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ITT

Engineered for life

WARNING

Conoflow's products are designed and manufactured using materials and workmanship required to meet applicable standards. The use of these products should be confined to services specified and/or recommended in the Conoflow catalogs, instructions, or by Conoflow application engineers.

To avoid personal injury or equipment damage resulting from misuse or misapplication of a product, it is necessary to select the proper materials of construction and pressure-temperature ratings which are consistent with performance requirements.

INSTALLATION AND MAINTENANCE MANUAL

LDNGV Series Compressed Natural Gas Vehicle Regulator

WARNING: These instructions must be read carefully prior to installation and system startup.

INTRODUCTION: The LDNGV Series regulator is a self contained, pressure reducing regulator designed and qualified for 3000 and 3600 psig CNG vehicular fuel systems. This regulator is factory calibrated and is not field adjustable. Various configurations of this regulator are available, based on the application needs. Consult the factory for part numbers, replacement filter kits, or configuration assistance.

SYSTEM REQUIREMENTS: This fuel pressure regulator is designed to provide controlled delivery pressure to fuel injected engines. The regulator accepts SAE o-ring boss fittings for inlet and outlet CNG flow.

The regulator has its own 10 micron filter element; upstream particulate filtration is not required.

This regulator has a solenoid valve option, however separate tank valves and / or a master line shut off valve must be used. This regulator also has a tank pressure sensor option. The tank pressure sensor requires 5 VDC power and provides a proportional voltage signal (0.25 to 4.75 or 0.50 to 4.50 VDC for a 0-5000 psi span) to the vehicles ECU (engine control unit) to drive the fuel gauge.

CONNECTIONS: The LDNGV Series regulator is connected to the fuel system by inlet and outlet ports. These ports are SAE J1926 o-ring boss connections for 1/4" size tubing at the inlet connection (7/16-20 thread) and 3/8" size tubing at the outlet connection (9/16-18 thread). These connections are marked "INLET" and "OUTLET".

Threaded ports (1/4" NPT) are provided for user installed coolant fittings. Heated engine coolant must be circulated through this CNG fuel pressure regulator in most applications.

An optional pressure bias connection (manifold pressure reference) is available for flexible tubing. The connection is a 3/16" diameter hose barb.

A pressure regulator relief valve (PRRV) is integrated into the regulator for outlet pressure protection. A 3/8" NPT connection is provided for the user to install a fitting and route potential gas discharge out of the area where the regulator is installed.

CAUTION: The regulator's PRRV is a downstream pressure control and not a system safety device. Proper high pressure PRD's must be employed at the cylinder valves for appropriate system safety.

The optional solenoid valve is connected by a 2 pin Amp Superseal connector. The optional sensor is connected by a 3 pin Packard Metripak 150 plug. See page 8 for connection polarity.

MOUNTING: M8 x 1.25 or M10 x 1.5 bolts can be used to mount the regulator. The regulator may be oriented in any direction; however Conoflow recommends that the gas ports are horizontally oriented to minimize exposure of the gas lines, and prevent collection of oil and moisture in the downstream line. The regulator must be rigidly mounted on the vehicle.

WARNING: Do not mount the regulator by gas or coolant connections only. This regulator must be securely mounted by mounting bolts.

Please refer to the interface drawings for mounting dimensions, connection identification and connection details.

SPECIFICATIONS:

Maximum Operating Inlet Pressure: 3600 psig (248 bar)

Outlet Pressure: Factory preset – see regulator marking

Outlet Pressure Variation in Service: -15 to +15 psi (+/- 1.04 bar) from marked set pressure through the range of operating inlet pressure, temperature and gas flow. See flow performance graph to see effect of inlet pressure and gas flow changes to the delivery pressure.

Temperature Range:	-40° F to 257° F (-40 °C to 125 °C)
CNG Port Torques:	Inlet (SAE-4): 14 ft-lb Outlet (SAE-6): 27 ft-lb

Flow Capacity: 110 lb/hr (13.9 g/s) of CNG for brief periods

PRRV Type:	Automatic reset type
Optional Solenoid:	12 or 24 volt. 2A max 5A line fuse recommended
Optional Sensor:	0.25 to 4.75 VDC output or 0.50 to 4.50 VDC output over 0-5000 psi tank pressure input. A 5.0 +/- 0.25 VDC power signal is required.
Approvals:	ECE R110, NGV 3.1, ISO 15500

NOTE: This regulator has been tested and certified for safe and reliable service in Natural Gas Vehicles.

