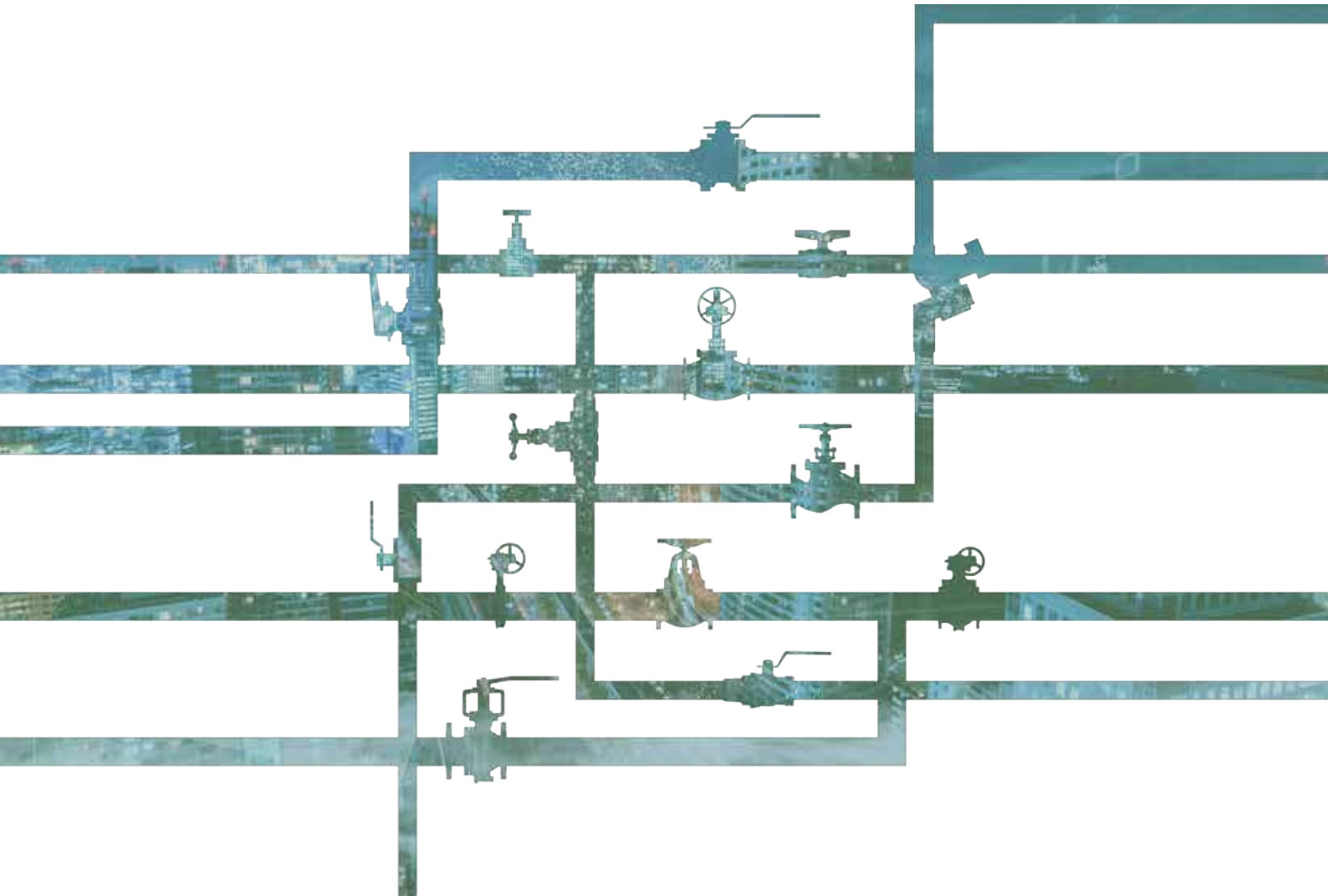
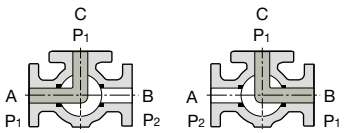
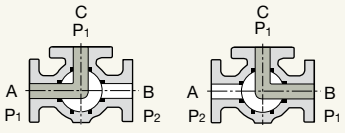
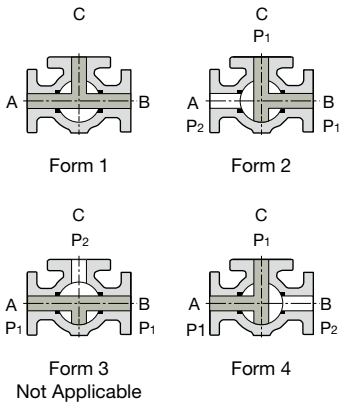
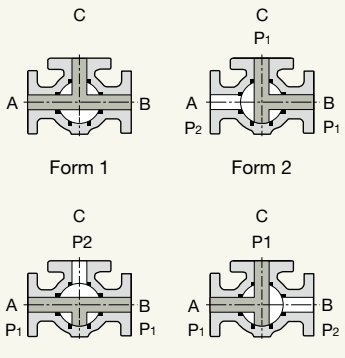
KITZ

