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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.

INSTRUCTION AND MAINTENANCE MANUAL
XRNGV Natural Gas Fuel Pressure Regulator

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

WARNING: It is the responsibility of the system designer and/or installer to qualify this product in the application/intended service.

INTRODUCTION: The XRNGV is a tied diaphragm, fixed output pressure regulator with an integral pressure regulator relief valve and pilot operated solenoid valve.

CONNECTIONS: (See Page 5)	SAE O-ring boss port (per SAE J1926) Inlet: SAE-8 (3/4-16 thread) Outlet: SAE-10 (7/8-14 thread) PRRV: SAE-6 (9/16-18 thread) Outlet Gauge Port: SAE-4 (7/16-20 thread)

SPECIFICATIONS:

Inlet Pressure:	225 to 3600 PSIG (15.5 to 248 bar)
Nominal Outlet Range:	Factory preset from 70 to 110 PSIG (4.8 to 7.6 bar)
CNG Flow Capacity:	220 lb/hr (99.8 kg/hr) of CNG
Inlet Solenoid:	12 or 24 VDC – See CED code Normally closed, pilot design
Outlet Relief Valve (PRRV):	Factory preset to 35 PSIG (2.4 bar) above regulator preset setting
Assembly Torques:	Inlet (SAE-8): 42 ft-lb Outlet (SAE-10): 60 ft-lb Transducer (SAE-4): 12 ft-lb PRRV (SAE-6): 26 ft-lb Mounting Bolts: 18 ft-lb
Ambient Temperature:	-40 to 248 °F (-40°C to +120°C)
Mounting:	3/8-16 bolting
Weight:	13 lb. / 5.9 kg
Approvals:	ECE R110, NGV 3.1, ISO 15500

MATERIALS OF CONSTRUCTION:

Body / Bonnet	Anodized Aluminum
Diaphragm	FKM Rubber
Seals:	FKM Rubber (gas) EPDM Rubber (engine coolant)
Valve Trim:	Stainless Steel
Valve Seal:	Polyimide

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 XRNGV regulator 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.

An engine coolant circulation path is provided in the body of 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

1. 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 - PAGES 3 and 4
2. Lightly lubricate the O-rings of the inlet and outlet gas fittings and install the fittings into the regulator to the recommended torques.
3. As applicable, remove the SAE-4 port plug, lubricate the O-ring of the pressure transducer or gauge, and install it into the SAE-4 port of the regulator to the recommended torque.
4. If the regulator is to have a vent pipe, connect the vent pipe to the PRRV vent port.
5. Attach regulator securely to vehicle, using four (4) 3/8-16 mounting bolts.
6. Connect the inlet, outlet, and coolant connections. Assure any entrapped air in regulator is fully purged from the coolant path. *If applicable, connect the transducer or outlet gauge.*
7. 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. Included but not limited to the following.

1. Fuel Quality

This regulator may be used with CNG or RNG (Renewable Natural Gas), provided the fuel quality meets SAE Standard J1616 for Compressed Natural Gas fuel.

2. Upstream Coalescing Filter

A suitable coalescing filter must be installed immediately upstream of the regulator. This filter should be sized for suitable flow and condensate capacity. The purpose of this filter is to prevent excessive moisture and compressor oil or particulate contaminants from entering the regulator and flowing downstream to the fuel management system.

A one (1) micron filter will sufficiently protect the regulator from particulate contamination damage.

This filter must be located as close to the regulator as possible.

3. Inlet Solenoid Valve

This regulator is equipped with a pilot operated, normally closed solenoid valve. When energized, the pilot valve will open, and sufficient time is required for a depressurized outlet line of regulator to charge with pressure before the main orifice of the solenoid opens with an audible click sound. Failure to allow equalization will result in reduced engine power or stalling if power is demanded immediately.

4. Sealants

Sealants are not required for the SAE O-ring boss connections. The use of sealants as a leakage preventive measure can contaminate the internal passages and valve in the regulator and cause a malfunction. *Sealant use in these connections will void the factory warranty*.

5. 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 1/2-inch OD tubing (SAE-8) for the inlet, and 5/8 inch OD tubing (SAE-10) for the outlet. These are the recommended line sizes. The minimum bore of the fittings must be a minimum of 0.37 inch (9.4 mm) for the SAE-8 inlet fitting and 0.50 inch (12.6 mm) for the SAE-10 outlet fitting. 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 oil and condensate collection. A level or downward run is preferred to prevent collection of any liquid.

6. Downstream Relief Valve

Although the regulator is equipped with a pressure regulator relief device (PRRV), a high flow relief valve or other protective strategy must be installed between the regulator outlet and the remainder of the fuel system. The regulator PRRV is not a high flow device and may not protect the regulator or fuel system in case of sudden failure.

7. 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 a coolant path for this purpose.

Engine coolant must be maintained for at least –40 degree antifreeze protection. If the coolant were to freeze in the regulator, for any reason, the coolant containment integrity may be compromised.