There are significant potential hazards associated with CNG which the user and / or installer must be aware of when using this product.

CAUTION: Install the regulator in accordance with NFPA 52, CAN/CGA-B149.4 and other codes and standards applicable to the jurisdiction of installation and service.

WARNING: CNG can cause damage and / or injury due to very high pressure, flammability, and extreme cold during expansion. Suitable safeguards must be employed during installation, commissioning and service to prevent harm to personnel and property.

PRINCIPLE OF OPERATION

The LDNGV series is a mechanical pressure regulator. The main valve, within the regulator, is coupled to a diaphragm assembly. A spring preload against the diaphragm assembly pushes the main valve open. As gas flows through the regulator, downstream pressure will increase and push the diaphragm assembly against the spring load, closing the main valve. The diaphragm and valve are dynamic, and will seek equilibrium so the inlet pressure is reduced and regulated throughout the useful range of gas flow.

When the engine is shut off, gas flow through the regulator ceases. The regulator's main valve is pulled closed by the diaphragm assembly and downstream pressure will be trapped in the low pressure side of the fuel system.

Engine coolant circulation ports are machined in the regulator to provide engine heat to the regulator valve and the gas. This heat prevents ice buildup in the regulator, which could reduce performance and regulator life.

INSTALLATION GUIDELINES

The following is a summary of the product installation process in the vehicle. Specific procedures may exist for the CNG fuel system which will incorporate additional installation instructions and steps for a safe and reliable fuel system assembly.

WARNING: Inspect the unit after unpacking. If the unit appears to be damaged do not place in service.

Plan the installation for the best combination of accessibility, protection from engine exhaust heat, mechanical vibration or impact, and suitable mounting orientation.

SEE SYSTEM IMPERATIVES ON PAGE 3

- A suitable lubricant (oil, synthetic grease, etc) should be applied to the o-ring of the fitting, prior to installation, to help the o-ring seat and seal. **Do not use silicon grease** – silicon may poison the oxygen sensor in some vehicles. Install the fitting in the applicable gas port.
- Connect vent line fitting to the PRRV port, using Teflon tape only.
- Connect coolant fittings to the regulator, using Teflon tape or other suitable thread sealant.
- Secure regulator to vehicle with appropriate mounting bolts. Do not mount to engine.
- Connect all gas and coolant connections.
- Connect optional solenoid and transducer.
    - o See pages 6 - 8 for connection details.

- Pressurize the system and perform a leak test of gas connections with liquid leak detection solution or soapy water.

SYSTEM IMPERATIVES

Imperatives are those conditions, when violated, can cause regulator or system failure and an increased risk of gas release. The following imperatives are listed with potential risks to assist the fuel system integrator with system design failure modes and effects analysis.

High Pressure Lockoff (solenoid) Valve

A normally closed solenoid valve must be installed upstream or integral to the fuel pressure regulator. This is a safety requirement to prevent gas from freely flowing during vehicle shutdown. Although the regulator is capable of bubble tight shutoff, the upstream lockoff valve is the correct safety device for this function.

Inlet / Outlet Lines

To prevent excessive pressure drop at flow, the inlet and outlet fuel lines should be of suitable size. The regulator has been designed for SAE o-ring boss fittings which correspond to 1/4 inch OD tubing (SAE-4) for the inlet, and 3/8 inch OD tubing (SAE-6) for the outlet. These are the recommended line sizes. Fittings may be of type SAE J1926/2 or SAE J1926/3.

Tubing must be clean and free of burrs, which could contaminate the regulator or system. The outlet line should not be run upward from the regulator outlet port, due to the potential for excessive oil and condensate collection. A level or downward run is preferred to prevent collection.

Engine Coolant

The expansion of high pressure gas to low pressure creates a significant temperature drop. To prevent moisture from freezing inside the regulator and creating a blockage, heated engine coolant must be circulated within the regulator. The regulator is equipped with ports to allow the installer to connect the regulator to the coolant system.

