SIZING GA Industries AIR & VACUUM and COMBINATION AIR VALVES

For exhausting air while filling and admitting air while draining pipelines

GENERAL CONSIDERATIONS

1. Determine valve size independently for each high point in line.
2. Calculate valve size for the more severe of the two slopes adjacent to the high point.
3. Determine the maximum pipeline flow rate that could occur during filling, intentional draining or unintentional draining (line break) and size for flow. Note that the flow rate while pushing water up hill during filling may be significantly less than that which occurs during reverse flow downhill during draining.
4. Determine valve size required for both filling and draining. DO NOT OVERSIZE. If the necessary inflow rate during draining greatly exceeds the outflow rate during filling, consider supplementing inflow with a separate Figure 990 or 991 vacuum breaking valve.
5. Air valve vaults, manholes and other structures should be adequately vented to accommodate the valve's air exhaust and intake rate.

SIZE FOR EXHAUSTING AIR WHILE FILLING A PIPELINE

1. Using Table 1, select the closest valve size that can exhaust air equal to the design pipeline filling rate or pumping rate at the desired differential pressure (ΔP) across air valve.
3. Although GA Industries Kinetic air & vacuum or combination air valves can vent air at virtually any pressure without blowing shut, they should be sized for a ΔP = 5 PSI to avoid excessive noise.
4. Sewage air & vacuum or combination air valves, or other non-Kinetic air valves, should be sized for a ΔP = 2 PSI. At higher ΔP they can blow shut before all the air has been exhausted.
5. To determine the actual air discharge rate:
   a. Convert liquid flow rate in GPM (Gallons per Minute) to CFM (Cubic Feet per Minute): CFM = GPM/7.48
   b. Convert to STANDARD Cubic Feet per Minute: SCFM = CFM x ((ΔP + Pa)/Pa) where
      ΔP = Filling Pressure
      Pa = Atmospheric Pressure (typically 14.7 PSIA)
   c. EXAMPLE: Filling Rate 1,530 GPM @ 5.0 PSI
      CFM = 1,530/7.48 = 204.5 CFM
      SCFM = 204.5 x ((5.0 +14.7)/14.7) = 274.1 SCFM

SIZE FOR ADMITTING AIR WHILE DRAINING A PIPELINE

1. Convert the GPM draining rate to CFM = GPM/7.48
2. Use Graph 1 or determine the gravity flow rate by this formula: $CFM = 4.72(SD^5)^{1/2}$ where
   S = Pipe Slope (ft./ft.)
   D = Pipe Inside Diameter (inches)
3. Graph and formula based on C = 100, for other Hazen-Williams values multiply CFM x C/100.
3. Determine maximum allowable negative pressure inside pipe. Minus 5 PSIG can be used for most small diameter pipes but large diameter and/or thin-walled pipe may collapse under minimal negative pressure. Consult pipe manufacturer or design handbook with respect to material, bedding and other factors.
4. Convert CFM draining rate to SCFM air inflow rate: SCFM = CFM x ((Pv + Pa)/Pa) where
   Pv = Allowable Negative Pressure (i.e., minus PSIG)
   Pa = Atmospheric Pressure (typically 14.7 PSIA)
5. Using Table 2, select closest valve size that can admit air at the required SCFM rate at no more than the allowable vacuum.
6. EXAMPLE: Draining Rate 5,250 GPM, Max Vacuum -5.0 PSI
   CFM = 5.250/7.48 = 701.9 CFM
   SCFM = 701.9 x ((-5.0 + 14.7)/14.7) = 463.5 SCFM (2" size)

Table 1. EXHAUSTING AIR WHILE FILLING A PIPELINE

FILLING PRESSURE, ΔP	AIR & VACUUM OR COMBINATION AIR VALVE SIZE									
	½"	¾"	1"	2"	3"	4"	6"	8"	10"	12"
1	**137** 19.6	**310** 44.2	**550** 78.5	**2,200** 314	**4,950** 707	**8,800** 1,260	**19,800** 2,830	**35,200** 5,030	**55,000** 7,850	**79,200** 11,300
2	**183** 27.8	**412** 62.5	**731** 111	**2,930** 444	**6,580** 1,000	**11,700** 1,780	**26,300** 4,000	**46,800** 7,110	**73,100** 11,100	**105,000** 16,000
3	**211** 34.0	**475** 76.5	**845** 136	**3,380** 544	**7,710** 1,220	**13,500** 2,180	**30,400** 4,900	**54,100** 8,710	**84,500** 13,600	**122,000** 19,600
4	**231** 39.3	**520** 88.4	**924** 157	**3,690** 628	**8,310** 1,410	**14,800** 2,510	**33,300** 5,660	**59,100** 10,100	**92,400** 15,700	**133,000** 22,600
5	**245** 43.9	**551** 98.8	**980** 176	**3,920** 703	**8,820** 1,580	**15,700** 2,810	**35,300** 6,320	**62,700** 11,200	**98,000** 17,600	**141,000** 25,300
6	**256** 48.1	**574** 108.0	**1,020** 192	**4,090** 770	**9,200** 1,730	**16,400** 3,080	**36,800** 6,930	**65,400** 12,300	**102,000** 19,200	**147,000** 27,700
7	**263** 52.0	**593** 117	**1,050** 208	**4,210** 831	**9,480** 1,870	**16,800** 3,320	**37,900** 7,480	**67,400** 13,300	**105,000** 20,800	**152,000** 29,900
8	**269** 55.5	**605** 125	**1,080** 222	**4,300** 889	**6,680** 2,000	**17,200** 3,550	**38,700** 8,000	**68,900** 14,200	**108,000** 22,200	**155,000** 32,000
9	**273** 58.9	**617** 133	**1,090** 236	**4,370** 943	**9,840** 2,120	**17,500** 3,770	**39,400** 8,480	**70,000** 15,100	**109,000** 23,600	**157,000** 33,900
10	**276** 62.1	**623** 140	**1,110** 248	**4,420** 994	**9,950** 2,240	**17,700** 3,970	**39,800** 8,940	**70,800** 15,900	**111,000** 24,800	**159,000** 35,800
15	**278** 75.2	**626** 169	**1,130** 304	**4,500** 1,217	**10,100** 2,740	**18,000** 4,870	**40,500** 11,000	**71,300** 19,500	**113,000** 30,400	**162,000** 43,800

