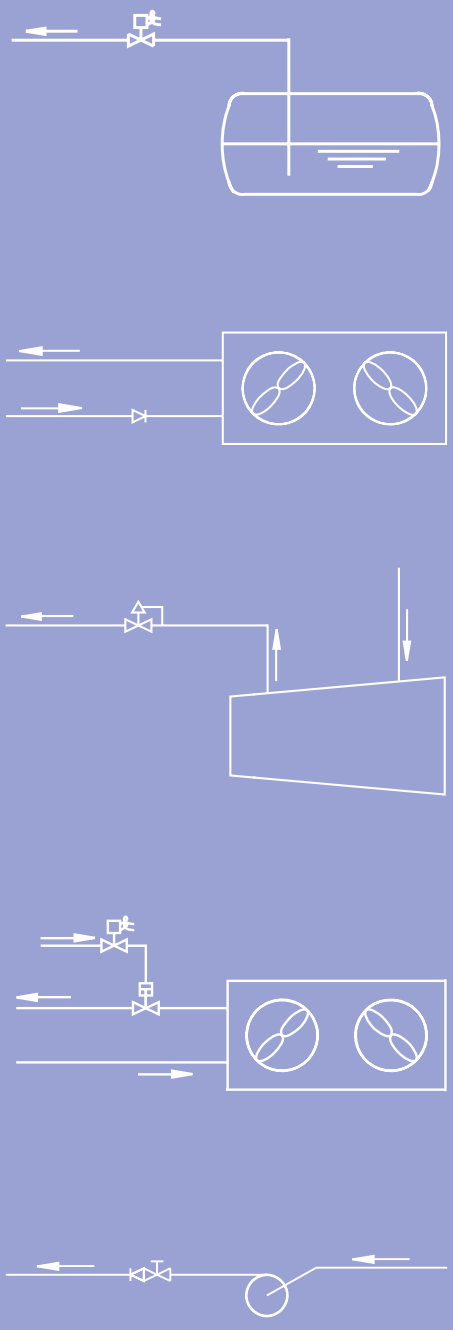

Refrigerant Valve Capacity Tables

for Ammonia

US & Metric

AMMONIA

HANSEN TECHNOLOGIES CORPORATION

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* Not Shown

Sizing Refrigeration Pressure Regulators

In nearly 99% of the cases, precise size selection is important but not critical. Merely determine maximum normal refrigeration load, desired pressure drop (frequently 2 psi or .15 bar) and nominal evaporator temperature. Enter the regulator manufacturer's selection tables and choose the closest (not the next larger) regulator port size. If necessary, approximate interpolation of temperature, pressure drop, and load can be utilized where the capacity tables are not in great detail. In some cases the regulator's available connections may not be the same as the designed or actual system pipe size, in which case pipe line reducers should be used. However, if the system pipe size is materially different, say more than two sizes, the regulator and system size calculations should be rechecked. Typically for gas or vapor lines the pipe size would be the same as or one size larger than the port size.

When chosen in the above manner, the regulator should perform well even at reduced loads of 15% or less of full load. For example, if a regulator is chosen for a capacity C at 2 psi drop, it should control well at a capacity of .15C at the same 2 psi drop. However, at light loads, the pressure drop presented by the system to the regulator may be greater than 2 psi. For example, a single compressor system may experience a much lower suction pressure under light load than during normal operating loads. In these cases, a correction should be made in the original selection in order to accommodate the light load, perhaps at the expense of slightly more pressure drop at full load as the result of choosing a smaller regulator.

In extreme cases, two regulators could be used in parallel with a smaller one sized for the light load and set for a slightly higher (1 or 2 psi) opening pressure. Actually, in many cases a greatly oversized regulator, although causing fluctuating upstream pressure due to a hunting regulator action, would not materially affect overall system operation. In most cases the regulator construction will tolerate hunting without damage although the hunting noise may be bothersome.

In general it requires 2 psi minimum pressure drop to reliably open a normal pilot operated regulator. Sizing a regulator larger (oversize) in an attempt to reduce pressure drop merely causes hunting with no actual decrease in pressure drop.

If a regulator is ever internally damaged (broken seat or piston parts) this is typically not caused by the regulator hunting but rather by liquid and gas slugs entering the regulator at very high velocities encouraged by high pressure drop across the regulator seat port. Such would only tend to occur with gross oversizing accompanied by liquid slugging from heat exchangers, accumulators or poor piping practices. As a matter of fact, whenever internal valve damage or parts breakage occurs it is usually caused by very high velocity liquid refrigerant slugs mixed with very high velocity gas flow through a valve or regulator. This usually occurs when a high pressure receiver has insufficient liquid level, when an evaporative condenser feeds liquid backwards to a hot gas defrost or reheat line, when a hot gas defrost line contains substantial liquid, when an evaporator or suction accumulator is overflowing onto the valve, when a defrosting evaporator containing liquid is suddenly exhausted though a valve to the suction pressure, or if a system flow direction is abnormally reversed through the regulator.

The above principles apply also to pilot operated solenoid valves except that sizing is less important because control of pressure is not involved.

When pressure regulators or solenoid valves exhibit erratic operation or short term abnormal wear or damage, it is usually caused by excessive dirt particles or by application problems rather than an inherent product flaw of valve design or construction. The existing designs of these valves have been proven to be sound during the past twenty years as proven in the field by hundreds of thousands of installations.

All efforts have been made to provide the most accurate information as possible. Some of the capacities may vary slightly from capacity tables in previous Hansen literature due to computer generated rounding, product improvements, and sources for thermodynamic tables. Hansen Technologies Corporation reserves the right to update capacity tables at any time.

Ammonia Capacities
US Units

Solenoid Valves

¾" to 6" Port Size
Type HS4A, HS4W

Ammonia US

Suction Line Valve Capacities (Tons Ammonia)

Evap. Temp. °F	Pressure Drop Across Valve (psi)	HS4A								HS4W	
		Port Size									
		¾"	1"	1¼"	1½"	2"	2½"	3"	4"	5"	6"
50	2	14	25	35	74	100	164	221	353	514	877
	3	17	30	42	91	122	199	269	430	626	1,069
	5	21	39	54	116	155	255	344	549	800	1,365
45	2	13	24	33	71	95	155	210	335	488	832
	3	16	29	40	86	115	189	255	407	594	1,014
	5	20	37	51	110	147	241	326	520	758	1,294
40	2	12	22	31	67	90	147	199	317	462	789
	3	15	27	38	81	109	179	242	386	563	961
	5	19	35	49	104	139	228	308	492	717	1,224
35	2	12	21	30	63	85	139	188	300	438	747
	3	14	26	36	77	103	169	229	365	532	909
	5	18	33	46	98	132	216	291	465	678	1,157
30	2	11	20	28	60	80	132	178	284	414	707
	3	13	24	34	73	98	160	216	345	503	859
	5	17	31	43	92	124	203	275	439	640	1,091
25	2	10	19	27	57	76	124	168	268	391	667
	3	13	23	32	69	92	151	204	326	475	810
	5	16	29	41	87	117	192	259	413	602	1,028
20	2	10	18	25	53	72	117	159	253	369	630
	3	12	22	30	65	87	142	192	307	448	764
	5	15	27	38	82	110	180	244	389	567	967
15	2	9.2	17	24	50	68	111	149	238	348	593
	3	11	20	29	61	82	134	181	289	421	719
	5	14	26	36	77	103	169	229	365	532	908
10	2	8.6	16	22	47	64	104	141	224	327	558
	3	10	19	27	57	77	126	170	271	396	675
	5	13	24	34	72	97	159	214	342	498	850
5	2	8.1	15	21	44	60	98	132	211	307	524
	3	10	18	25	54	72	118	159	254	371	633
	5	12	23	32	67	90	148	200	319	466	795
Cv		6.4	11.7	16.4	35	47	77	104	166	242	413

Continued on next page.

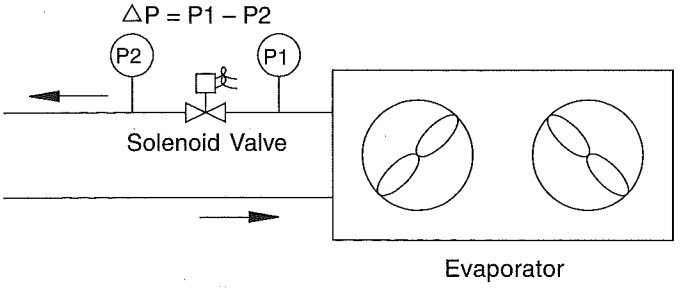
Suction Line Valve Capacities (Tons Ammonia)

Evap. Temp. °F	Pressure Drop Across Valve (psi)	HS4A Port Size ¾"	1"	1¼"	1½"	2"	2½"	3"	4"	HS4W 5"	6"
0	2	7.6	14	20	42	56	92	124	197	288	491
	3	9.2	17	24	50	67	110	149	238	347	592
	5	11	21	29	63	84	138	187	298	434	741
–5	2	7.1	13	18	39	52	86	116	185	269	459
	3	8.6	16	22	47	63	103	139	222	324	553
	5	11	19	27	58	78	128	173	277	403	688
–10	2	6.7	12	17	36	49	80	108	173	251	429
	3	8.0	15	20	44	59	96	130	207	302	515
	5	10	18	25	54	73	119	161	256	374	638
–15	2	6.2	11	16	34	45	75	101	161	234	400
	3	7.4	14	19	41	54	89	120	192	280	478
	5	9	17	23	50	67	110	148	237	345	589

Suction Line Valve Capacities: Two-Stage System (Tons Ammonia)

–20	2	6.7	12	17	36	49	80	108	173	252	431
	3	8.0	15	20	44	58	96	129	206	301	514
	5	9.7	18	25	53	71	117	158	252	368	627
–25	2	6.2	11	16	34	45	74	101	160	234	399
	3	7.3	13	19	40	54	88	119	191	278	474
	5	8.9	16	23	49	65	107	145	231	336	574
–30	2	5.7	10	15	31	42	69	93	148	216	369
	3	6.8	12	17	37	50	81	110	175	256	436
	5	8.1	15	21	44	59	97	132	210	306	522
–35	2	5.3	9.6	14	29	39	63	86	137	199	340
	3	6.2	11	16	34	45	74	101	161	234	399
	5	7.3	13	19	40	54	88	119	190	276	472
–40	2	4.8	8.8	12	26	36	58	79	125	183	312
	3	5.6	10	14	31	41	68	92	146	213	364
	5	6.5	12	17	36	48	79	106	170	248	422
Cv		6.4	11.7	16.4	35	47	77	104	166	242	413

Notes: Conditions: Capacities for evaporator temperatures to –15°F are based on the evaporator temperature shown and +86°F liquid. Capacity changes 3% for each 10°F increase or decrease in liquid temperature. Capacities for evaporator temperatures between –20°F and –40°F are based on +20°F liquid temperature. (Example: Flooded evaporator). For pressure drop across the valve less than 2 psi, use HS9B, HCK2, or HCK5 Gas-Powered Check Valves. For liquid overfeed evaporator suction between normal 2:1 to 5:1 rate, add 20% to the evaporator load or use the next larger port size to accomodate liquid volume accompanying the suction gas and to reduce impact velocity.



Solenoid Valves

5/32" to 6" Port Size
Type HS6, HS8, HS7, HS4A, HS4W

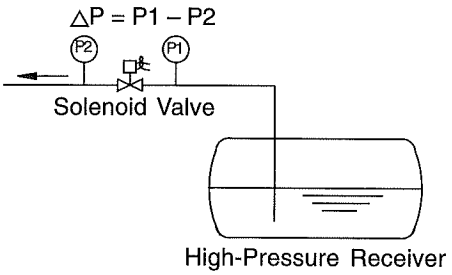
US

Ammonia

High Pressure Liquid Line Valve Capacities (Tons Ammonia)

Pressure Drop Across Valve (psi)	HS6	HS8	HS7			HS4A									HS4W
	Port Size														
	5/32"	½"	¾"	1"	1¼"	¾"	1"	1¼"	1 ½"	2"	2½	3"	4"	5"	6"
2	8.9	63	174	229	355	139	255	357	762	1,023	1,676	2,264	3,614	5,268	8,991
3	11	77	213	280	435	171	312	437	933	1,253	2,053	2,773	4,426	6,452	11,011
4	13	89	246	323	502	197	360	505	1,078	1,447	2,371	3,202	5,111	7,450	12,715
5	14	100	275	361	561	220	403	564	1,205	1,618	2,650	3,580	5,714	8,330	14,216
7	17	118	326	428	664	261	477	668	1,425	1,914	3,136	4,236	6,761	9,856	16,820
Cv	0.41	2.9	8	10.5	16.3	6.4	11.7	16.4	35	47	77	104	166	242	413

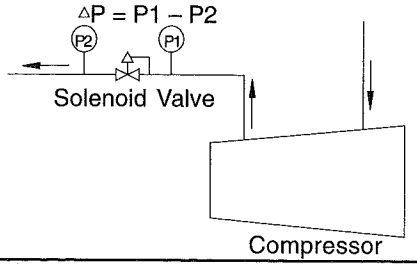
Notes: Ammonia capacities are based on +86°F liquid temperature, +20°F evaporator temperature, and no flashing through the valve.



High Pressure Discharge Line Valve Capacities (Tons Ammonia)

Cond. Temp. °F	Discharge Gas Temp. °F	Pressure Drop Across Valve (psi)	HS6	HS8	HS7			HS4A									HS4W
			Port Size														
			5/32"	½"	¾"	1"	1¼"	¾"	1"	1¼"	1½"	2"	2½"	3"	4"	5"	6"
77	131	2	1.0	7.2	20	26	41	16	29	41	87	117	191	259	413	602	1,027
		3	1.2	8.8	24	32	49	19	36	50	106	143	234	316	504	734	1,253
		5	1.6	11	31	41	63	25	46	64	136	183	300	405	646	942	1,608
86	140	2	1.1	7.6	21	28	43	17	31	43	92	124	203	274	438	638	1,089
		3	1.3	9.3	26	34	52	21	38	53	113	151	248	335	535	779	1,330
		5	1.7	12	33	43	67	26	48	68	145	194	318	430	686	1,001	1,708
95	149	2	1.1	7.8	22	28	44	17	32	44	94	127	208	281	448	653	1,114
		3	1.4	9.6	26	35	54	21	39	54	115	155	254	343	547	798	1,361
		5	1.7	12	34	44	69	27	50	69	148	199	326	440	703	1,025	1,749
Cv			0.41	2.9	8	10.5	16.3	6.4	11.7	16.4	35	47	77	104	166	242	413

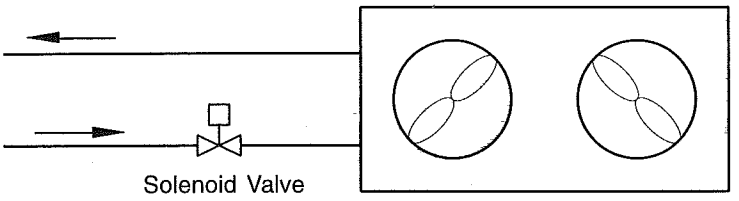
Notes: Ammonia capacities are based on condensing temperatures, discharge gas temperature shown, and 0°F evaporator temperature. For evaporator temperature between –40°F and +40°F capacities are within 3%.



Pumped Liquid Line Valve Capacities (Tons Ammonia; 4:1 Recirculation)

Pressure Drop Across Valve (psi)	HS6	HS8	HS7			HS4A								HS4W	
	Port Size														
	$^{5}/_{32}$"	½"	¾"	1"	1¼"	¾"	1"	1¼"	1½"	2"	2½"	3"	4"	5"	6"
2	2.8	20	55	72	112	44	80	112	240	322	528	713	1,138	1,659	2,831
3	3.4	24	67	88	137	54	98	138	294	395	646	873	1,394	2,032	3,467
4	4.0	28	78	102	158	62	113	159	339	456	746	1,008	1,609	2,346	4,004
5	4.4	31	87	114	177	69	127	178	379	509	835	1,127	1,799	2,623	4,477
7	5.3	37	103	135	209	82	150	210	449	603	988	1,334	2,129	3,104	5,297
Cv	0.41	2.9	8	10.5	16.3	6.4	11.7	16.4	35	47	77	104	166	242	413

Notes: Ammonia capacities are based on 0°F liquid temperature. For evaporator temperatures between –40°F amd +40°F capacities are within 5%. Based on 4:1 recirculation. For other recirculation rates, divide 4 by the new recirculation rate and multiply values shown in table to arrive at new capacity.



Pressure Regulators

¾" to 6" Port Size
Type HA4A, HA4W

Ammonia US

Suction Line Valve Capacities (Tons Ammonia)

Evap. Temp. °F	Pressure Drop Across Valve (psi)	HA4A										HA4W	
		Port Size											
		¾" @ 25%	¾" @ 50%	¾"	1"	1¼"	1½"	2"	2½"	3"	4"	5"	6"
50	2	3.4	6.8	14	25	35	74	100	164	221	353	514	877
	3	4.1	8.3	17	30	42	91	122	199	269	430	626	1,069
	5	5.3	11	21	39	54	116	155	255	344	549	800	1,365
	10	7.3	15	29	53	75	159	214	351	474	756	1,102	1,881
	15	8.7	17	35	63	89	190	255	418	564	901	1,313	2,241
	20	10	20	39	71	100	213	286	469	634	1,012	1,475	2,517
45	2	3.2	6.4	13	24	33	71	95	155	210	335	488	832
	3	3.9	7.9	16	29	40	86	115	189	255	407	594	1,014
	5	5.0	10	20	37	51	110	147	241	326	520	758	1,294
	10	6.9	14	28	50	71	151	202	331	447	714	1,041	1,776
	15	8.2	16	33	60	84	179	240	394	532	848	1,237	2,111
	20	9.2	18	37	67	94	200	269	441	595	950	1,385	2,363
40	2	3.1	6.1	12	22	31	67	90	147	199	317	462	789
	3	3.7	7.4	15	27	38	81	109	179	242	386	563	961
	5	4.7	9.5	19	35	49	104	139	228	308	492	717	1,224
	10	6.5	13	26	47	67	142	191	313	422	674	982	1,676
	15	7.7	15	31	56	79	168	226	370	500	798	1,163	1,985
	20	8.6	17	34	63	88	188	252	413	557	890	1,297	2,214
35	2	2.9	5.8	12	21	30	63	85	139	188	300	438	747
	3	3.5	7.0	14	26	36	77	103	169	229	365	532	909
	5	4.5	9.0	18	33	46	98	132	216	291	465	678	1,157
	10	6.1	12	24	45	63	134	180	294	397	634	924	1,578
	15	7.2	14	29	53	74	158	212	347	469	748	1,090	1,861
	20	8.0	16	32	59	82	175	235	385	520	831	1,211	2,067
30	2	2.7	5.5	11	20	28	60	80	132	178	284	414	707
	3	3.3	6.7	13	24	34	73	98	160	216	345	503	859
	5	4.2	8.5	17	31	43	92	124	203	275	439	640	1,091
	10	5.7	11	23	42	59	126	169	276	373	596	869	1,482
	15	6.7	13	27	49	69	148	198	325	438	700	1,020	1,741
	20	7.5	15	30	55	76	163	219	359	484	773	1,127	1,924
25	2	2.6	5.2	10	19	27	57	76	124	168	268	391	667
	3	3.1	6.3	13	23	32	69	92	151	204	326	475	810
	5	4.0	8.0	16	29	41	87	117	192	259	413	602	1,028
	10	5.4	11	22	39	55	118	158	259	350	559	814	1,390
	15	6.3	13	25	46	64	138	185	303	409	653	951	1,623
	20	6.9	14	28	51	71	151	203	333	449	717	1,045	1,784
20	2	2.4	4.9	10	18	25	53	72	117	159	253	369	630
	3	3.0	5.9	12	22	30	65	87	142	192	307	448	764
	5	3.7	7.5	15	27	38	82	110	180	244	389	567	967
	10	5.0	10	20	37	52	110	148	242	327	522	762	1,300
	15	5.8	12	23	43	60	128	172	281	380	607	884	1,509
	20	6.4	13	26	47	65	140	187	307	415	662	965	1,647
15	2	2.3	4.6	9.2	17	24	50	68	111	149	238	348	593
	3	2.8	5.6	11	20	29	61	82	134	181	289	421	719
	5	3.5	7.0	14	26	36	77	103	169	229	365	532	908
	10	4.7	9.4	19	34	48	103	138	226	305	487	710	1,212
	15	5.4	11	22	40	55	118	159	261	352	562	819	1,397
	20	5.9	12	23	43	60	128	172	282	381	608	886	1,513
10	2	2.2	4.3	8.6	16	22	47	64	104	141	224	327	558
	3	2.6	5.2	10	19	27	57	77	126	170	271	396	675
	5	3.3	6.6	13	24	34	72	97	159	214	342	498	850
	10	4.4	8.7	17	32	45	96	128	210	284	453	660	1,127
	15	5.0	10	20	36	51	109	147	240	324	518	755	1,288
	20	5.3	11	21	39	55	117	157	257	348	555	809	1,381
5	2	2.0	4.1	8.1	15	21	44	60	98	132	211	307	524
	3	2.5	4.9	10	18	25	54	72	118	159	254	371	633
	5	3.1	6.2	12	23	32	67	90	148	200	319	466	795
	10	4.0	8.1	16	30	41	88	119	195	263	420	612	1,044
	15	4.6	9.1	18	33	47	100	134	220	297	475	692	1,181
	20	4.8	10	19	35	50	106	142	233	315	503	733	1,251
Cv		1.6	3.2	6.4	11.7	16.4	35	47	77	104	166	242	413

Continued on next page.