8. Excessive Temperature

The regulator is designed for safe and reliable operation within a temperature range of –40 to 250 °F. Temperatures beyond 275 °F can cause permanent damage to internal seals and must be avoided. If the regulator is in an area with the potential for high temperature (such as radiated energy from exhaust system components, etc.), suitable heat shields must be employed.

9. Fitting Torque

The correct assembly torque for the inlet (SAE-8) fitting is 42 ft-lb. The correct assembly torque for the outlet (SAE-10) fitting is 60 ft-lb. The correct assembly torque for the optional transducer port is 12 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. 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.

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

10. Submergence in water

The XRNGV 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.

11. 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 di-ester and polyalkylene glycol (PAG) compressor oils, however ITT Conoflow should be contacted regarding other materials including other compressor oils.

12. Rapid or Frequent Fuel System Decompression

CNG Fuel systems should not be rapidly or frequently decompressed of gas. Doing so will cause high pressure gas absorbed in non-metallic materials to attempt to escape those materials, increasing the speed of component degradation.

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) DO NOT DISABLE any automatic upstream isolation valves and to 2) CLOSE upstream isolation valves, whenever feasible during servicing.

TROUBLESHOOTING:

1. <u>The regulator "pops" when I turn on ignition key and activate tank solenoid valve(s).</u>

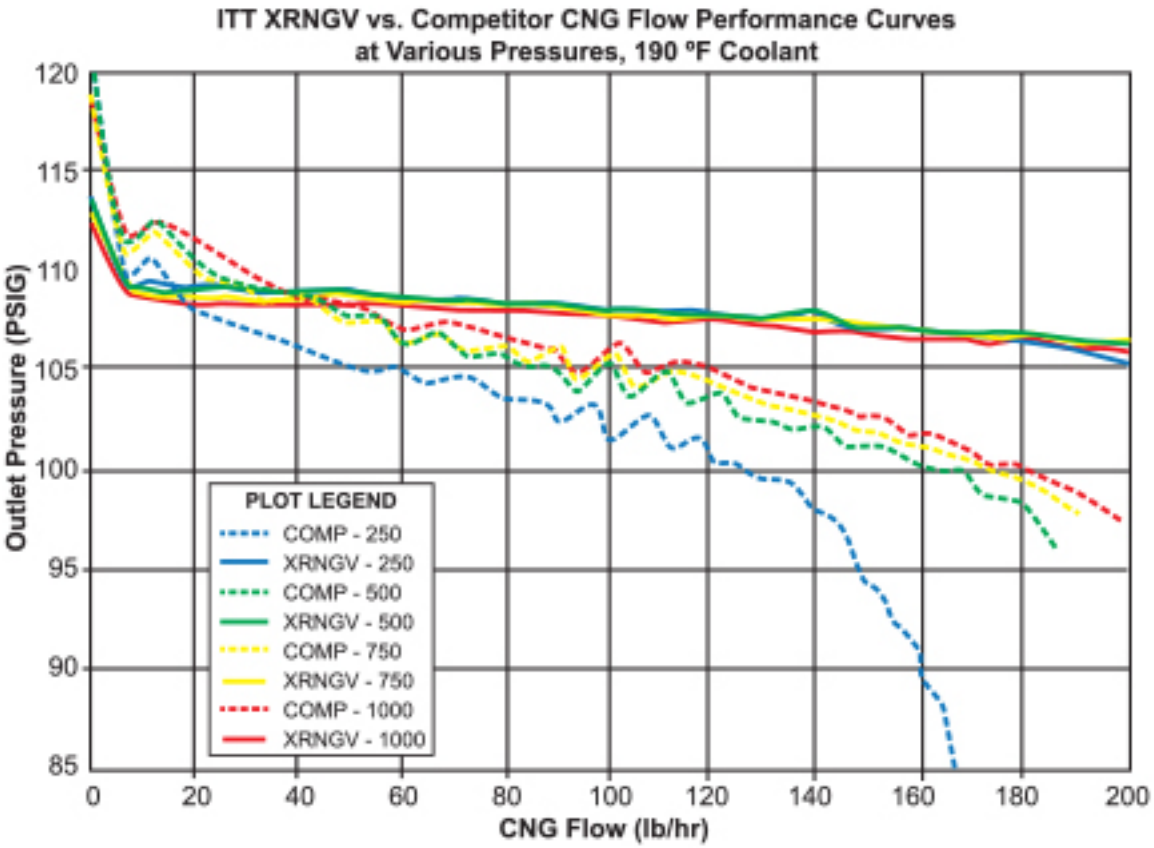
   This is caused by downstream leakage, or regulator damage caused by particulates. If the downstream pressure bleeds down, the inrush of high pressure CNG can cause the regulator outlet pressure to overshoot the PRRV opening pressure and discharge excessive pressure from the line. Correct / repair any downstream leakage to prevent system depressurization when the vehicle is not operating.

2. <u>When leak testing the system, our gas detector shows leakage from the white plug on the regulator.</u>

   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.

