TULSA GAS TECHNOLOGIES, INC.
www.tulsagastech.com

Tulsa Gas Technologies, Inc.
4809 S. 101st E. Ave., Tulsa, OK 74146
Phone: 918-665-2641 Fax: 918-665-2657

TGT PROVER MANUAL

PROV-CNG50

07-2012

Tulsa Gas Technologies, Inc.
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Last Edit: November 24, 2003

PROV-CNG50

1.0 Safety

After opening the prover, look at all connection points for debris and damage. Any sign of wear, oil deposit or physical damage needs to be repaired by a qualified person before any attempt to use this device. Look around the fueling area and locate all emergency shutdown devices in the dispenser area. Block traffic from coming within 20 feet of your test area. Ensure the PROV-50 has a secure place to set while it is performing the test. The area around the dispenser is Class 1, Division 2, Group D within five (5) feet in any direction. The dispenser is equipped with an electrically conductive hose that will dissipate any static electricity that would build. You should visually inspect the hose before each use for cuts, bubbles and abrasions, and replace hoses as needed. The hose should be checked with a 500v Meger per NGV-4 within the month that you are using it. The PROV-50 is not watertight, so try to keep it out of direct rain. A secondary ground cable may be necessary at some locations to ensure that no static is built up in the system. Contact TGT for a 5 Meg ohm secondary ground cable if necessary.

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2.0 Sequence of Operation

When beginning the calibration process, look at the area and make an evaluation for safety. In the NFPA52, Table 4-12, the Class 1, Division 2 area extends 5 feet from the dispenser in any direction. You should have the prover outside the Division 2 area. Make sure there are no gas leaks and then inspect the hose for safety. The hose will conduct electricity while it is connected. If you disconnect the hose from the dispenser you will need to connect a ground wire to the ground lug on the prover to maintain electrical continuity.

The prover is a self-powered device that has a 24VDC battery supply. It is recommended that you do a fresh charge on the batteries before you begin proving the dispenser. The battery life, with the unit on, is approximately (12) hours.

1. Attach the discharge hose to the prover.
2. Close the vent valve on the prover by turning the needle valve clockwise until tight.
3. Attach the hose to the vehicle or tank.
4. Turn the three-way valve on the end of the discharge hose to the **"VENT"** position.
5. Connect the hose from the dispenser to the inlet on the prover.
6. Turn the valve on the dispenser nozzle to the **"FILL"** position.
7. Pressurize the prover to the final temperature compensated pressure that the dispenser will deliver.
8. The dispenser and the prover must be equalized to the temperature compensated stop pressure before every batch is run. The start pressure and the final pressure needs to be as close to the same as possible to ensure an accurate calibration.
9. Now the prover MUST be zeroed. Refer to "Zeroing the Meter" in this manual. The zeroing process only needs to be done on the initial setup when you move the prover. You can skip this step until you relocate the prover.
10. After you are sure the dispenser is equalized, the three-way valve on the end of the discharge hose will now, in effect, be your fill valve for the dispenser.
11. You now need to reset the totals for the pounds (lb) display. (See Resetting Totalizer)
12. After you reset the total you now need to tell the PROVER to start to total the flow through the meter. (See Starting the Totalizer)
13. Begin the fill of the vehicle or tank through the normal authorize procedure. Turn the three-way valve on the end of the discharge hose to the **"FILL"** position after the dispenser has reset its totals. If you must stop the dispenser, use the valve on the end of the discharge hose and let the pressure reach the equalized pressure (Temperature Compensated Stop Pressure). It is best to let the dispenser do a complete fill of the tank or vehicle. A minimum of a 1 GGE draft is required to get an accurate test.

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2.0 Sequence of Operation (Cont.)

14. Turn the three-way valve on the discharge hose of the prover to the **"VENT"** position at the end of each test to ensure that the gas stops flowing and the test is over. It is not necessary to disconnect the hose from the tank after each test.
15. To perform another test on the same dispenser hose, repeat steps 10 through 14.
16. To perform a test on a different dispenser hose, repeat steps 2 thought 14.
17. If you relocate the prover you must zero the meter.

3.0 Zeroing the Meter

1. After power is applied to the prover, allow it to warm up for approximately 30 minutes.
2. Ensure that the prover is at full temperature compensated stop pressure.
3. Turn the three-way valve on the discharge hose to the **"VENT"** position to insure there is no flow through the meter.
4. With the Prov-50 at pressure and the discharge hose valve in the vent position press the **ZERO** button.
5. While the zero is in process the LED on the display face will turn Orange until complete.
6. When the zero is complete the LED will turn Green.

4.0 Resetting Totalizer

1. Press and release the **SCROLL** button until the display shows **"TOTAL LB".**
2. Press **SELECT** and the word **"RESET"** will appear beneath the current totalizer value.
3. Press **SELECT** and the word **"YES"** begins to alternate with the word **"RESET".**
4. Press **SELECT** to reset the mass total.
5. When resetting totalizer process is complete, return to Sequence of Operations 3.0.11.

5.0 Starting the Totalizer

1. Press **SCROLL** until the word **"START"** appears beneath the current totalizer value.
2. Press **SELECT** and the word **"START"** will appear beneath the current totalizer value.
3. Press **SELECT** and the word **"YES"** begins to alternate with the word **"START".**
4. Press **SELECT** to start the mass display total.
5. You can now flow gas. Return to the main Sequence of Operation. 3.0.12.

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6.0 Math

The math formula to determine the accuracy of a dispenser is as follows:
See form in attachments.
1 GGE=5.66 Lbs. of natural gas, per NIST Handbook 44, Sec.3.37, Mass Flow Meter Table S.5.1.

D = Display in Mass. If no mass reading is available, multiply Volume x 5.66lbs.

P = Prove-50 Display in Lbs.

((P-D) / P) X 100 = % of Error

Maintenance tolerance 2.0%, per NIST Handbook 44, Sec.3.37, Mass Flow Meter Table T.2

7.0 Purging for Shipment

1. Disconnect the Prov-50 from the discharge tank and the dispenser.
2. Open the vent valve on the front of the prover to release any gas in the prover.
3. The gauge on the prover will show you when the pressure is gone.
4. Install the purging adapter in series with the discharge hose of the prover.
5. Turn the three-way valve on the end of the discharge hose to the **"FILL"** position.
6. Attach the nozzle to the inlet connector on the prover.
7. Attach an air hose or an inert gas to the Schrader valve on the purging adapter and let the air or gas flow freely until the prover is purged of all natural gas.
8. Remove purging adapter and discharge hose but leave the vent valve open.
9. Return discharge hose and purging adapter to the storage section of the prover.

8.0 Storage of the PROV50

1. Purge the Prov-50 in the same manner as you would for shipment. If you are going to have the prover in storage for more than 3 months you will need to charge the battery to keep it performing to its maximum potential.
2. The Prov-50 should be kept in a clean, dry place. The Prov-50 is NOT watertight.

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9.0 Recharging the Battery

1. The batteries in the PROV-50 are two 12VDC batteries connected in series to make 24VDC.
2. The charging receptacle is located on the front panel near the On/Off Switch.
3. The charger is **NOT** rated to be used in a classified area and should only be used in a safe area.
4. The green light will come on when the batteries are fully charged.
5. Full charge of the batteries should last approximately 12 hours of operating time.

