16	15.81	15.51	15.21	14.91											
				psi ^{*2}																							
				bar	258.6	258.6	253.3	229.6	213.3	202.3	194.3	190.8	188.2	186.8	183.1	181.7											
			MPa ^{*1}	25.86	25.86	25.33	22.96	21.33	20.23	19.43	19.08	18.82	18.68	18.31	18.17												
			psi ^{*2}																								
			bar	258.6	258.6	253.3	229.6	213.3	202.3	194.3	190.8	188.2	186.8	183.1	181.7												
			MPa ^{*1}	25.86	25.86	25.33	22.96	21.33	20.23	19.43	19.08	18.82	18.68	18.31	18.17												
			psi ^{*2}																								
			bar	3,750	3,750	3,720	3,335	3,070	2,905	2,785	2,735	2,685	2,635	2,585	2,535	2,485	2,435	2,385	2,335	2,285	2,235	2,185	2,135	2,085			
			MPa ^{*1}	375	375	372	333.5	307	290.5	278.5	273.5	268.5	263.5	258.5	253.5	248.5	243.5	238.5	233.5	228.5	223.5	218.5	213.5	208.5			
			psi ^{*2}																								
			bar	206.8	201.2	179.7	168.7	163.5	163.0	163.0	163.0	162.8	161.9	160.4	158.2												
			MPa ^{*1}	20.68	20.12	17.97	16.87	16.35	16.30	16.30	16.30	16.28	16.19	16.04	15.82												
			psi ^{*2}																								
			bar	206.8	203.2	189.0	179.3	169.6	161.3	153.7	150.3	147.1	143.6	141.3	138.4												
			MPa ^{*1}	20.68	20.32	18.90	17.93	16.96	16.13	15.37	15.03	14.71	14.36	14.13	13.84												
			psi ^{*2}																								
			bar	206.8	203.2	189.0	179.3	169.6	161.3	153.7	150.3	147.1	143.6	141.3	138.4												
			MPa ^{*1}	20.68	20.32	18.90	17.93	16.96	16.13	15.37	15.03	14.71	14.36	14.13	13.84												
			psi ^{*2}																								
			bar	206.8	203.2	189.0	179.3	169.6	161.3	153.7	150.3	147.1	143.6	141.3	138.4												
			MPa ^{*1}	20.68	20.32	18.90	17.93	16.96	16.13	15.37	15.03	14.71	14.36	14.13	13.84												
			psi ^{*2}																								
			bar	258.6	258.6	257.6	250.8	241.7	231.8	214.4	206.6	201.1	194.1	183.1	175.1												
			MPa ^{*1}	25.86	25.86	25.76	25.08	24.17	23.18	21.44	20.66	20.11	19.41	18.31	17.51												
			psi ^{*2}																								
			bar	3,750	3,750	3,640	3,490	3,325	3,025	2,940	2,840	2,660	2,480	2,300	2,120	1,940	1,760	1,580	1,400	1,220	1,040	860	680	500			
			MPa ^{*1}	375	375	364	349	332.5	302.5	294	284	266	248	230	212	194	176	158	140	122	104	86	68	50			
			psi ^{*2}																								

- Notes
- The above chart does not indicate ASME standards the latest values.
 - The range of use may be limited by valve structures and specifications. It is required to consider operating temperature of packing and gasket and seat rating of ball seat.
 - *1 Mpa is equivalent value.
 - *2 Psi is specified value of ASME B16.34 Table 1B-2.
 - *3 KITZ original is material not specified in ASME B16.34.
 - *4 Maximum temperature of flanged valve is up to 538°C.

Reference (Basic Terms)

Item	Description
Ferrite content calculation method and effect	<ol style="list-style-type: none"> 1. ASTM A800 (applicable only to SUS304, SUS316 and their equivalent) 2. Q Factor (applicable only to duplex stainless steel) 3. Increased strength at room temperature and improved weldability (toughness is degraded when too much [impact value at room temperature : 250J at 20%, 235J at 60%, 185J at 70% and 70J at 80%]) (extremely less strength at high temperature)
475°C embrittlement	<ol style="list-style-type: none"> 1. Embrittlement when maintained at 300 to 500°C and no microstructure change. (outstanding at 450 to 530°C at electron microscope level) 2. Outstanding with high Cr. (a few minutes with 28Cr) 3. Solved when heated at \approx 600°C.
σ phase embrittlement	<ol style="list-style-type: none"> 1. σ phase is separated when maintained at 800 to 1000°C. Outstanding at 850 to 950°C. Detected at $\times 100$ when KOH electrolytic etched. Composition is Fe+Ni \approx 50%, Cr+Mo \approx 50%. 2. Outstanding with high Cr. (1 minute with 28Cr) Separated for very short period with fine grain and highly distorted, which requires caution. 3. 5% separation makes toughness at room temperature zero, which requires caution. 4. Solved when heated at 1120°C and up (high temperature is required for high Cr)
Intermetallic compound	<ol style="list-style-type: none"> 1. Separation of higher concentration composition than base metal such as μ phase and P phase for HC material. (42Mo-10W-11Cr-33Ni for base metal 15Cr-16Mo-4W) 2. Laves phase (Fe₂Nb) and γ' phase Ni₃Al are common. 3. Solved with proper soaking.
Deformation induced martensite	<ol style="list-style-type: none"> 1. SUS304 is metastable austenitic stainless steel rather than complete austenitic stainless steel. Therefore it is changed into its original stable martensitic steel when distorted at processing or maintained at low temperature. (Md30 : Temperature that 50% martensite is generated with 30% process distortion at) 2. Ms point : Martensite transformation start temperature. 3. Mf point : Martensite transformation finish temperature.
Weldability	<ol style="list-style-type: none"> 1. Appropriate ferrite content : Ferrite improves weldability since it dissolves [S], which deteriorates weldability, and decreases segregation to grain boundary. (appropriate range is 4 to 15% considering grain refining effect)

Memo

CAUTION

Pressure-temperature ratings and other performance data published in this catalog have been developed from our design calculation, in-house testing, field reports provided by our customers, and/or published official standards or specifications. They are good only to cover typical applications as a general guideline to users of KITZ products introduced in this catalog.

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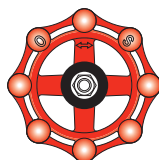
Read the instruction manual carefully before use.

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