Engine coolant must be maintained for at least –40 degree antifreeze protection.

Excessive Temperature

The regulator is designed for safe and reliable operation within a temperature range of –40 to 257 °F. Temperatures beyond 275 °F cause permanent damage and must be avoided. If the regulator is located in an area with the potential for high temperature (such as radiated energy from exhaust system components, etc), suitable heat shields must be employed.

Fitting Torque

The correct assembly torque for the inlet (SAE-4) fitting is 14 ft-lb.
The correct assembly torque for the outlet (SAE-6) fitting is 27 ft-lb.

Inadequate torque could allow the fitting to loosen in service and leak. Excessive torque could weaken or shear the threads in the inlet and / or outlet port of the regulator. Use correct tools and exercise caution when installing or connecting fittings to prevent injury.

The inlet and outlet fitting is sealed with an o-ring. Thread sealant is not required, nor recommended.

Submergence in water

Except for bonnet bias models, the regulator uses an atmospheric reference hole in the bonnet to sense ambient pressure. This hole is “filled” with a porous hydrophobic plastic plug to prevent water intrusion from splashing, wash down, etc. This plug may not prevent water intrusion if the regulator were to be submerged in water. For this reason, the regulator should not be mounted low in a vehicle which would have to cross flooded roads, etc.

Chemicals in Fuel

Any cleaners or abnormal additives, drying agents, etc in the fuel could cause damage to the regulator’s internal seals. The regulator is tolerant to substances that occur in compressed natural gas, including aggressive compressor oils, however ITT Conoflow should be contacted regarding other materials.

As part of your fuel system and vehicle protection review, ITT recommends the incorporation of a system warning label that clearly advises maintenance technicians to 1) NOT DISABLE any automatic upstream isolation valves and to 2) CLOSE upstream isolation valves and bleed system pressure prior to servicing.

WARNING: Bleed system pressure prior to removal and servicing of this pressure regulator.

TROUBLESHOOTING:

The regulator "pops" when I turn on ignition key and activate the solenoid valve(s).

This is caused by downstream leakage. If the downstream pressure bleeds down, the inrush of high pressure CNG can cause the regulator outlet pressure to overshoot the PRRV opening pressure. This in turn causes a momentary discharge excessive pressure from the PRRV. Correct / repair any downstream leakage to prevent system depressurization when the vehicle is not operating.

After driving the vehicle, I see frost on the exterior of the regulator and outlet fuel line.

This is quite common for driving cycles where there is a significant amount of gas flow. Although the regulator is heated with engine coolant, this heat is used to protect the valve, and is not sufficient to heat the fuel completely. As the fuel flows to the engine, it will pick up heat from the fuel line.

