SRV Calculator

The Gartner SRV calculator is used to calculate the required relief valve capacity for each device requiring a relief valve, and size the riser and mains to assure that the total pressure drop does not exceed the code required amount. The revision to the ASHRAE code from 1999 requires that the total backpressure not exceed 15% of the set pressure of the valve. Previously, code called for a total backpressure not to exceed 27.5%. The program uses compressible flow formulas to calculate pressure drop in the lines and produces a calculation sheet for each valve, verifying that it's riser and main losses do not exceed allowable.

Advantages

- ✓ Quickly performs the detailed calculations necessary to comply with ASHRAE safety code.
- ✓ Detailed output shows each relief valve's calculations.
- ✓ Calculates inlet restrictions for three way valves and nozzles – reducing required mains size.
- ✓ Can easily switch between 1999 code and earlier versions of the ASHRAE code to check "grandfathered" installations.
- ✓ Most relief valves are oversized, and simply replacing them with properly sized relief valves often reduces the scope of work required to meet the code.
- ✓ No software to purchase or learn. All SRV program calculations are input by Gartner engineers.

Determining required relief valve capacity

Vessels

Vessel requirements are calculated using the following formula

$$C = f D L$$

Where C is the required capacity in 3air/minute
D is the vessel diameter in feet
L is the vessel length in feet
f is a constant for the refrigerant

Table for f

ID	Name	f
R717	Ammonia	0.5
R11	Freon	1
R123	Freon	1
R12	Freon	1.6
R22	Freon	1.6
R134A	Freon	1.6
R402a	Freon	2.5
R502	Freon	2.5
R507	Freon	2.5

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Compressors

ANSI/ASHRAE 15, section 9.8 addresses the protection requirement for Positive Displacement Compressors. It states:

> ***" The discharge capacity of the device is allowed to be the minimum regulated flow rate of the compressor when the following conditions are met:***
>
> ***a. The compressor is equipped with capacity regulation***
> ***b. Capacity regulation actuates to minimum flow at 90% of the pressure relief device setting***
> ***c. A pressure limiting device is installed and set in accortdance with the requirements of 9.9 "***

Both Frick and FES now publish data for their compressors, booster and high stage, showing the code required relief valve capacity. The programs use these tables to determine the required capacities for the compressors.

Inlet Reduction Calculation

The rated capacity of the relief valve is not the only factor determining flow. The nozzle out of the vessel, the existence of a 90° elbow, and the three-way valve all limit the flow into the relief valve. Cv values for the entrance nozzle, three-way valves (generic values used) and elbow were combined with the Cv of the relief valve to come up with the overall flow coefficient for the combination. This method was used to make sure that the safety relief valve was sized adequately, and that the flowrates used to calculate relief header sizing were not excessively high. The following is a table of the Cv values the program uses.

Cv Table

Size	Entrance	Elbow	3Way
0.5	12.6	10.1	3.8
0.75	23.2	19.4	7.3
1	38.7	32.9	12
1.25	68.9	61.4	22
1.5	95	85.6	31
2	158.7	148.6	52

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Mains Pipe Sizing

The relief vents were sized using the compressible flow gas equations as specified in ASHRAE 15 Appendix H. The following is the formula used to determine allowable length.

$$L = \frac{0.2146 * d^5 * (P_0^2 - P_2^2)}{f * C_r^2} - \frac{d * \ln(P_0/P_2)}{6 * f}$$

The program goes through each section of pipe to determine the pressure at each node, and the pressure drop from that node to the next upstream node. The individual pressure drops are added together to find the total pressure drop in all of the lines.

Allowable Pressure Drop Selection

The pressure drop used for the example calculation conforms to the latest ASHRAE revision, calling for 15% as the maximum back pressure. The program can be run to calculate mains for any back pressure, as well as calculating the effect of having a terminal pressure – a submerged pipe in a water tank, for example.

Relief Valve Selection

Manufacturers literature was used to obtain the capacities of all relief valves currently in common use. The capacities shown in this table are in # of air per minute.
Note that capacities shown in red indicate where valves where outlet pipe size is a concern. The valves shown in red will exceed the maximum allowable pressure drop if piped with 20 equivalent feet of pipe the same size as the outlet.

Mfr	Model	Inlet	Outlet	150#	200#	250#	300#
Shank	800	0.5	0.75	5.8	7.6	9.3	11.1
R/S	SR1	0.5	0.75	10	13	16	19
Hansen	H5600R	0.5	0.75	10.6	13.9	17.2	20.5
Hansen	H5602R	0.75	1	10.6	13.9	17.2	20.5
Henry	5340	0.5	0.75	18.5	24.2	29.8	35.5
Henry	5342	0.75	0.75	18.5	24.2	29.8	35.5
R/S	SR2	0.5	1	19	25	30	36
Shank	803	0.5	0.75	27.2	35.5	43.8	52.1
Shank	813	0.5	1	27.3	35.7	44	52.4
R/S	SR3	0.75	1.25	29	38	46	55
Henry	5600	0.5	0.75	30.9	40.4	49.9	59.4
Hansen	H5600A	0.5	0.75	31.3	40.9	50.5	60.1
Henry	5344	1	1	33.2	43.4	53.6	63.8
R/S	SRH1	0.5	0.75	35	46	57	68
R/S	SRH2	0.5	1	35	46	57	68
R/S	SRH3	0.75	1	35	46	57	68
Mfr	**Model**	**Inlet**	**Outlet**	**150#**	**200#**	**250#**	**300#**
Henry	5601	0.5	1	35.7	46.6	57.6	68.5

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Henry	5602	0.75	1	35.7	46.6	57.6	68.5
Hansen	H5601	0.5	1	35.8	46.8	57.7	68.6
Hansen	H5602	0.75	1	35.8	46.8	57.7	68.6
R/S	SR4	0.75	1.5	37	49	60	72
Henry	5603	1	1.25	37.5	48.9	60.4	71.9
Shank	804	0.75	1	41.7	54.5	67.3	80.1
Shank	814	0.75	1.25	45.2	59	72.8	86.6
Hansen	H5613	1	1.25	53	69.2	85.4	101.6
Shank	805	1	1.25	56.1	73.3	90.5	107.7
Shank	815	1	1.5	56.1	73.3	90.5	107.7
Henry	5346	1.25	1.25	58.3	76.1	94	111.8
R/S	H2	0.75	1	60	78	96	114
Hansen	H5604	1.25	1.5	72	94	116.1	127.1
Henry	5604	1.25	1.5	72	94	116.1	138.1
REGO	AA3130	0.75	1	77	NA	128	136
Shank	850-.75	0.75	1.5	84.7	110.6	136.6	162.5
Shank	850-1	1	1.5	84.7	110.6	136.6	162.5
Shank	850-1.25	1.25	1.5	84.7	110.6	136.6	162.5
Shank	851-.75	0.75	2	84.7	110.6	136.6	162.5
Shank	851-1	1	2	84.7	110.6	136.6	162.5
Shank	851-1.25	1.25	2	84.7	110.6	136.6	162.5
R/S	H3	1	1.25	98	128	158	188
R/S	H4	1.25	1.5	146	191	236	281
Shank	900	1.25	2	208.4	272.2	336	399.8
Shank	901	1.25	3	208.4	272.2	336	399.8
Shank	902	1.5	2	208.4	272.2	336	399.8
Shank	903	1.5	3	208.4	272.2	336	399.8
REGO	AA3135	1.25	2	223	NA	381	431
R/S	H5	1.25	2	244	319	394	469