Pressure Regulators

¾" to 6" Port Size
Type HA4A, HA4W

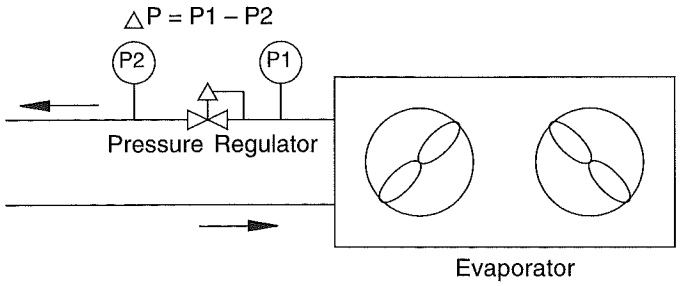
Suction Line Valve Capacities (Tons Ammonia)

Evap Temp. °F	Pressure Drop Across Valve (psi)	HA4A Port Size										HA4W	
		¾" @ 25%	¾" @ 50%	¾"	1"	1¼"	1½"	2"	2½"	3"	4"	5"	6"
0	2	1.9	3.8	7.6	14	20	42	56	92	124	197	288	491
	3	2.3	4.6	9.2	17	24	50	67	110	149	238	347	592
	5	2.9	5.7	11	21	29	63	84	138	187	298	434	741
	10	3.7	7.5	15	27	38	82	110	180	243	387	564	963
	15	4.2	8.3	17	30	43	91	122	201	271	432	630	1,076
	20	4.3	8.7	17	32	45	95	128	209	283	451	658	1,123
–5	2	1.8	3.6	7.1	13	18	39	52	86	116	185	269	459
	3	2.1	4.3	8.6	16	22	47	63	103	139	222	324	553
	5	2.7	5.3	11	19	27	58	78	128	173	277	403	688
	10	3.4	6.8	14	25	35	75	101	165	222	355	518	883
	15	3.8	7.5	15	28	39	82	111	181	245	391	570	972
	20	3.9	7.7	15	28	40	84	113	186	251	400	583	996
–10	2	1.7	3.3	6.7	12	17	36	49	80	108	173	251	429
	3	2.0	4.0	8.0	15	20	44	59	96	130	207	302	515
	5	2.5	4.9	10	18	25	54	73	119	161	256	374	638
	10	3.1	6.3	13	23	32	68	92	150	203	324	473	807
–15	2	1.5	3.1	6.2	11	16	34	45	75	101	161	234	400
	3	1.9	3.7	7.4	14	19	41	54	89	120	192	280	478
	5	2.3	4.6	9	17	23	50	67	110	148	237	345	589
	10	2.8	5.7	11	21	29	62	83	136	184	294	428	731

Suction Line Valve Capacities: Two-Stage System (Tons Ammonia)

–20	2	1.7	3.3	6.7	12	17	36	49	80	108	173	252	431
	3	2.0	4.0	8.0	15	20	44	58	96	129	206	301	514
	5	2.4	4.9	9.7	18	25	53	71	117	158	252	368	627
–25	2	1.5	3.1	6.2	11	16	34	45	74	101	160	234	399
	3	1.8	3.7	7.3	13	19	40	54	88	119	191	278	474
	5	2.2	4.4	8.9	16	23	49	65	107	145	231	336	574
–30	2	1.4	2.9	5.7	10	15	31	42	69	93	148	216	369
	3	1.7	3.4	6.8	12	17	37	50	81	110	175	256	436
	5	2.0	4.0	8.1	15	21	44	59	97	132	210	306	522
–35	2	1.3	2.6	5.3	9.6	14	29	39	63	86	137	199	340
	3	1.5	3.1	6.2	11	16	34	45	74	101	161	234	399
	5	1.8	3.7	7.3	13	19	40	54	88	119	190	276	472
–40	2	1.2	2.4	4.8	8.8	12	26	36	58	79	125	183	312
	3	1.4	2.8	5.6	10	14	31	41	68	92	146	213	364
	5	1.6	3.3	6.5	12	17	36	48	79	106	170	248	422
Cv		1.6	3.2	6.4	11.7	16.4	35	47	77	104	166	242	413

Notes: Conditions: Capacities for evaporator temperature to –15°F are based on the evaporator temperature shown and +86°F liquid. Capacity changes 3% for each 10°F increase or decrease in liquid temperature. Capacities for evaporator temperatures between –20°F and –40°F are based on +20°F liquid temperature. (Example: flooded evaporator). For liquid overfeed evaporator suction between normal 2:1 to 5;1 rate, add 20% to the evaporator load or use the next larger port size to accomodate liquid volume accompanying the suction gas and to reduce impact velocity. For pressure drop across the valve less than 2 psi, use HS9B, HCK2, or HCK5 Gas-Powered Check Valves.



Pressure Regulators

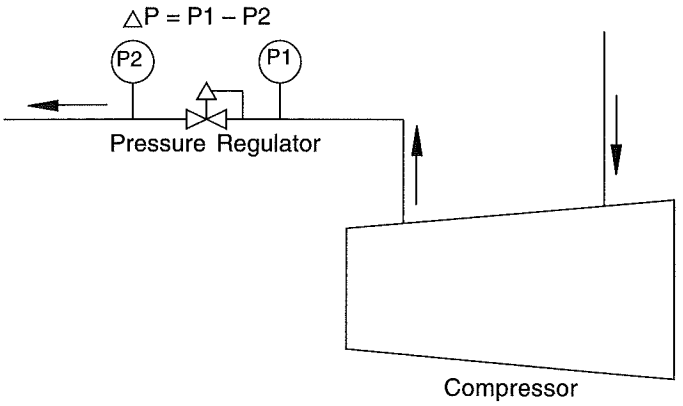
¾" to 6" Port Size
Type HA4A, HA4W

Ammonia US

High Pressure Discharge Line Valve Capacities (Tons Ammonia)

Cond. Temp. °F	Discharge Gas Temp. °F	Pressure Drop Across Valve (psi)	HA4A										HA4W	
			Port Size											
			¾" @ 25%	¾" @ 50%	¾"	1"	1¼"	1½"	2"	2½"	3"	4"	5"	6"
77	131	2	4.0	8.0	16	29	41	87	117	191	259	413	602	1,027
		3	4.9	9.7	19	36	50	106	143	234	316	504	734	1,253
		5	6.2	12	25	46	64	136	183	300	405	646	942	1,608
		10	8.7	17	35	63	89	190	255	417	563	899	1,311	2,238
		20	12	24	47	87	122	259	348	571	771	1,231	1,794	3,062
86	140	2	4.2	8.4	17	31	43	92	124	203	274	438	638	1,089
		3	5.2	10	21	38	53	113	151	248	335	535	779	1,330
		5	6.6	13	26	48	68	145	194	318	430	686	1,001	1,708
		10	9.2	18	37	67	95	202	271	444	600	957	1,396	2,382
		20	13	25	51	93	130	278	373	611	825	1,317	1,920	3,276
95	149	2	4.3	8.6	17	32	44	94	127	208	281	448	653	1,114
		3	5.3	11	21	39	54	115	155	254	343	547	798	1,361
		5	6.8	14	27	50	69	148	199	326	440	703	1,025	1,749
		10	9.5	19	38	69	97	207	278	456	616	982	1,432	2,444
		20	13	26	52	96	134	286	384	629	850	1,356	1,977	3,374
Cv			1.6	3.2	6.4	11.7	16.4	35	47	77	104	166	242	413

Notes: Ammonia capacities are based on condensing temperatures, discharge gas temperatures as shown, and 0°F evaporator temperature. For evaporator temperatures between –40°F and +40°F capacities are within 3%.



Pressure Regulators

¾" to 6" Port Size
Type HA4A, HA4W

High Pressure Discharge Line Valve Capacities (lb/min Ammonia)

Cond. Temp. °F	Discharge Gas Temp. °F	Pressure Drop Across Valve (psi)	HA4A										HA4W	
			Port Size											
			¾" @ 25%	¾" @ 50%	¾"	1"	1¼"	1½"	2"	2½"	3"	4"	5"	6"
77	131	2	1.6	3.3	6.6	12	17	36	48	79	107	171	249	425
		3	2.0	4.0	8.0	15	21	44	59	97	131	209	304	519
		5	2.6	5.2	10	19	26	56	76	124	168	268	390	666
		10	3.6	7.2	14	26	37	79	106	173	233	373	543	927
		20	4.9	10	20	36	50	108	144	237	319	510	743	1,269
86	140	2	1.8	3.6	7.1	13	18	39	52	86	116	185	270	461
		3	2.2	4.4	8.7	16	22	48	64	105	142	226	330	563
		5	2.8	5.6	11	20	29	61	82	135	182	291	424	723
		10	3.9	7.8	16	29	40	85	115	188	254	405	591	1,009
		20	5.4	11	21	39	55	118	158	259	349	558	813	1,387
95	149	2	1.9	3.7	7.5	14	19	41	55	90	121	194	283	482
		3	2.3	4.6	9.1	17	23	50	67	110	148	237	345	590
		5	2.9	5.9	12	21	30	64	86	141	191	304	444	757
		10	4.1	8.2	16	30	42	90	120	197	267	425	620	1,059
		20	5.7	11	23	41	58	124	166	272	368	587	856	1,461
Cv			1.6	3.2	6.4	11.7	16.4	35	47	77	104	166	242	413

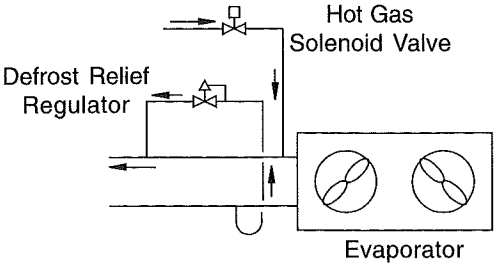
Notes: Ammonia capacities are based on condensing temperatures, discharge gas temperatures as shown.

¾" to 2½" Port Size
Type HA4AK, HS4A, HA4AOS

Hot Gas Defrost Nominal Valve Sizing Capacities (Evaporator Size in Tons Ammonia)

Application	Type	Port Size					
		¾"	1"	1 ¼"	1 ½"	2"	2 ½"
Hot Gas Solenoid*	HS4A, HA4AOS	9 to 15	15 to 28	28 to 39	39 to 73	73 to 106	106 to 165
Defrost Relief Regulator	HA4AK	17 to 24	24 to 45	45 to 60	60 to 96	96 to 140	140 to 225

Notes: *HS4A Solenoid valve or an outlet pressure regulator with electric shut-off (HA4AOS). Evaporator tons at 10°F TD (temperature differential), valve capacities are conservative. These capacities can be modified up or down depending on the type of evaporator, temperature, mass, frost thickness, defrosting time, etc. Typical for –20°F evaporator temperature.



Pressure Regulators

¾" to 4" Port Size
Type HA4AO

US

Hot Gas By-Pass Line Valve Capacities (Tons Ammonia)

Cond. Temp. °F	Discharge Gas Temp. °F	Pressure Drop Across Valve (psi)	HA4AO Port Size									
			¾ @ 25%	¾ @ 50%	¾	1"	1¼"	1½"	2"	2½"	3"	4"
77	131	100	19	37	74	136	191	407	547	896	1,210	1,932
86	140	100	21	43	85	156	219	467	627	1,028	1,388	2,216
95	149	100	23	47	93	171	239	510	686	1,123	1,517	2,421
Cv			1.6	3.2	6.4	11.7	16.4	35	47	77	104	166

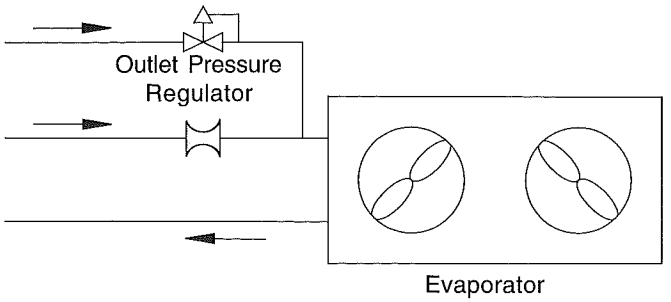
Notes: Ammonia capacities are based on condensing temperature, discharge gas temperature as shown, and 0°F evaporator temperature. For evaporator temperatures between –40°F and +40°F capacities are within 3%.

Ammonia

Hot Gas By-Pass Line Valve Capacities (lb/min Ammonia)

Cond. Temp. °F	Discharge Gas Temp. °F	Pressure Drop Across Valve (psi)	HA4AO Port Size									
			¾" @ 25%	¾" @ 50%	¾"	1"	1¼"	1½"	2"	2½"	3"	4"
77	131	100	7.7	15.4	31	56	79	169	226	371	501	800
86	140	100	9.0	18.1	36	66	93	198	266	435	588	938
95	149	100	10.4	20.7	41	76	106	227	304	499	673	1,075
Cv			1.6	3.2	6.4	11.7	16.4	35	47	77	104	166

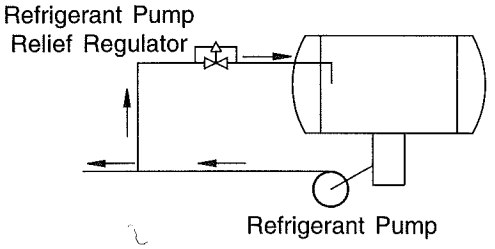
Notes: Ammonia capacities are based on condensing temperature, discharge gas temperature as shown.



Refrigerant Pump Relief Line Valve Capacities (GPM Ammonia)

Pressure Drop across Valve (psi)	HA4AL Port Size								
	¾" @ 25%	¾" @ 50%	¾"	1"	1¼"	1½"	2"	2½"	3"
10	6	12	25	46	64	136	183	300	405
15	8	15	31	56	78	167	224	367	496
20	9	18	35	64	90	193	259	424	573
25	10	20	39	72	101	215	289	474	640
30	11	22	43	79	111	236	317	519	701
35	12	23	47	85	119	255	342	561	757
40	12	25	50	91	128	272	366	599	810
45	13	26	53	97	135	289	388	636	859
50	14	28	56	102	143	305	409	670	905
Cv	1.6	3.2	6.4	11.7	16.4	35	47	77	104

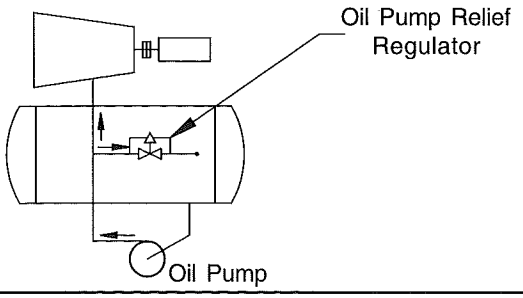
Notes: Capacities are based on 0°F liquid ammonia and no flash gas. For evaporator temperatures between –40°F and +40°F, capacities are within 5%.



Oil Pump Relief Line Valve Capacities (GPM Oil)

Pressure Drop across Valve (psi)	HA4AL Port Size								
	¾" @ 25%	¾" @ 50%	¾"	1"	1¼"	1½"	2"	2½"	3"
10	5	11	21	39	54	115	155	254	343
15	6	13	26	47	66	141	190	311	420
20	7	15	30	55	76	163	219	359	485
25	8	17	33	61	85	182	245	401	542
30	9	18	37	67	94	200	268	440	594
35	10	20	39	72	101	216	290	475	641
40	11	21	42	77	108	231	310	508	686
45	11	22	45	82	115	245	329	539	727
50	12	24	47	86	121	258	346	568	767
Cv	1.6	3.2	6.4	11.7	16.4	35	47	77	104

Notes: Capacities are based on oil with less than 300 SSU viscosity.



Gas-Powered Suction Stop Valves

1¼" to 6" Port Size
Type HS9B, HCK2, HCK5

Ammonia US

Suction Line Valve Capacities (Tons Ammonia)

Evap. Temp. F	Pressure Drop Across Valve (psi)	Port Size							
		1¼"	1½"	2"	2½"	3"	4"	5"	6"
50	0.25	16	39	45	73	104	227	288	370
	0.50	23	55	64	103	146	320	406	522
	1.0	32	77	90	146	206	452	573	737
	2.0	46	108	127	205	290	636	806	1,036
45	0.25	16	37	43	70	99	218	276	355
	0.50	22	52	61	99	140	307	390	501
	1.0	31	74	86	140	198	434	550	707
	2.0	44	104	121	197	278	610	773	994
40	0.25	15	36	42	67	95	209	265	340
	0.50	21	50	59	95	135	295	374	481
	1.0	30	71	83	134	190	416	527	678
	2.0	42	99	116	188	267	584	741	953
35	0.25	14	34	40	65	91	200	254	326
	0.50	20	48	56	91	129	282	358	460
	1.0	29	68	79	128	182	398	505	649
	2.0	40	95	111	180	255	559	709	911
30	0.25	14	33	38	62	87	191	243	312
	0.50	19	46	54	87	123	270	343	441
	1.0	27	65	76	123	174	381	483	621
	2.0	38	91	106	172	244	534	677	871
25	0.25	13	31	36	59	84	183	232	298
	0.50	19	44	51	83	118	258	327	421
	1.0	26	62	72	117	166	364	461	593
	2.0	37	87	102	164	233	510	647	831
20	0.25	13	30	35	56	80	175	222	285
	0.50	18	42	49	79	113	247	313	402
	1.0	25	59	69	112	158	347	440	566
	2.0	35	83	97	157	222	486	616	792
15	0.25	12	28	33	54	76	167	211	272
	0.50	17	40	47	76	107	235	298	383
	1.0	24	56	66	107	151	331	419	539
	2.0	33	79	92	149	211	463	587	754
10	0.25	11	27	32	51	72	159	201	259
	0.50	16	38	45	72	102	224	284	365
	1.0	23	54	63	101	144	315	399	513
	2.0	32	75	88	142	201	440	557	717
5	0.25	11	26	30	49	69	151	191	246
	0.50	15	36	42	69	97	213	270	347
	1.0	21	51	60	96	136	299	379	487
	2.0	30	71	83	134	190	417	529	680
0	0.25	10	24	29	46	65	143	182	234
	0.50	14	34	40	65	92	202	256	329
	1.0	20	48	57	91	129	284	360	462
	2.0	28	67	79	127	180	395	501	644
–5	0.25	10	23	27	44	62	136	172	222
	0.50	14	33	38	62	87	191	243	312
	1.0	19	46	53	87	123	268	340	438
	2.0	27	64	74	120	170	373	473	608
Cv		19.8	47	55	89	126	276	350	450

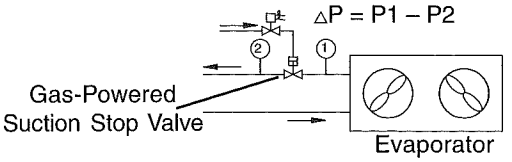
Gas-Powered Suction Stop Valves

1¼" to 6" Port Size
Type HS9B, HCK2, HCK5

Suction Line Valve Capacities (Tons Ammonia)

Evap. Temp. °F	Pressure Drop Across Valve (psi)	Port Size							
		1¼"	1½"	2"	2½"	3"	4"	5"	6"
–10	0.25	9.2	22	26	42	59	129	163	210
	0.50	13	31	36	58	83	181	230	296
	1.0	18	43	51	82	116	254	322	414
	2.0	25	60	70	114	161	352	446	574
–15	0.25	8.7	21	24	39	56	122	154	199
	0.50	12	29	34	55	78	171	217	279
	1.0	17	41	48	77	109	240	304	391
	2.0	24	56	66	107	151	331	420	540
–20	0.25	8.2	20	23	37	52	115	146	187
	0.50	12	27	32	52	74	161	205	263
	1.0	16	38	45	73	103	225	286	368
	2.0	22	53	62	100	142	311	394	507
–25	0.25	7.8	18	22	35	49	108	137	177
	0.50	11	26	30	49	69	152	193	248
	1.0	15	36	42	68	97	212	269	346
	2.0	21	50	58	94	133	291	369	474
–30	0.25	7.3	17	20	33	47	102	129	166
	0.50	10	24	28	46	65	143	181	233
	1.0	14	34	40	64	91	199	252	324
	2.0	19	46	54	88	124	272	344	443
–35	0.25	6.9	16	19	31	44	96	121	156
	0.50	10	23	27	43	61	134	170	218
	1.0	13	32	37	60	85	186	236	303
	2.0	18	43	50	81	115	252	320	412
–40	0.25	6.4	15	18	29	41	90	114	146
	0.50	9.0	21	25	40	57	125	159	204
	1.0	12	29	35	56	79	173	220	282
	2.0	17	40	47	75	107	234	296	381
–45	0.25	6.0	14	17	27	38	84	106	137
	0.50	8.4	20	23	38	53	117	148	191
	1.0	12	27	32	52	73	161	204	262
	2.0	15	37	43	69	98	215	273	351
–50	0.25	5.6	13	16	25	36	78	99	127
	0.50	7.8	19	22	35	50	109	138	177
	1.0	11	25	30	48	68	149	189	243
	2.0	14	34	39	64	90	198	250	322
–55	0.25	5.2	12	14	23	33	73	92	118
	0.50	7.2	17	20	33	46	101	128	164
	1.0	10	23	27	44	63	137	174	224
	2.0	13	31	36	58	82	180	228	293
–60	0.25	4.8	11	13	22	31	67	85	110
	0.50	6.7	16	19	30	43	93	118	152
	1.0	9.1	21	25	41	58	126	160	206
	2.0	12	28	32	52	74	163	206	265
Cv		19.8	47	55	89	126	276	350	450

Notes: For liquid overfeed systems, nominal 2:1 to 5:1 ratio, add 20% to the evaporator load and select a valve based on the increased load. For gravity flooded application, the valve should be the same port size as properly sized liquid leg or gas line. Above capacities are based on liquid temperature equal to evaporator temperature.