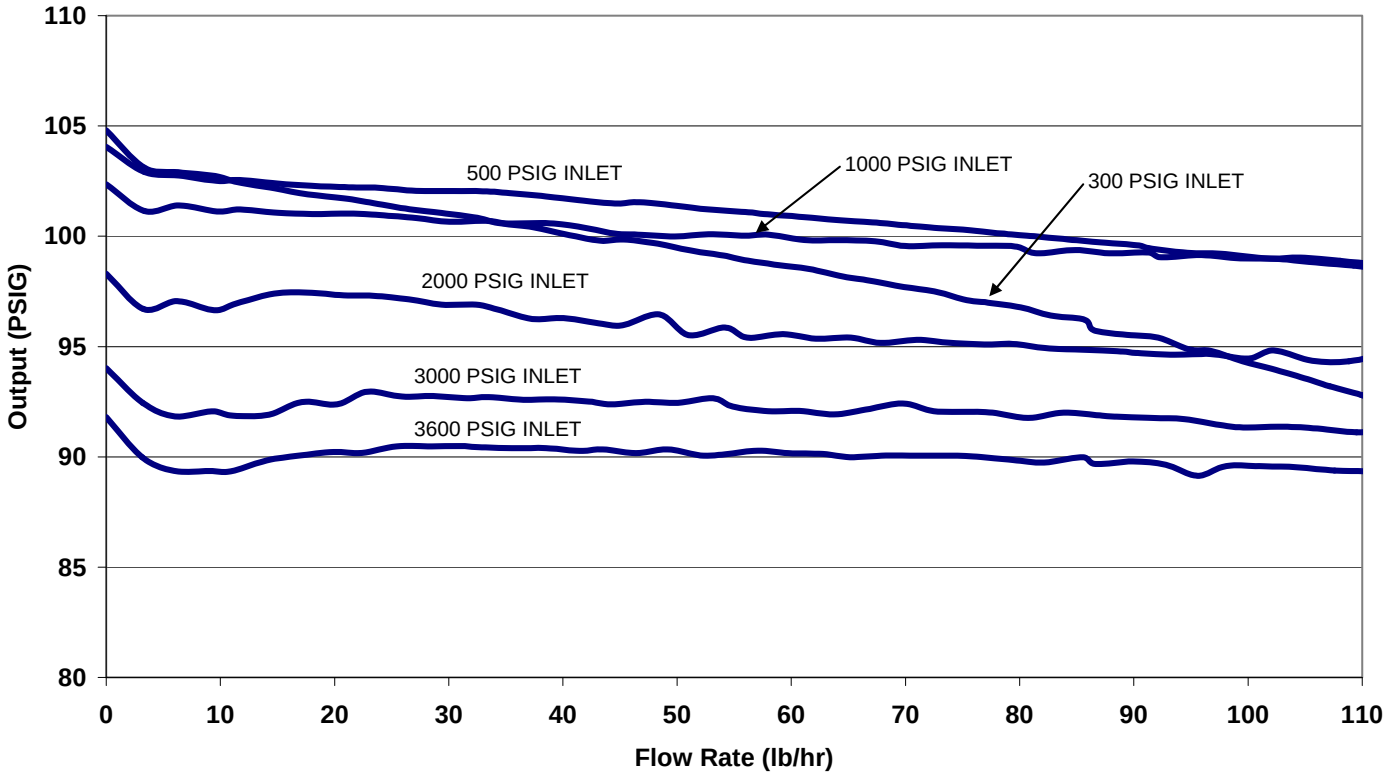
When leak testing the system, our gas detector shows leakage from the white plug on the regulator.

A very slight amount of gas permeates from the regulator, and this is normal. A gas detector can show leakage "false alarms", as this instrument is very sensitive. Conoflow recommends using commercially available leak detection solution, or soapy water, to leak test the system.

Loud noises are coming from the regulator.

Noisy operation can be caused by a number of system related issues. If incorrect fittings or line sizes are used (small bore fittings, tubing too small, restrictions upstream, etc), the regulator may be starved for pressure and overshoot the steady equilibrium it is trying to achieve. This will cause internal oscillation which can create noises ranging from a buzzing sound to a rapid internal knocking sound.

TYPICAL LDNGV CNG DELIVERY PRESSURE
EXAMPLE - LDNGVSXX12C095
TESTED AT 300, 500, 1000, 2000, 3000 AND 3600 PSIG INLET PRESSURE



Regulator Model Number Breakdown (CED Code)