10.0 Attachments

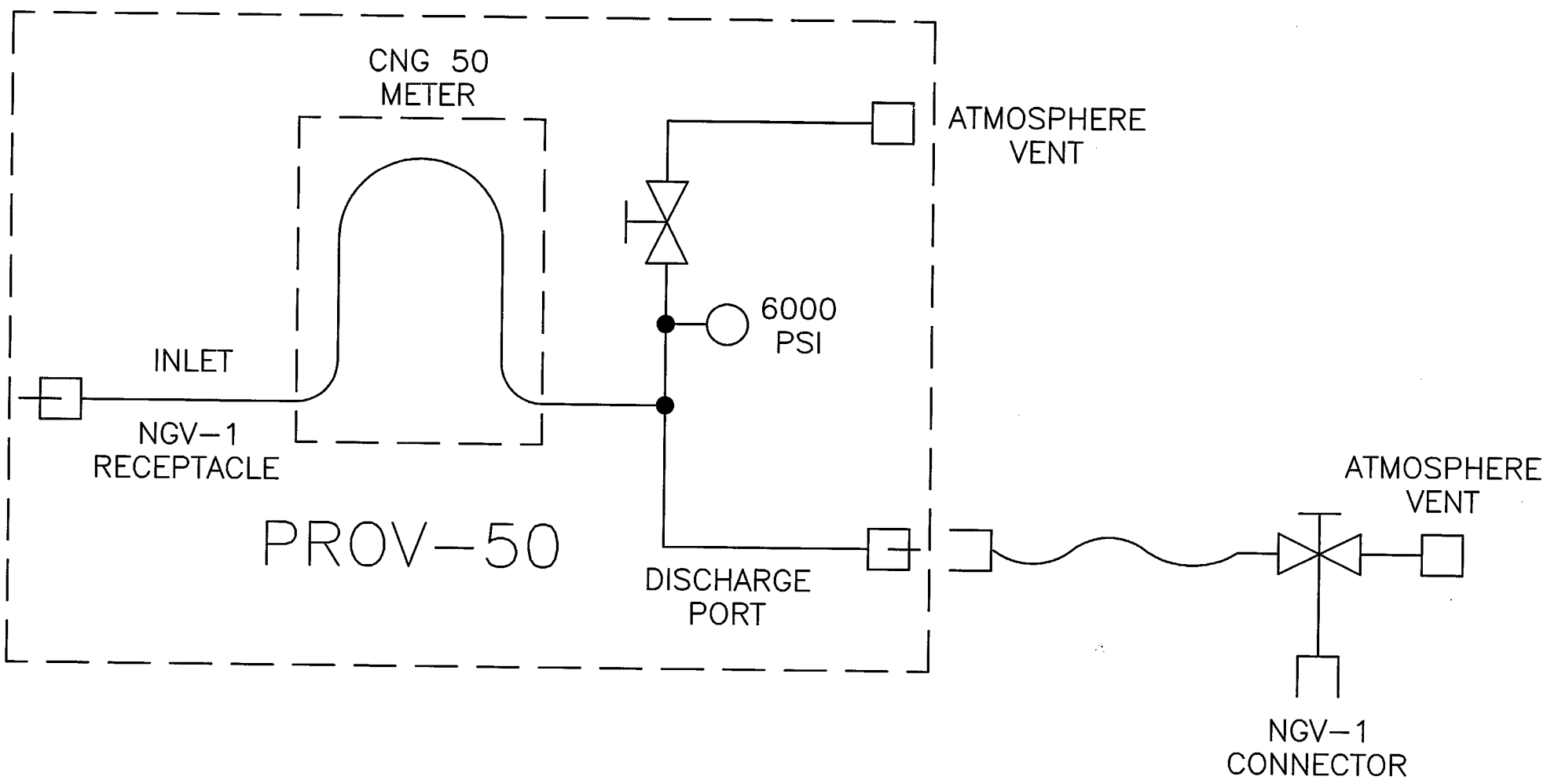
Error calculation form
P&ID Drawing
Electrical Drawing
Physical Dimensions
Bill of Material
Battery Charger Product Data Sheet
Micro Motion CNG50 Product Data Sheet

11.0 Calibration Report on Meter

12.0 Documentation

Certificate of Conformance NIST (When Available)
Certificate of Conformance on Hose
Manufactures Data and Contact Information
Quality control/ final inspection sheet.

13.0 TGT Calibration Software



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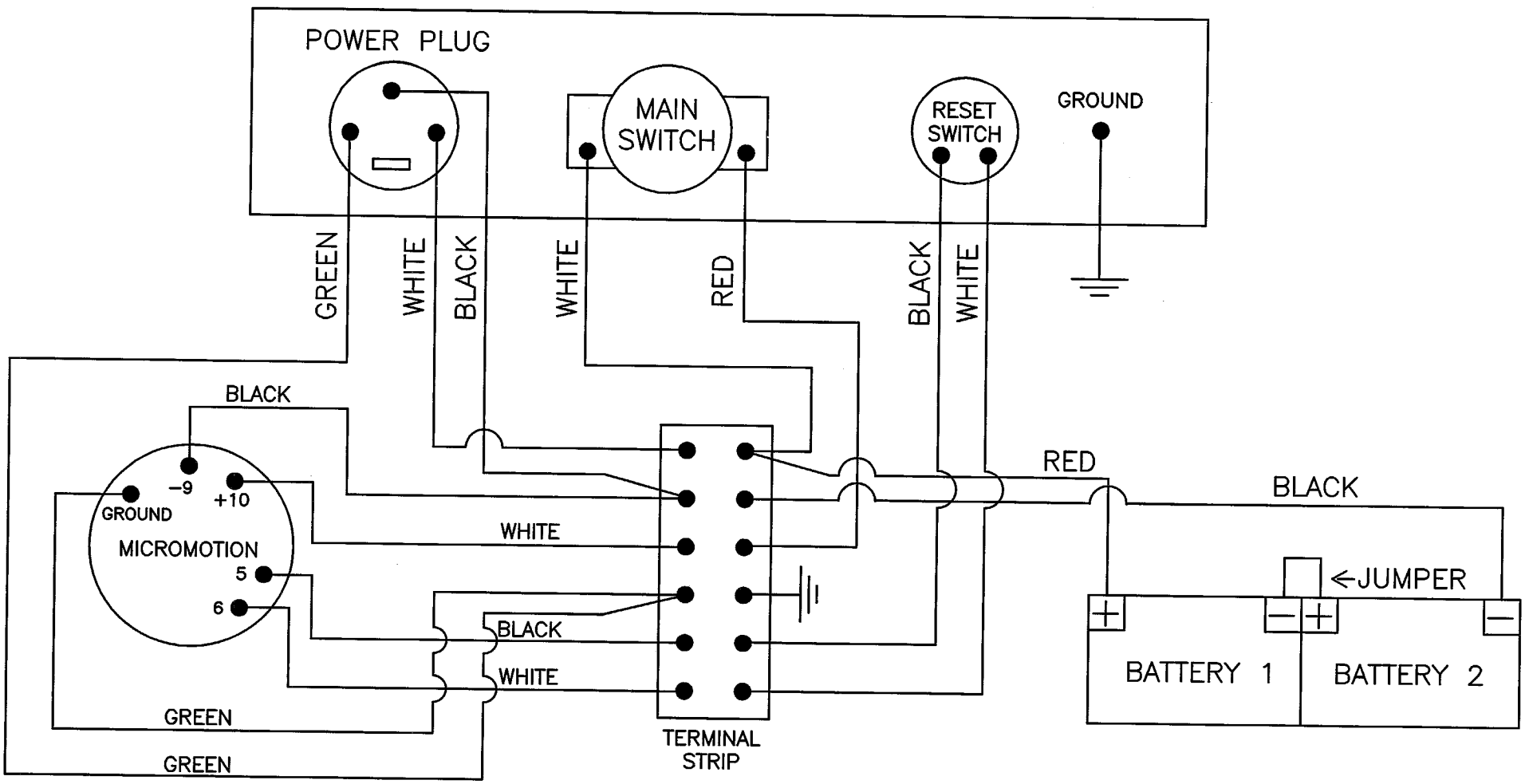
MODEL:	DRAWN BY: MB	DATE
SEQUENCE –	CHECKED BY: –	5–15–03
PROGRAM: –	APPROVED BY: –	
SERIAL NO.: –	PART: –	
WORK ORDER: –	DWG. NO. PROV–50 P&ID	

PANEL BACK VIEW



GROUNDS GO TO BATTERY BOX STUD.