In-Line Check Valves

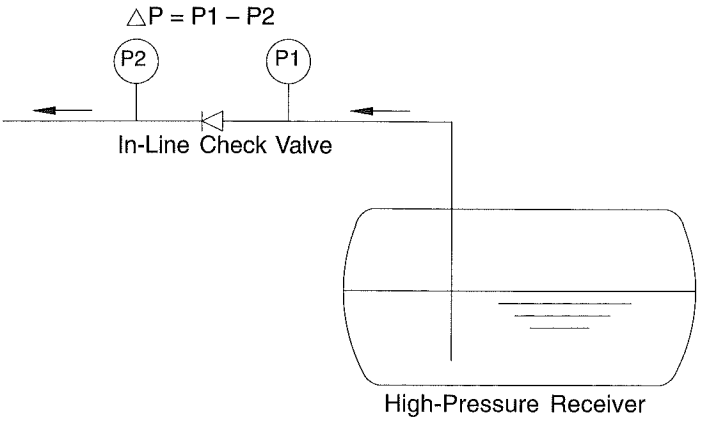
5/8" to 4" Port Size
Type HCK4

Ammonia US

High Pressure Liquid Line Valve Capacities (Tons Ammonia)

Pressure Drop Across Valve (psi)	HCK4 Port Size								
	5/8"	3/4"	1"	1¼"	1½"	2"	2½"	3"	4"
1	89	126	180	216	600	770	1,139	1,432	3,233
2	126	179	255	305	849	1,088	1,611	2,025	4,572
3	155	219	312	373	1,040	1,333	1,973	2,480	5,599
4	179	252	360	431	1,201	1,539	2,278	2,863	6,465
5	200	282	403	482	1,342	1,721	2,547	3,201	7,228
7	236	334	477	570	1,588	2,036	3,014	3,788	8,553
Cv	5.8	8.2	11.7	14	39	50	74	93	210

Notes: Ammonia capacities are based on +86°F liquid temperature and +20°F evaporator temperature and no flashing through the valve.



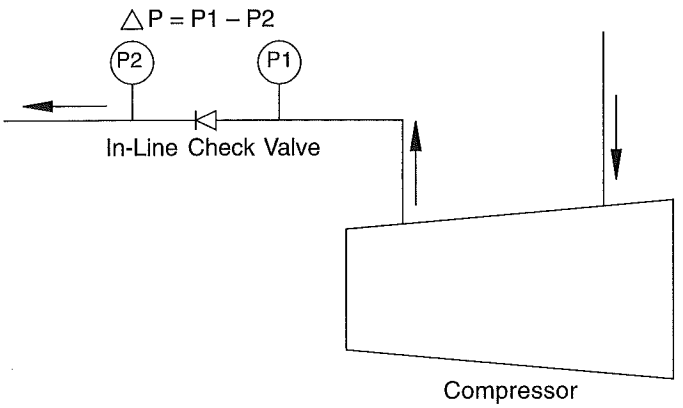
In-Line Check Valves

5/8" to 4" Port Size
Type HCK4

High Pressure Discharge Line Valve Capacities (Tons Ammonia)

Cond. Temp. °F	Discharge Gas Temp. °F	Pressure Drop Across Valve (psi)	HCK4 Port Size								
			5/8"	3/4"	1"	1¼"	1½"	2"	2½"	3"	4"
77	131	1*	10	14	21	25	69	88	130	164	370
		2	14	20	29	35	97	124	184	231	522
		3	18	25	36	42	118	152	225	282	637
		5	23	32	46	55	152	195	288	362	818
86	140	1*	11	15	22	26	73	93	138	174	392
		2	15	22	31	37	103	132	195	245	554
		3	19	26	38	45	126	161	238	299	676
		5	24	34	48	58	161	207	306	385	868
95	149	1*	11	16	22	27	75	96	141	178	402
		2	16	22	32	38	105	135	200	251	567
		3	19	27	39	46	129	165	244	307	692
		5	25	35	50	59	165	212	313	394	889
Cv			5.8	8.2	11.7	14	39	50	74	93	210

Notes: Ammonia capacities are based on condensing temperature, discharge gas temperature as shown, and 0°F evaporator temperature. For evaporator temperatures between –40°F and +40°F capacities are within 3%. *When sizing in-line check valves for compressor discharge, a minimum of 1 psid pressure drop at minimum compressor capacity (fully unloaded) must be maintained. Use Piston Type Check Valve HCK1 for applications where pressure drop is less than 1 psid.



In-Line Check Valves

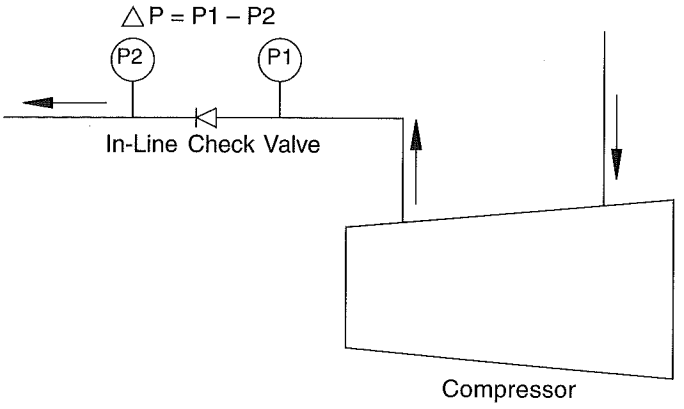
5/8" to 4" Port Size
Type HCK4

Ammonia US

High Pressure Discharge Line Valve Capacities (lb/min Ammonia)

Cond. Temp. °F	Discharge Gas Temp. °F	Pressure Drop Across Valve (psi)	HCK4 Port Size								
			5/8"	¾"	1"	1¼"	1½"	2"	2½"	3"	4"
77	131	1*	4.2	6.0	8.5	10	28	37	54	68	153
		2	6.0	8.4	12	14	40	51	76	96	216
		3	7.3	10	15	18	49	63	93	117	264
		5	9.4	13	19	23	63	81	119	150	339
86	140	1*	4.6	6.5	9.3	11	31	40	59	74	166
		2	6.5	9.2	13	16	44	56	83	104	234
		3	7.9	11	16	19	53	68	101	127	286
		5	10	14	20	25	68	88	130	163	368
95	149	1*	4.8	6.8	10	12	32	41	61	77	174
		2	6.8	10	14	16	46	58	86	109	245
		3	8.3	12	17	20	56	71	106	133	300
		5	11	15	21	26	72	92	136	171	385
Cv			5.8	8.2	11.7	14	39	50	74	93	210

Notes: Ammonia capacities are based on condensing temperature and discharge gas temperature as shown. *When sizing in-line check valves for compressor discharge, a minimum of 1 psid pressure drop at minimum compressor capacity (fully unloaded) must be maintained. Use Piston Type Check Valve for applications where pressure drop is less than 1 psid.



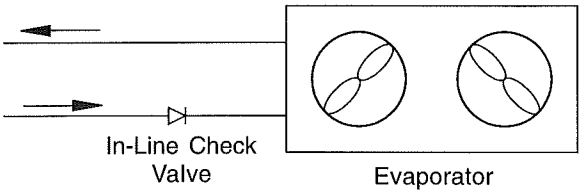
In-Line Check Valves

5/8" to 4" Port Size
Type HCK4

Pumped Liquid Line Valve Capacities (Tons Ammonia, 4:1 Recirculation)

Pressure Drop Across Valve (psi)	HCK4 Port Size								
	5/8"	¾"	1"	1¼"	1½"	2"	2½"	3"	4"
1	28	39	56	67	186	239	353	444	1,003
2	39	55	79	95	263	338	500	628	1,418
3	48	68	97	116	323	413	612	769	1,737
4	55	78	112	134	372	477	707	888	2,005
5	62	88	125	149	416	534	790	993	2,242
7	73	104	148	177	493	632	935	1,175	2,653
Cv	5.8	8.2	11.7	14	39	50	74	93	210

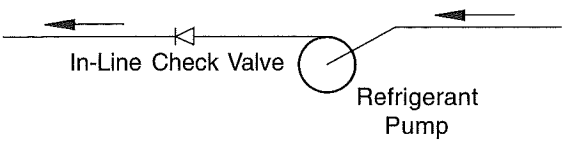
Notes: Ammonia capacities are based on 0°F pumped liquid temperature and 0°F evaporator temperature. For evaporator temperatures between –40°F and +40°F capacities are within 5%. Based on 4:1 recirculation. For other recirculation rates, divide 4 by the new recirculation rate and multiply values shown in table to arrive at new capacity.



Pump Discharge Liquid Line Valve Capacities (GPM Ammonia)

Pressure Drop Across Valve (psi)	HCK4 Port Size								
	5/8"	¾"	1"	1¼"	1½"	2"	2½"	3"	4"
1	7.1	10	14	17	48	62	91	114	258
2	10	14	20	24	68	87	129	162	366
3	12	17	25	30	83	107	158	198	448
4	14	20	29	34	96	123	182	229	517
5	16	23	32	39	107	138	204	256	578
7	19	27	38	46	127	163	241	303	684
Cv	5.8	8.2	11.7	14	39	50	74	93	210

Notes: Ammonia capacities are based on 0°F pumped liquid temperature and 0°F evaporator temperature. For evaporator temperatures between –40°F and +40°F capacites are within 5%.



Piston Type Check Valves

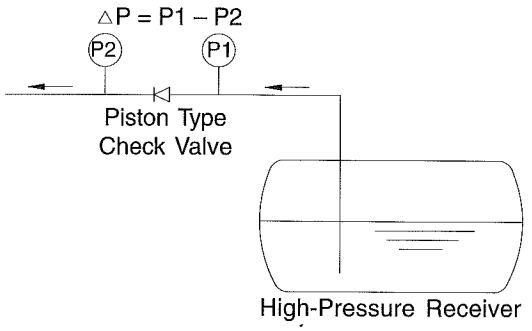
¾" to 6" Port Size
Type HCK1, HCK1W

Ammonia US

High Pressure Liquid Line Valve Capacities (Tons Ammonia)

Pressure Drop Across Valve (psi)	HCK1								HCK1 W	
	Port Size									
	¾"	1"	1 ¼"	1 ½"	2"	2 ½"	3"	4"	5"	6"
1	123	162	251	723	847	1,370	1,940	4,249	5,388	6,927
2	174	229	355	1,023	1,197	1,937	2,743	6,008	7,619	9,796
3	213	280	435	1,253	1,466	2,373	3,359	7,359	9,332	11,998
4	246	323	502	1,447	1,693	2,740	3,879	8,497	10,775	13,854
5	275	361	561	1,618	1,893	3,063	4,337	9,500	12,047	15,489
7	326	428	664	1,914	2,240	3,625	5,132	11,241	14,254	18,327
Cv	8	10.5	16.3	47	55	89	126	276	350	450

Notes: Ammonia capacities are based on +86°F liquid temperature, +20°F evaporator temperature and no flashing through the valve.



High Pressure Discharge Line Valve Capacities (Tons Ammonia)

Cond. Temp. °F	Discharge Gas Temp. °F	Pressure Drop Across Valve (psi)	HCK1								HCK1 W	
			Port Size									
			¾"	1"	1 ¼"	1 ½"	2"	2 ½"	3"	4"	5"	6"
77	131	1	14	19	29	83	97	157	222	487	617	793
		2	20	26	41	117	137	221	313	686	870	1,119
		3	24	32	49	143	167	270	382	838	1,062	1,366
		5	31	41	63	183	214	346	491	1,074	1,363	1,752
86	140	1	15	20	30	88	103	166	235	516	654	841
		2	21	28	43	124	145	235	332	728	923	1,186
		3	26	34	52	151	177	287	406	889	1,127	1,449
		5	33	43	67	194	227	368	521	1,141	1,447	1,861
95	149	1	15	20	31	90	105	170	241	528	669	860
		2	22	28	44	127	148	240	340	745	944	1,214
		3	26	35	54	155	181	293	415	910	1,154	1,483
		5	34	44	69	199	233	377	534	1,169	1,482	1,906
Cv			8	10.5	16.3	47	55	89	126	276	350	450

Notes: Ammonia capacities are based on condensing temperature, discharge gas temperature as shown, and 0°F evaporator temperature. For evaporator temperatures between –40°F and +40°F capacities are within 3%.

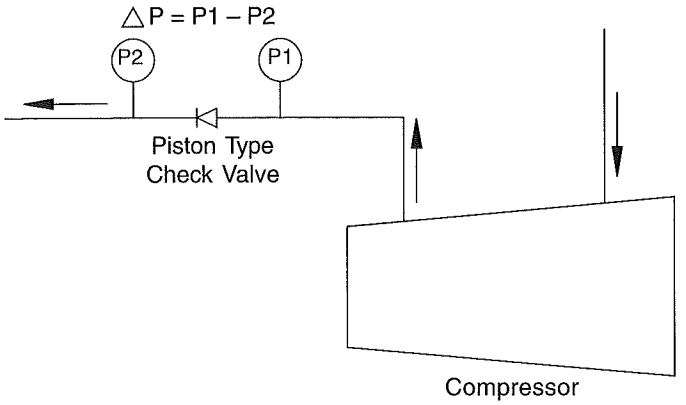
Piston Type Check Valves

¾" to 6" Port Size
Type HCK1, HCK1W

High Pressure Discharge Line Valve Capacities (lb/min Ammonia)

Cond. Temp. °F	Discharge Gas Temp. °F	Pressure Drop Across Valve (psi)	HCK1								HCK1 W	
			Port Size									
			¾"	1"	1 ¼"	1 ½"	2"	2 ½"	3"	4"	5"	6"
77	131	1	5.8	7.7	12	34	40	65	92	202	256	329
		2	8.2	11	17	48	57	92	130	284	360	463
		3	10	13	20	59	69	112	158	347	440	566
		5	13	17	26	76	89	144	203	445	565	726
86	140	1	6.3	8.3	13	37	44	70	100	218	277	356
		2	8.9	12	18	52	61	99	141	308	391	502
		3	11	14	22	64	75	121	172	376	477	614
		5	14	18	29	82	96	156	221	483	613	788
95	149	1	6.6	8.7	13	39	46	74	104	229	290	373
		2	9.3	12	19	55	64	104	147	322	409	526
		3	11	15	23	67	79	127	180	394	500	642
		5	15	19	30	86	101	163	231	506	642	825
Cv			8	10.5	16.3	47	55	89	126	276	350	450

Notes: Ammonia capacities are based on condensing temperature and discharge gas temperature as shown.



Piston Type Check Valves

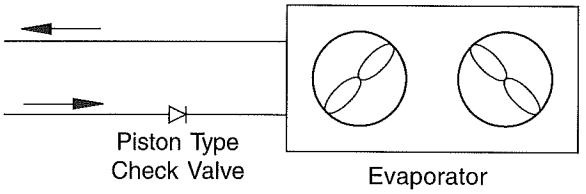
¾" to 6" Port Size
Type HCK1, HCK1W

Ammonia US

Pumped Liquid Line Valve Capacities (Tons Ammonia, 4:1 Recirculation)

Pressure Drop Across Valve (psi)	HCK1								HCK1 W	
	Port Size									
	¾"	1"	1 ¼"	1 ½"	2"	2 ½"	3"	4"	5"	6"
1	38	50	78	224	263	425	602	1,318	1,671	2,148
2	54	71	110	317	371	601	851	1,864	2,363	3,038
3	66	87	135	389	455	736	1,042	2,282	2,894	3,721
4	76	100	156	449	525	850	1,203	2,635	3,342	4,297
5	85	112	174	502	587	950	1,345	2,946	3,736	4,804
7	101	133	206	594	695	1,124	1,592	3,486	4,421	5,684
Cv	8	10.5	16.3	47	55	89	126	276	350	450

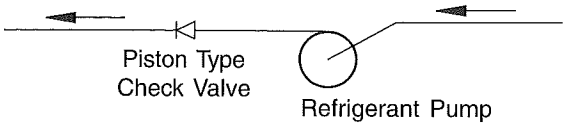
Notes: Ammonia capacities are based on 0°F liquid temperature and 0°F evaporator temperature. For evaporator temperatures between –40°F and +40°F capacities are within 5%. Based on 4:1 recirculation. For other recirculation rates, divide 4 by the new recirculation rate and multiply values shown in table to arrive at the new capacity.



Pump Discharge Liquid Line Valve Capacities (GPM Ammonia)

Pressure Drop Across Valve (psi)	HCK1								HCK1 W	
	Port Size									
	¾"	1"	1 ¼"	1 ½"	2"	2 ½"	3"	4"	5"	6"
1	10	13	20	58	68	110	155	340	431	554
2	14	18	28	82	96	155	219	480	609	783
3	17	22	35	100	117	190	269	588	746	959
4	20	26	40	116	135	219	310	679	862	1,108
5	22	29	45	129	151	245	347	760	963	1,239
7	26	34	53	153	179	290	410	899	1,140	1,466
Cv	8	10.5	16.3	47	55	89	126	276	350	450

Notes: Ammonia capacities are based on 0°F liquid temperature and 0°F evaporator temperature. For evaporator temperatures between –40°F and +40°F capacities are within 5%.



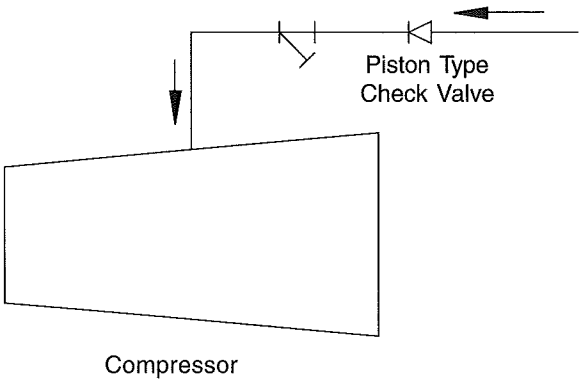
Piston Type Check Valves

¾" to 3" Port Size
Type HCK1

Compressor Side Port Suction Line Capacities (Tons Ammonia)

Economizer Temp. °F	Pressure Drop Across Valve (psi)	HCK1 Port Size						
		¾"	1"	1 ¼"	1 ½"	2"	2 ½"	3"
40	1	11	14	22	64	75	121	171
	2	15	20	31	90	105	170	240
	3	19	24	38	109	128	206	292
	5	24	31	48	139	163	263	373
20	1	8.7	11	18	51	60	97	137
	2	12	16	25	72	84	135	192
	3	15	19	30	87	101	164	233
	5	19	25	38	110	128	208	294
0	1	6.8	8.9	14	40	47	76	107
	2	9.5	12	19	56	65	106	150
	3	11	15	23	67	79	127	180
	5	14	19	29	84	98	159	225
Cv		8	10.5	16.3	47	55	89	126

Notes: Ammonia capacities are based on +86°F condensing temperature and economizer temperatures as shown.



Combination Stop/Check Valves

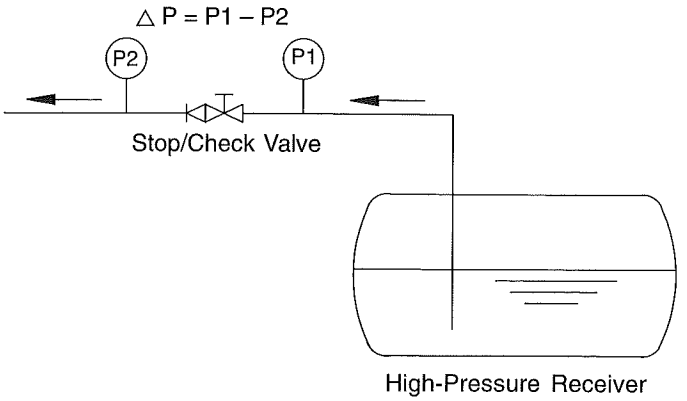
1¼" to 6" Port Size
Type SCK

Ammonia US

High Pressure Liquid Line Valve Capacities (Tons Ammonia)

Pressure Drop Across Valve (psi)	SCK							
	Port Size							
	1 ¼"	1 ½"	2"	2 ½"	3"	4"	5"	6"
1	647	770	1,278	2,155	3,156	4,772	9,236	12,623
2	914	1,088	1,807	3,048	4,463	6,749	13,062	17,851
3	1,120	1,333	2,213	3,733	5,466	8,265	15,997	21,863
4	1,293	1,539	2,555	4,310	6,311	9,544	18,472	25,245
5	1,446	1,721	2,857	4,819	7,056	10,670	20,652	28,225
7	1,711	2,036	3,380	5,702	8,349	12,625	24,436	33,396
Cv	42	50	83	140	205	310	600	820

Notes: Ammonia capacities are based on +86°F liquid temperature and +20°F evaporator temperature and no flashing through the valve.



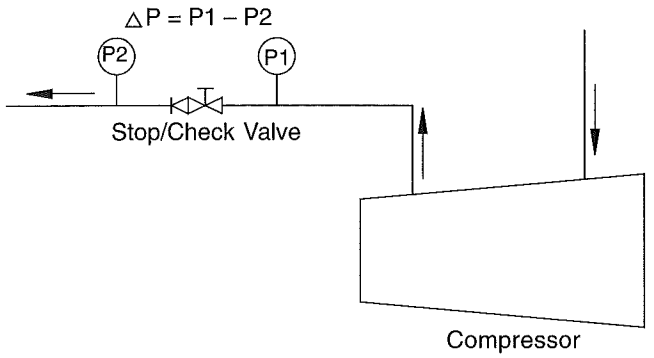
Combination Stop/Check Valves

1¼" to 6" Port Size
Type SCK

High Pressure Discharge Line Valve Capacities (Tons Ammonia)

Cond. Temp. °F	Discharge Gas Temp. °F	Pressure Drop Across Valve (psi)	SCK							
			Port Size							
			1 ¼"	1 ½"	2"	2 ½"	3"	4"	5"	6"
77	131	1*	74	88	146	247	361	547	1,058	1,446
		2	104	124	206	348	510	771	1,491	2,038
		3	127	152	252	425	622	941	1,821	2,488
		5	164	195	323	545	798	1,207	2,336	3,192
86	140	1*	78	93	155	262	383	579	1,121	1,533
		2	111	132	219	369	540	817	1,582	2,162
		3	135	161	267	451	660	998	1,932	2,640
		5	174	207	343	579	848	1,282	2,481	3,390
95	149	1*	80	96	159	268	392	593	1,147	1,568
		2	113	135	224	378	553	836	1,619	2,212
		3	138	165	274	461	676	1,022	1,978	2,703
		5	178	212	352	593	868	1,313	2,541	3,473
Cv			42	50	83	140	205	310	600	820

Notes: Ammonia capacities are based on condensing temperature, discharge gas temperature as shown, and 0°F evaporator temperature. For evaporator temperatures between –40°F and +40°F capacities are within 3%. *When sizing stop/check valves for compressor discharge, a minimum of 1 psid pressure drop at minimum compressor capacity (fully unloaded) must be maintained. Use Piston Type Check Valve HCK1 for applications where pressure drop is less than 1 psid.



