



Clean Air Power
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SP-Series Gaseous Fuel Injectors

for medium and heavy-duty nav engines

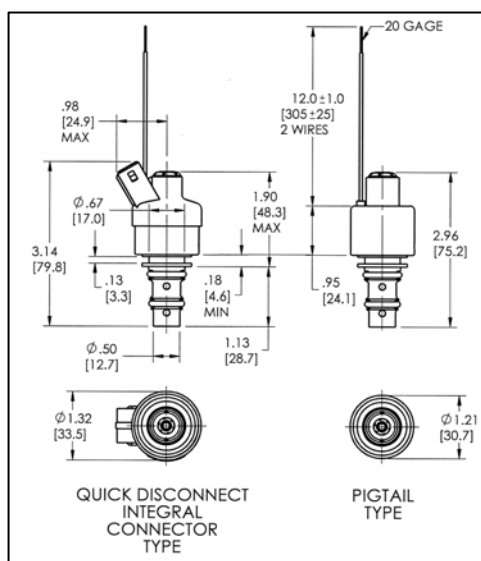


Features

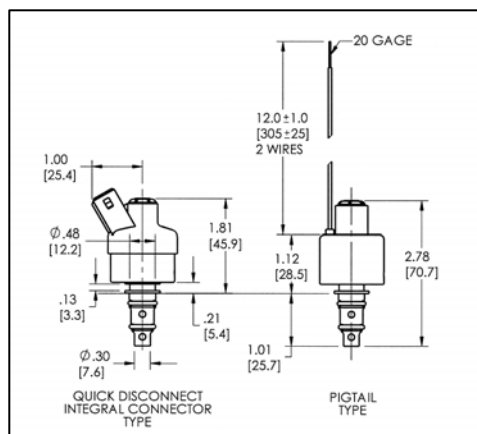
Fuel types	CNG, LNG
Material	Stainless steel
Pressure ratings (kPa, gauge)	850, 1400, 2100
Mounting	Drop-in cartridge
Operating temperature range	-40 to +120°C
Normal operating voltage	12V and 24V DC
Weight	137 to 157 grams
Upstream filtration requirement	Coalescing filter: .01 micron Sintered metal filter: 10 microns
Max. oil concentration in gas	25ppm
Driver circuit	4 amp peak, 1 amp hold
Certification	ECE R110



Accessories	
Driver module	Electronic current limiter permitting use of low voltage digital input
Porting tools	Special plunge forming tools for machining ports
Injector blocks	Drilled manifold blocks accept tubing connections



SP010



SP014, 021, 051

Electrical Coil Options		
Resistance (ohms)	Voltage (DC)	Application
1.6	12	Pulse-width modulated
9.0	24	Pulse-width modulated





How to calculate flow of gaseous fluids through Clean Air Power injectors

Model	Maximum Pressure (kPa, gauge)	Static Air Flow @ 690 kPa, gauge & 70° F-SLPM	Valve Constant (K)
SP-010	850	432	1.46 X 10 E -4
SP-014	1200	275	9.46 X 10 E -5
SP-021	2100	200	6.86 X 10 E -5
SP-051	2100	115	3.92 X 10 E -5

The formula for calculating gas flow is as follows:

$$\dot{m}_g = K \rho_1 \sqrt{2 \left(\frac{\gamma}{\gamma-1} \right) \frac{P_1}{\rho_1} \left(\frac{P_2}{P_1} \right)^{\frac{2}{\gamma}} \left(1 - \left(\frac{P_2}{P_1} \right)^{\frac{\gamma-1}{\gamma}} \right)}$$

Where

\dot{m}_g = Mass flow rate of gas, kg/s

K = Valve constant = $C_d * A$, where C_d is discharge coefficient and A is valve flow area

ρ_1 = Inlet Density, kg/m³

γ = specific heat ratio = c_p / c_v

c_p = Gas constant pressure specific heat, kJ/kg. °K

c_v = Gas constant volume specific heat, kJ/kg. °K

P_1 = Absolute Inlet Pressure, kPa

P_2 = Absolute outlet Pressure, kPa

This equation is valid only for ratios of P_2/P_1 greater than the critical pressure ratio of gaseous fluid, P_r .

For P_2/P_1 ratios less than P_r , flow is choked.

To make equation valid for P_2/P_1 ratios less than P_r , use

$P_2/P_1 = P_r$ instead.

To calculate the critical pressure ratio of a gas, P_r , use the following formula:

$$P_r = \left(\frac{2}{\gamma+1} \right)^{\frac{\gamma}{\gamma-1}}$$

P_r for air equals .528 and for methane equals .542.

Ordering Information

Example: Model # **SP - 010 - DI - PT - 12**

Injector Series	Injector Base Model	Mounting	Coil Type	Voltage (VDC)
SP	010	DI (drop-in)	QD (quick disconnect)	12V
	014			24V
	021	PT (pigtail)		
	051			

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