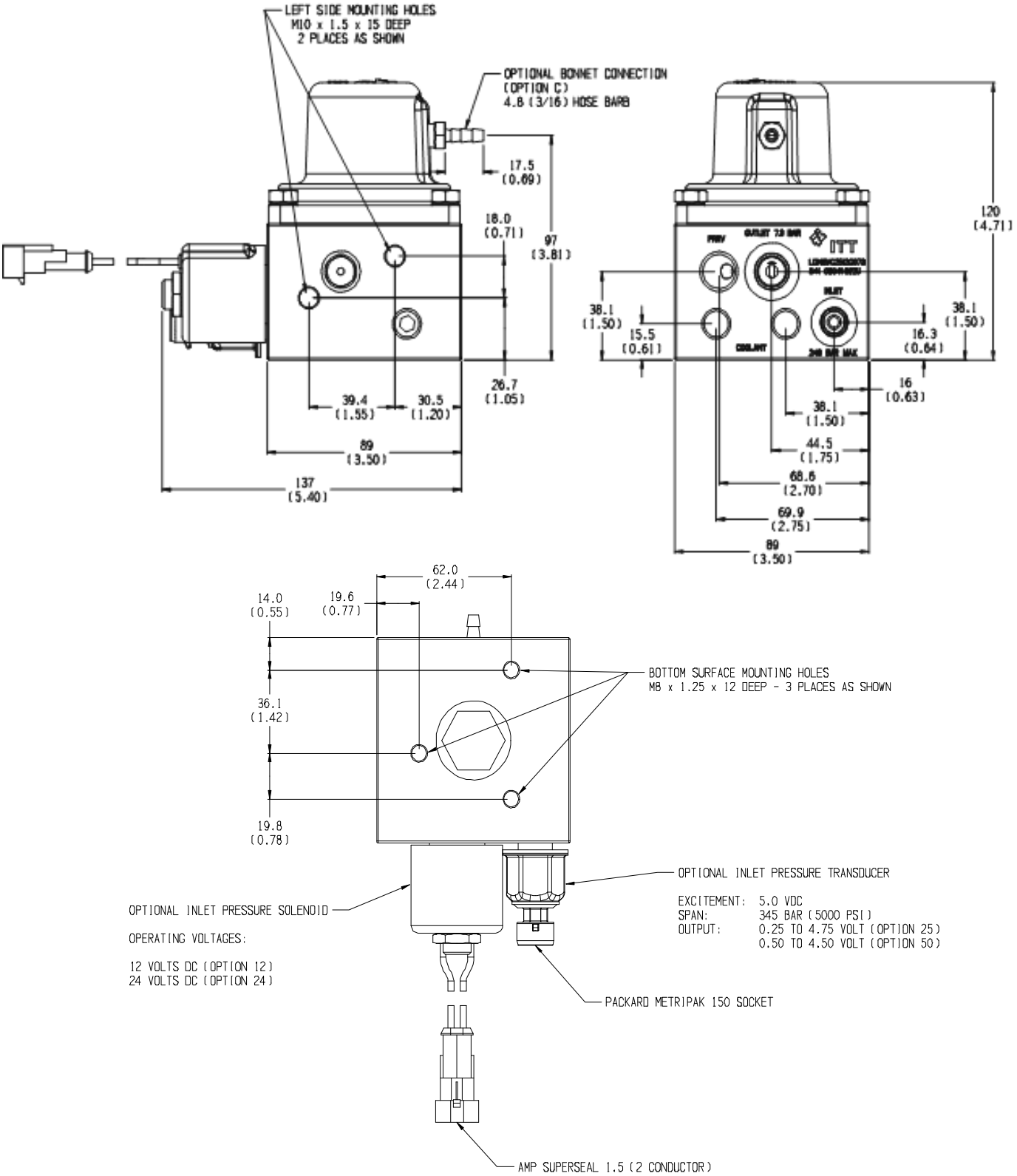
Text Position	Code	Definition of Character
1 - 5	LDNGV	Regulator Model / Product Designation
6		Bonnet Option Codes
	S	Standard Bonnet
	C	3/16” Straight Hose Barb Connection on Bonnet
7-8		Sensor Option Codes
	XX	No sensor (SAE-3 sensor port will be plugged)
	25	0.25 to 4.75 VDC Optional Sensor
	50	0.50 to 4.50 VDC Optional Sensor
9-10		Solenoid Option Codes
	XX	No solenoid (port will be plugged)
	12	Normally closed high pressure solenoid – 12 VDC operation
	24	Normally closed high pressure – 24 VDC operation
11		PRRV Opening Pressure Codes
	A	100 psi PRRV Setting
	B	150 psi PRRV Setting
	C	200 psi PRRV Setting
	D	250 psi PRRV Setting
12-14		Output Pressure Codes
XXX		Regulator’s set point in psig Valid Range is from 050 to 150 Note: Regulator setting labeled in Bar unit