GENERAL CATALOG

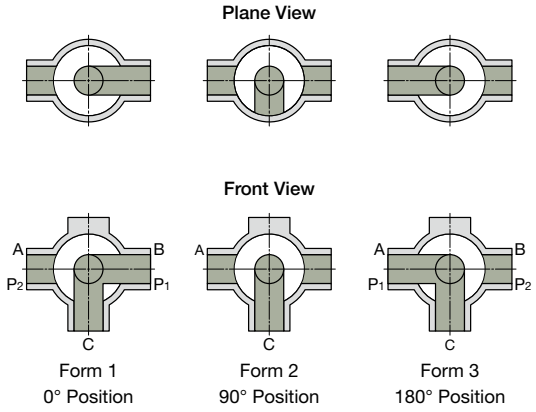
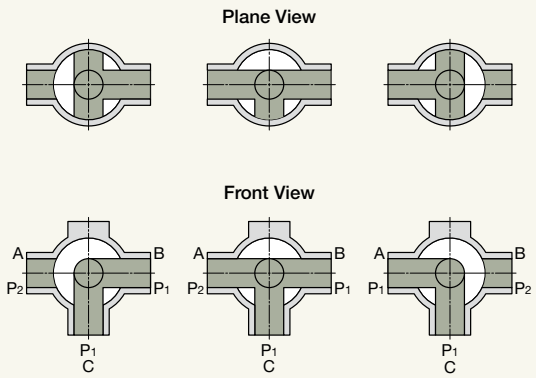
Technical Information



3-way Ball Valve Switching Form and Fluid Flow

Valve Design	Form	Fluid Passage
3-Way 2-Seat L-Port Ball Valve	Top View  Form 1 Form 2	1 Flow in Form 1 is between Ports “A” and “C”. Flow in Form 2 is between Ports “B” and “C”. The flow paths in Form 1 and Form 2 can be exchanged. 2 When the fluid pressure P2 in the closed path is higher than P1 in the open path, slight fluid leakage may occur to P1 through the ball seat of the closed path.
3-Way 4-Seat L-Port Ball Valve	Top View  Form 1 Form 2	1 Flow in Form 1 is between Ports “A” and “C”. Flow in Form 2 is between Ports “B” and “C”. The flow paths in Form 1 and Form 2 can be exchanged. 2 When the fluid pressure P2 in the closed path is higher than P1 in the open path, slight fluid leakage may occur to P1 through the ball seat of the closed path.
3-Way 2-Seat T-Port Ball Valve	Top View  Form 1 Form 2 Form 3 Not Applicable Form 4	1 In Form 1, all ports are open. Flow in Form 2 is between Ports “B” and “C”. Flow in Form 4 is between Ports “A” and “C”. Flow can be switched from Form 1 to Form 2, (standard operation pattern) or from Form 1 to Form 4 in either direction. The stopper is assembled for the standard operation pattern. 2 When the fluid pressure P2 in the closed path is higher than P1 in the open path, slight fluid leakage may occur to P1 through the ball seat of the closed path. ■ Available operation patterns • Pattern 1: From Form 4 to Form 1 • Pattern 2: From Form 1 to Form 2 (Standard) Please select one of the above operation patterns when ordering.
3-Way 4-Seat T-Port Ball Valve	Top View  Form 1 Form 2 Form 3 Form 4	1 In Form 1, all ports are open. Flow in Form 2 is between Ports “B” and “C”. Flow in Form 3 is between Ports “A” and “B”. Flow in Form 4 is between Ports ”A” and ”C”. All forms are available for switching, diverging, or mixing of flows. The stopper is assembled for a standard operation pattern to switch flow from Form 1 to Form 2. 2 When the fluid pressure P2 in the closed path is higher than P1 in the open path, slight fluid leakage may occur to P1 through the ball seat of the closed path. ■ Available operation patterns • Pattern 1: From Form 4 to Form 1 • Pattern 2: From Form 1 to Form 2 (Standard) • Pattern 3: From Form 3 to Form 4 • Pattern 4: From Form 2 to Form 3 Please select one of the above operation patterns when ordering.

3-way Ball Valve Switching Form and Fluid Flow

Valve Design	Form	Fluid Passage
Vertical 3-Way 2-Seated L-Port	 Form 1 0° Position Form 2 90° Position Form 3 180° Position	1 Switch from Form 1 to Form 3 in turning the ball 180 deg., B ⇔ C become A ⇔ C. 2 Switch from Form 1 to Form 2 in turning the ball 90 deg., C port become close. Seat leakage will occur when C port pressure is higher than other port. 3 Seat leakage will occur when P_2 pressure is higher than P_1 pressure on Form. 1 and Form 3.
Vertical 3-Way 2-Seated T-Port	 Form 1 0° Position Form 2 90° Position Form 3 180° Position	1 Switch from Form 1 to Form 3 in turning the ball 180 deg., B ⇔ C become A ⇔ C. 2 Switch from Form 1 to Form 2 in turning the ball 90 deg., Port A, B and C will be able to flow any direction. 3 Seat leakage will occur when P_2 pressure is higher than P_1 pressure on Form. 1 and Form 3.