Combination Stop/Check Valves

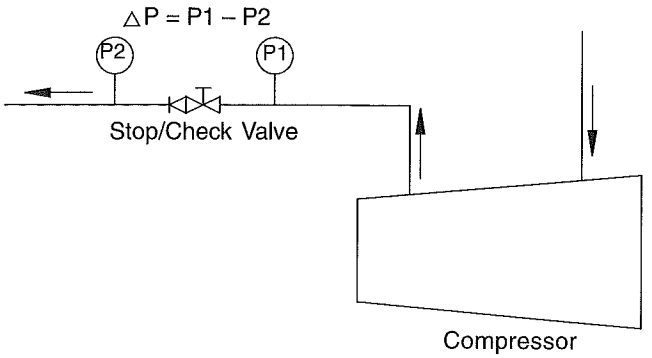
1¼" to 6" Port Size
Type SCK

Ammonia US

High Pressure Discharge Line Valve Capacities (lb/min Ammonia)

Cond. Temp. °F	Discharge Gas Temp. °F	Pressure Drop Across Valve (psi)	SCK Port Size							
			1 ¼"	1 ½"	2"	2 ½"	3"	4"	5"	6"
77	131	1*	31	37	61	102	150	226	438	599
		2	43	51	85	144	211	319	618	845
		3	53	63	104	176	258	390	754	1,031
		5	68	81	134	226	331	500	968	1,323
86	140	1*	33	40	66	111	162	245	475	649
		2	47	56	93	156	229	346	670	915
		3	57	68	113	191	280	423	818	1,118
		5	74	88	145	245	359	543	1,050	1,436
95	149	1*	35	41	69	116	170	257	497	679
		2	49	58	97	164	239	362	701	958
		3	60	71	118	200	293	443	856	1,171
		5	77	92	152	257	376	569	1,100	1,504
Cv			42	50	83	140	205	310	600	820

Notes: Ammonia capacities are based on condensing temperature and discharge gas temperature as shown. *When sizing stop/check valves for compressor discharge, a minimum of 1 psid pressure drop at minimum compressor capacity (fully unloaded) must be maintained. Use Piston Type Check Valve HCK1 for applications where pressure drop is less than 1 psid.



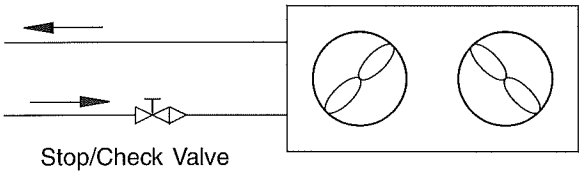
Combination Stop/Check Valves

1¼" to 6" Port Size
Type SCK

Pumped Liquid Line Valve Capacities (Tons Ammonia, 4:1 Recirculation)

Pressure Drop Across Valve (psi)	SCK							
	Port Size							
	1 ¼"	1 ½"	2"	2 ½"	3"	4"	5"	6"
1	201	239	396	668	979	1,480	2,865	3,915
2	284	338	560	945	1,384	2,093	4,051	5,537
3	347	413	686	1,158	1,695	2,563	4,962	6,781
4	401	477	793	1,337	1,957	2,960	5,729	7,830
5	448	534	886	1,495	2,189	3,309	6,405	8,754
7	531	632	1,048	1,768	2,589	3,916	7,579	10,358
Cv	42	50	83	140	205	310	600	820

Notes: Ammonia capacities are based on 0°F liquid temperature and 0°F evaporator temperature. For evaporator temperatures betweeen –40°F and +40°F, capacities are within 5%. Based on 4:1 recirculation. For other recirculation rates, divide 4 by the new recirculation rate and multiply values shown in table to arrive at new capacity.



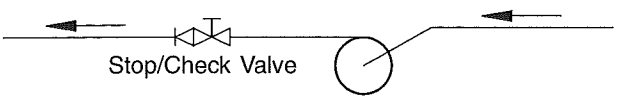
Stop/Check Valve

Evaporator

Pump Discharge Liquid Line Valve Capacities (GPM Ammonia)

Pressure Drop Across Valve (psi)	SCK							
	Port Size							
	1 ¼"	1 ½"	2"	2 ½"	3"	4"	5"	6"
1	52	62	102	172	252	382	739	1,009
2	73	87	144	244	357	540	1,044	1,427
3	90	107	177	298	437	661	1,279	1,748
4	103	123	204	345	505	763	1,477	2,019
5	116	138	228	385	564	853	1,651	2,257
7	137	163	270	456	668	1,010	1,954	2,670
Cv	42	50	83	140	205	310	600	820

Notes: Ammonia capacities are based on 0°F liquid temperature and 0°F evaporator temperature. For evaporator temperatures betweeen –40°F and +40°F, capacities are within 5%.



Stop/Check Valve

Refrigerant Pump

Shut-Off Valves

½" to 2½" Port Size
Type AS, GS

Economic Line Sizing/Capacity Table (Tons Ammonia)

Service	Conditions		Type AS, GS						
	Temp. °F	Pressure (psig)	Port Size						
			½"	¾"	1"	1 ¼"	1 ½"	2"	2 ½"
Suction Lines	+20	33.5	—	—	8.6	15.8	21.3	35.7	51.1
Single Stage Compressor	0	15.7	—	—	5.7	10.4	13.9	22.7	34.0
Suction Lines	–20	3.6	—	—	4.2	7.4	10.3	16.8	24.8
Booster	–40	8.7"	—	—	—	4.4	6.3	9.9	14.4
Liquid	+20	33.5	—	—	5.0	9.1	12.3	20.6	29.4
Overfeed	0	15.7	—	—	3.4	6.3	8.5	13.6	20.5
Return	–20	3.6	—	—	2.2	4.0	5.5	8.9	13.1
Lines (4x)	–40	8.7"	—	—	—	2.4	3.4	5.4	7.9
Hot Gas Feed	+70	114.1	2.2	4.3	7.3	14.1	19.6	36.5	53.0
Hot Gas Main	+70	114.1	4.4	8.6	14.7	28.1	39.2	73.0	106
Compressor Discharge	+86	154.5	—	—	12.6	24.1	33.6	62.6	90.3
Condenser Drains	+86	—	6.0	14.5	24.0	50.0	77.0	140	220
Liquid Mains	+86	—	28.3	53.1	90.8	143	202	454	657
Liquid Feed Branch	+86	—	54.9	103	176	277	392	881	1,273
Liquid Overfeed Supply (4x)	+10	—	9.0	17.0	29.0	46.0	65.0	144	208

Threaded Shut-Off Valve Flow Coefficients ½" to 1¼"

Size	½"	¾"	1"	1¼"
Cv Angle	9	10	26	30
Cv Globe	6	7	18	21

Socket Weld Shut-Off Valve Flow Coefficients ½" to 2½"

Size	½"	¾"	1"	1¼"	1½"	2"	2½"
Cv Angle	6	9	26	30	53	80	173
Cv Globe	4	8	18	21	41	67	163

Shut-off (stop) valves are nearly always sized on the line size determined by the system designer. Angle type shut-off valves have lower pressure drop than globe valves. Whenever possible, good engineering practice is to use angle valves in order to reduce pressure drop and also reduce cost.

Shut-Off Valves

3" to 16" Port Size
Type AW, GW, EW, DW

Economic Line Sizing/Capacity Table (Tons Ammonia)

Service	Conditions		Type AW, GW, EW, DW								
	Temp. °F	Pressure (psig)	Port Size								
			3"	4"	5"	6"	8"	10"	12"	14"	16"
Suction Lines	+20	33.5	82	146	235	343	628	1,020	1,490	1,821	2,310
Single Stage Compressor	0	15.7	54	94.6	156	225	414	662	946	1,156	1,684
Suction Lines	–20	3.6	40	68.9	114	165	306	486	709	867	1,162
Booster	–40	8.7"	23	40.8	66.8	97.8	181	288	419	512	692
Liquid	+20	33.5	47	84.3	135	198	362	587	856	1,046	1,258
Overfeed	0	15.7	32	56.8	93.8	135	249	398	568	694	944
Return	–20	3.6	21	36.4	60.5	87.5	162	256	375	458	614
Lines (4x)	–40	8.7"	13	22.4	36.7	53.7	100	158	232	284	381
Hot Gas Feed	+70	114.1	83	145	231	338	595	949	1,377	1,683	—
Hot Gas Main	+70	114.1	165	290	463	673	1,190	1,898	2,754	3,366	—
Compressor Discharge	+86	154.5	142	249	397	580	1,021	1,629	2,363	2,888	3,883
Condenser Drains	+86	—	375	740	1,320	2,030	4,200	—	—	—	—
Liquid Mains	+86	—	1,031	1,808	2,886	4,218	—	—	—	—	—
Liquid Feed Branch	+86	—	1,999	3,506	5,596	8,179	—	—	—	—	—
Liquid Overfeed Supply (4x)	+10	—	327	573	915	1,337	—	—	—	—	—

Butt-Weld Shut-Off Valve Flow Coefficients 3" to 16"

Size	3"	4"	5"	6"	8"	10"	12"	14"	16"
Cv Angle	205	320	600	820	1435	2450	3400	4600	5639
Cv Globe	195	290	575	790	1380	2350	3270	4350	—

Sizing Guide

These capacity recommendations are not affected by the length of the pipe line. These are approximate optimum sizes based on power costs versus the investment cost of piping and its total installed cost. Piping sized to these capacities will have 1 degree F pressure drop for the following equivalent lengths:

Suction lines.....700 diameters
Discharge lines.....1400 diameters
Liquid lines.....2400 diameters

Example: Hansen angle socket weld valves have about 145 diameters of equivalent flow resistance, or 145/700 = 0.2 degrees F of equivalent pressure drop at the suction line capacities shown for a valve in a suction line. Globe valves equal about 225 diameters.

Thermostatic Expansion Valves

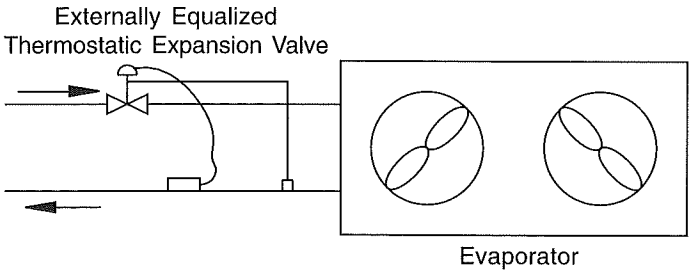
1 to 40 Tons Ammonia
Type HTG

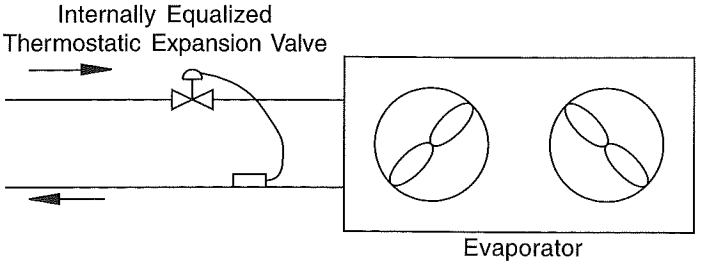
Ammonia US

Ammonia Capacities in Tons

Evap Temp °F	Pressure Drop Across Valve (psi)	Model Number									
		HTG1AZ	HTG2AZ	HTG3AZ	HTG5AZ	HTG7½AZ	HTG10AZ	HTG15AZ	HTG20AZ	HTG25AZ	HTG40AZ
+40	80	0.77	1.54	2.3	3.9	5.8	7.7	11.6	15.4	19.3	30.9
	100	0.86	1.72	2.6	4.3	6.5	8.6	12.9	17.2	21.6	34.5
	120	0.94	1.89	2.8	4.7	7.1	9.5	14.2	18.9	23.6	37.8
	140	1.02	2.0	3.1	5.1	7.7	10.2	15.3	20.4	25.5	40.8
+20	100	0.85	1.71	2.6	4.3	6.4	8.5	12.8	17.1	21.3	34.1
	120	0.94	1.87	2.8	4.7	7.0	9.4	14.0	18.7	23.4	37.4
	140	1.01	2.0	3.0	5.1	7.6	10.1	15.1	20.2	25.2	40.4
	160	1.08	2.2	3.2	5.4	8.1	10.8	16.2	21.6	27.0	43.2
+5	100	0.85	1.69	2.5	4.2	6.3	8.5	12.7	16.9	21.1	33.8
	120	0.93	1.85	2.8	4.6	6.9	9.3	13.9	18.5	23.1	37.0
	140	1.0	2.0	3.0	5.0	7.5	10.0	15.0	20.0	25.0	40.0
	160	1.07	2.1	3.2	5.3	8.0	10.7	16.0	21.4	26.7	42.8
–10	120	0.79	1.57	2.4	3.9	5.9	7.9	11.8	15.7	19.7	31.5
	140	0.85	1.7	2.6	4.3	6.4	8.5	12.8	17.0	21.3	34.0
	160	0.91	1.82	2.7	4.5	6.8	9.1	13.6	18.2	22.7	36.3
	180	0.96	1.92	2.9	4.8	7.2	9.6	14.5	19.3	24.1	38.6

Notes: Capacities are based on +86°F condensing temperature, and vapor-free liquid at the inlet. Refer to evaporator manufacturer recommendations for direct expansion ammonia feed sizing and derating of capacities for suction temperature below 0°F.





Hand Expansion (Regulating) Valves

3/8" to 1¼" Port Size
Type RT, VT Threaded

Liquid Make Up Capacities (Tons Ammonia)

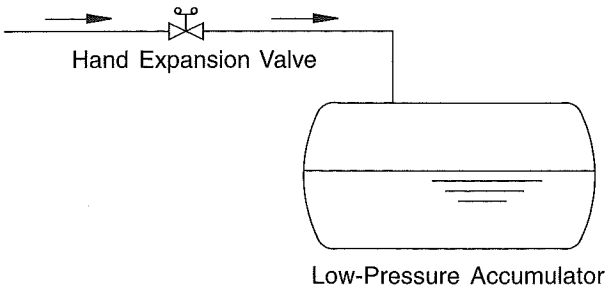
	Turns Open							
Size	1	2	3	4	5	6	7	7½
3/8"	7.4	15	30	45	59	—	—	—
½"	7.4	22	45	67	82	—	—	—
¾"	7.4	59	111	163	215	—	—	—
1"	7.4	22	45	89	163	245	312	334
1 ¼"	7.4	22	67	148	297	430	519	549

½" to 4" Port Size
Type RS, VS Socket Weld
Type RW, VW Butt Weld

Liquid Make Up Capacities (Tons Ammonia)

	Turns Open							
Size	1	2	3	4	5	6	7	7½
½"	7.4	15	22	30	45	59	67	82
¾"	7.4	15	37	67	104	148	193	215
1"	7.4	22	45	89	163	245	312	334
1 ¼"	7.4	22	67	148	297	430	519	549
1 ½"	45	111	334	519	742	1002	1113	—
2"	89	297	557	816	1076	1336	1632	—
2 ½"	319	646	1128	1610	2078	2597	3213	—
3"	482	965	1707	2449	3116	3858	4823	—
4"	742	1484	2597	3710	4823	5936	7420	—

Notes: Based on +86°F condensing temperature and 50 psi pressure drop across the valve. Shaded area exceeds 7 ft/sec. Consider larger line size to inlet of valve to minimize "water hammer" when opening or closing the adjacent solenoid valve. Size hand expansion valve for 50% "on" time. (i.e. For 100 ton recirculator, select valve based on 2 x 100 = 200 tons.)



Hand Expansion (Regulating) Valves

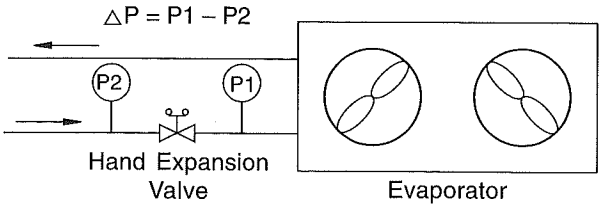
3/8" to 1¼" Port Size
Type RT, VT Threaded

Ammonia US

Liquid Overfeed Capacities (Tons Ammonia, 4:1 Recirculation)

Size	Pressure Drop (psi)	Turns Open							
		1	2	3	4	5	6	7	7½
3/8"	5	1.1	2.2	4.3	6.5	8.6	—	—	—
	10	1.5	3.0	6.1	9.1	12	—	—	—
	15	1.9	3.7	7.5	11	15	—	—	—
	20	2.2	4.3	8.6	13	17	—	—	—
	30	2.6	5.3	11	16	21	—	—	—
½"	5	1.1	3.2	6.5	10	12	—	—	—
	10	1.5	4.6	9.1	14	17	—	—	—
	15	1.9	5.6	11	17	20	—	—	—
	20	2.2	6.5	13	19	24	—	—	—
	30	2.6	7.9	16	24	29	—	—	—
¾"	5	1.1	8.6	16	24	31	—	—	—
	10	1.5	12	23	33	44	—	—	—
	15	1.9	15	28	41	54	—	—	—
	20	2.2	17	32	47	62	—	—	—
	30	2.6	21	40	58	76	—	—	—
1"	5	1.1	3.2	6.5	13	24	35	45	48
	10	1.5	4.6	9.1	18	33	50	64	68
	15	1.9	5.6	11	22	41	61	78	84
	20	2.2	6.5	13	26	47	71	90	97
	30	2.6	7.9	16	32	58	87	111	119
1 ¼"	5	1.1	3.2	10	22	43	62	75	80
	10	1.5	4.6	14	30	61	88	106	113
	15	1.9	5.6	17	37	75	108	130	138
	20	2.2	6.5	19	43	86	125	151	160
	30	2.6	7.9	24	53	106	153	185	196

Notes: Capacities are based on 0°F liquid. For other evaporator temperatures these values will change only slightly due to density and latent heat variations. Based on 4:1 recirculation. For other recirculation rates, divide 4 by the new recirculation rate and multiply values shown in table to arrive at new capacity.



Hand Expansion (Regulating) Valves

½" to 4" Port Size
Type RS, VS Socket Weld
Type RW, VW Butt Weld

Liquid Overfeed Capacities (Tons Ammonia, 4:1 Recirculation)

Size	Pressure Drop (psi)	Turns Open							
		1	2	3	4	5	6	7	7½
½"	5	1.1	2.2	3.2	4.3	6.5	8.6	10	12
	10	1.5	3.0	4.6	6.1	9.1	12	14	17
	15	1.9	3.7	5.6	7.5	11	15	17	20
	20	2.2	4.3	6.5	8.6	13	17	19	24
	30	2.6	5.3	7.9	11	16	21	24	29
¾"	5	1.1	2.2	5.4	10	15	22	28	31
	10	1.5	3.0	7.6	14	21	30	40	44
	15	1.9	3.7	9.3	17	26	37	49	54
	20	2.2	4.3	11	19	30	43	56	62
	30	2.6	5.3	13	24	37	53	69	76
1"	5	1.1	3.2	6.5	13	24	35	45	48
	10	1.5	4.6	9.1	19	33	50	64	68
	15	1.9	5.6	11	22	41	61	78	84
	20	2.2	6.5	13	26	47	71	90	97
	30	2.6	7.9	16	32	58	87	111	119
1 ¼"	5	1.1	3.2	10	22	43	62	75	80
	10	1.5	4.6	14	30	61	88	106	112
	15	1.9	5.6	17	37	75	108	130	138
	20	2.2	6.5	19	43	86	125	151	159
	30	2.6	7.9	24	53	106	153	185	195
1 ½"	5	6.5	16	48	75	108	145	161	—
	10	9.1	23	68	106	152	205	228	—
	15	11	28	84	130	186	251	279	—
	20	13	32	97	151	215	291	323	—
	30	16	40	119	185	264	356	396	—
2"	5	13	43	81	118	156	194	237	—
	10	18	61	114	167	220	274	334	—
	15	22	75	140	205	270	335	410	—
	20	26	86	161	237	312	387	474	—
	30	32	106	198	290	382	475	580	—
2 ½"	5	46	94	163	233	301	376	465	—
	10	65	132	231	330	426	532	658	—
	15	80	162	283	404	522	652	806	—
	20	93	187	327	467	603	753	932	—
	30	113	229	401	572	739	923	1142	—
3"	5	70	140	247	355	452	559	699	—
	10	99	198	350	502	638	790	988	—
	15	121	242	428	615	782	969	1211	—
	20	140	280	495	710	904	1119	1399	—
	30	171	343	607	870	1108	1372	1714	—
4"	5	108	215	376	538	699	860	1075	—
	10	152	304	532	760	988	1216	1520	—
	15	186	373	652	931	1211	1490	1863	—
	20	215	431	753	1076	1399	1722	2153	—
	30	264	528	923	1319	1714	2110	2638	—

Notes: Capacities are based on 0°F liquid temperature and 0°F evaporator temperature. For other evaporator temperatures, these values will change only slightly due to density and laten heat variations. Based on 4:1 recirculation. For other recirculation rates, divide 4 by the new recirculation rate and multiply values shown in table to arrive at new capacity.