ADD A GROUND WIRE FROM THE BATTERY BOX TO THE LID.

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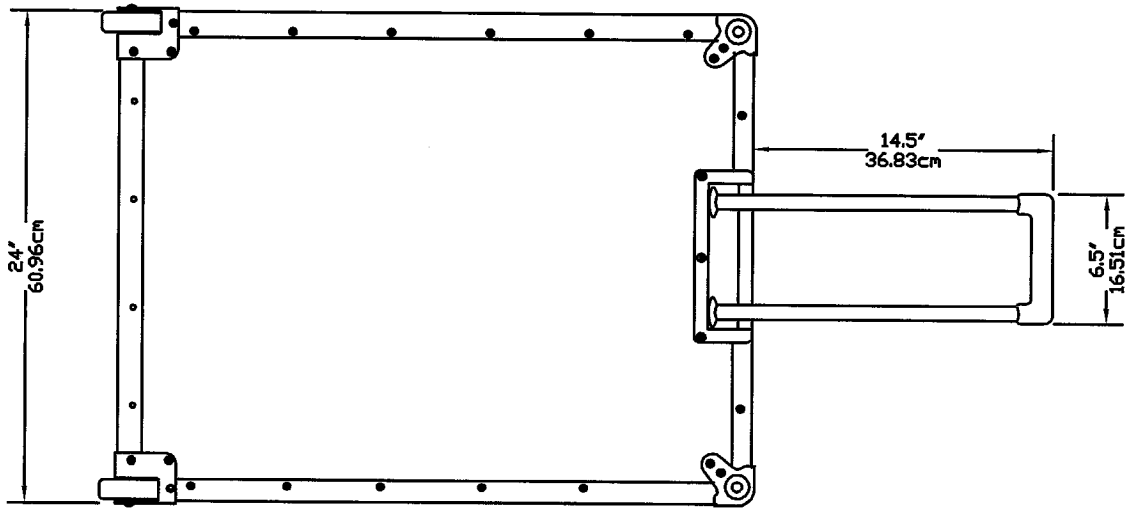
MODEL:	DRAWN BY: MB FOR J.A.L.	DATE
SEQUENCE –	CHECKED BY: –	02-03-10
PROGRAM: –	APPROVED BY: –	
SERIAL NO.: –	PART: –	
WORK ORDER: –	DWG. NO. PROVER WIRING 02-03-10	



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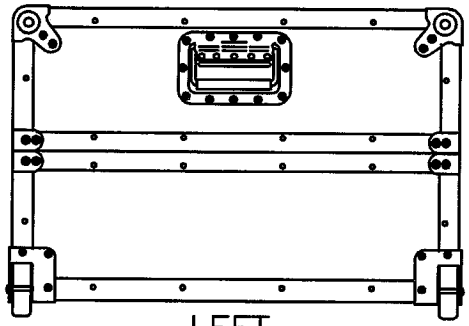

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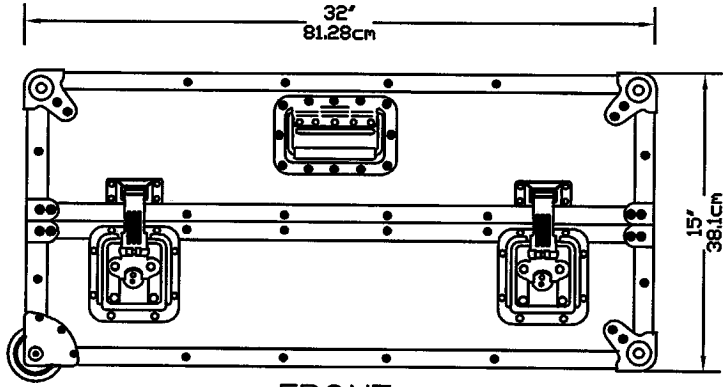

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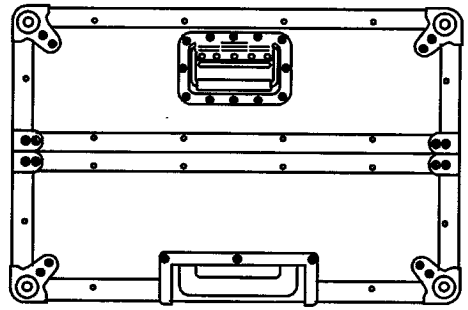

RIGHT

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MODEL:	DRAWN BY: MB	DATE
SEQUENCE –	CHECKED BY: –	05–22–03
PROGRAM: –	APPROVED BY: –	
SERIAL NO.: –	PART: –	
WORK ORDER: –	DWG. NO. PROV–CNG50 BOX SPECS	

7/9/2012	CNG Dispenser Prover	PROV-CNG50	
7/9/2012			
Quantity	**Part Number**	**Discription**	**Manf./ Suppler**
1		Box	Vicking
1		Batery Box	
1	CNG050S290NCAAEZZZ	CNG 50, 30 point cal. meter	Micro Motion
1	2700I13BBAZZZZ	Transmitter	Micro Motion
1	2403SR	Charger	
2	BP7-12	Battery 12v 7.0 AH	
1	N 011 406 96	NGV-1 recpticle	Staubli
1	N 010 219 95	3000 Psi Staubli	Staubli
1	53.213.2.5	Gauge	Wika
1	13NK4ZA-V4LR-SS	Neadle Valve	Parker
1	SS-400-3-4TTF	Female Branch TEE	Swagelok
1	SS-810-3	Union TEE	Swagelok
1	SS-810-11-6	Bulkhead Male Connector	Swagelok
2	SS-810-R-12	Reducer	Swagelok
2	SS-12-VCO-6-1210	VCO Connector	Swagelok
1	SH3-62-643	Female quick Connect	Parker
1	SH3-63-643	Male quick Connect	Parker
1	LRNO	Switch	Control Concepts
12	5CNG-4/520N4	3/8 X 1/4 HOSE	PARKER\TGT
2	PFLX 10158-4-4	3/8 HOSE--1/4 NPT MALE	PARKER\TGT
1	PFLX 10155-2-2	1/8HOSE--1/8 NPT MALE	PARKER\TGT
1	PFLX 10155-4-2	1/8HOSE--1/8 FMALE JIC	PARKER\TGT
2	PFLX CNGG5-4	BEND RESRTICTOR 1/4 HOSE	PARKER\TGT
1		HYDRO TEST	PARKER\TGT
0.5		LABOR	TGT
1		MUFFLER	Parker Fluid
1		3/8" Female T	
2		3/8 Male Hex Nipple	
		3/8" X 1/8" Reducing Bushing	
		Shrader Valve	
		Panel Front	
1	8427-12	COLD SHRINK	3M\ HUNZ.
1	4F-HB4XPKR-SSP	3 WAY VALVE	Parker\PFG
1	SS-400-1	1/4 TUBE CONN	SWAGELOK
1	TGTFVT	VENT-FILL TAG	TGT
8		LABOR	TGT

Filed Session of October 22, 2003
Approved as Recommended
and so Ordered
by the Commission

JACLYN A. BRILLING
Acting Secretary
Issued and Effective October 31, 2003

STATE OF NEW YORK
DEPARTMENT OF PUBLIC SERVICE

October 6, 2003

TO: THE COMMISSION

FROM: OFFICE OF CONSUMER EDUCATION AND ADVOCACY

SUBJECT: CASE 03-G-0796 - Petition of KeySpan Energy for the Approval of the TGT Model PROV-CNG50, filed in C 6480.