Specification of Standard Strainer Screen

Strainer Type	Standard Specification	Option
Bronze Strainer	60°Perforated Stainless Steel Sheet	40・60・80・100・120・150・200 Mesh (Stainless Steel Wired Mesh reinforced by perforated sheet.)
Casi Iron, Ductile Iron (Excluding Class 20K) Y Strainer	60°Perforated Stainless Steel Sheet	20・30・40・60・80・100 Mesh (Stainless Steel Wired Mesh reinforced by perforated sheet.)
Ductile Iron (Class 20K), Stainless Steel, Carbon Steel Y Strainer	40 Mesh (Stainless Steel Wired Mesh reinforced by perforated sheet.)	20・30・60・80・100 Mesh (Stainless Steel Wired Mesh reinforced by perforated sheet.)
Casi Iron U Strainer	60°Perforated Stainless Steel Sheet	20・40・60・80・100・120 Mesh

* Please inquire separately for other mesh support than those listed below.

Please refer to following perforation diameter, pitch and screen opening for 60° Perforated SS Sheet & SS Wired Mesh reinforced by Perforated Sheet

	Nominal Size		60° Perforated SS Sheet			SS Wired Mesh reinforced by perforated sheet		
	mm	inch	A (ϕ)	P (mm)	Screen Opening (%)	A (ϕ)	P(mm)	Screen Opening (%)
Y Type	8 ～ 20	1/4 ～ 3/4	1.4	2.4	28.5	2.0	3.0	40.3
	25 ～ 50	1 ～ 2				3.0	4.0	51.0
	65 ～ 125	21/2 ～ 5	1.5	2.5	32.7	6.0	8.0	51.0
	150・200	6・8	3.0	5.0	32.7	8.0	10.0	58.0
	250 ～ 350	10 ～ 14	5.0	7.0	46.4	10.0	13.0	53.7
U Type	50 ～ 100	2 ～ 4	1.5	2.5	32.7	–	–	–

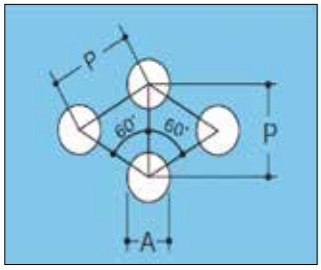
* Please refer to the drawing for A (Φ) & P (mm) of the multi-perforation.

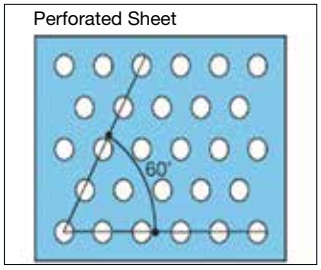
Selecting Y-Strainer・Screen

Strainer is designed to remove foreign objects with a screen equipped inside the strainer. However, it is necessary to select mesh of screen depending on service conditions for each fluid. Screens in Y-Strainers are perforated SS sheet and SS wired mesh reinforced by perforated sheet.

■60° Perforated SS Sheet

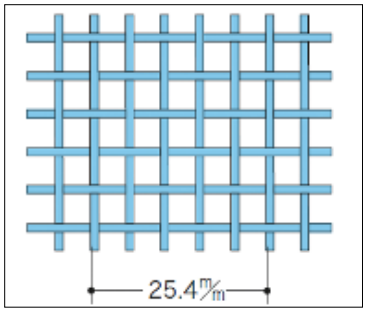
Fineness is not referred to mesh number.
Perforated SS Sheet expressed in A x P.





■SS Wired Mesh reinforced by Perforated Sheet

Mesh number indicates the number of wires per linear inch of wire filter cloth.



■Mesh wire diameter and screen opening (Sizes of KITZ use)

Mesh	Wire Number (SWG)	Wire Diameter (mm ϕ)	Sieve Size Opening (mm)	Open Area* (%)
10	22	0.40	2.14	71.0
20	32	0.26	1.01	63.2
30	35	0.22	0.62	59.4
40	36.5	0.16	0.47	55.7
60	38	0.15	0.27	41.3
80	40	0.12	0.20	39.1
100	42	0.10	0.15	36.0

* Open area is the proportion of total screen area that is open space. It is given as a percentage.

■Standard Velocity of Fluids

	Fluid		Velocity (m/s)	Pressure Loss (kPa)
Liquid	Water		1.5～2.5	0.5～15
	Industrial Water		1.0～3.0	2.0～20
	Sea Water		1.5～2.0	0.5～10
	Piston Pump		0.5～1.0	0.5～3
	Centrifugal Pump		2.0～2.5	10～15
Gas	Compressed Air	0.2～0.4MPa (G)	15	2～3
		0.2～0.4MPa (G)	30	10～15
		1.0～2.0MPa (G)	15	10～20
		1.0～2.0MPa (G)	30	30～60
Vapor	Saturation Vapor	0.2～1.0MPa (G)	15	1～3
		0.2～1.0MPa (G)	30	5～15

*1 For reference
*2 Compressed air is normal temperature (20°C).