Pressure Relief Valves

Type H5600, H5601, H5602, H5613, H5604

Pressure-Relief Valve Capacity Ratings

Cat. No.	Air Capacity	Standard Pressure Settings (psig)								
		150	175	200	225	250	275	300	325	350
H5600 H5601 H5602	lb/min	35.8	41.3	46.8	52.2	57.7	63.2	68.6	74.1	79.6
	scfm	476	549	622	695	768	841	913	986	1059
H5613	lb/min	53	61.1	69.2	77.3	85.4	93.5	101.6	109.7	117.8
	scfm	704	812	920	1028	1136	1243	1351	1459	1567
H5604	lb/min	72	83	94	105.1	116.1	127.1	138.1	149.1	160.2
	scfm	958	1104	1251	1397	1544	1691	1837	1984	2130

Notes: These are atmospheric relief valves Settings equal pressure above atmosphere when outlet is connected via proper schedule piping to the atmosphere (outside). scfm = standard cubic feet per minute.

US

Ammonia

Valve Sizing and Selection

Step 1: Use the formula below, per ANSI/ASHRAE 15-1994, "Safety Code for Mechanical Refrigeration" to calculate the minimum required discharge capacity in pounds of air per minute.

When selecting a dual pressure-relief valve system, be aware that each individual valve must have sufficient capacity to protect the vessel.

$$C = fDL$$

C = minimum required discharge capacity of the relief device in pounds of air per minute.
f = factor for ammonia refrigerant 0.5**.
D = outside diameter of vessel in feet.
L = length of vessel in feet.

** This factor is not suitable when combustible materials are within 20 feet of the pressure vessel; refer to relevant codes for corrected sizing method.

Example: To determine the minimum required capacity of a relief valve for a vessel that measures 16 feet in length and 6 feet in outside diameter, the equation would be as follows: 0.5 x 6 x 16 = 48 lb/min air.

Step2: Determine the pressure setting needed. This should be at or below the design pressure of the vessel. The relief setting should also be at least 25% above the maximum expected operating pressure to avoid weeping of relief valves. The setting may be below (never above) the design pressure of the vessel, but it is sometimes best to match vessel design pressure and relief setting to minimize the likelihood of ammonia discharge.

Step 3: Refer to valve capacity ratings above and select the valve with the required capacity (C) at the desired pressure setting.

Sizing Relief Valves with Rupture Discs

When a rupture disc is installed with a pressure-relief valve, the stamped capacity of the pressure-relief valve must be multiplied by .9 (90%) per ASME B & PV Code.

Pulse Width Valves

¾" to 2" Port Size
Type PWV

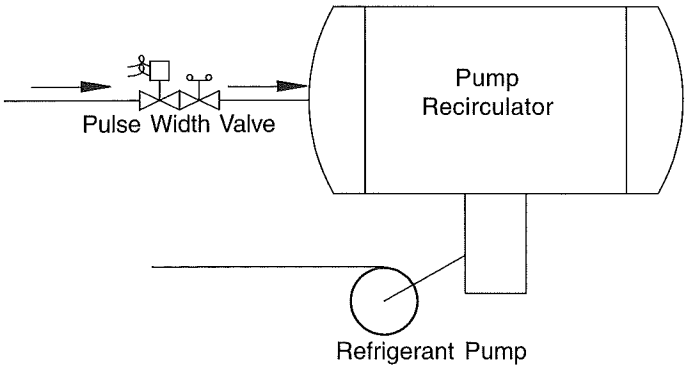
Liquid Make Up Capacities (Tons Ammonia)

Cat No.	Size	Turns Open				
		2	**3**	**4**	**5**	**6**
PWV1	¾"	12	28	52	80	114
PWV2	1"	17	35	68	125	188
PWV3	1¼"	17	52	114	229	331
PWV5	2"	228	428	628	828	1027

Notes: Based on +86°F condensing temperature and 50 psi pressure drop across the valve.

Recommended Inlet Line Size

Line Size	Tons Ammonia
¾"	40
1"	80
1 ¼"	175
1 ½"	270
2"	620
2 ½"	900
3"	1700



Ammonia Capacities
Metric Units

Solenoid Valves

20 mm to 150 mm Port Size
Type HS4A, HS4W

Suction Line Valve Capacities (kW Ammonia)

Evap. Temp. °C	Pressure Drop Across Valve (bar)	HS4A								HS4W	
		Port Size (mm)									
		20	25	32	40	50	65	80	100	125	150
10	0.15	50	91	127	272	363	599	807	1,288	1,895	3,237
	0.20	57	104	146	313	417	689	928	1,481	2,180	3,724
	0.40	80	145	203	436	581	959	1,293	2,063	3,037	5,188
5	0.15	45	82	115	247	330	544	734	1,171	1,723	2,943
	0.20	52	95	133	284	379	625	843	1,346	1,981	3,383
	0.40	72	132	184	395	526	869	1,171	1,869	2,751	4,699
0	0.15	41	75	105	224	299	493	665	1,060	1,561	2,666
	0.20	47	86	120	257	343	566	763	1,218	1,793	3,062
	0.40	65	119	166	356	475	783	1,056	1,685	2,480	4,236
–5	0.15	37	67	94	202	270	445	600	957	1,408	2,406
	0.20	43	77	108	232	309	510	688	1,098	1,615	2,759
	0.40	59	106	149	319	426	702	947	1,511	2,224	3,800
–10	0.15	33	61	85	182	242	399	539	859	1,265	2,161
	0.20	38	69	97	208	277	458	617	984	1,449	2,475
	0.40	52	95	133	285	379	626	844	1,347	1,983	3,387
Kv		5.5	10	14	30	41	67	90	144	209	357

Continued on next page.

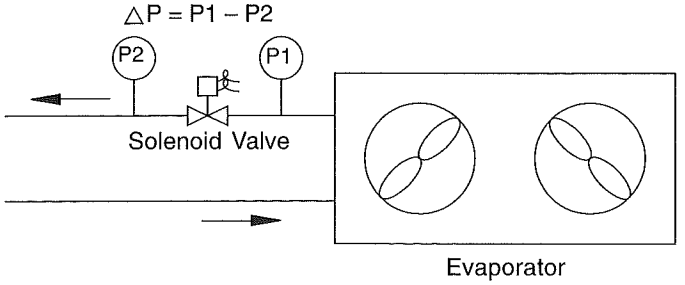
Suction Line Valve Capacities (kW Ammonia)

Evap. Temp. °C	Pressure Drop Across Valve (bar)	HS4A								HS4W	
		Port Size (mm)									
		20	25	32	40	50	65	80	100	125	150
–15	0.15	30	54	76	162	222	362	487	779	1,130	1,931
	0.20	34	62	87	185	254	414	556	890	1,292	2,207
	0.40	46	84	118	252	344	562	755	1,209	1,754	2,996
–20	0.15	26	48	67	144	197	322	432	692	1,004	1,715
	0.20	30	55	77	164	225	367	493	789	1,145	1,956
	0.40	40	74	103	221	302	493	662	1,060	1,538	2,627
–25	0.15	23	42	59	127	174	284	382	611	886	1,514
	0.20	27	48	67	145	198	323	434	694	1,007	1,720
	0.40	35	64	89	191	262	427	574	919	1,333	2,277

Suction Line Valve Capacities: Two-Stage System (kW Ammonia)

–30	0.15	24	44	61	131	179	292	392	627	911	1,555
	0.20	27	49	69	148	202	330	444	710	1,030	1,760
	0.40	35	64	90	192	262	428	576	921	1,337	2,283
–35	0.15	21	38	53	113	155	253	340	544	790	1,350
	0.20	23	42	59	127	174	285	382	612	888	1,517
	0.40	29	54	75	161	220	359	482	772	1,120	1,913
–40	0.15	18	32	45	97	133	217	292	467	677	1,157
	0.20	20	36	51	108	148	242	325	520	754	1,289
	0.40	24	44	61	131	179	292	393	628	912	1,557
Kv		5.5	10	14	30	41	67	90	144	209	357

Notes: Conditions for evaporator temperatures are based on the evaporator temperature shown and 30°C liquid. Capacity changes 3% for each 5.6°C increase or decrease in liquid temperature. Capacities for evaporator temperatures between –25°C and –40°C are based on –10°C liquid temperature. (Example: Flooded evaporator). For pressure drop across the valve less than 0.15 bar, use HS9B, HCK2, or HCK5 Gas-Powered Check Valves. For liquid overfeed evaporator suction between normal 2:1 to 5:1 rate, add 20% to the evaporator load or use the next larger port size to accomodate liquid volume accompanying the suction gas and to reduce impact velocity.



Solenoid Valves

4 mm to 150 mm Port Size
Type HS6, HS7, HS4A, HS4W

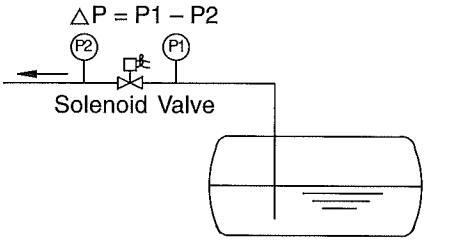
Metric

Ammonia

High Pressure Liquid Line Valve Capacities (kW Ammonia)

Pressure Drop Across Valve (bar)	HS6	HS8	HS7			HS4A								HS4W	
	Port Size (mm)														
	4	13	20	25	32	20	25	32	40	50	65	80	100	125	150
0.2	38	273	765	983	1,530	601	1,093	1,530	3,278	4,480	7,320	9,833	15,733	22,835	39,005
0.3	47	335	937	1,204	1,873	736	1,338	1,873	4,014	5,486	8,965	12,043	19,269	27,967	47,771
0.4	54	386	1,082	1,391	2,163	850	1,545	2,163	4,635	6,335	10,352	13,906	22,250	32,293	55,161
0.5	60	432	1,209	1,555	2,418	950	1,727	2,418	5,182	7,083	11,574	15,547	24,876	36,105	61,672
Kv	0.35	2.5	7	9	14	5.5	10	14	30	41	67	90	144	209	357

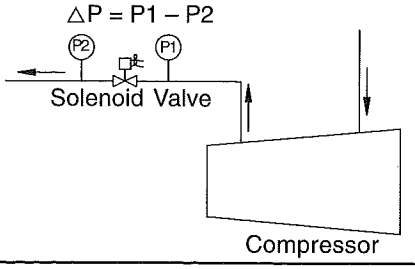
Notes: Ammonia capacities are based on +25°C liquid temperature and –10°C evaporator temperature, and no flashing through the valve.



High Pressure Discharge Line Valve Capacities (kW Ammonia)

Cond. Temp. °C	Disharge Gas Temp. °C	Pressure Drop Across Valve (bar)	HS6	HS8	HS7			HS4A								HS4W	
			Port Size (mm)														
			4	13	20	25	32	20	25	32	40	50	65	80	100	125	150
25	55	0.15	3.8	27	75	96	150	59	107	150	322	439	718	965	1,544	2,240	3,827
		0.20	4.3	31	86	111	173	68	123	173	370	506	827	1,111	1,778	2,581	4,408
		0.40	6.1	43	121	156	242	95	173	242	519	709	1,159	1,557	2,492	3,616	6,177
		0.60	7.3	52	147	189	294	115	210	294	630	861	1,407	1,890	3,023	4,388	7,496
30	60	0.15	4.0	28	79	102	159	62	113	159	340	465	760	1,021	1,633	2,370	4,049
		0.20	4.6	33	91	118	183	72	131	183	392	536	876	1,176	1,882	2,732	4,666
		0.40	6.4	46	128	165	257	101	183	257	550	752	1,229	1,650	2,641	3,833	6,547
		0.60	7.8	56	156	201	312	123	223	312	668	914	1,493	2,005	3,209	4,657	7,954
35	65	0.15	4.2	30	84	108	167	66	120	167	359	490	801	1,077	1,723	2,500	4,270
		0.20	4.8	34	97	124	193	76	138	193	414	565	924	1,241	1,986	2,882	4,923
		0.40	6.8	48	136	174	271	107	194	271	581	794	1,298	1,743	2,789	4,048	6,914
		0.60	8.2	59	165	212	330	130	236	330	707	966	1,578	2,120	3,392	4,924	8,410
Kv			0.35	2.5	7	9	14	5.5	10	14	30	41	67	90	144	209	357

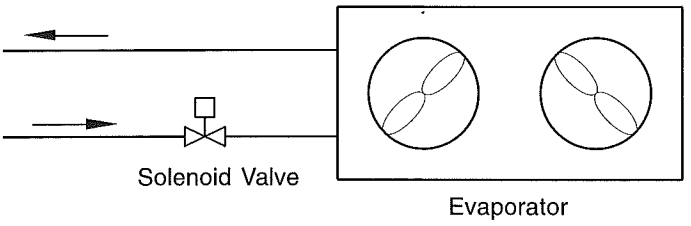
Notes: Ammonia capacities are based on condensing temperatures, discharge gas temperature shown, and –10°C evaporator pressure. For evaporator temperatures between –40°C and +10°C capacities are within 3%.



Pumped Liquid Line Valve Capacities (kW Ammonia, 4:1 Recirculation)

Pressure Drop Across Valve (bar)	HS6	HS8	HS7			HS4A								HS4W	
	Port Size														
	4	13	20	25	32	20	25	32	40	50	65	80	100	125	150
0.2	11	81	228	293	455	179	325	455	975	1,333	2,178	2,926	4,682	6,795	11,607
0.3	14	100	279	358	557	219	398	557	1,195	1,633	2,668	3,584	5,734	8,322	14,215
0.4	16	115	322	414	644	253	460	644	1,379	1,885	3,081	4,138	6,621	9,610	16,415
0.5	18	129	360	463	720	283	514	720	1,542	2,108	3,444	4,627	7,402	10,744	18,352
Kv	0.35	2.5	7	9	14	5.5	10	14	30	41	67	90	144	209	357

Notes: Ammonia capacities are based on –10°C liquid temperature and –10°C evaporator temperature. For evaporator temperatures between –40°C and +10°C capacities are within 5%. Based on 4:1 recirculation. For other recirculation rates, divide 4 by the new recirculation rate and multiply values in table to arrive at new capacity.



Pressure Regulators

20 mm to 150 mm Port Size
Type HA4A, HA4W

Metric

Ammonia

Suction Line Valve Capacities (kW Ammonia)

Evap. Temp. °C	Pressure Drop Across Valve (bar)	HA4A										HA4W	
		Port Size (mm)											
		20 @ 25%	20 @ 50%	20	25	32	40	50	65	80	100	125	150
10	0.15	12	25	50	91	127	272	372	608	816	1,306	1,895	3,237
	0.20	14	29	57	104	146	313	428	699	939	1,502	2,180	3,724
	0.40	20	40	80	145	203	436	596	974	1,308	2,092	3,037	5,188
	0.60	24	48	96	175	245	526	719	1,174	1,577	2,524	3,663	6,256
	1.00	30	60	121	219	307	658	899	1,469	1,973	3,157	4,582	7,826
	1.50	35	71	142	258	361	773	1,057	1,727	2,320	3,712	5,387	9,202
5	0.15	11	23	45	82	115	247	338	552	742	1,187	1,723	2,943
	0.20	13	26	52	95	133	284	389	635	853	1,365	1,981	3,383
	0.40	18	36	72	132	184	395	540	882	1,185	1,895	2,751	4,699
	0.60	22	44	87	158	222	475	649	1,060	1,424	2,279	3,307	5,649
	1.00	27	54	108	197	275	590	806	1,318	1,770	2,832	4,110	7,021
	1.50	32	63	126	229	321	688	940	1,536	2,063	3,300	4,790	8,182
0	0.15	10	21	41	75	105	224	306	500	672	1,075	1,561	2,666
	0.20	12	24	47	86	120	257	352	575	772	1,235	1,793	3,062
	0.40	16	33	65	119	166	356	487	795	1,068	1,709	2,480	4,236
	0.60	20	39	78	142	199	426	583	952	1,279	2,046	2,970	5,073
	1.00	24	48	96	175	245	525	718	1,173	1,576	2,522	3,660	6,253
	1.50	28	55	111	202	282	605	827	1,352	1,816	2,905	4,217	7,203
–5	0.15	9.3	19	37	67	94	202	276	451	606	970	1,408	2,406
	0.20	11	21	43	77	108	232	317	518	696	1,113	1,615	2,759
	0.40	15	29	59	106	149	319	436	713	958	1,533	2,224	3,800
	0.60	17	35	70	127	178	380	520	850	1,141	1,826	2,650	4,527
	1.00	21	43	85	155	216	464	634	1,036	1,391	2,226	3,231	5,519
	1.50	24	48	96	175	246	526	719	1,175	1,579	2,526	3,666	6,261
–10	0.15	8.3	17	33	61	85	182	248	405	545	871	1,265	2,161
	0.20	10	19	38	69	97	208	284	464	624	998	1,449	2,475
	0.40	13	26	52	95	133	285	389	636	854	1,366	1,983	3,387
	0.60	15	31	62	112	157	337	460	752	1,011	1,617	2,347	4,009
	1.00	19	37	74	135	189	405	553	904	1,214	1,943	2,820	4,817
	1.50	21	41	82	150	210	450	615	1,004	1,349	2,159	3,133	5,351
Kv		1.38	2.75	5.5	10	14	30	41	67	90	144	209	357

Continued on next page

Pressure Regulators

20 mm to 150 mm Port Size
Type HA4A, HA4W

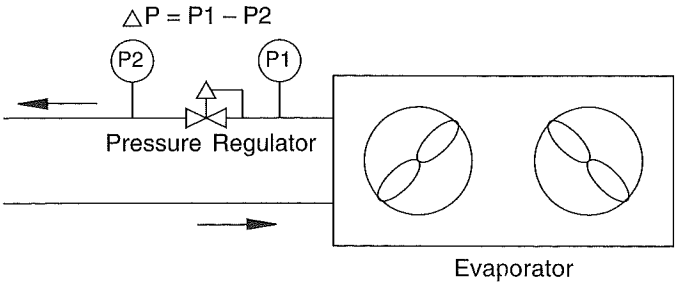
Suction Line Valve Capacities (kW Ammonia)

Evap. Temp. °C	Pressure Drop Across Valve (bar)	HA4A										HA4W	
		Port Size (mm)											
		20 @ 25%	20 @ 50%	20	25	32	40	50	65	80	100	125	150
–15	0.15	7.4	15	30	54	76	162	216	357	481	768	1,130	1,931
	0.20	8.5	17	34	62	87	185	247	408	550	878	1,292	2,207
	0.40	12	23	46	84	118	252	336	554	747	1,192	1,754	2,996
	0.60	14	27	54	98	138	295	394	650	877	1,399	2,059	3,516
	1.00	16	32	64	116	162	348	464	766	1,033	1,648	2,426	4,143
	1.50	17	34	69	125	175	375	501	826	1,114	1,777	2,616	4,468
–20	0.15	6.6	13	26	48	67	144	192	317	428	682	1,004	1,715
	0.20	7.5	15	30	55	77	164	219	362	488	778	1,145	1,956
	0.40	10	20	40	74	103	221	294	486	655	1,045	1,538	2,627
	0.60	12	23	47	85	119	256	341	563	760	1,212	1,784	3,047
–25	0.15	5.8	12	23	42	59	127	170	280	377	602	886	1,514
	0.20	6.6	13	27	48	67	145	193	318	429	684	1,007	1,720
	0.40	8.8	18	35	64	89	191	255	421	568	906	1,333	2,277
	0.60	10	20	40	73	102	218	291	480	648	1,034	1,521	2,598

Suction Line Valve Capacities: Two Stage System (kW Ammonia)

–30	0.15	6.0	12	24	44	61	131	174	288	388	619	911	1,555
	0.20	6.8	14	27	49	69	148	197	325	439	700	1,030	1,760
	0.40	9	18	35	64	90	192	256	422	569	908	1,337	2,283
–35	0.15	5.2	10	21	38	53	113	151	250	336	537	790	1,350
	0.20	5.8	12	23	42	59	127	170	280	378	603	888	1,517
	0.40	7.4	15	29	54	75	161	214	354	477	761	1,120	1,913
–40	0.15	4.5	8.9	18	32	45	97	130	214	288	460	677	1,157
	0.20	5.0	10	20	36	51	108	144	238	321	513	754	1,289
	0.40	6.0	12	24	44	61	131	174	288	388	619	912	1,557
Kv		1.38	2.75	5.5	10	14	30	41	67	90	144	209	357

Notes: Conditions: Capacities for evaporator temperatures to –25°C are based on the evaporator temperature shown and +30°C liquid. Capacity changes 3% for each 5.6°C increase or decrease in liquid temperature. Capacities for evaporator temperatures between –25°C and –40°C are based on –10°C liquid temperature. (Example: Flooded evaporator). For liquid overfeed evaporator suction between normal 2:1 to 5:1 rate, add 20% to the evaporator load or use the next larger port size to accommodate liquid volume accompanying the suction gas and to reduce impact velocity. For pressure drop across the valve less than 0.15 bar, use HS9B, HCK2, or HCK5 Gas-Powered Check Valves.