RECOMMENDATION: Staff recommends that the Commission approve the application of KeySpan Energy and thereby permit the use of the TGT Model PROV-CNG50 Transfer Prover for calibration of meters used for dispensing of compressed natural gas to public vehicles provided that the TGT PROV-CNG50 Transfer Prover is re-certified to a NIST standard at an interval of no greater than 2 years and that the case be closed.

Application

By letter dated May 22, 2003, KeySpan Energy applied for approval of the TGT Model PROV-CNG50 Transfer Prover (TGT Transfer Prover) manufactured by Tulsa Gas Technologies, in accordance with 16 NYCRR Part 227. KeySpan Energy intends to use the TGT Transfer Prover to calibrate meters used to dispense compressed natural gas (CNG) to public vehicles. The approximate cost of this device is $7,800 depending on selected options.

General Description

The TGT Transfer Prover is portable and battery powered, which will allow the utility to test and calibrate Micro Motion meters used to measure CNG for public vehicles. The TGT Transfer Prover is equipped with a Commission approved meter that has been customized to bear an accuracy that is traceable to the National Institute of Standards Technology (NIST). The TGT Transfer Prover is safe and accurate for field testing Micro Motion meters, where the TGT Transfer Prover is connected in series with a CNG dispenser and a vehicle designed to accept CNG. As gas is dispensed into the vehicle the dispenser and the prover register consumption. The total volume registered by the meter under test is compared to the TGT Transfer Prover display, and a calculation is used to determine accuracy.

The advantages of the TGT Transfer Prover is that it eliminates the need to handle and transport high pressure CNG tanks to various CNG sites, and it can be used in poor climatic conditions.

Tests

KeySpan Energy conducted extensive tests on the TGT Transfer Prover in accordance with the provisions of 16 NYCRR Part 227. Tests were made by KeySpan personnel who have experience in gas measurement, using test equipment with accuracy traceable to NIST. Staff also conducted tests at KeySpan's CNG site in July 2003. These tests demonstrated repeatable test accuracy and an error rate of less than +/-.10% for this TGT Transfer Prover.

Conclusion

Based on the results of tests conducted by KeySpan Energy and Staff, it is recommended that the Commission approve the application by KeySpan Energy.

Respectfully submitted,

KENNETH RESCA
Utility Consumer Program
Specialist II
Office of Consumer Education
and Advocacy

Reviewed by:

LUANN SCHERER
Office of Consumer Education
and Advocacy

PETER CATALANO
Assistant Counsel
Office of General Counsel

Approved:

MICHAEL CORSO
Chief, Residential Advocacy
Office of Consumer Education
and Advocacy

TGT DISPENSER / PROVER FINAL SCALE SHEET

S/N _____ Date _____ Time _____

Original Mass Factor: _____ Changed to: _____

	Scale/ lbs	Disp/lbs	% Error	
Test 1:	_____	_____	_____	
Test 2:	_____	_____	_____	
Test 3:	_____	_____	_____	**Largest Batch Difference**
Average:	_____	_____	_____	_____

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SPECIFICATIONS - 2403SR CHARGER

Totally Automatic Switch-Mode Battery Chargers

"Suitable for Gel, Sealed & Wet Lead Acid Batteries"

Summary: **24 Volts, 1.5Amp Constant Current**
(equivalent to 3A tapered charger in charging time)

- **Universal Input 90VAC to 264VAC** - Suitable anywhere in the world.
- Automatic Cut-off and then true Float. Can be left connected indefinitely without harming the battery.
- **De-sulfation of battery**
- **UL, CSA, CE Listed.**
- Meets FCC Class B; EN55022 Class B.
- Can also be used for On-board (internal) applications.
- Increases battery life by de-sulfating the battery.
- Many advance features described in this spec.
- **Very small size and very light weight**

Explanation of the Features:

The advance technology of the OEM Battery Chargers supplied by Soneil is fundamentally different from other battery chargers. The conventional linear battery charger is an electrical device whereas the 2403SR is a light weight sophisticated electronic device.

1. Switch-Mode Technology:

Most of the battery chargers use linear technology, which convert the 115/230 VAC to 24 VDC at 60 or 50 Hz. This requires a large transformer, which has the disadvantage of lower efficiency resulting in higher heat generation, larger size and weight.

Soneil's Battery Charger transforms the 115/230 VAC into 24 VDC at 100,000 Hz (1667 times faster than conventional charger) which requires a much smaller

transformer and this results in a unit of smaller size, low weight and improved efficiency.

The 2403SR uses sophisticated electronic circuitry with microchips. All present day computers use switch-mode technology.

2. **International Safety Approvals & Listing:**

Both North American (UL & cUL) and European (CE) approvals in a single charger.

3. **Input Requirements:** Universal Input

a) 90VAC to 264VAC

b) 47 - 63 Hz

Very wide AC input tolerance. **Suitable for every part of the world**.

4. **Output:**

1.5 Amps Constant Current @ 24 Volts DC
(Equivalent to 3 Amps tapered charger in charging time)

a) Line Regulation @ Full Load 2%

b) Load Regulation @ 3%

c) **Ripple Voltage**: Very low

The peak to peak ripple voltage into a resistive load is less than 200mV for the output voltage above 24 VDC.

5. **Charging Cycle:**

The charging curve is attached. The explanation of the charging cycle is as following.

Stages	Condition	Mode*	Current	Voltage	LED Indication
Stage 1	Charging Pulse mode	Pulse mode	1.5A Pulsing	0.5V to 5.0V	Flash
Stage 2	Constant Current mode	CC mode	1.5A	5.0V to 28.8.V	Orange
Stage 3	Constant Voltage mode	CV mode	Reduces from 1.5A***	Holds at 28.8V	Orange
Stage 4	Standby Voltage mode	Standby CV mode	Reduces to zero	Maintains 27.6V	Green
	Recharging mode	CC mode	1.5A	27.6V	Orange

* CC mode = Constant current charge
* CV mode = Constant voltage charge
*** See Stage 3 description below

Stage 1: Deep Discharge Charging Pulse Mode: LED Flash
The charger starts charging at 0.5V and give pulse current up to 5V. This has effect of removing loose sulphation formed during deep discharge state of the battery.

Stage 2: Constant Current Mode (CC): LED Orange
The charger changes to constant current 1.5A. When the battery voltage reaches up to 28.8V, the charging stage changes from CC (Constant Current) to CV (Constant Voltage) mode.

Stage 3: Constant Voltage Mode (CV): LED Orange
The charger holds the battery at 28.8V and the current slowly reduces. When the current reaches at 0.10CC (CC=Constant Current), this point called the Switching Point. The Switching Point is one of the great feature of this battery charger that it can adjust the current automatically according to battery capacity. Other chargers are not capable to adjust the current automatically.

Stage 4: Standby Voltage Mode: LED Green
The charger maintains the battery voltage at 27.6V and current slowly reduces to zero. Charger can be left connected indefinitely without harming the battery.

Recharging: LED Orange
If the battery voltage drops down to 27.6V, the charger changes from any mode to Constant Current mode and restart charging. The charging cycle will go through Stage 2 to Stage 4.

Soneil charger can charge gel, sealed or wet lead acid batteries without use

of any switch.

6. **Two colours and function in one LED:**

LED is used to show the charging status. When the LED is Orange, the charger is in charging or recharging mode and the current is 1.5A constant. When the LED Green, the charger is in Standby mode and no current (zero) is flowing.