Pressure Conversion Table

MPa → kgf/cm^2

(1MPa=10.19716kgf/cm^2)

0.1～50		5.1～10.0		10.5～35.0		35.5～60.0		60.5～85.0	
MPa	kgf/cm^2	MPa	kgf/cm^2	MPa	kgf/cm^2	MPa	kgf/cm^2	MPa	kgf/cm^2
0.1	1.0197	5.1	52.006	10.5	107.07	35.5	362.00	60.5	616.93
0.2	2.0394	5.2	53.025	11.0	112.17	36.0	367.10	61.0	622.03
0.3	3.0591	5.3	54.045	11.5	117.27	36.5	372.20	61.5	627.13
0.4	4.0789	5.4	55.065	12.0	122.37	37.0	377.29	62.0	632.22
0.5	5.0986	5.5	56.084	12.5	127.46	37.5	382.39	62.5	637.32
0.6	6.1183	5.6	57.104	13.0	132.56	38.0	387.49	63.0	642.42
0.7	7.1380	5.7	58.124	13.5	137.66	38.5	392.59	63.5	647.52
0.8	8.1557	5.8	59.144	14.0	142.76	39.0	397.69	64.0	652.62
0.9	9.1774	5.9	60.163	14.5	147.86	39.5	402.79	64.5	657.72
1.0	10.197	6.0	61.163	15.0	152.96	40.0	407.89	65.0	662.82
1.1	11.217	6.1	62.203	15.5	158.06	40.5	412.98	65.5	667.91
1.2	12.237	6.2	63.222	16.0	163.15	41.0	418.08	66.0	673.01
1.3	13.256	6.3	64.242	16.5	168.25	41.5	423.18	66.5	678.11
1.4	14.276	6.4	65.262	17.0	173.35	42.0	428.28	67.0	683.21
1.5	15.296	6.5	66.282	17.5	178.45	42.5	433.38	67.5	688.31
1.6	16.315	6.6	67.301	18.0	183.55	43.0	438.48	68.0	693.41
1.7	17.335	6.7	68.321	18.5	188.65	43.5	443.58	68.5	698.51
1.8	18.355	6.8	69.341	19.0	193.75	44.0	448.68	69.0	703.60
1.9	19.375	6.9	70.360	19.5	198.84	44.5	453.77	69.5	708.70
2.0	20.394	7.0	71.380	20.0	203.94	45.0	458.87	70.0	713.80
2.1	21.414	7.1	72.400	20.5	209.04	45.5	463.97	70.5	718.90
2.2	22.434	7.2	73.420	21.0	214.14	46.0	469.07	71.0	724.00
2.3	23.453	7.3	74.439	21.5	219.24	46.5	474.17	71.5	729.10
2.4	24.473	7.4	75.459	22.0	224.34	47.0	479.27	72.0	734.20
2.5	25.493	7.5	76.479	22.5	229.44	47.5	484.37	72.5	739.29
2.6	26.513	7.6	77.498	23.0	234.53	48.0	489.46	73.0	744.39
2.7	27.532	7.7	78.518	23.5	239.63	48.5	494.56	73.5	749.49
2.8	28.552	7.8	79.538	24.0	244.73	49.0	499.66	74.0	754.59
2.9	29.572	7.9	80.558	24.5	249.83	49.5	504.45	74.5	759.69
3.0	30.591	8.0	81.577	25.0	254.93	50.0	504.76	75.0	764.79
3.1	31.611	8.1	82.597	25.5	260.03	50.5	509.86	75.5	769.89
3.2	32.631	8.2	83.617	26.0	265.13	51.0	514.96	76.0	774.98
3.3	33.651	8.3	84.636	26.5	270.22	51.5	520.06	76.5	780.08
3.4	34.670	8.4	85.656	27.0	275.32	52.0	525.15	77.0	785.18
3.5	35.690	8.5	86.676	27.5	280.42	52.5	530.25	77.5	790.28
3.6	36.710	8.6	87.696	28.0	285.52	53.0	535.35	78.0	795.38
3.7	37.729	8.7	88.715	28.5	290.62	53.5	545.55	78.5	800.48
3.8	38.749	8.8	89.735	29.0	295.72	54.0	550.65	79.0	805.58
3.9	39.769	8.9	90.755	29.5	300.82	54.5	555.75	79.5	810.67
4.0	40.789	9.0	91.774	30.0	305.91	55.0	560.84	80.0	815.77
4.1	41.808	9.1	92.794	30.5	311.01	55.5	565.94	80.5	820.87
4.2	42.828	9.2	93.814	31.0	316.11	56.0	571.04	81.0	825.97
4.3	43.848	9.3	94.834	31.5	321.21	56.5	576.14	81.5	831.07
4.4	44.868	9.4	95.853	32.0	326.31	57.0	581.24	82.0	836.17
4.5	45.887	9.5	96.873	32.5	331.41	57.5	586.34	82.5	841.27
4.6	46.907	9.6	97.892	33.0	336.51	58.0	591.44	83.0	846.36
4.7	47.927	9.7	98.912	33.5	341.60	58.5	596.53	83.5	851.46
4.8	48.946	9.8	99.932	34.0	346.70	59.0	601.63	84.0	856.56
4.9	49.966	9.9	100.95	34.5	351.80	59.5	606.73	84.5	861.66
5.0	50.986	10.0	101.97	35.0	356.90	60.0	611.83	85.0	866.76

$lb/in^2 \rightarrow kgf/cm^2$

($1lb/in^2=0.070307kgf/cm^2$)