Pressure Regulators

20 mm to 150 mm Port Size
Type HA4A, HA4W

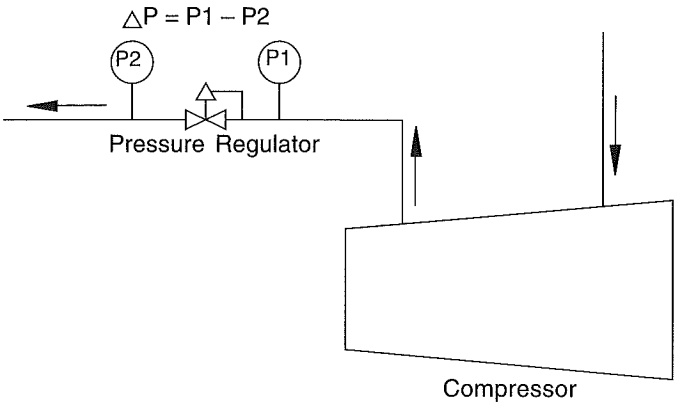
Metric

Ammonia

High Pressure Discharge Line Valve Capacities (kW Ammonia)

Cond. Temp. °C	Discharge Gas Temp. °C	Pressure Drop Across Valve (bar)	HA4A											HA4W
			Port Size (mm)											
			20 @ 25%	20 @ 50%	20	25	32	40	50	65	80	100	125	150
25	55	0.15	15	29	59	107	150	322	439	718	965	1,544	2,240	3,827
		0.20	17	34	68	123	173	370	506	827	1,111	1,778	2,581	4,408
		0.40	24	48	95	173	242	519	709	1,159	1,557	2,492	3,616	6,177
		0.60	29	58	115	210	294	630	861	1,407	1,890	3,023	4,388	7,496
		1.00	37	73	146	266	372	798	1,091	1,782	2,394	3,830	5,559	9,496
		2.00	49	99	197	358	502	1,075	1,469	2,400	3,224	5,159	7,488	12,790
30	60	0.15	16	31	62	113	159	340	465	760	1,021	1,633	2,370	4,049
		0.20	18	36	72	131	183	392	536	876	1,176	1,882	2,732	4,666
		0.40	25	50	101	183	257	550	752	1,229	1,650	2,641	3,833	6,547
		0.60	31	61	123	223	312	668	914	1,493	2,005	3,209	4,657	7,954
		1.00	39	78	156	283	396	849	1,161	1,896	2,547	4,076	5,916	10,105
		2.00	53	106	211	384	538	1,152	1,574	2,573	3,456	5,530	8,026	13,710
35	65	0.15	16	33	66	120	167	359	490	801	1,077	1,723	2,500	4,270
		0.20	19	38	76	138	193	414	565	924	1,241	1,986	2,882	4,923
		0.40	27	53	107	194	271	581	794	1,298	1,743	2,789	4,048	6,914
		0.60	32	65	130	236	330	707	966	1,578	2,120	3,392	4,924	8,410
		1.00	41	82	165	300	420	900	1,230	2,010	2,700	4,319	6,269	10,708
		2.00	56	113	225	409	573	1,228	1,678	2,743	3,684	5,895	8,556	14,615
Kv			1.38	2.75	5.5	10	14	30	41	67	90	144	209	357

Notes: Ammonia capacities are based on condensing temperatures, discharge gas temperature shown, and –10°C evaporator temperature. For evaporator temperatures between –40°C and +10°C capacities are within 3%.



Pressure Regulators

20 mm to 150 mm Port Size
Type HA4A, HA4W

High Pressure Discharge Line Valve Capacities (kg/s Ammonia)

Cond. Temp. °C	Discharge Gas Temp. °C	Pressure Drop Across Valve (bar)	HA4A										HA4W	
			Port Size (mm)											
			20 @ 25%	20 @ 50%	20	25	32	40	50	65	80	100	125	150
25	55	0.15	0.01	0.03	0.05	0.09	0.13	0.28	0.39	0.63	0.85	1.36	1.98	3.38
		0.20	0.01	0.03	0.06	0.11	0.15	0.33	0.45	0.73	0.98	1.57	2.28	3.89
		0.40	0.02	0.04	0.08	0.15	0.21	0.46	0.63	1.02	1.37	2.20	3.19	5.45
		0.60	0.03	0.05	0.10	0.19	0.26	0.56	0.76	1.24	1.67	2.67	3.87	6.62
		1.00	0.03	0.06	0.13	0.23	0.33	0.70	0.96	1.57	2.11	3.38	4.91	8.38
		2.00	0.04	0.09	0.17	0.32	0.44	0.95	1.30	2.12	2.85	4.56	6.61	11.29
30	60	0.15	0.01	0.03	0.06	0.10	0.14	0.31	0.42	0.69	0.92	1.47	2.14	3.65
		0.20	0.02	0.03	0.06	0.12	0.17	0.35	0.48	0.79	1.06	1.70	2.46	4.21
		0.40	0.02	0.05	0.09	0.17	0.23	0.50	0.68	1.11	1.49	2.38	3.46	5.91
		0.60	0.03	0.06	0.11	0.20	0.28	0.60	0.82	1.35	1.81	2.89	4.20	7.18
		1.00	0.04	0.07	0.14	0.26	0.36	0.77	1.05	1.71	2.30	3.68	5.34	9.12
		2.00	0.05	0.10	0.19	0.35	0.49	1.04	1.42	2.32	3.12	4.99	7.24	12.37
35	65	0.15	0.02	0.03	0.06	0.11	0.15	0.33	0.45	0.74	0.99	1.59	2.31	3.94
		0.20	0.02	0.03	0.07	0.13	0.18	0.38	0.52	0.85	1.14	1.83	2.66	4.54
		0.40	0.02	0.05	0.10	0.18	0.25	0.54	0.73	1.20	1.61	2.57	3.73	6.38
		0.60	0.03	0.06	0.12	0.22	0.30	0.65	0.89	1.46	1.96	3.13	4.54	7.76
		1.00	0.04	0.08	0.15	0.28	0.39	0.83	1.13	1.85	2.49	3.98	5.78	9.88
		2.00	0.05	0.10	0.21	0.38	0.53	1.13	1.55	2.53	3.40	5.44	7.89	13.48
Kv			1.38	2.75	5.5	10	14	30	41	67	90	144	209	357

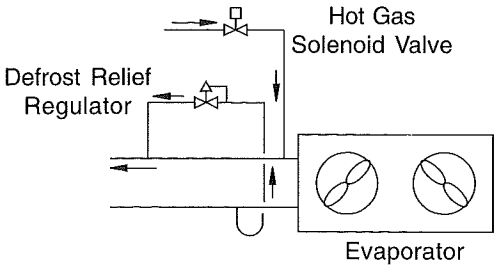
Notes: Ammonia capacities are based on condensing temperatures, inlet discharge gas temperature as shown.

20 mm to 65mm Port Size
Type HA4AK, HS4A, HA4AOS

Hot Gas Defrost Nominal Valve Sizing Capacities (Evaporator Size in kW Ammonia)

Application	Type	Port Size (mm)					
		20	25	32	40	50	65
Hot Gas Solenoid*	HS4A, HA4AOS	32 to 53	53 to 98	98 to 137	137 to 257	257 to 373	373 to 580
Defrost Relief Regulator	HA4AK	60 to 84	84 to 158	158 to 211	211 to 338	338 to 492	492 to 791

Notes: *HS4A Solenoid valve or an outlet pressure regulator with electric shut-off (HA4AOS). Evaporator tons at 5°C TD (temperature differential), valve capacities are conservative. These capacities can be modified up or down depending on the type of evaporator, temperature, mass, frost thickness, defrosting time, etc. Typical for –30°C evaporator temperature.



Pressure Regulators

20 mm to 100 mm Port Size
Type HA4AO

Metric

Ammonia

Hot Gas By-Pass Line Valve Capacities (kW Ammonia)

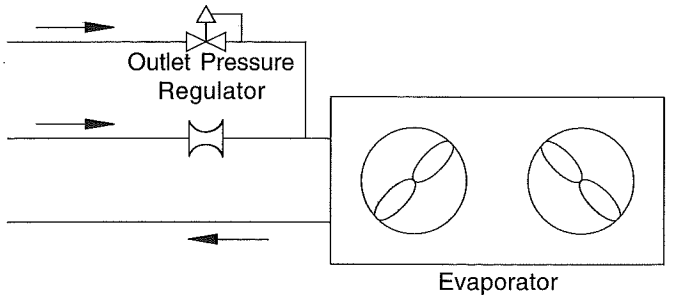
Cond. Temp °C	Discharge Gas Temp. °C	Pressure Drop Across Valve (bar)	HA4AO									
			Port Size (mm)									
			20 @ 25%	20 @ 50%	20	25	32	40	50	65	80	100
25	55	8	66	132	265	482	674	1,445	1,974	3,226	4,334	6,934
30	60	8	75	151	302	549	769	1,647	2,251	3,679	4,941	7,906
35	65	8	86	171	342	622	871	1,867	2,552	4,171	5,602	8,964
Kv			1.38	2.75	5.5	10	14	30	41	67	90	144

Notes: Ammonia capacities are based on condensing temperatures, discharge gas temperature as shown, and –10°C evaporator temperature. For evaporator temperatures between –40°C and +10°C capacities are within 3%.

Hot Gas By-Pass Line Valve Capacities (kg/s Ammonia)

Cond. Temp. °C	Discharge Gas Temp. °C	Pressure Drop Across Valve (bar)	HA4AO									
			Port Size (mm)									
			20 @ 25%	20 @ 50%	20	25	32	40	50	65	80	100
25	55	8	0.06	0.12	0.23	0.43	0.60	1.28	1.74	2.85	3.83	6.12
30	60	8	0.07	0.14	0.27	0.50	0.69	1.49	2.03	3.32	4.46	7.13
35	65	8	0.08	0.16	0.32	0.57	0.80	1.72	2.35	3.85	5.17	8.27
Kv			1.38	2.75	5.5	10	14	30	41	67	90	144

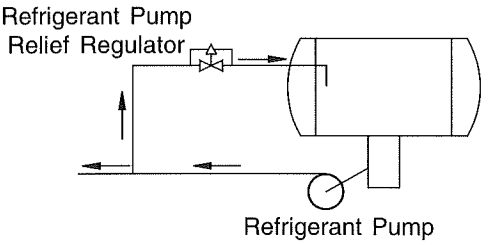
Notes: Ammonia capacities are based on condensing temperatures, and discharge gas temperatures as shown.



Refrigerant Pump Relief Line Valve Capacities (m^3/h Ammonia)

Pressure Drop across Valve (Bar)	HA4AL Port Size (mm)								
	20 @ 25%	20 @ 50%	20	25	32	40	50	65	80
0.5	1.2	2.4	4.8	8.7	12	26	36	58	78
1	1.7	3.4	6.8	12	17	37	50	82	111
1.5	2.1	4.1	8.3	15	21	45	62	101	135
2	2.4	4.8	10	17	24	52	71	116	156
2.5	2.7	5.3	11	19	27	58	80	130	175
3	2.9	5.9	12	21	30	64	87	143	192
3.5	3.2	6.3	13	23	32	69	94	154	207
4	3.4	6.8	14	25	34	74	101	165	221
Kv	1.38	2.75	5.5	10	14	30	41	67	90

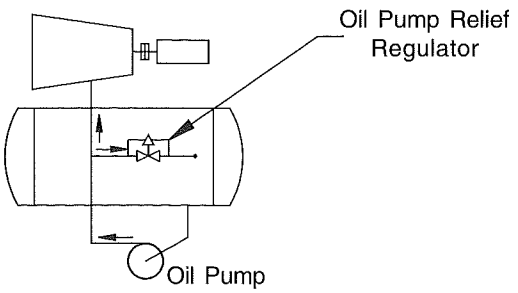
Notes: Capacities are based on –10°C liquid ammonia and no flash gas. For temperatures between –40°C and +10°C capacities are within 5%.



Oil Pump Relief Line Valve Capacities (m^3/h Oil)

Pressure Drop across Valve (Bar)	HA4AL Port Size (mm)								
	20 @ 25%	20 @ 50%	20	25	32	40	50	65	80
0.5	1.0	2.1	4.1	7.5	11	23	31	50	68
1	1.5	2.9	5.8	11	15	32	44	71	96
1.5	1.8	3.6	7.2	13	18	39	53	87	117
2	2.1	4.1	8.3	15	21	45	62	101	135
2.5	2.3	4.6	9.2	17	24	50	69	113	151
3	2.5	5.1	10	18	26	55	75	123	166
3.5	2.7	5.5	11	20	28	60	82	133	179
4	2.9	5.8	12	21	30	64	87	142	191
Kv	1.38	2.75	5.5	10	14	30	41	67	90

Notes: Capacities are based on oil with less than 300 SSU viscosity.



Gas-Powered Suction Stop Valves

32 mm to 150 mm Port Size
Type HS9B, HCK2, HCK5

Metric

Ammonia

Suction Line Valve Capacities (kW Ammonia)

Evap. Temp. °C	Pressure Drop Across Valve (bar)	Port Size (mm)							
		32	40	50	65	80	100	125	150
10	0.02	62	149	174	279	395	867	1,099	1,411
	0.04	87	210	246	394	558	1,224	1,552	1,992
	0.07	115	277	324	520	737	1,615	2,048	2,629
	0.15	169	407	477	764	1,082	2,373	3,008	3,862
5	0.02	57	138	162	259	367	805	1,020	1,310
	0.04	81	195	228	366	518	1,136	1,440	1,849
	0.07	107	257	301	483	684	1,499	1,900	2,440
	0.15	156	377	442	708	1,003	2,199	2,788	3,579
0	0.02	53	128	150	240	340	745	944	1,212
	0.04	75	180	211	339	479	1,051	1,332	1,711
	0.07	99	238	278	446	632	1,386	1,757	2,256
	0.14	144	347	406	652	923	2,023	2,565	3,292
–5	0.02	49	118	138	221	313	687	871	1,118
	0.04	69	166	195	312	442	969	1,228	1,576
	0.07	91	219	256	411	582	1,276	1,618	2,077
	0.14	131	315	369	591	837	1,835	2,327	2,987
–10	0.02	45	108	127	203	288	631	800	1,027
	0.04	63	153	179	286	405	889	1,127	1,447
	0.07	83	201	235	377	534	1,171	1,484	1,905
	0.15	120	290	339	544	770	1,688	2,140	2,748
–15	0.02	41	99	116	186	263	577	731	939
	0.04	58	139	163	262	371	813	1,030	1,323
	0.07	76	183	215	344	487	1,069	1,355	1,739
	0.15	108	260	305	489	692	1,518	1,924	2,470
–20	0.02	37	90	105	169	240	525	666	855
	0.04	53	127	148	238	337	739	937	1,203
	0.07	69	167	195	313	443	971	1,231	1,580
	0.15	98	236	276	443	627	1,375	1,744	2,239
–25	0.02	34	82	96	153	217	476	603	774
	0.04	48	115	134	215	305	669	848	1,088
	0.07	62	150	176	282	400	877	1,111	1,427
	0.15	89	215	252	404	573	1,255	1,592	2,043
–30	0.02	30	74	86	138	195	429	543	698
	0.04	43	103	121	194	274	601	763	979
	0.07	56	135	158	253	359	786	997	1,280
	0.15	80	192	225	361	511	1,120	1,420	1,823
Kv		17	41	48	77	109	239	303	389

Continued on next page.

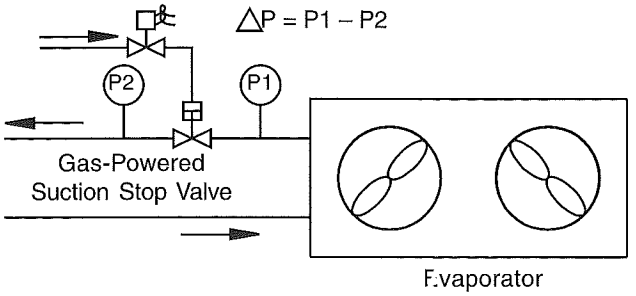
Gas-Powered Suction Stop Valves

32 mm to 150 mm Port Size
Type HS9B, HCK2, HCK5

Suction Line Valve Capacities (kW Ammonia)

Evap. Temp. °C	Pressure Drop Across Valve (bar)	Port Size (mm)							
		32	40	50	65	80	100	125	150
–35	0.02	27	64	76	122	174	379	482	619
	0.04	38	90	106	171	243	531	675	866
	0.07	50	117	138	223	317	692	880	1,129
	0.15	70	164	193	312	443	969	1,232	1,580
–40	0.02	24	57	67	109	154	337	429	550
	0.04	34	80	94	152	216	471	599	768
	0.07	44	104	122	197	280	611	777	997
	0.15	60	142	167	269	383	836	1,063	1,364
–45	0.02	21	51	59	96	136	298	379	486
	0.04	30	70	83	133	190	414	527	676
	0.07	38	90	106	172	244	534	679	871
	0.15	53	124	146	236	335	732	931	1,195
–50	0.02	19	44	52	84	119	261	332	426
	0.04	26	61	72	116	165	361	459	589
	0.07	33	78	92	148	211	461	586	751
	0.15	44	103	121	195	277	606	770	989
–55	0.02	16	38	45	73	104	226	288	369
	0.04	22	53	62	100	142	310	394	506
	0.07	28	66	78	126	179	391	497	637
	0.15	36	84	99	159	227	495	630	808
–60	0.02	14	33	39	63	89	194	247	317
	0.04	19	45	52	85	120	263	334	429
	0.07	23	55	65	104	148	324	412	529
	0.15	27	65	76	123	175	382	485	623
Kv		17	41	48	77	109	239	303	389

Notes: For liquid overfeed systems, nominal 2:1 to 5:1 ratio, add 20% to the evaporator load and select a valve based on the increased load. For gravity flooded application, the valve should be the same port size as properly sized liquid leg or gas line. Above capacities are based on liquid temperature equal to evaporator temperature.



In-Line Check Valves

16 mm to 100 mm Port Size
Type HCK4

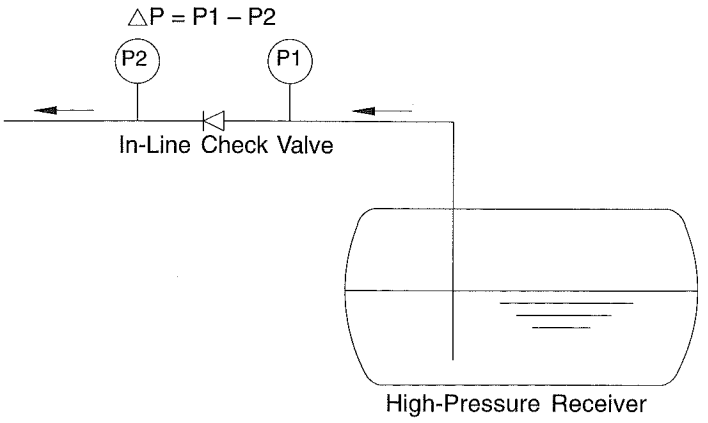
Metric

Ammonia

High Pressure Liquid Line Valve Capacities (kW Ammonia)

Pressure Drop Across Valve (bar)	HCK4 Port Size (mm)								
	16	20	25	32	40	50	65	80	100
0.07	323	452	646	776	2,198	2,779	4,137	5,171	11,764
0.15	473	662	946	1,135	3,217	4,069	6,056	7,570	17,221
0.20	546	765	1,093	1,311	3,715	4,698	6,992	8,741	19,885
0.30	669	937	1,338	1,606	4,550	5,754	8,564	10,705	24,354
0.40	773	1,082	1,545	1,854	5,253	6,644	9,889	12,361	28,121
0.50	864	1,209	1,727	2,073	5,873	7,428	11,056	13,820	31,440
Kv	5	7	10	12	34	43	64	80	182

Notes: Ammonia capacities are based on +25°C liquid temperature and –10°C evaporator temperature and no flashing through the valve.



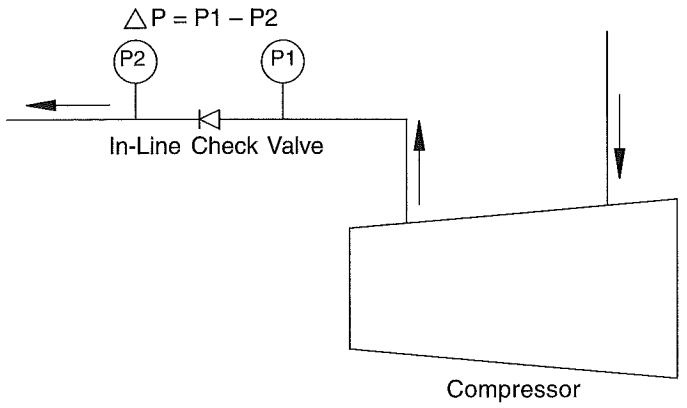
In-Line Check Valves

16 mm to 100 mm Port Size
Type HCK4

High Pressure Discharge Line Valve Capacities (kW Ammonia)

Cond. Temp. °C	Discharge Gas Temp. °C	Pressure Drop Across Valve (bar)	HCK4 Port Size (mm)								
			16	20	25	32	40	50	65	80	100
25	55	0.07*	37	51	73	88	250	316	470	588	1,338
		0.15	54	75	107	129	364	461	686	858	1,951
		0.20	62	86	123	148	420	531	790	988	2,247
		0.40	87	121	173	208	588	744	1,107	1,384	3,149
30	60	0.07*	39	54	78	93	264	334	497	622	1,414
		0.15	57	79	113	136	386	488	726	907	2,064
		0.20	65	91	131	157	444	562	836	1,046	2,379
		0.40	92	128	183	220	623	789	1,174	1,467	3,338
35	65	0.07*	41	57	82	98	279	352	524	656	1,491
		0.15	60	84	120	144	407	514	766	957	2,177
		0.20	69	97	138	165	469	593	883	1,103	2,510
		0.40	97	136	194	232	659	833	1,240	1,549	3,525
Kv			5	7	10	12	34	43	64	80	182

Notes: Ammonia capacities are based on condensing temperatures, discharge gas temperatures as shown, and -10°C evaporator temperature. For evaporator temperatures between –40°C and +10°C, capacities are within 3%. *When sizing in-line check valves for compressor discharge, a minimum of .07 bar pressure drop at minimum compressor capacity (fully unloaded) must be maintained. Use piston type HCK1 for applications where pressure drop is less than 0.07 bar.