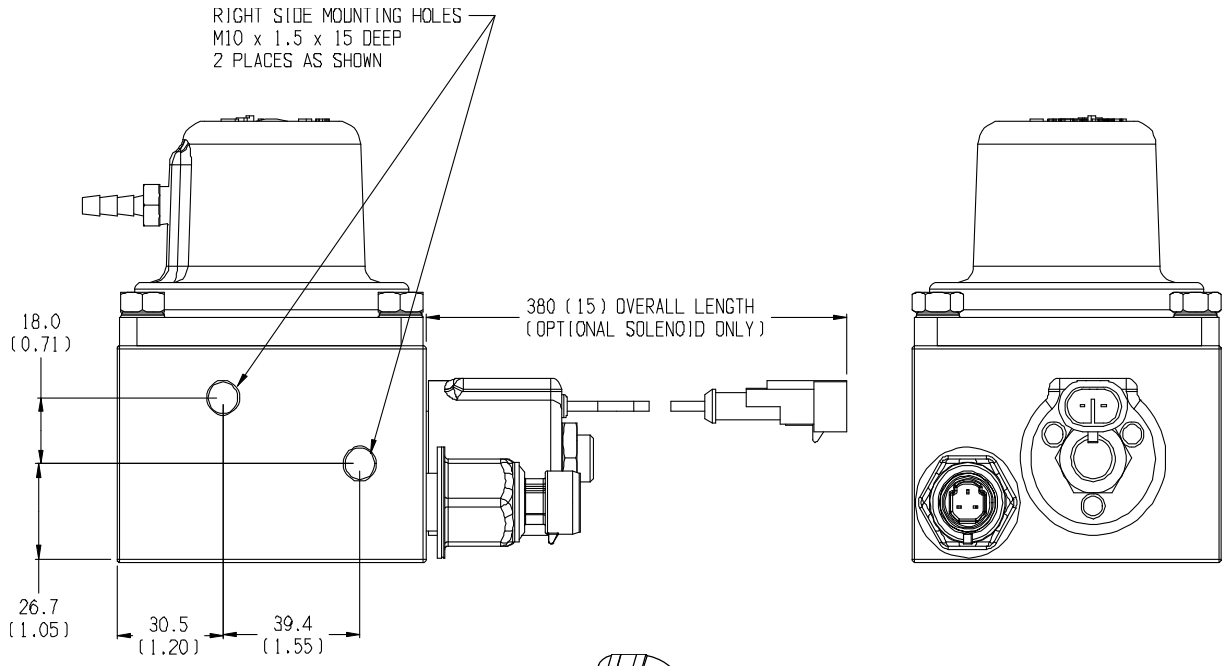
CAUTION: Regulator output is factory calibrated. Changing the pressure setting can cause unexpected and/or potentially hazardous operation.