7. **Protection:**

a) **Reverse polarity protection** - provided
b) **Short circuit protection** - provided
c) Over-Voltage Protection - provided
d) Over current protection - provided
e) **AC Surge Protection** - provided
f) **Soft start and stop:** Starts and stops gradually.

No sudden in-rush of current. This protects both the batteries and any other circuits connected to the charger.

8. **De-sulfation of battery:** The charger will remove loose sulfation and increase the battery life. (Hard sulfation cannot be reversed).

9. **No current drain:**

No (zero) current is taken from the battery when connected to battery but AC not plugged in. (Many other chargers in the market draw 30-40 mAmp which drains the battery.)

10. **Reliability:**

a) **Mean Time between failures (MTBF):** 50,000 power-on-hours (POH) or greater. This translates into 17 years of everyday operation of 8 hours.

b) **Burn-in:** All chargers are burned in at an average DC load of 1.5 Amps.

11. **Electromagnetic Interference (EMI):**

The charger will not generate excessive radiated or conducted emissions. No interference with TV, radio, computer or other equipment.

Meets FCC Class B; EN555022 Class B; IEC-801-3 (3V/M from 27MHZ to 1GHZ).

12. **Ground leakage current**:

The ground leakage current is 87 microAmp, which complies with the requirements.

14. **On-board (internal) Feature:** Standard (not an option)

The model has a third output wire, which provides an interlock signal that will prohibit the operation of the vehicle's motor controller whenever the charger is plugged to an AC source.

Inhibit signal: The interlock signal is an open circuit output, leakage less than 5 microAmp or less, when the charger is not connected to an AC source. This signal will be less than 50 mV DC while sinking 10 mA when the charger is connected to an AC source.

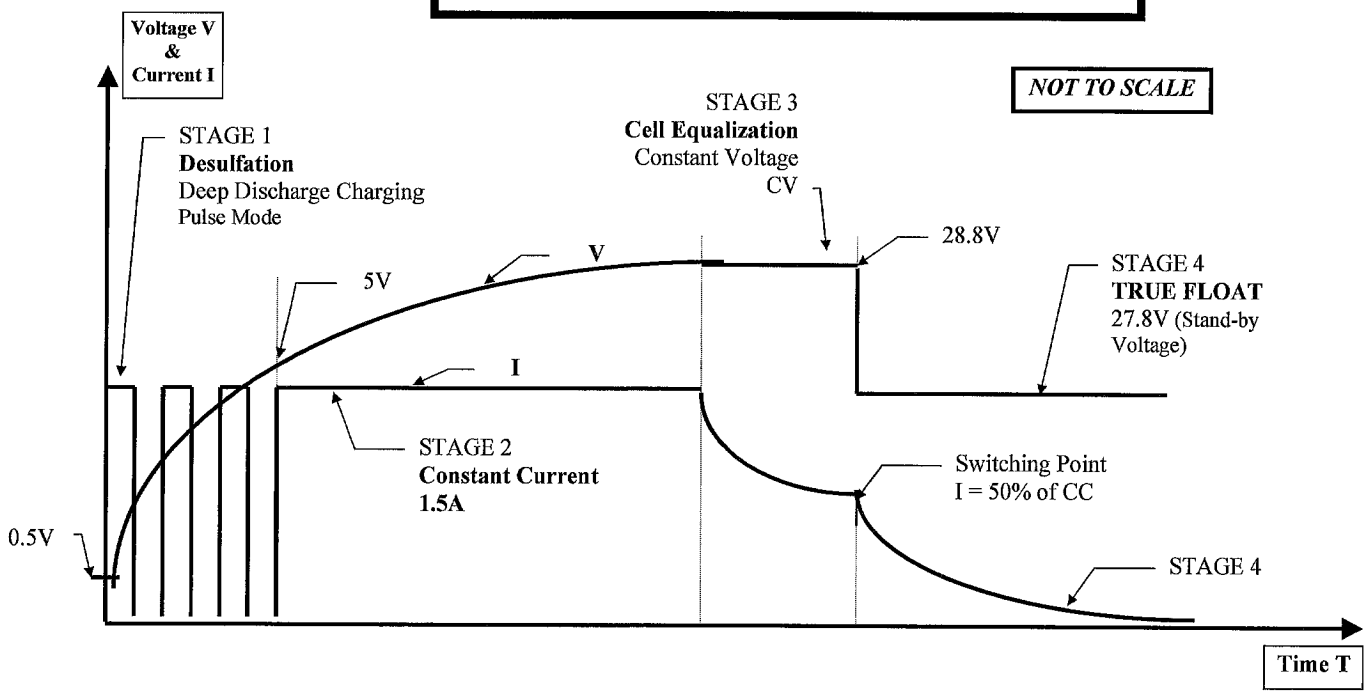
15. **Size:** **Very Small** Length - 4.7" (119 mm)
Width - 2.9" (73 mm)
Height - 1.6" (41. mm)

Very Light Weight 0.5 lbs (220 grams)

Ref: SPEC2403SR(REV12).14-Jul-03

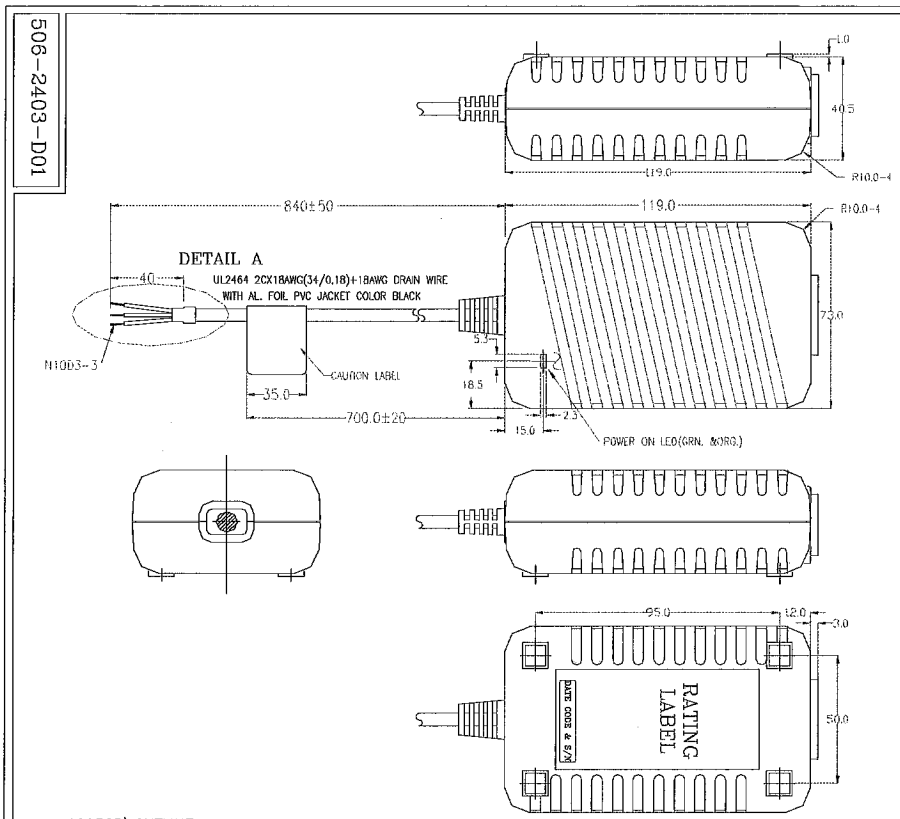
CHARGING CURVE
MODEL 2403SR

SONEIL 24V/3A CHARGER
(1.5A CONSTANT CURRENT)