In-Line Check Valves

16 mm to 100 mm Port Size
Type HCK4

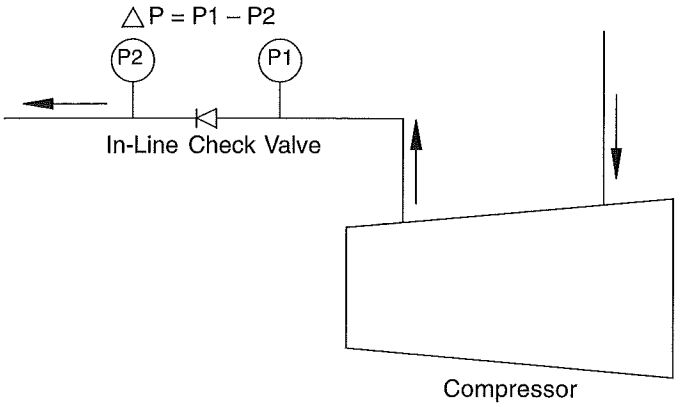
Metric

Ammonia

High Pressure Discharge Line Valve Capacities (kg/s Ammonia)

Cond. Temp. °C	Discharge Gas Temp. °C	Pressure Drop Across Valve (bar)	HCK4 Port Size (mm)								
			16	20	25	32	40	50	65	80	100
25	55	0.07*	0.03	0.05	0.06	0.08	0.22	0.28	0.42	0.52	1.18
		0.15	0.05	0.07	0.09	0.11	0.32	0.41	0.61	0.76	1.72
		0.20	0.05	0.08	0.11	0.13	0.37	0.47	0.70	0.87	1.98
		0.40	0.08	0.11	0.15	0.18	0.52	0.66	0.98	1.22	2.78
30	60	0.07*	0.04	0.05	0.07	0.08	0.24	0.30	0.45	0.56	1.28
		0.15	0.05	0.07	0.10	0.12	0.35	0.44	0.65	0.82	1.86
		0.20	0.06	0.08	0.12	0.14	0.40	0.51	0.75	0.94	2.15
		0.40	0.08	0.12	0.17	0.20	0.56	0.71	1.06	1.32	3.01
35	65	0.07*	0.04	0.05	0.08	0.09	0.26	0.33	0.48	0.60	1.38
		0.15	0.06	0.08	0.11	0.13	0.38	0.47	0.71	0.88	2.01
		0.20	0.06	0.09	0.13	0.15	0.43	0.55	0.81	1.02	2.32
		0.40	0.09	0.13	0.18	0.21	0.61	0.77	1.14	1.43	3.25
Kv			5	7	10	12	34	43	64	80	182

Notes: Ammonia capacities are based on condensing temperatures, and dishcharge gas temperature as shown. *When sizing in-line check valves for compressor discharge, a minimum of 0.07 bar pressure drop at minimum compressor capacity (fully unloaded) must be maintained. Use piston type HCK1 for applications where pressure drop is less than 0.07 bar.



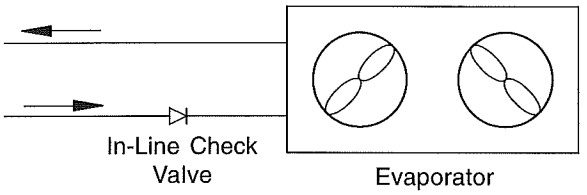
In-Line Check Valves

16 mm to 100 mm Port Size
Type HCK4

Pumped Liquid Line Valve Capacities (kW Ammonia, 4:1 Recirculation)

Pressure Drop Across Valve (bar)	HCK4								
	Port Size (mm)								
	16	20	25	32	40	50	65	80	100
0.07	96	135	192	231	654	827	1,231	1,539	3,501
0.15	141	197	282	338	957	1,211	1,802	2,253	5,124
0.20	163	228	325	390	1,105	1,398	2,081	2,601	5,917
0.30	199	279	398	478	1,354	1,712	2,548	3,186	7,247
0.40	230	322	460	552	1,563	1,977	2,943	3,678	8,368
0.50	257	360	514	617	1,748	2,210	3,290	4,112	9,356
Kv	5	7	10	12	34	43	64	80	182

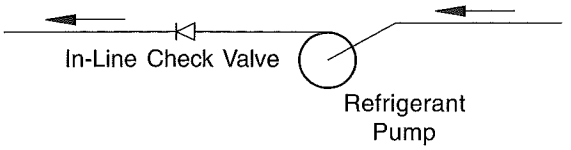
Notes: Ammonia capacities are based on –10°C pumped liquid temperature and –10°C evaporator temperture. For evaporator temperatures between –40°C and +10°C capacities are within 5%. Based on 4:1 recirculation. For other recirculation rates, divide 4 by the new recirculation rate and multiply values shown in table to arrive at new capacity.



Pump Discharge Liquid Line Valve Capacities (m^3/h Ammonia)

Pressure Drop Across Valve (bar)	HCK4								
	Port Size (mm)								
	16	20	25	32	40	50	65	80	100
0.07	1.6	2.3	3.3	3.9	11	14	21	26	59
0.15	2.4	3.3	4.8	5.7	16	20	30	38	87
0.20	2.7	3.8	5.5	6.6	19	24	35	44	100
0.30	3.4	4.7	6.7	8.1	23	29	43	54	123
0.40	3.9	5.4	7.8	9.3	26	33	50	62	141
0.50	4.3	6.1	8.7	10	30	37	56	70	158
Kv	5	7	10	12	34	43	64	80	182

Notes: Ammonia capacities are based on –10°C pumped liquid temperature and –10°C evaporator temperature. For evaporator temperatures between –40°C and +10°C capacities are within 5%.



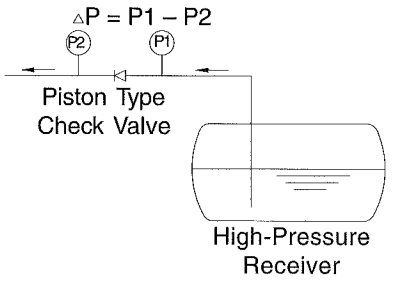
Piston Type Check Valves

20 mm to 150 mm Port Size
Type HCK1, HCK1W

High Pressure Liquid Line Valve Capacities (kW Ammonia)

Pressure Drop Across Valve (bar)	HCK1								HCK1 W	
	Port Size (mm)									
	20	25	32	40	50	65	80	100	125	150
0.07	452	582	905	2,650	3,103	4,977	7,045	15,448	19,585	25,144
0.15	662	852	1,325	3,879	4,542	7,286	10,313	22,614	28,670	36,807
0.20	765	983	1,530	4,480	5,244	8,413	11,909	26,112	33,105	42,501
0.30	937	1,204	1,873	5,486	6,423	10,303	14,585	31,981	40,545	52,053
0.40	1,082	1,391	2,163	6,335	7,417	11,897	16,842	36,928	46,817	60,105
0.50	1,209	1,555	2,418	7,083	8,292	13,302	18,830	41,287	52,343	67,200
Kv	7	9	14	41	48	77	109	239	303	389

Notes: Ammonia capacities are based on +25°C liquid temperature and –10°C evaporator temperature.

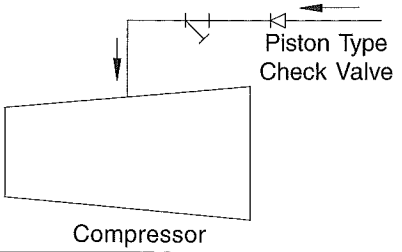


20 mm to 80 mm Port Size
Type HCK1

Compressor Side Port Suction Line Capacities (kW Ammonia)

Economizer Temp. °C	Pressure Drop Across Valve (bar)	HCK1						
		Port Size						
		20	25	32	40	50	65	80
5	0.07	40	51	79	233	272	437	618
	0.15	58	74	115	338	396	635	899
	0.20	66	85	133	389	455	730	1,033
	0.40	92	118	184	540	632	1,013	1,435
–5	0.07	33	42	65	191	223	358	507
	0.15	47	61	94	276	323	519	734
	0.20	54	70	108	317	371	595	843
	0.40	75	96	149	436	511	820	1,160
–15	0.07	26	34	53	154	180	289	409
	0.15	38	49	76	222	260	416	590
	0.20	43	56	87	254	297	476	674
	0.40	59	76	118	344	403	646	915
Kv		7	9	14	41	48	77	109

Notes: Ammonia capacities are based on +30°C condensing temperature and economizer temperatures as shown.



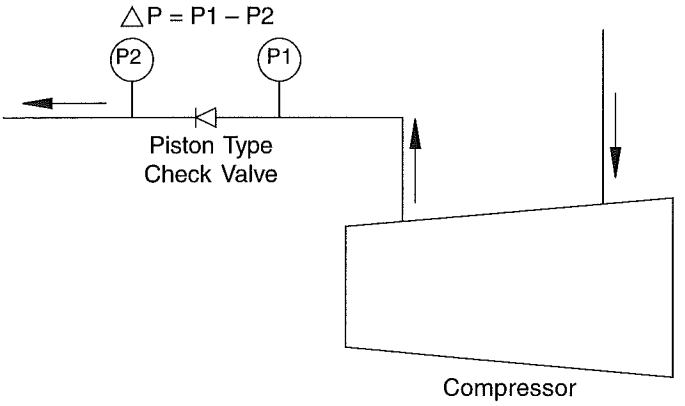
Piston Type Check Valves

20 mm to 150 mm Port Size
Type HCK1, HCK1W

High Pressure Discharge Line Valve Capacities (kW Ammonia)

Cond. Temp. °C	Discharge Gas Temp. °C	Pressure Drop Across Valve (bar)	Port Size (mm)									
			HCK1								HCK1 W	
			20	25	32	40	50	65	80	100	125	150
25	55	0.07	51	66	103	301	353	566	801	1,756	2,227	2,859
		0.15	76	97	152	444	520	833	1,180	2,587	3,280	4,211
		0.20	86	111	173	506	593	951	1,346	2,951	3,742	4,804
		0.40	121	156	242	709	831	1,332	1,886	4,136	5,243	6,731
30	60	0.07	54	70	109	319	373	598	847	1,857	2,355	3,023
		0.15	79	101	158	462	541	867	1,228	2,693	3,414	4,383
		0.20	91	118	183	536	627	1,006	1,425	3,124	3,960	5,084
		0.40	128	165	257	752	880	1,412	1,999	4,383	5,556	7,134
35	65	0.07	57	74	115	336	393	631	893	1,958	2,483	3,187
		0.15	83	107	167	489	572	918	1,300	2,849	3,613	4,638
		0.20	97	124	193	565	662	1,062	1,503	3,296	4,178	5,364
		0.40	136	174	271	794	930	1,491	2,111	4,629	5,869	7,534
Kv			7	9	14	41	48	77	109	239	303	389

Notes: Ammonia capacities are based on condensing temperatures, discharge gas temperatures as shown, and –10°C evaporator temperature. For evaporator temperatures between –40°C and +10°C capacities are within 3%.



Piston Type Check Valves

20 mm to 150 mm Port Size
Type HCK1, HCK1W

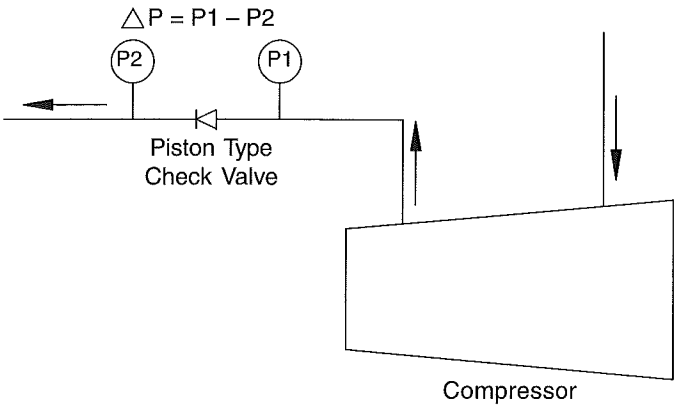
Metric

Ammonia

High Pressure Discharge Line Valve Capacities (kg/s Ammonia)

Cond. Temp. °C	Discharge Gas Temp. °C	Pressure Drop Across Valve (bar)	Port Size (mm)									
			HCK1								HCK1 W	
			20	25	32	40	50	65	80	100	125	150
25	55	0.07	0.05	0.06	0.09	0.27	0.31	0.50	0.71	1.55	1.97	2.52
		0.15	0.07	0.09	0.13	0.39	0.46	0.74	1.04	2.28	2.90	3.72
		0.20	0.08	0.10	0.15	0.45	0.52	0.84	1.19	2.61	3.30	4.24
		0.40	0.11	0.14	0.21	0.63	0.73	1.18	1.67	3.65	4.63	5.94
30	60	0.07	0.05	0.06	0.10	0.29	0.34	0.54	0.76	1.68	2.12	2.73
		0.15	0.07	0.09	0.14	0.42	0.49	0.78	1.11	2.43	3.08	3.95
		0.20	0.08	0.11	0.17	0.48	0.57	0.91	1.29	2.82	3.57	4.59
		0.40	0.12	0.15	0.23	0.68	0.79	1.27	1.80	3.95	5.01	6.44
35	65	0.07	0.05	0.07	0.11	0.31	0.36	0.58	0.82	1.81	2.29	2.94
		0.15	0.08	0.10	0.15	0.45	0.53	0.85	1.20	2.63	3.33	4.28
		0.20	0.09	0.11	0.18	0.52	0.61	0.98	1.39	3.04	3.85	4.95
		0.40	0.13	0.16	0.25	0.73	0.86	1.38	1.95	4.27	5.41	6.95
Kv			7	9	14	41	48	77	109	239	303	389

Notes: Ammonia capacities are based on condensing temperatures, and discharge gas temperatures as shown.



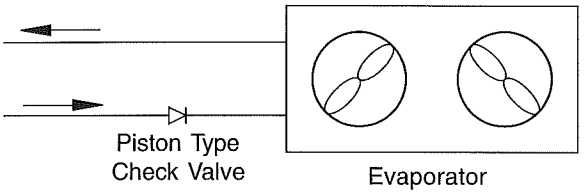
Piston Type Check Valves

20 mm to 150 mm Port Size
Type HCK1, HCK1W

Pumped Liquid Line Valve Capacities (kW Ammonia: 4:1 Recirculation)

Pressure Drop Across Valve (bar)	HCK1								HCK1 W	
	Port Size (mm)									
	20	25	32	40	50	65	80	100	125	150
0.07	135	173	269	789	923	1,481	2,097	4,597	5,828	7,482
0.15	197	253	394	1,154	1,352	2,168	3,069	6,729	8,531	10,953
0.20	228	293	455	1,333	1,561	2,503	3,544	7,770	9,851	12,647
0.30	279	358	557	1,633	1,911	3,066	4,340	9,517	12,065	15,490
0.40	322	414	644	1,885	2,207	3,540	5,012	10,989	13,932	17,886
0.50	360	463	720	2,108	2,467	3,958	5,603	12,286	15,576	19,997
Kv	7	9	14	41	48	77	109	239	303	389

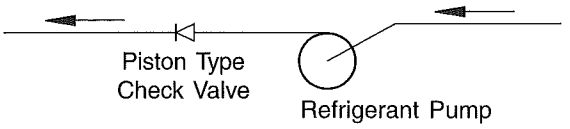
Notes: Ammonia capacities are based on –10°C liquid temperature and –10°C evaporator temperature. For evaporator temperatures between –40°C and +10°C capacities are within 5%. Based on 4:1 recirculation. For other recirculation rates, divide 4 by the new recirculation rate and multiply values shown in table to arrive at new capacity.



Pump Discharge Liquid Line Valve Capacities (m^3/h Ammonia)

Pressure Drop Across Valve (bar)	HCK1								HCK1 W	
	Port Size (mm)									
	20	25	32	40	50	65	80	100	125	150
0.07	2.3	2.9	4.6	13	16	25	35	78	99	126
0.15	3.3	4.3	6.7	20	23	37	52	114	144	185
0.20	3.8	4.9	7.7	23	26	42	60	131	167	214
0.30	4.7	6.1	9.4	28	32	52	73	161	204	262
0.40	5.4	7.0	11	32	37	60	85	186	236	302
0.50	6.1	7.8	12	36	42	67	95	208	263	338
Kv	7	9	14	41	48	77	109	239	303	389

Notes: Ammonia capacities are based on –10°C liquid temperature and –10°C evaporator temperature. For evaporator temperatures between –40°C and +10°C capacities are within 5%.



Combination Stop/Check Valves

32 mm to 150 mm Port Size
Type SCK

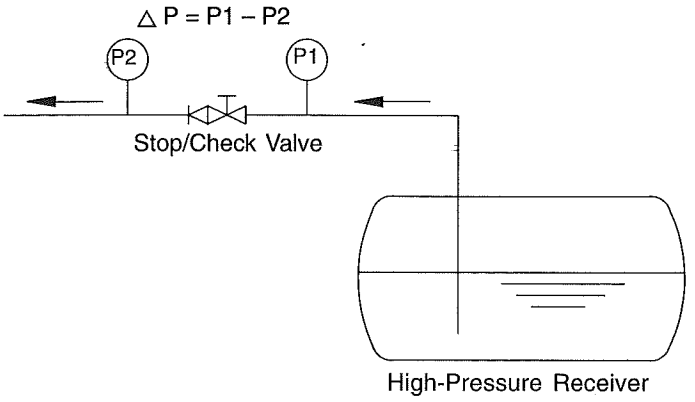
Metric

Ammonia

High Pressure Discharge Line Valve Capacities (kW Ammonia)

Pressure Drop Across Valve (bar)	SCK							
	Port Size (mm)							
	32	40	50	65	80	100	125	150
0.07	2,348	2,796	4,641	7,821	11,462	17,332	33,547	45,847
0.15	3,438	4,092	6,793	11,449	16,778	25,372	49,107	67,113
0.20	3,969	4,725	7,844	13,220	19,374	29,297	56,704	77,496
0.30	4,861	5,787	9,607	16,191	23,728	35,882	69,448	94,912
0.40	5,613	6,683	11,093	18,696	27,399	41,432	80,192	109,595
0.50	6,276	7,471	12,403	20,903	30,633	46,323	89,657	122,531
Kv	36	43	72	121	177	268	519	709

Notes: Ammonia capacities are based on +25°C liquid temperature, –10°C evaporator temperature, and no flashing through the valve.



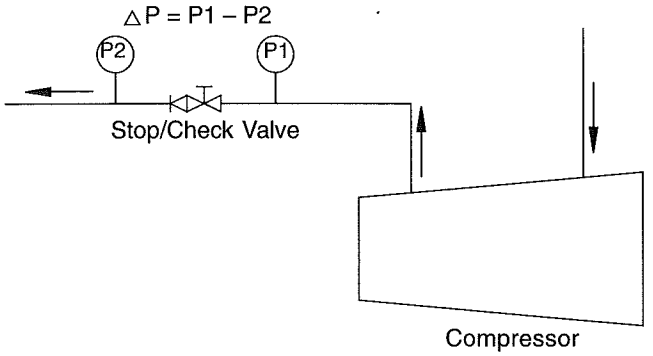
Combination Stop/Check Valves

32 mm to 150 mm Port Size
Type SCK

High Pressure Discharge Line Valve Capacities (kW Ammonia)

Cond. Temp. °C	Discharge Gas Temp. °C	Pressure Drop Across Valve (bar)	SCK							
			Port Size (mm)							
			32	40	50	65	80	100	125	150
25	55	0.07	265	316	529	889	1,301	1,970	3,814	5,211
		0.15	386	461	772	1,297	1,897	2,873	5,563	7,600
		0.20	445	531	889	1,494	2,186	3,309	6,409	8,755
		0.40	623	744	1,246	2,094	3,063	4,637	8,980	12,268
30	60	0.07	280	334	560	940	1,376	2,083	4,034	5,510
		0.15	408	488	817	1,372	2,007	3,039	5,886	8,041
		0.20	471	562	941	1,581	2,313	3,503	6,783	9,267
		0.40	660	789	1,320	2,219	3,246	4,915	9,518	13,002
35	65	0.07	295	352	590	991	1,450	2,196	4,253	5,809
		0.15	431	514	861	1,447	2,117	3,206	6,208	8,481
		0.20	496	593	993	1,668	2,441	3,695	7,157	9,776
		0.40	697	833	1,395	2,344	3,428	5,191	10,052	13,732
Kv			36	43	72	121	177	268	519	709

Notes: Ammonia capacities are based on condensing temperatures, discharge gas temperature as shown, and –10°C evaporator temperature. For evaporator temperatures between –40°C and +10°C, capacities are within 3%. When sizing stop/check valves for compressor discharge, a minimum of 0.07 bar pressure drop at minimum compressor capacity (fully unloaded) must be maintained. Use piston type HCK1 for applications where pressure drop is less than 0.07 bar.