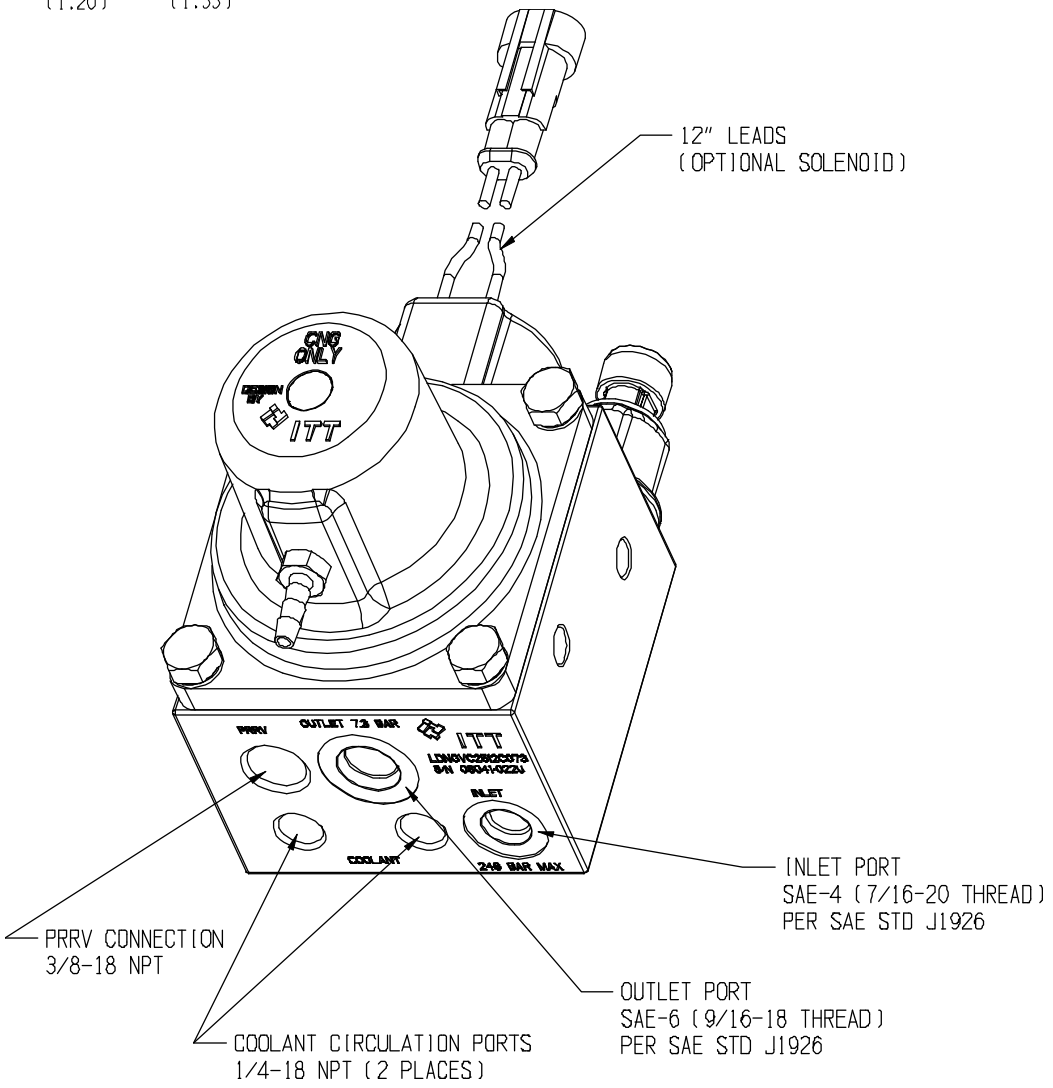
CAUTION: Stored spring compression within the regulator can be unexpectedly released if the regulator is disassembled incorrectly.

TYPICAL GEOMETRY AND CONNECTION IDENTIFICATION

DIMENSIONS IN MILLIMETER (INCH)







Electrical Interface Data

ELECTRICAL INTERFACE DATA

OEM solenoid lock-off valve electrical mating connector part numbers:

Housing: Amp / Tyco Electronics 282080-X (X designates color)
Contacts: Amp / Tyco Electronics 282110 female connector
Seal: Amp / Tyco Electronics 281934-2

Suggested wire gauge: 18 gauge

WARNING: Circuit protection with a 5A maximum current is required for solenoid valve wiring.

OEM pressure sensor electrical mating connector part numbers:

Housing: Delphi 12065287 (with included weather seal)
Contacts: Delphi 12110236

Suggested wire gauge: 18 gauge

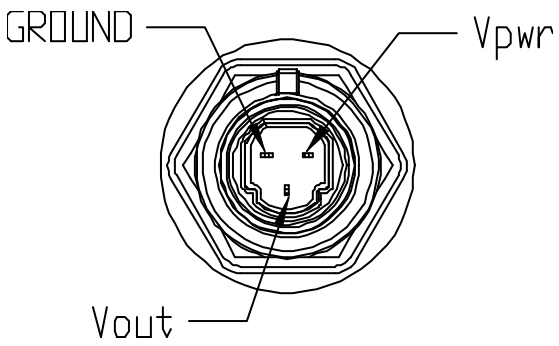
WARNING: Circuit protection with a 1A maximum current is required for sensor power lead wiring.

The components above may be substituted for functional equivalents. Other contacts and seals are available for alternative wire sizes. Consult OEM connector supplier data.

When selecting alternatives, the following guidelines must be considered:

- Mating terminals must be tin-plated. Gold-plated connectors may cause galvanic corrosion of the connection interface and ultimately prevent the solenoid valve and/or pressure sensor from operating.
- Weather seals must be used between the connector bodies, and at the cable ports.

Sensor polarity / pin connection diagram:



Vpwr = 5.0 +/- 0.25 VDC
Vout = Ratiometric output (product dependent)
Ground = Common ground

There are no polarity requirements for the solenoid valve electrical connection.