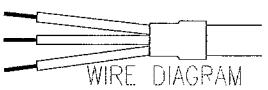


Ref: Curve2403SR.23-Jan-04

506-2403-D01

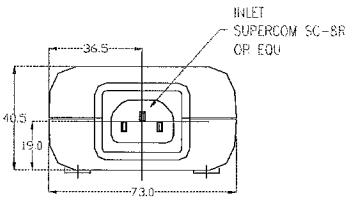


DETAIL A
DC OUTPUT CONNECTOR



WIRE DIAGRAM

COLOR	SIGNAL
BLACK	GND
GREEN	INHIBT
WHITE	+24VDC



FILE: 1205SR\OUTLINE

ISSUE

SONEIL — MISSISSAUGA ONTARIO CANADA

UNIT	SCALE	SHEET 1 OF 1	R	0	C
mm	n/a				

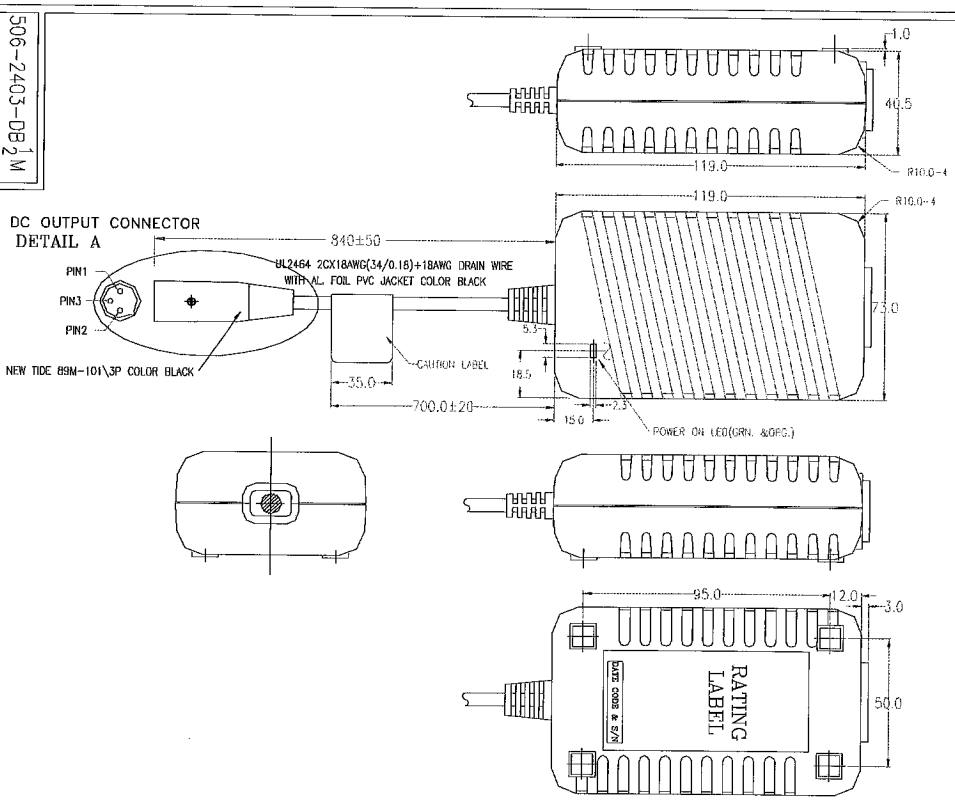
TOLERENCE: UNLESS OTHERWISE SPECIFIED .X ±0.3 .XX ±0.10 .XXX ±0.05 X° ±1.0 XX° ±0.5

DRAWN	DESIGNED	CHECKED	APPV'D	DATE
				MAY.17.2002

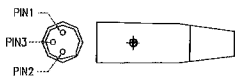
506-2403-D01

TITLE 2403SRD ADAPTER

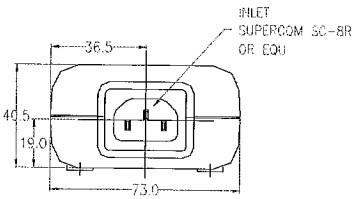
506-2403-DB$\frac{1}{2}$M



DETAIL A
DC OUTPUT CONNECTOR



PIN1 : +24V
PIN2,3 : GND

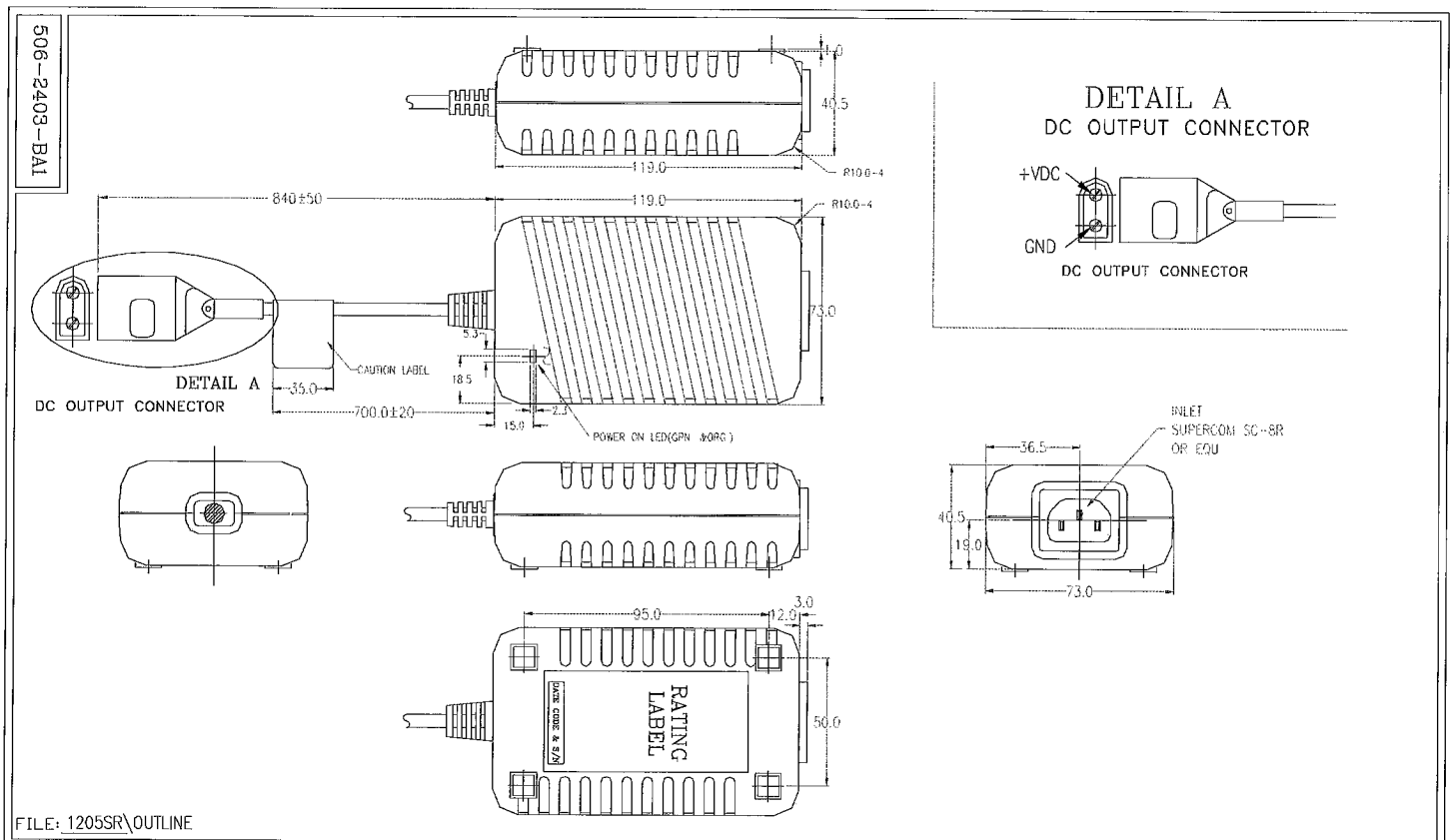


FILE: 1205SR\OUTLINE

ISSUE

SONEIL – MISSISSAUGA ONTARIO CANADA					506-2403-DB$\frac{1}{2}$M
UNIT mm	SCALE (2/1)	SHEET 1 OF 1	R	0	C
TOLERENCE: UNLESS OTHERWISE SPECIFIED					TITLE 2403SRD-B ADAPTER
DRAWN	DESIGNED	CHECKED	APPV'D	DATE MAY.17.2002	