Combination Stop/Check Valves

32 mm to 150 mm Port Size
Type SCK

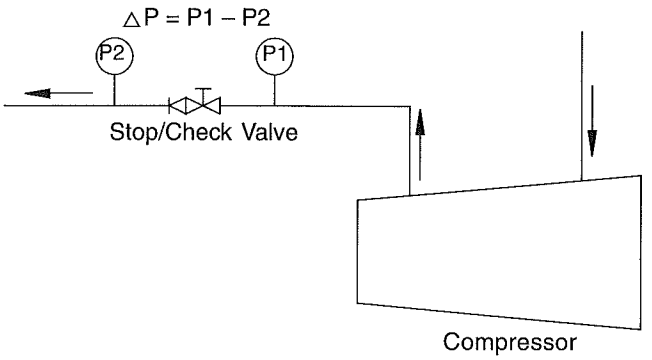
Metric

Ammonia

High Pressure Discharge Line Valve Capacities (kg/s Ammonia)

Cond. Temp. °C	Discharge Gas Temp. °C	Pressure Drop Across Valve (bar)	SCK							
			Port Size (mm)							
			32	40	50	65	80	100	125	150
25	55	0.07	0.23	0.28	0.47	0.79	1.15	1.74	3.37	4.60
		0.15	0.34	0.41	0.68	1.15	1.68	2.54	4.91	6.71
		0.20	0.39	0.47	0.79	1.32	1.93	2.92	5.66	7.73
		0.40	0.55	0.66	1.10	1.85	2.70	4.09	7.93	10.83
30	60	0.07	0.25	0.30	0.50	0.85	1.24	1.88	3.64	4.97
		0.15	0.37	0.44	0.74	1.24	1.81	2.74	5.31	7.25
		0.20	0.42	0.51	0.85	1.43	2.09	3.16	6.12	8.36
		0.40	0.60	0.71	1.19	2.00	2.93	4.43	8.59	11.73
35	65	0.07	0.27	0.33	0.54	0.91	1.34	2.03	3.92	5.36
		0.15	0.40	0.47	0.79	1.34	1.95	2.96	5.73	7.82
		0.20	0.46	0.55	0.92	1.54	2.25	3.41	6.60	9.02
		0.40	0.64	0.77	1.29	2.16	3.16	4.79	9.27	12.67
Kv			36	43	72	121	177	268	519	709

Notes: Ammonia capacities are based on condensing temperatures, and discharge gas temperatures as shown. When sizing stop/check valves for compressor discharge, a minimum of 0.07 bar pressure drop at minimum compressor capacity (fully unloaded) must be maintained. Use piston type HCK1 for applications where pressure drop is less than 0.07 bar.



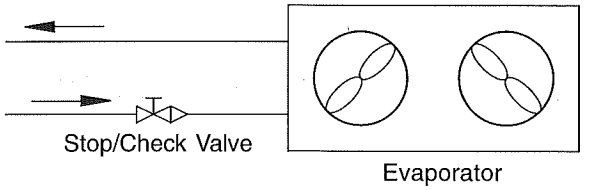
Combination Stop/Check Valves

32 mm to 150 mm Port Size
Type SCK

Pumped Liquid Line Valve Capacities (kW Ammonia, 4:1 Recirculation)

Pressure Drop Across Valve (bar)	SCK Port Size (mm)							
	32	40	50	65	80	100	125	150
0.07	699	832	1,381	2,327	3,411	5,158	9,983	13,643
0.15	1,023	1,218	2,021	3,407	4,993	7,550	14,613	19,971
0.20	1,181	1,406	2,334	3,934	5,765	8,718	16,874	23,061
0.30	1,447	1,722	2,859	4,818	7,061	10,677	20,666	28,244
0.40	1,670	1,989	3,301	5,563	8,153	12,329	23,863	32,613
0.50	1,868	2,223	3,691	6,220	9,116	13,785	26,680	36,462
Kv	36	43	72	121	177	268	519	709

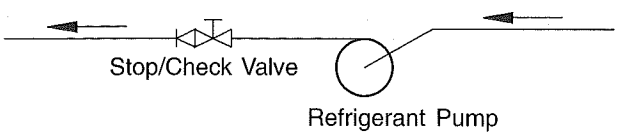
Notes: Ammonia capacities are based on –10°C liquid temperature and –10°C evaporator temperature. For evaporator temperatures between –40°C and +10°C capacities are within 5%. Based on 4:1 recirculation. For other recirculation rates, divide 4 by the new recirculation rate and multiply values shown in table to arrive at new capacity.



Pump Discharge Liquid Line Valve Capacities (m^3/h Ammonia)

Pressure Drop Across Valve (bar)	SCK Port Size (mm)							
	32	40	50	65	80	100	125	150
0.07	12	14	23	39	58	87	169	231
0.15	17	21	34	58	84	128	247	338
0.20	20	24	39	67	97	147	285	390
0.30	24	29	48	81	119	181	349	477
0.40	28	34	56	94	138	208	403	551
0.50	32	38	62	105	154	233	451	616
Kv	36	43	72	121	177	268	519	709

Notes: Ammonia capacities are based on –10°C liquid temperature and –10°C evaporator temperature. For evaporator temperatures between –40°C and +10°C capacities are within 5%.



Shut-Off Valves

13 mm to 65 mm Port Size
Type AS, GS

Metric

Ammonia

Economic Line Sizing/Capacity Table (kW Ammonia)

Service	Conditions		Type AS, GS						
	Temp. °C	Pressure (bar)	Port Size						
			13 mm	20 mm	25 mm	32 mm	40 mm	50 mm	65 mm
Suction Lines	–6.7	2.3	—	—	30	56	75	126	180
Single Stage Compressor	–17.8	1.1	—	—	20	37	49	80	120
Suction Lines	–28.9	0.2	—	—	15	26	36	59	87
Booster	–40	–0.3	—	—	—	15	22	35	51
Liquid	–6.7	2.3	—	—	18	32	43	73	103
Overfeed	–17.8	1.1	—	—	12	22	30	48	72
Return	–28.9	0.2	—	—	8	14	19	31	46
Lines (4x)	–40	–0.3	—	—	—	8	12	19	28
Hot Gas Feed	+21.1	7.9	8	15	26	50	69	128	187
Hot Gas Main	+21.1	7.9	15	30	52	99	138	257	373
Compressor Discharge	+30	10.7	—	—	44	85	118	220	318
Condenser Drains	+30	—	21	51	84	176	271	493	774
Liquid Mains	+30	—	100	187	320	503	711	1598	2313
Liquid Feed Branch	+30	—	193	363	620	975	1380	3101	4481
Liquid Overfeed Supply (4x)	–12.2	—	32	60	102	162	229	507	732

Threaded Shut-Off Valve Flow Coefficients (13 mm to 32 mm)

Size	13 mm	20 mm	25 mm	32 mm
Kv Angle	7.8	8.7	22.5	26.0
Kv Globe	5.2	6.1	15.6	18.2

Socket Weld Shut-Off Valve Flow Coefficients (13 mm to 65 mm)

Size	13 mm	20 mm	25 mm	32 mm	40 mm	50 mm	65 mm
Kv Angle	5.2	7.8	22.5	26	45.9	69.2	149.7
Kv Globe	3.5	6.9	15.6	18.2	35.5	58	141

Shut-off (stop) valves are nearly always sized on the line size determined by the system designer. Angle type shut-off valves have lower pressure drop than globe valves. Whenever possible, good engineering practice is to use angle valves in order to reduce pressure drop and also reduce cost.

Shut-Off Valves

80 mm to 400 mm Port Size
Type AW, GW, EW, DW

Economic Line Sizing/Capacity Table (kW Ammonia)

Service	Conditions		Type AW, GW, EW, DW								
	Temp. °C	Pressure (bar)	Port Size								
			80 mm	100 mm	125 mm	150 mm	200 mm	250 mm	300 mm	350 mm	400 mm
Suction Lines	–6.7	2.3	289	514	827	1207	2211	3590	5245	6410	8131
Single Stage Compressor	–17.8	1.1	190	333	549	792	1457	2330	3330	4069	5928
Suction Lines	–28.9	0.2	141	243	401	581	1077	1711	2496	3052	4090
Booster	–40	–0.3	81	144	235	344	637	1014	1475	1802	2436
Liquid	–6.7	2.3	165	297	475	697	1274	2066	3013	3682	4428
Overfeed	–17.8	1.1	113	200	330	475	876	1401	1999	2443	3323
Return	–28.9	0.2	74	128	213	308	570	901	1320	1612	2161
Lines (4x)	–40	–0.3	46	79	129	189	352	556	817	1000	1341
Hot Gas Feed	+21.1	7.9	292	510	813	1190	2094	3340	4847	5924	—
Hot Gas Main	+21.1	7.9	581	1021	1630	2369	4189	6681	9694	11848	—
Compressor Discharge	+30	10.7	500	876	1397	2042	3594	5734	8318	10166	13668
Condenser Drains	+30	—	1320	2605	4646	7146	14784	—	—	—	—
Liquid Mains	+30	—	3629	6364	10159	14847	—	—	—	—	—
Liquid Feed Branch	+30	—	7036	12341	19698	28790	—	—	—	—	—
Liquid Overfeed Supply (4x)	–12.2	—	1151	2017	3221	4706	—	—	—	—	—

Butt-Weld Shut-Off Valve Flow Coefficients (80 mm to 400 mm)

Size	80 mm	100 mm	125 mm	150 mm	200 mm	250 mm	300 mm	350 mm	400 mm
Kv Angle	177	277	519	709	1241	2119	2941	3979	4877
Kv Globe	169	251	497	683	1194	2033	2829	3763	—

Thermostatic Expansion Valves

1 to 140 kW Ammonia
Type HTG

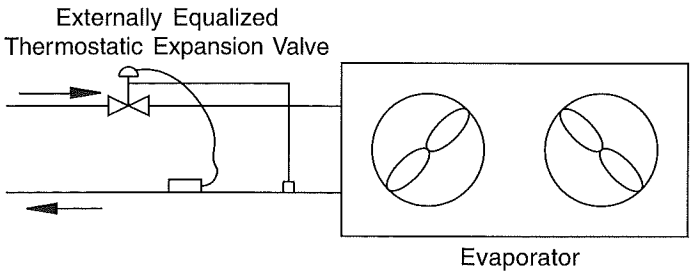
Metric

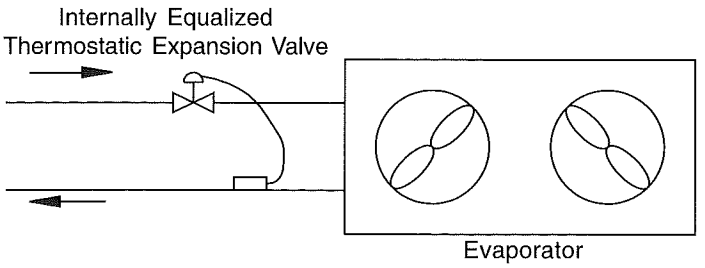
Ammonia

Ammonia Capacities in kW

Evap Temp. °C	Pressure Drop Across Valve (bar)	Model Number									
		HTG 1AZ	HTG 2AZ	HTG 3AZ	HTG 5AZ	HTG 7½AZ	HTG 10AZ	HTG 15AZ	HTG 20AZ	HTG 25AZ	HTG 40AZ
+4.4°C	5.5	2.7	5.4	8.1	14	20	27	41	54	68	109
	6.9	3.0	6.0	9.1	15	23	30	45	61	76	121
	8.3	3.3	6.6	10	17	25	33	50	67	83	133
	9.7	3.6	7.0	11	18	27	36	54	72	90	143
−6.7°C	6.9	3.0	6.0	9.1	15	23	30	45	60	75	120
	8.3	3.3	6.6	10	17	25	33	49	66	82	132
	9.7	3.6	7.0	11	18	27	36	53	71	89	142
	11.0	3.8	7.7	11	19	29	38	57	76	95	152
−15°C	6.9	3.0	5.9	8.8	15	22	30	45	59	74	119
	8.3	3.3	6.5	10	16	24	33	49	65	81	130
	9.7	3.5	7.0	11	18	26	35	53	70	88	141
	11.0	3.8	7.4	11	19	28	38	56	75	94	151
−23°C	8.3	2.8	5.5	8.4	14	21	28	42	55	69	111
	9.7	3.0	6.0	9.1	15	23	30	45	60	75	120
	11.0	3.2	6.4	9.5	16	24	32	48	64	80	128
	12.4	3.4	6.8	10	17	25	34	51	68	85	136

Notes: Capacities are based on +30°C condensing temperature, and vapor-free liquid at the inlet. Refer to evaporator manufacturer recommendations for direct expansion ammonia feed sizing and derating of capacities for suction temperatures below −20°C.





Hand Expansion (Regulating) Valves

10 mm to 32 mm Port Size
Type RT, VT Threaded

Liquid Make Up Capacities (kW Ammonia)

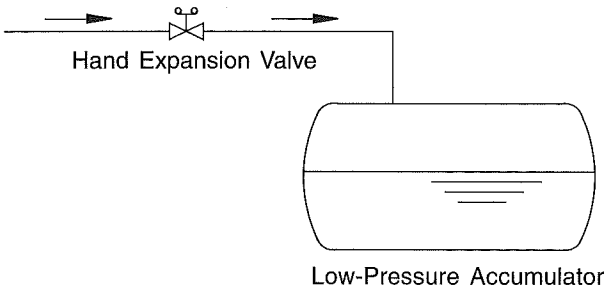
	Turns Open							
Size	1	2	3	4	5	6	7	7½
10 mm	26	52	104	156	208	—	—	—
13 mm	26	78	156	234	286	—	—	—
20 mm	26	208	390	571	753	—	—	—
25 mm	26	78	156	312	571	857	1091	1169
32 mm	26	78	234	519	1039	1506	1818	1922

13 mm to 100 mm Port Size
Type RS, VS Socket Weld
Type RW, VW Butt Weld

Liquid Make Up Capacities (kW Ammonia)

	Turns Open							
Size	1	2	3	4	5	6	7	7½
13 mm	26	52	78	104	156	208	234	286
20 mm	26	52	130	234	364	519	675	753
25 mm	26	78	156	312	571	857	1091	1169
32 mm	26	78	234	519	1039	1506	1818	1922
40 mm	156	390	1169	1818	2597	3506	3896	—
50 mm	312	1039	1948	2857	3766	4675	5713	—
65 mm	1117	2259	3947	5635	7272	9090	11167	—
80 mm	1688	3376	5973	8570	10907	13504	16881	—
100 mm	2597	5194	9090	12985	16881	20776	25970	—

Notes: Based on +25°C condensing temperature and 3.5 bar pressure drop across the valve. Shaded area exceeds 2 m/sec. Consider larger line size to inlet of valve to minimize "water hammer" when opening or closing the adjacent solenoid valve. Size hand expansion valve for 50% "on" time. (i.e. For 400 kW recirculator, select valve based on 2 x 400 = 800 kW.)



Hand Expansion (Regulating) Valves

10 mm to 32 mm Port Size
Type RT, VT Threaded

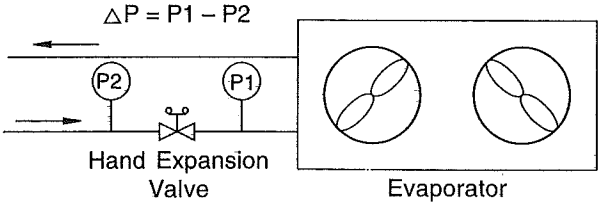
Metric

Ammonia

Liquid Overfeed Capacities (kW Ammonia, 4:1 Recirculation)

Size	Pressure Drop (bar)	Turns Open							
		1	2	3	4	5	6	7	7½
10 mm	0.3	3.8	7.5	15	23	30	—	—	—
	0.6	5.3	11	21	32	43	—	—	—
	1.0	6.5	13	26	39	52	—	—	—
	1.5	7.5	15	30	45	60	—	—	—
	2.0	9.2	18	37	55	74	—	—	—
12 mm	0.3	3.8	11	23	34	41	—	—	—
	0.6	5.3	16	32	48	59	—	—	—
	1.0	6.5	20	39	59	72	—	—	—
	1.5	7.5	23	45	68	83	—	—	—
	2.0	9.2	28	55	83	102	—	—	—
20 mm	0.3	3.8	30	56	83	109	—	—	—
	0.6	5.3	43	80	117	154	—	—	—
	1.0	6.5	52	98	143	189	—	—	—
	1.5	7.5	60	113	166	218	—	—	—
	2.0	9.2	74	138	203	268	—	—	—
25 mm	0.3	3.8	11	23	45	83	124	158	169
	0.6	5.3	16	32	64	117	176	223	239
	1.0	6.5	20	39	78	143	215	274	293
	1.5	7.5	23	45	90	166	249	316	339
	2.0	9.2	28	55	111	203	305	388	415
32 mm	0.3	3.8	11	34	75	151	218	263	278
	0.6	5.3	16	48	106	213	309	372	394
	1.0	6.5	20	59	130	261	378	456	482
	1.5	7.5	23	68	151	301	437	527	557
	2.0	9.2	28	83	185	369	535	646	683

Notes: Capacities are based on –20°C liquid. For other evaporator temperatures these values will change only slightly due to density and latent heat variations. Based on 4:1 recirculation. For other recirculation rates, divide 4 by the new recirculation rate and multiply values shown in table to arrive at new capacity.



Hand Expansion (Regulating) Valves

10 mm to 100 mm Port Size
Type RS, VS Socket Weld
Type RW, VW Butt Weld

Liquid Overfeed Capacities (kW Ammonia, 4:1 Recirculation)

Size	Pressure Drop (bar)	Turns Open							
		1	2	3	4	5	6	7	7½
12 mm	0.3	3.8	7.5	11	15	23	30	34	41
	0.6	5.3	11	16	21	32	43	48	59
	1.0	6.5	13	20	26	39	52	59	72
	1.5	7.5	15	23	30	45	60	68	83
	2.0	9.2	18	28	37	55	74	83	102
20 mm	0.3	3.8	7.5	19	34	53	75	98	109
	0.6	5.3	11	27	48	74	106	138	154
	1.0	6.5	13	33	59	91	130	169	189
	1.5	7.5	15	38	68	105	151	196	218
	2.0	9.2	18	46	83	129	185	240	268
25 mm	0.3	3.8	11	23	45	83	124	158	169
	0.6	5.3	16	32	64	117	176	223	239
	1.0	6.5	20	39	78	143	215	274	293
	1.5	7.5	23	45	90	166	249	316	339
	2.0	9.2	28	55	111	203	305	388	415
32 mm	0.3	3.8	11.3	34	75	151	218	263	278
	0.6	5.3	16	48	106	213	309	372	394
	1.0	6.5	20	59	130	261	378	456	482
	1.5	7.5	23	68	151	301	437	527	557
	2.0	9.2	28	83	185	369	535	646	683
40 mm	0.3	23	56	169	263	376	508	564	—
	0.6	32	80	239	372	532	718	798	—
	1.0	39	98	293	456	652	880	978	—
	1.5	45	113	339	527	753	1017	1130	—
	2.0	55	138	415	646	923	1246	1385	—
510 mm	0.3	45	151	282	414	546	677	828	—
	0.6	64	213	399	585	771	958	1170	—
	1.0	78	261	489	717	945	1173	1434	—
	1.5	90	301	565	829	1092	1356	1657	—
	2.0	111	369	692	1015	1339	1662	2031	—
65 mm	0.3	162	327	572	816	1054	1317	1629	—
	0.6	229	463	809	1154	1490	1862	2304	—
	1.0	280	567	991	1415	1825	2282	2823	—
	1.5	324	655	1145	1635	2109	2637	3262	—
	2.0	397	803	1403	2003	2585	3231	3997	—
80 mm	0.3	245	489	865	1242	1580	1957	2446	—
	0.6	346	692	1224	1756	2234	2766	3458	—
	1.0	424	847	1499	2151	2738	3390	4237	—
	1.5	490	979	1733	2486	3164	3918	4897	—
	2.0	600	1200	2123	3046	3877	4800	6000	—
100 mm	0.3	376	753	1317	1881	2446	3010	3763	—
	0.6	532	1064	1862	2660	3458	4256	5320	—
	1.0	652	1304	2282	3259	4237	5215	6519	—
	1.5	753	1507	2637	3767	4897	6027	7534	—
	2.0	923	1846	3231	4616	6000	7385	9231	—

Notes: Capacities are based on –20°C liquid. For other evaporator temperatures, these values will change only slightly due to density and latent heat variations. Based on 4:1 recirculation. For other recirculation rates, divide 4 by the new recirculation rate and multiply values shown in table to arrive at new capacity.

Pressure-Relief Valves

Type H5600, H5601, H5602, H5613, H5604

Pressure-Relief Valve Capacity Ratings

Cat. No.	Air Capacity	Standard Pressure Settings (bar)								
		10.3	12.1	13.8	15.5	17.2	19.0	20.7	22.4	24.1
H5600 H5601 H5602	kg/h	971	1120	1268	1417	1566	1714	1863	2012	2160
H5613	kg/h	1437	1656	1876	2096	2316	2536	2756	2976	3196
H5604	kg/h	1954	2252	2552	2850	3149	3449	3748	4047	4345

Notes: These are atmospheric relief valves. Setting equal pressure above atmosphere when outlet is connected via proper piping to the atmosphere (outside). For valve sizing and selection, see page 34.

Metric

Ammonia

Pulse Width Valves

20 mm to 50 mm Port Size
Type PWV

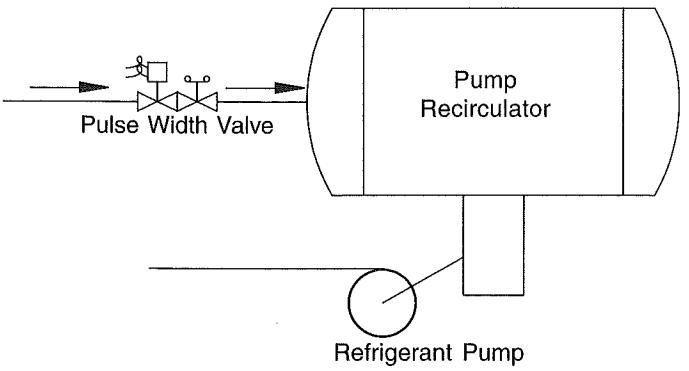
Liquid Make Up Capacities (kW Ammonia)

Cat No.	Size	Turns Open				
		2	3	4	5	6
PWV1	20 mm	42	98	183	281	401
PWV2	25 mm	60	123	239	440	661
PWV3	32 mm	60	183	401	805	1164
PWV5	50 mm	802	1506	2208	2911	3613

Notes: Based on 30°C condensing temperature and 3.5 bar pressure drop across the valve.

Recommended Inlet Line Size

Line Size	kW Ammonia
20 mm	141
25 mm	281
32 mm	615
40 mm	950
50 mm	2170
65 mm	3170
80 mm	5980



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