1～50		51～100		105～400		410～900		910～1700	
lb/in^2	kgf/cm^2	lb/in^2	kgf/cm^2	lb/in^2	kgf/cm^2	lb/in^2	kgf/cm^2	lb/in^2	kgf/cm^2
1	0.07	51	3.59	105	7.38	410	28.83	910	63.98
2	0.14	52	3.66	110	7.73	420	29.53	920	64.68
3	0.21	53	3.73	115	8.09	430	30.23	930	65.39
4	0.28	54	3.80	120	8.44	440	30.93	940	66.09
5	0.35	55	3.87	125	8.79	450	31.64	950	66.79
6	0.42	56	3.94	130	9.14	460	32.34	960	67.49
7	0.49	57	4.01	135	9.49	470	33.04	970	68.20
8	0.56	58	4.08	140	9.84	480	33.75	980	68.90
9	0.63	59	4.15	145	10.19	490	34.45	990	69.60
10	0.70	60	4.22	150	10.55	500	35.15	1000	70.31
11	0.77	61	4.29	155	10.90	510	35.86	1010	71.01
12	0.84	62	4.36	160	11.25	520	36.56	1020	71.71
13	0.91	63	4.43	165	11.60	530	37.26	1030	72.42
14	0.98	64	4.50	170	11.95	540	37.97	1040	73.12
15	1.05	65	4.57	175	12.30	550	38.67	1050	73.82
16	1.12	66	4.64	180	12.66	560	39.37	1060	74.52
17	1.20	67	4.71	185	13.01	570	40.07	1070	75.23
18	1.27	68	4.78	190	13.36	580	40.78	1080	75.93
19	1.34	69	4.85	195	13.71	590	41.48	1090	76.63
20	1.41	70	4.92	200	14.06	600	42.18	1100	77.34
21	1.48	71	4.99	205	14.41	610	42.89	1120	78.74
22	1.55	72	5.06	210	14.76	620	43.59	1140	80.15
23	1.62	73	5.13	215	15.12	630	44.29	1160	81.56
24	1.69	74	5.20	220	15.47	640	45.00	1180	82.96
25	1.76	75	5.27	225	15.82	650	45.70	1200	84.37
26	1.83	76	5.34	230	16.17	660	46.40	1220	85.77
27	1.90	77	5.41	235	16.52	670	47.11	1240	87.18
28	1.97	78	5.48	240	16.87	680	47.81	1260	88.59
29	2.04	79	5.55	245	17.23	690	48.51	1280	89.99
30	2.11	80	5.62	250	17.58	700	49.21	1300	91.40
31	2.18	81	5.69	255	17.93	710	49.92	1320	92.80
32	2.25	82	5.77	260	18.28	720	50.62	1340	94.21
33	2.32	83	5.84	265	18.63	730	51.32	1360	95.62
34	2.39	84	5.91	270	18.98	740	52.03	1380	97.02
35	2.46	85	5.98	275	19.33	750	52.73	1400	98.43
36	2.53	86	6.05	280	19.69	760	53.43	1420	99.84
37	2.60	87	6.12	285	20.04	770	54.14	1440	101.24
38	2.67	88	6.19	290	20.39	780	54.84	1460	102.65
39	2.74	89	6.26	295	20.74	790	55.54	1480	104.05
40	2.81	90	6.33	300	21.09	800	56.25	1500	105.46
41	2.88	91	6.40	310	21.80	810	56.95	1520	106.87
42	2.95	92	6.47	320	22.50	820	57.65	1540	108.27
43	3.02	93	6.54	330	23.20	830	58.35	1560	109.68
44	3.09	94	6.61	340	23.90	840	59.06	1580	111.09
45	3.16	95	6.68	350	24.61	850	59.76	1600	112.49
46	3.23	96	6.75	360	25.31	860	60.46	1620	113.90
47	3.30	97	6.82	370	26.01	870	61.17	1640	115.30
48	3.37	98	6.89	380	26.72	880	61.87	1660	116.71
49	3.45	99	6.96	390	27.42	890	62.57	1680	118.12
50	3.52	100	7.03	400	28.12	900	63.28	1700	119.52

Pressure Conversion Table

Bar → kgf/cm^2

(1Bar=1.019716kgf/cm^2)