506-2403-BA1

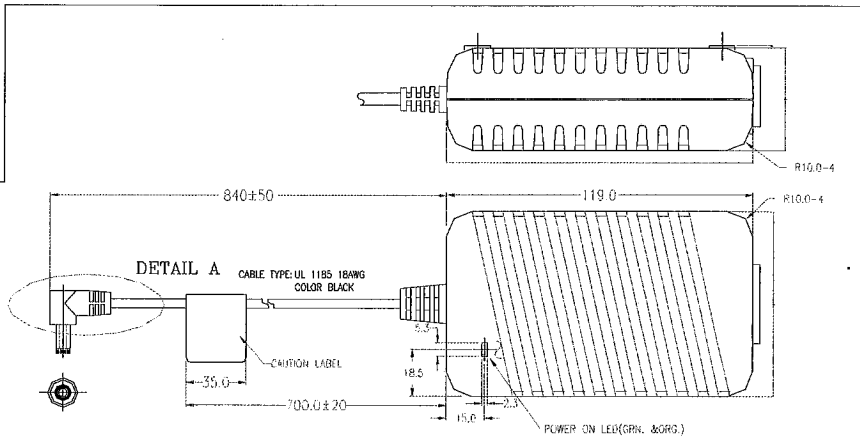


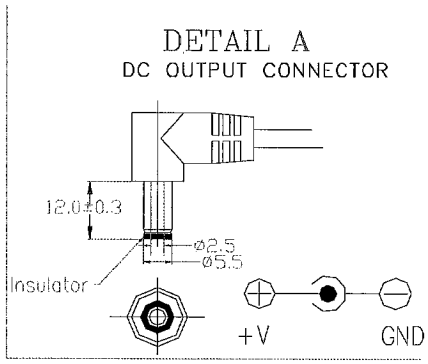
FILE: 1205SR\OUTLINE

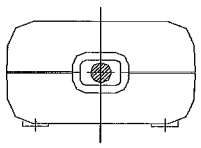
ISSUE

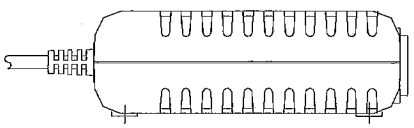
SONEIL – MISSISSAUGA ONTARIO CANADA						506-2403-BA1
UNIT mm	SCALE	SHEET 1 OF 1		R	0	C
TOLERENCE: UNLESS OTHERWISE SPECIFIED						TITLE 2403SRB-A ADAPTER
DRAWN	DESIGNED	CHECKED	APPV'D	DATE MAY.17.2002		

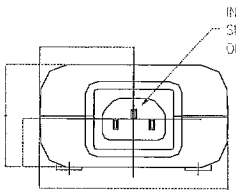
506-2403-DA1M

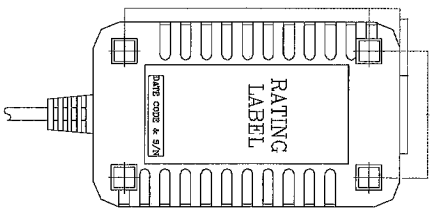












FILE: 1205SR\OUTLINE

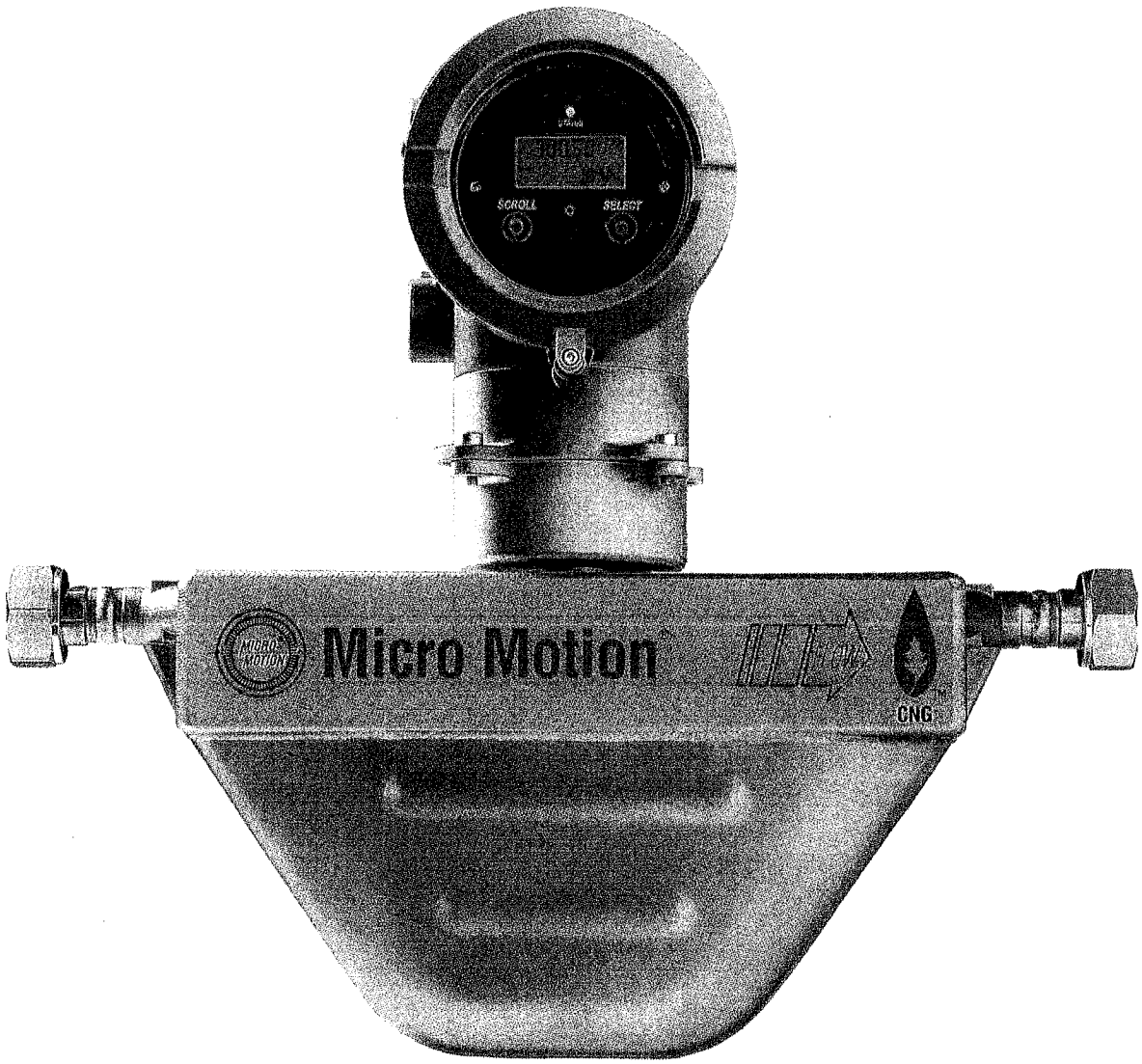
ISSUE

SONEIL — MISSISSAUGA ONTARIO CANADA						506-2403-DA1M
UNIT mm	SCALE NTS	SHEET 1 OF 1	R	0	B	TITLE 2403SRD-A ADAPTER
TOLERENCE UNLESS OTHERWISE SPECIFIED						
DRAWN	DESIGNED	CHECKED	APPV'D	DATE MAY.17.2002		