XXX = Maximum Pipeline Filling or Pumping Rate in GPM   XXX = Equivalent Air Discharge Rate, SCFM

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GRAPH 1. PIPELINE FLOW DUE TO GRAVITY (C = 100)

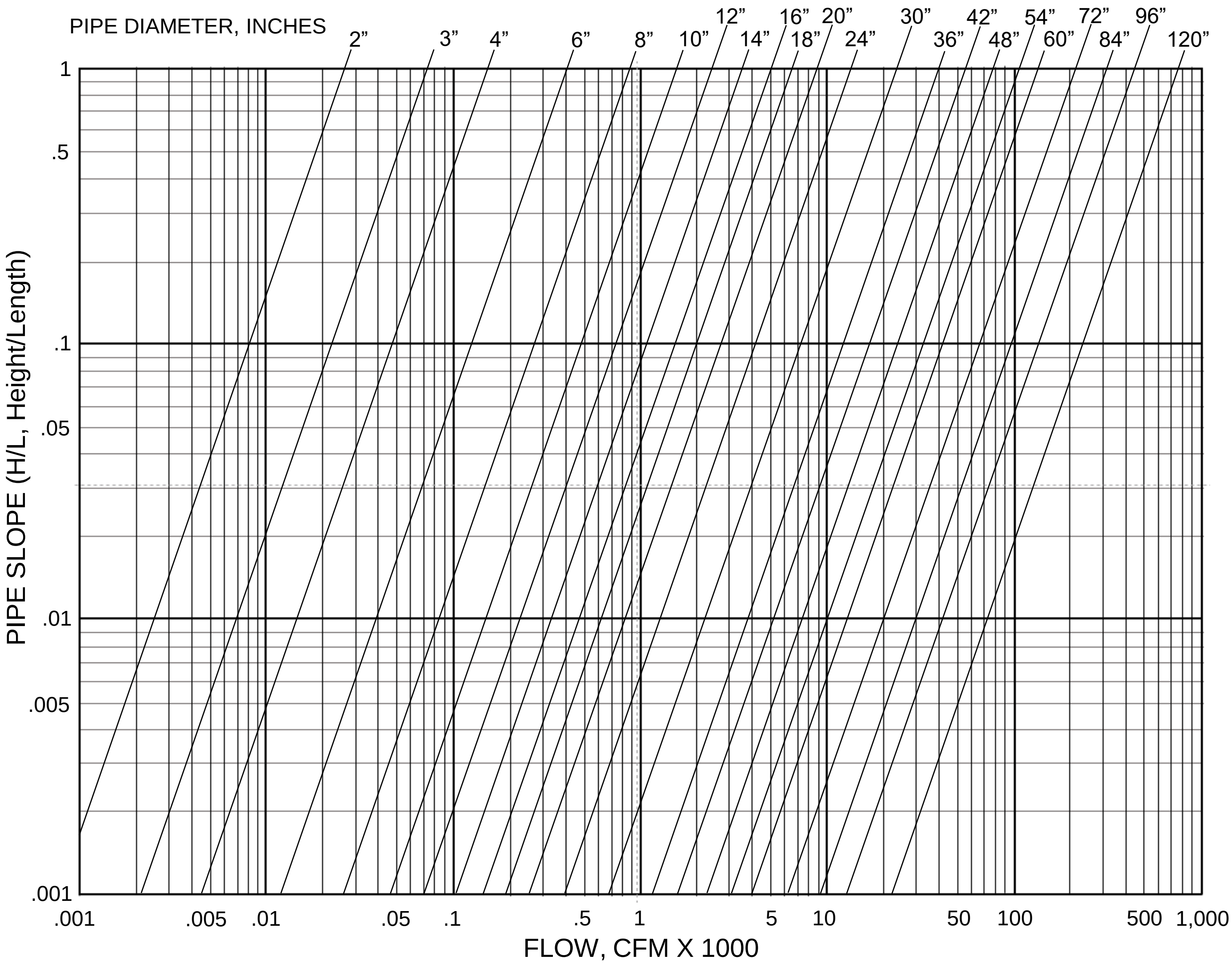

Table 2. MAXIMUM AIR INTAKE RATE WHILE DRAINING A PIPELINE, SCFM

VALVE SIZE*		½"	¾"	1"	2"	3"	4"	6"	8"	10"	12"
MAXIMUM ALLOWABLE VACUUM PRESSURE, PSIG	Minus 1	20.0	45.2	80.0	320	721	1,280	2,880	5,130	8,010	11,600
	Minus 2	28.3	63.9	113	453	1,020	1,810	4,080	7,250	11,300	16,400
	Minus 3	34.7	78.3	138	555	1,250	2,220	5,000	8,880	13,900	20,000
	Minus 4	40.1	90.4	160	641	1,440	2,560	5,770	10,300	16,000	23,100
	Minus 5	44.9	101	179	716	1,610	2,870	6,430	11,500	17,900	25,900

* Air & vacuum or combination valve. Table 2 can also be used to determine air intake through GA Industries vacuum breaking valves such as Figures 990, 991, 992 and 993.

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