1～50		51～100		105～350		355～600		605～850	
Bar	kgf/cm^2	Bar	kgf/cm^2	Bar	kgf/cm^2	Bar	kgf/cm^2	Bar	kgf/cm^2
1	1.0197	51	52.006	105	107.07	355	362.00	605	616.93
2	2.0394	52	53.025	110	112.17	360	367.10	610	622.03
3	3.0591	53	54.045	115	117.27	365	372.20	615	627.13
4	4.0789	54	55.065	120	122.37	370	377.29	620	632.22
5	5.0986	55	56.084	125	127.46	375	382.39	625	637.32
6	6.1183	56	57.104	130	132.56	380	387.49	630	642.42
7	7.1380	57	58.124	135	137.66	385	392.59	635	647.52
8	8.1557	58	59.144	140	142.76	390	397.69	640	652.62
9	9.1774	59	60.163	145	147.86	395	402.79	645	657.72
10	10.197	60	61.183	150	152.96	400	407.89	650	662.82
11	11.217	61	62.203	155	158.06	405	412.98	655	667.91
12	12.237	62	63.222	160	163.15	410	418.08	660	673.01
13	13.256	63	64.242	165	168.25	415	423.18	665	678.11
14	14.276	64	65.262	170	173.35	420	428.28	670	683.21
15	15.296	65	66.282	175	178.45	425	433.38	675	688.31
16	16.315	66	67.301	180	183.55	430	438.48	680	693.41
17	17.335	67	68.321	185	188.65	435	443.58	685	698.51
18	18.355	68	69.341	190	193.75	440	448.68	690	703.60
19	19.375	69	70.360	195	198.84	445	453.77	695	708.70
20	20.394	70	71.380	200	203.94	450	458.87	700	713.80
21	21.414	71	72.400	205	209.04	455	463.97	705	718.90
22	22.434	72	73.420	210	214.14	460	469.07	710	724.00
23	23.453	73	74.439	215	219.24	465	474.17	715	729.10
24	24.473	74	75.459	220	224.34	470	479.27	720	734.20
25	25.493	75	76.479	225	229.44	475	484.37	725	739.29
26	26.513	76	77.498	230	234.53	480	489.46	730	744.39
27	27.532	77	78.518	235	239.63	485	494.56	735	749.49
28	28.552	78	79.538	240	244.73	490	499.66	740	754.59
29	29.572	79	80.558	245	249.83	495	504.45	745	759.69
30	30.591	80	81.577	250	254.93	500	504.76	750	764.79
31	31.611	81	82.597	255	260.03	505	509.86	755	769.89
32	32.631	82	83.617	260	265.13	510	514.96	760	774.98
33	33.651	83	84.636	265	270.22	515	520.06	765	780.08
34	34.670	84	85.656	270	275.32	520	525.15	770	785.18
35	35.690	85	86.676	275	280.42	525	530.25	775	790.28
36	36.710	86	87.696	280	285.52	530	535.35	780	795.38
37	37.729	87	88.715	285	290.62	535	545.55	785	800.48
38	38.749	88	89.735	290	295.72	540	550.65	790	805.58
39	39.769	89	90.755	295	300.82	545	555.75	795	810.67
40	40.789	90	91.774	300	305.91	550	560.84	800	815.77
41	41.808	91	92.794	305	311.01	555	565.94	805	820.87
42	42.828	92	93.814	310	316.11	560	571.04	810	825.97
43	43.848	93	94.834	315	321.21	565	576.14	815	831.07
44	44.868	94	95.853	320	326.31	570	581.24	820	836.17
45	45.887	95	96.873	325	331.41	575	586.34	825	841.27
46	46.907	96	97.892	330	336.51	580	591.44	830	846.36
47	47.927	97	98.912	335	341.60	585	596.53	835	851.46
48	48.946	98	99.932	340	346.70	590	601.63	840	856.56
49	49.966	99	100.95	345	351.80	595	606.73	845	861.66
50	50.986	100	101.97	350	356.90	600	611.83	850	866.76

