

# Side Feed Gaseous (SFG) Injector

## Part Number 1309-6293 (Manso)

### Applications

The Side Feed Gaseous (SFG) Injector is designed for compressed natural gas (CNG) and vapor phase Liquefied Natural Gas (LNG), on-highway, commercial engines.

CNG or LNG is preconditioned on the vehicle to the appropriate fuel temperature and pressure before delivery to the injector. A peak-and-hold driver circuit commands the required pulse width to the injector to provide the desired fuel mass to the engine.

### Description

#### Flow Direction

Fuel admission is through a 25  $\mu$ m filter screen and side ports around the injector body circumference. Metered fuel is discharged through the outlet nozzle at the bottom of the injector.

#### Permitted Media

Vapor phase natural gas consisting of primarily methane (typically 85% minimum) with balance of longer hydrocarbons such as ethane or propane, and inert gases such as nitrogen or carbon dioxide.

#### Media Constraints

Fuel sulfur levels must be in accordance with ISO 15403-2:2006. Upstream particulate filtration is required with 95% efficiency at rating of 1  $\mu$ m or smaller.

### Installation Guidelines

#### Orientation

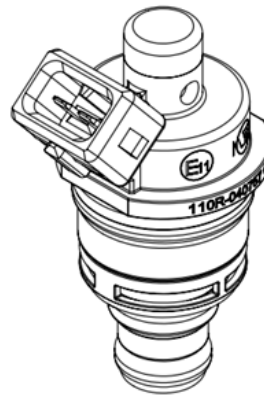
- Inlet above outlet (see diagram)

#### Installation Procedure

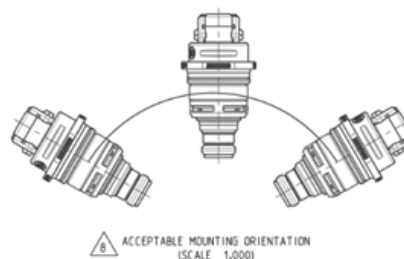
- O-rings must be lightly lubricated with oil before installation (clean motor oil 0W-40).
- Using a light twisting motion, gently push injector into installation pod.

#### Retention

Injector must be retained in installation pod by means of a hold-down clamp or clip applied over main body flange. 260° of flange circumference should be supported in order to meet final assembly burst and leakage specification, and the retaining clamp must be supported by no less than two fasteners adjacent to each injector, spaced evenly (180°) apart.



- Designed for heavy duty on-highway applications
- Cartridge-style body for simple fuel block or rail integration
- Fluorosilicone and low-temperature fluorocarbon
- O-rings for operation in cold environments
- Packard mating connector (P/N 12129140) with 2x Packard terminals (P/N 12077939) or equivalent
- Proven through 400 million cycle endurance testing.
- ECE R110 Certification (E11 110R-040757)



## Specifications

<b>Electrical and Driver</b>	
Coil Resistance	$(4.2 \pm 0.50) \Omega @ 20^\circ \text{C}$
Inductance (reference)	11.4 mH @ 20 °C
Insulation Resistance	10 M $\Omega$ minimum @ 500 V(dc)
Operating Voltage:	<b>Do not operate without flow.</b>
Nominal	27.6 V (18 to 36) V(dc)range
Driver	3A peak with 0.75A hold
<b>Performance Specification</b>	
Static Flow Rate	19.69 kg/h $\pm 5\%$
Static ACd (supporting calculations for translation to ACd units per PS-649)	2.36 mm <sup>2</sup> $\pm 5\%$
Dynamic Flow Rate	15.87 mg/pulse $\pm 7\%$ @ 3.0 ms pulse width
Dynamic ACd (supporting calculations for translation to ACd units per PS-649)	0.686 mm <sup>2</sup> $\pm 7\%$ @ 3.0 ms pulse width
External Leakage	0.25 sccm at 9 bar differential
Internal Leakage	0.25 sccm at 9 bar differential
	0.25 sccm at 1.6+/-0.3 bar abs
	(Measure the transient leakage when start to supply pressure)
<b>Cold Performance</b>	
Opening Capability	9 bar differential, 16ms 3A pulse, -40 °C
External Leakage	0.25 sccm at 9 bar differential, -40 °C
Internal Leakage	0.25 sccm at 9 bar differential, -35 °C
<b>Flow Test Conditions</b>	
Engineering Test Stand	FI-ETS1
Voltage	$(27.60 \pm 0.05) \text{ V(dc)}$
Pulse Period (frequency)	10.0 ms (100 Hz)
Drive Circuit Type	Peak and Hold
Drive Card Number	U9122-765
Peak/Hold Current Levels	3A / 0.75A
Peak Dwell Time	2 ms
Test Fluid Type	Nitrogen Test Fluid SpecGrade 4.0
Pressure	$(10.00 \pm 0.01) \text{ bar absolute}$
Temperature	$(25 \pm 1)^\circ \text{C}$
<b>Minimum Pulse Width</b>	
Linearity $\pm 5\%$	2.5 ms
Duration of injection	1.2 ms
<b>Reference Flow Values</b>	
Reference Fluid	Compressed natural gas
Static Flow Rate	14.74 kg/h
Dynamic Flow Rate	11.40 mg/pulse
<b>Operating Pressure</b>	
Maximum Operating Pressure	10.0 bar absolute
Minimum Operating Inlet Pressure	5.0 bar absolute
<b>Operating Temperature</b>	
Operating Temperature Range (media and ambient)	-40 °C to +125 °C
<b>Storage Temperature</b>	
Long Term	-40 °C to +60 °C
<b>Burst Pressure</b>	
No release of components below 114 bar gauge	
<b>Overpressure without Damage</b>	
Short term operation with pressure spikes no larger than 21.7 bar gauge	
<b>Weight (dry)</b>	
75 g (approx.)	

## Specifications (cont'd.)

### Operating Environment

- Automotive under hood
- Tolerant of external exposure to water, condensing and non-condensing petrochemicals (oil, fuel, exhaust emissions, gasoline, diesel, natural gas)

### Environmental Verification Procedures

Salt Fog	144-hour salt fog test, 5% aqueous NaCl, (33 to 36) °C Upon completion, unit must pass leakage specification
Vibration	Random vibration to demonstrate 20 000 h field life at up to 6 Grms
Mechanical:	
Shock	MIL-STD 810F, Method 516.2, Procedure 1, Basic Design Test at 40 g, 11 ms sawtooth pulse, in each of 3 planes, 3 shocks per axis
Endurance	Bench durability to 400 million cycles at 100 Hz, dry gas. Tolerance limits: static flow shift ( $\pm 7\%$ ), dynamic flow shift ( $\pm 15\%$ ) and room temperature internal leakage ( $\leq 0.25$ sccm)

### Permitted Flushing (Cleaning) Solutions

It is permitted to clean the injector wetted parts and external surfaces with n-Heptane, Stoddard solvent or Jet A-1. Methanol-containing solutions are not allowed for cleaning. For LNG applications, injector must be flushed internally with fresh clean motor oil after cleaning; see manual 51490 for cleaning and oiling procedure



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