3. Loud noises are coming from the regulator.

   Noisy operation can be caused by several system related issues. If incorrect fittings or line sizes are used (small bore fittings, tubing too small), 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. In rare instances, the regulator's resonant frequency will match the fuel system's resonant frequency. Simply changing the length of the outlet line will usually solve this issue.



Regulator Model Breakdown (CED Code)

Character Position	Option
1-5	**XRNGV** - Base Product Family
6-7	Inlet Solenoid Valve Options **NA** = No Inlet Solenoid Valve **12** = High Capacity 12 volt solenoid valve **24** = High Capacity 24 volt solenoid valve
8-10	**XXX** = Outlet Pressure in psi (at Full Tank / Idle Flow Conditions)

Example: XRNGV12085 will contain a 12 Volt inlet pressure solenoid valve and is factory preset to 85 psi (5.86 bar)

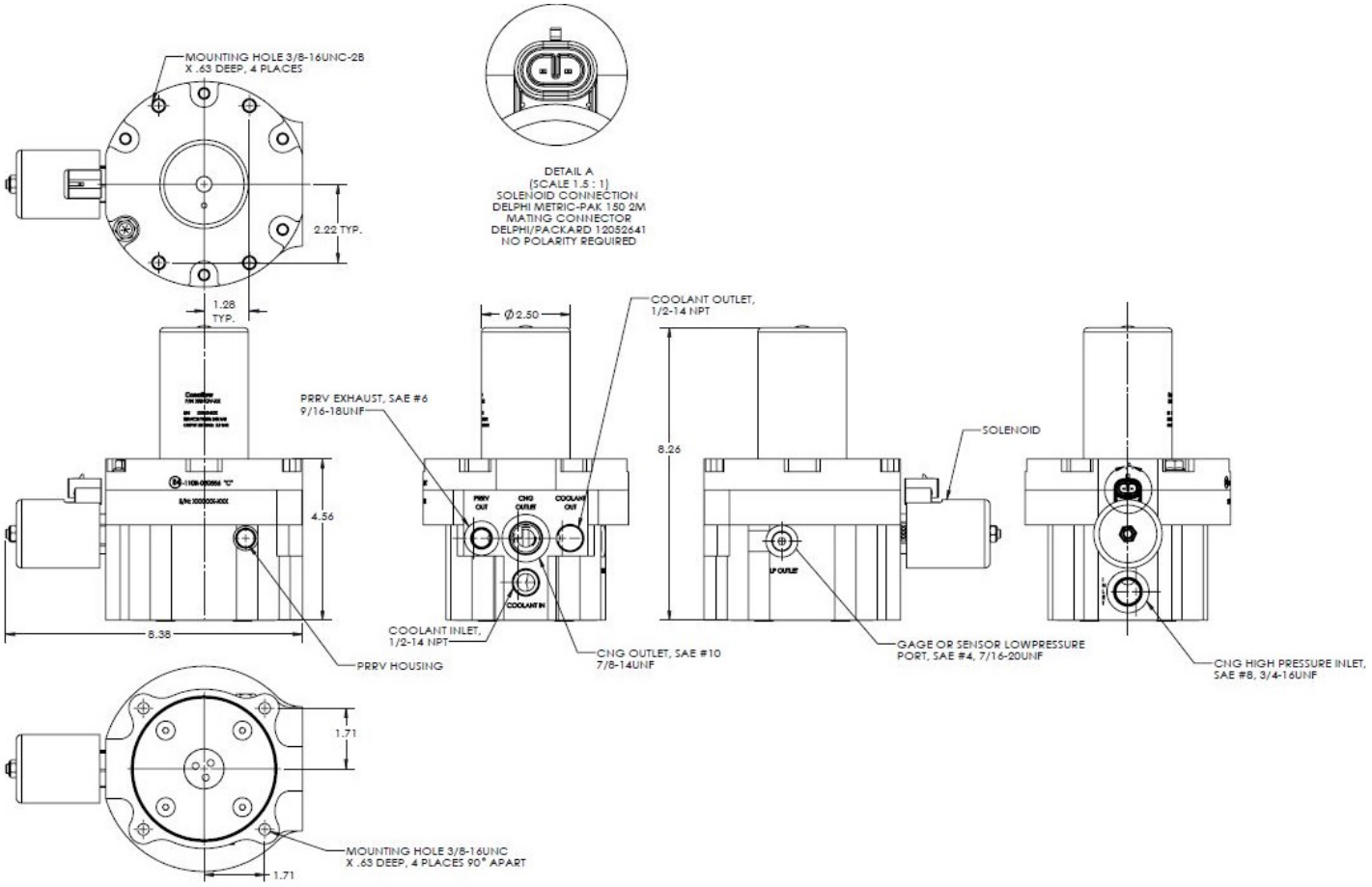
NOTES:

Outlet pressure range will be 70 psi through 110 psi (4.82 to 7.59 bar)

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

CONNECTION IDENTIFICATION AND TYPICAL GEOMETRY

DIMENSIONS (IN INCH)



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