Temperature Conversion Table

-459° ～0°			-1° ～60°			61° ～290°			300° ～890°			900° ～3000°		
°C	°C / °F	°F	°C	°C / °F	°F	°C	°C / °F	°F	°C	°C / °F	°F	°C	°C / °F	°F
-273	-459		-17.2	1	33.8	16.1	61	141.8	149	300	572	482	900	1652
-268	-450		-16.7	2	35.6	16.7	62	143.6	154	310	590	488	910	1670
-262	-440		-16.1	3	37.4	17.2	63	145.4	160	320	608	493	920	1688
-257	-430		-15.6	4	39.2	17.8	64	147.2	166	330	626	499	930	1706
-251	-420		-15.0	5	41.0	18.3	65	149.0	171	340	644	504	940	1724
-246	-410		-14.4	6	42.8	18.9	66	150.8	177	350	662	510	950	1742
-240	-400		-13.9	7	44.6	19.4	67	152.6	182	360	680	516	960	1760
-234	-390		-13.3	8	46.4	20.0	68	154.4	188	370	698	521	970	1778
-229	-380		-12.8	9	48.2	20.6	69	156.2	193	380	716	527	980	1796
-223	-370		-12.2	10	50.0	21.1	70	158.0	196	390	734	532	990	1814
-218	-360		-11.7	11	51.8	21.7	71	159.8	204	400	752	538	1000	1832
-212	-350		-11.1	12	53.6	22.2	72	161.6	210	410	770	549	1020	1868
-207	-340		-10.6	13	55.4	22.8	73	163.4	216	420	788	560	1040	1904
-201	-330		-10.0	14	57.2	23.3	74	165.2	221	430	806	571	1060	1940
-196	-320		-9.4	15	59.0	23.9	75	167.0	227	440	824	582	1080	1976
-190	-310		-8.9	16	60.8	24.4	76	168.8	232	450	842	593	1100	2012
-184	-300		-8.3	17	62.6	25.0	77	170.6	238	460	860	604	1120	2048
-179	-290		-7.8	18	64.4	25.6	78	172.4	243	470	878	616	1140	2084
-173	-280		-7.2	19	66.2	26.1	79	174.2	249	480	896	627	1160	2120
-169	-273	-459.4	-6.7	20	68.0	26.7	80	176.0	254	490	914	638	1180	2156
-168	-270	-454	-6.1	21	69.8	27.2	81	177.8	260	500	932	649	1200	2192
-162	-260	-436	-5.6	22	71.6	27.8	82	179.6	266	510	950	660	1220	2228
-157	-250	-418	-5.0	23	73.4	28.3	83	181.4	271	520	968	671	1240	2264
-151	-240	-400	-4.4	24	75.2	28.9	84	183.2	277	530	986	682	1260	2300
-146	-230	-382	-3.9	25	77.0	29.4	85	185.0	282	540	1004	693	1280	2336
-140	-220	-364	-3.3	26	78.8	30.0	86	186.8	288	550	1022	704	1300	2372
-134	-210	-346	-2.8	27	80.6	30.6	87	188.6	293	560	1040	732	1350	2462
-129	-200	-328	-2.2	28	82.4	31.1	88	190.4	299	570	1058	760	1400	2552
-123	-190	-310	-1.7	29	84.2	31.7	89	192.2	304	580	1076	788	1450	2642
-118	-180	-292	-1.1	30	86.0	32.2	90	194.0	310	590	1094	816	1500	2732
-112	-170	-274	-0.6	31	87.8	32.8	91	195.8	316	600	1112	843	1550	2822
-107	-160	-256	-0.6	32	89.6	33.3	92	197.6	321	610	1130	871	1600	2912
-101	-150	-238	0.0	33	91.4	33.9	93	199.4	327	620	1148	899	1650	3002
-96	-140	-220	1.1	34	93.2	34.4	94	201.2	332	630	1166	927	1700	3092
-90	-130	-202	1.7	35	95.0	35.0	95	203.0	338	640	1184	954	1750	3182
-84	-120	-184	2.2	36	96.8	35.6	96	204.8	343	650	1202	982	1800	3272
-79	-110	-166	2.8	37	98.6	36.1	97	206.6	349	660	1220	1010	1850	3362
-73	-100	-148	3.3	38	100.4	36.7	98	208.4	354	670	1238	1038	1900	3452
-68	-90	-130	3.9	39	102.2	37.2	99	210.2	360	680	1256	1066	1950	3542
-62	-80	-112	4.4	40	104.0	37.8	100	212	366	690	1274	1093	2000	3632
-57	-70	-94	5.0	41	105.8	43	110	230	371	700	1292	1121	2050	3722
-51	-60	-76	5.6	42	107.6	49	120	248	377	710	1310	1149	2100	3812
-46	-50	-58	6.1	43	109.4	54	130	266	382	720	1328	1177	2150	3902
-40	-40	-40	6.7	44	111.2	60	140	284	388	730	1346	1204	2200	3992
-34	-30	-22	7.2	45	113.0	66	150	302	393	740	1364	1232	2250	4082
-29	-20	-4	7.8	46	114.8	71	160	320	399	750	1382	1260	2300	4172
-23	-10	14	8.3	47	116.6	77	170	338	404	760	1400	1288	2350	4262
-17.8	0	32	8.9	48	118.4	82	180	356	410	770	1418	1316	2400	4352
			9.4	49	120.2	88	190	374	416	780	1436	1343	2450	4442
			10.0	50	122.0	93	200	392	421	790	1454	1371	2500	4532
			10.6	51	123.8	99	210	410	427	800	1472	1399	2550	4622
			11.1	52	125.6	100	212	413.6	432	810	1490	1427	2600	4712
			11.7	53	127.4	104	220	428	438	820	1508	1454	2650	4802
			12.2	54	129.2	110	230	446	443	830	1526	1482	2700	4892
			12.8	55	131.0	116	240	464	449	840	1544	1510	2750	4982
			13.3	56	132.8	121	250	482	454	850	1562	1538	2800	5072
			13.9	57	134.6	127	260	500	460	860	1580	1566	2850	5162
			14.4	58	136.4	132	270	518	466	870	1598	1593	2900	5252
			15.0	59	138.2	138	280	536	471	880	1616	1621	2950	5342
			15.6	60	140.0	143	290	554	477	890	1634	1649	3000	5432

Temperature Pressure Table for Saturated Vapor

Temperature			Pressure (abs.)			Pressure (G)		
Temperature °C	Pressure (abs.) MPa	Pressure (G) MPa	Pressure (abs.) MPa	Pressure (G) MPa	Saturation Temperature °C	Pressure (G) MPa	Pressure (abs.) MPa	Saturation Temperature °C
70	0.03	-0.07	0.09	-0.01	99.1	0	0.10	100.0
80	0.05	-0.05	0.19	0.09	119.6	0.09	0.19	120.1
90	0.07	-0.03	0.29	0.19	132.9	0.19	0.29	133.2
100	0.10	0	0.39	0.29	142.9	0.29	0.39	143.2
110	0.14	0.04	0.49	0.39	151.1	0.39	0.49	151.3
120	0.19	0.09	0.58	0.48	158.1	0.49	0.59	158.3
130	0.26	0.16	0.68	0.58	164.2	0.58	0.68	164.3
140	0.36	0.26	0.78	0.68	169.6	0.68	0.78	169.8
150	0.47	0.37	0.88	0.78	174.5	0.78	0.88	174.7
160	0.61	0.51	0.98	0.88	179.0	0.88	0.98	179.3
170	0.79	0.69	1.17	1.07	187.1	0.98	1.08	183.2
180	1.00	0.90	1.37	1.27	194.1	1.17	1.27	190.0
190	1.25	1.15	1.56	1.46	200.4	1.37	1.47	197.4
200	1.55	1.45	1.76	1.66	206.2	1.56	1.66	203.4
210	1.90	1.80	1.96	1.86	211.4	1.78	1.88	208.9
220	2.32	2.21	2.45	2.35	222.9	1.96	2.06	213.8
230	2.79	2.69	2.94	2.84	232.8	2.45	2.55	223.8
240	3.34	3.24	3.43	3.33	241.4	2.94	3.04	234.5
250	3.97	3.87	3.92	3.82	249.2	3.92	4.02	250.6
260	4.66	4.56	4.90	4.80	262.7	4.90	5.00	263.9
270	5.50	5.40	5.88	5.78	274.3	5.88	5.98	275.3
280	6.41	6.31	6.86	6.76	284.5	6.86	6.96	285.4
290	7.44	7.34	7.84	7.74	293.6	7.84	7.94	294.5
300	8.59	8.49	8.82	8.72	301.9	8.82	8.92	302.7
310	9.87	9.77	9.80	9.70	309.5	9.80	9.90	310.9
320	11.28	11.18	11.76	11.66	323.1	11.76	11.86	323.8
330	12.86	12.76	13.72	13.62	335.1	13.72	13.82	335.6
340	14.61	14.51	15.69	15.59	345.7	15.69	15.79	346.2
350	16.47	16.37	17.65	17.55	355.4	17.65	17.75	355.8
360	18.77	18.67	19.61	19.51	364.1	19.61	19.71	364.5
370	21.15	21.05	21.57	21.47	372.0	21.57	21.67	372.5

