Computing Pressure Increase Due to Hydraulic Head Effect

HYDRAULIC HEAD EFFECTS ON PIPELINE PRESSURES

Example: A regulator station is supplying a pipeline with (0.585 relative density) natural gas at 535 psig. The station is located at an elevation 850 feet higher than the lowest point of the pipeline.

Determine: The increased pressure at the low point due to hydraulic head effects. Assume the gas is at static condition (i.e., no flow).

Solution:

$$\Delta P = \Delta H \times density_{gas} / 144$$

where,

ΔP = pressure increase in lb/in^2

ΔH = elevation in feet

$density_{gas}$ = density of gas (lb/ft^3) at actual pressure & temperature for given gas composition.

= 1.81 lb_m/ft^3 (interpolated from density table shown on the following page for 535 psig)

$$\Delta P = 850 \text{ ft} \times 1.81 \text{ lb}_m/\text{ft}^3 / 144 \text{ in}^2/\text{ft}^2 = \underline{10.7 \text{ psi}}$$

Therefore, the pressure at the lowest point of the pipeline is 10.7 psi higher than the pressure leaving the regulator station or (545.7 psi.)

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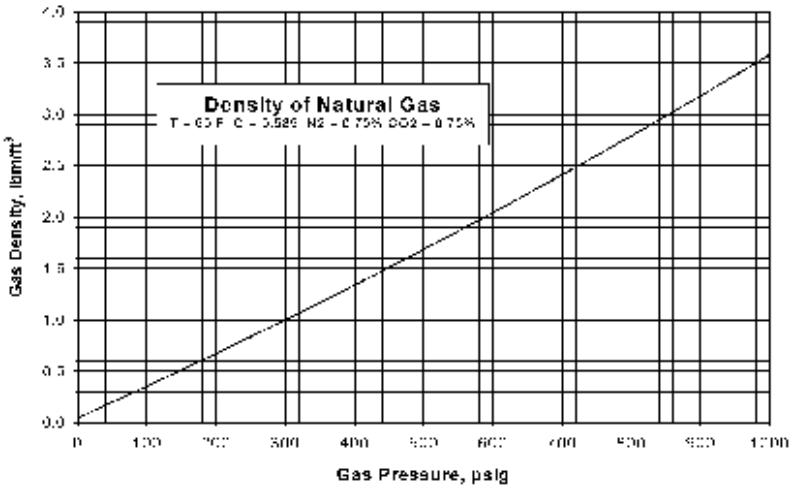
DENSITY OF NATURAL GAS CALCULATED WITH AGA-8, 1992

(Based on 0.585 Sp.Gr.; 60 deg F; 0.75% N_2; & 0.75% CO_2)

PSIG	Density	PSIG	Density	PSIG	Density	PSIG	Density
0	0.05 lb_m/ft^3	250	0.84 lb_m/ft^3	500	1.69 lb_m/ft^3	750	2.60 lb_m/ft^3
25	0.12	275	0.92	525	1.77	775	2.70
50	0.20	300	1.00	550	1.86	800	2.79
75	0.28	325	1.08	575	1.95	825	2.89
100	0.35	350	1.17	600	2.04	850	2.99
125	0.43	375	1.25	625	2.14	875	3.08
150	0.51	400	1.34	650	2.23	900	3.18
175	0.59	425	1.42	675	2.32	925	3.28
200	0.67	450	1.51	700	2.41	950	3.38
225	0.75	475	1.60	725	2.51	975	3.48
250	0.84	500	1.69	750	2.60	1000	3.58



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