Fugitive Emission Standards

■**Federal Clean Air Act in US** (EPA Method 21-1994)
Allowable Leakage ≦ 500PPM

■**California State Regulation** (1997)
Allowable Leakage ≦ 100PPM

■**API 622** (2011) Type Testing for Process Valve Packing for Fugitive Emissions

■**API 624** (2014) Type Testing of Rising Stem Valves Equipped with Flexible Graphite Packing for Fugitive Emissions
Acceptance criteria (100ppmv) for figitive emission type testing of rising and rising-rotating stem valves equipped with packing previously tested in accordance with API 622.

■**API 641** (2016) Type Testing for Quarter-turn Valves for Fugitive Emissions
Valves larger than 24^{B} and pressure class greater than 1500 are out of this scope.
Valves with pressure rating at ambient temperature lower than 100 psig are out of this scope.
Acceptance criteria : Not exceeding 100 ppmv
* Valve groups are belows for reference

• Valve Groups: Valve Temperature Rating ≧ 260℃ (500°F)

Velve Pressure Rating at 260℃ (500℉) is ≧ 41.1 barg (600psig)	Valve Pressure Rating at 260℃ (500℉) is < 41.1 barg (600psig) and ≧ 6.89 barg (100 psig)	Valve with Temperature Rating ≧ 260℃ (500℉) and does not comply with the requirements of Group A or Group B
Group A	Group B	Group C

Note: Valves with pressure rating less than 6.89 barg (100 psig) at ambient temperature are out of this standard.

• Valve Groups:Valve Tenperature Rating < 260℃ (500℉)

Velve Pressure Rating at its Maximum-rated Temperature is ≧ 41.1 barg (600psig)	Velve Pressure Rating at its Maximum-rated Temperature is < 41.1 barg (600psig) and ≧ 6.89 barg (100 psig)	Valve with Temperature Rating < 260℃ (500℉) and does not comply with the requirements of Group D or Group E
Group D	Group E	Group F

Note: Valves with pressure rating less than 6.89 barg (100 psig) at ambient temperature are out of this standard.

■**ISO 15848-1** (2015) Industrial valves - Measurement, test and qualification procedures for fugitive emissions
Part 1: Classification system and qualification procedures for type testing of valves
* Tightness classes are belows for reference

• Tightness Classes for Stem (or Shaft) Seals with Helium

Class	Measured Leak Rate (Mass Flow) $mg \cdot s^{-1} \cdot m^{-1}$ Stem Perimeter (for information)	Measured Leak Rate (Mass Flow) $mg \cdot s^{-1} \cdot mm^{-1}$ Stem Diameter Through Stem Seal System	Measured Leak Rate (Volumic Flow) $mbar \cdot l \cdot s^{-1}$ · per mm Stem Diameter Through Stem Seal System	Remarks
Ah	$\leqq 10^{-5}$	$\leqq 3.14 \cdot 10^{-8}$	$\leqq 1.78 \cdot 10^{-7}$	Typically achieved with bellow seals or equivalent stem (shaft) sealing system for quarter turn valves
BH	$\leqq 10^{-4}$	$\leqq 3.14 \cdot 10^{-7}$	$\leqq 1.78 \cdot 10^{-6}$	Typically achieved with PTFE based packings or elastomeric seals
CH	$\leqq 10^{-2}$	$\leqq 3.14 \cdot 10^{-5}$	$\leqq 1.78 \cdot 10^{-4}$	Typically achieved with flexible graphite based packings

■**ISO 15848-2** (2015) Industrial valves - Measurement, test and qualification procedures and fugitive emissions
Part 2: Production acceptance test of valves

■**TA Luft** (2002): "Technical Instructions on Air Quality Control" (Technische Anleitung zur Reinhaltung der Luft)
TA Luft specifies sealing system of stem passage. A simple manufacturer declaration is sufficient for verification TA Luft qualifies "high quality sealing system" only. TA Luft is considers its compliance if metal bellows with safety packing or similar sealing systems are used; whereby equivalence in the verification system must be in accordance with VDI 2440.

■**End user specification from Shell Oil Company** (MESC SPE 77/312).
MESC SPE 77/312 (February 2019) Fugitive Emission Production Testing
Amendments and Supplements to ISO 15848-2

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- KITZ does not take any responsibilities for damages arising from product modification not entrusted to KITZ or usage under the load applied from other devices.

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