Product Data Sheet
PS-00408, Rev. B
October 2004

Micro Motion® CNG050 Compressed Natural Gas Flowmeter

With MVD™ Technology



Micro Motion™

EMERSON™
Process Management

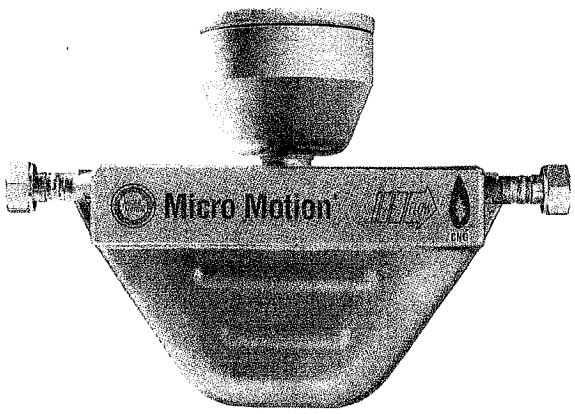
Micro Motion® CNG050 flowmeters

The first full-range CNG flowmeter designed and tested specifically for compressed natural gas, resulting in better performance in CNG applications.

The CNG050 meter was specifically designed for the CNG industry to meet the challenges of measuring compressed natural gas. The meter's increased rangeability allows customers the flexibility to use the sensor for automobile or light- or heavy-duty vehicle dispenser designs.

Micro Motion CNG050 meters feature integral transmitters, making them easy to install. Offered with Series 1000 and 2000 transmitters with MVD™ Technology, customers can choose either single or multivariable output configurations with milliamp, pulse, dual pulse, digital outputs, and an integral display.

Micro Motion MVD™ Direct Connect™ Technology is making Coriolis flowmeters from Micro Motion even more suitable for CNG applications. OEMs can benefit from MVD Direct Connect Technology, which allows smart sensors to communicate directly with dispenser head electronics via Modbus — no transmitter is required!



Like all Micro Motion flowmeters, CNG050 meters offer highly accurate direct mass and volume flow measurement.

Micro Motion CNG050 meters are designed to perform in even the most harsh operating environments, and carry hazardous area approvals for the U.S.A., Canada, and Europe.

Easy to use

CNG050 meters have no moving parts, no need for periodic recalibration, non-intrusive design, and no regular maintenance requirements.

Wide rangeability

The CNG050 meter is used for both car and bus dispenser designs alike. With a 1–100 kg/min flow range, the CNG050 is truly a one-size-fits-all CNG flowmeter.

CNG station reconciliation

The AGA 11 guidelines recently published by the American Gas Association allow for the use of Coriolis meters like the Micro Motion CNG050 in the custody transfer of natural gas. Combining a low pressure check meter (such as a Micro Motion ELITE® or F-Series sensor) on the natural gas inlet with a CNG050 dispensing meter allows for true mass balancing of CNG stations.

MVD™ technology

Reduced fill times

Having a higher flow rate capacity means that vehicles can get back on the road faster than ever.

Proven technology

Micro Motion is known worldwide for increasing plant efficiency, production, and profitability. More than 400,000 Micro Motion meters are installed in applications worldwide, including 15,000 CNG applications.

Greater accuracy and versatility

Micro Motion CNG050 meters have a CNG accuracy of 0.5% of delivered batch over a flow range of 2 to 220 lbs/min (1 to 100 kg/min). This translates to reduced dispenser losses and is approved worldwide by weights and measures authorities.

Weights and measures approvals

Country	Approval
U.S.A.	NTEP
Germany	PTB
Netherlands	NMI
China	Pattern approval
Malaysia	SIRIM
India	Ministry of Consumer Affairs
Italy	Ufficio Metrico Italiano
Canada	Measurement Canada (pending)
Brazil	Inmetro (pending)

Vehicle filling

Because of its clean combustion, CNG is increasingly used as a vehicle fuel in many parts of the world. Micro Motion CNG050 meters used in dispenser stations are routinely verified (proved) against a gravimetric standard, the highest performance rating possible. In addition, the CNG050 meter can be used as a Master Meter standard, thus providing increased safety and eliminating cumbersome scale setup and venting of gas.

Micro Motion CNG050 flowmeters *continued*

Software functionality

The CNG050 sensor can be used with Micro Motion transmitter with MVD Technology. The standard software option of the Series 1000 or 2000 is most common.

A Micro Motion MVD Direct Connect pass-through I.S. barrier can also be used in public stations if it is installed in a separate, sealable housing.

Weights and measures configuration lockout

For applications that require weights and measures approval for legal trade (i.e., public CNG stations), the weights and measures configuration lockout software option for Model 2500 and 2700 transmitters should be ordered with the CNG050 sensor. The configuration lockout software option allows the transmitter to be changed from operating (secure) mode to configuration mode (and back again) using ProLink® II software. The transmitter will register flow only when in the operating (secure) mode. The transmitter will allow configuration changes and zeroing of the meter only when in configuration mode.

When the configuration lockout option is ordered, a means is provided for physically sealing the transmitter housing.

The configuration lockout software option may not be required by certain world area weights and measures authorities. The performance of the CNG050 sensor is not affected by configuration lockout, and the sensor meets batch and accuracy specifications with standard features.

Flow specifications

	Mass		Standard volume[1]	
	lb/min	kg/min	SCFM	Nm^3/hr
Flow range	2 to 220	1 to 100	40 to 4444	68 to 7550
Batch accuracy[2][3]	±0.50% of batch			
Repeatability[2]	±0.30% of rate			
	lb/min	kg/min		
Zero stability	0.02	0.009		

(1) CNG with SG = 0.66 at 60 °F (15.5 °C) and 14.73 psia (1 bar-a).

(2) In terms of percent of total batch delivered on CNG.

(3) Accuracy is under typical CNG batch/dispensing conditions. Typical batch/dispensing conditions are defined as those where the flow rate is greater than 4 lbs/min (109 kg/hr).

Pressure ratings

	psi	bar
Flow tube rating	5000	345
Pressure limits[1]	5000	345
Union to NPT adapter piece rating[2]	4600	317
Housing rating	Housing is not rated for pressure containment.	
PED compliance	Sensor complies with council directive 97/23/EC of 29 May 1997 on Pressure Equipment	

(1) All fittings are rated to 5000 psi (345 bar) — the Union SWG type fitting according to ASME B31.3, and the SAE fitting according to SAE J1453.

(2) Pressure rating of the additional adapter piece (#12 O-ring face seal to female NPT) that is provided with process connection option 239.

Environmental limits

		°F	°C
Process fluid temperature limits		–40 to +257	–40 to +125
Ambient temperature limits	CSA and MMI standard (no approval)	–40 to +140	–40 to +60
	ATEX	Refer to the graph below.	
Humidity limits	5 to 95% relative humidity, non-condensing at 140 °F (60 °C)		
Vibration limits	Meets IEC 68.2.6, endurance sweep, 5 to 2000 Hz, 50 sweep cycles at 1.0 g		

Hazardous area classifications

CSA is a Canadian approvals agency that provides approvals accepted both in the U.S.A (C-US) and in Canada. ATEX is a European directive.

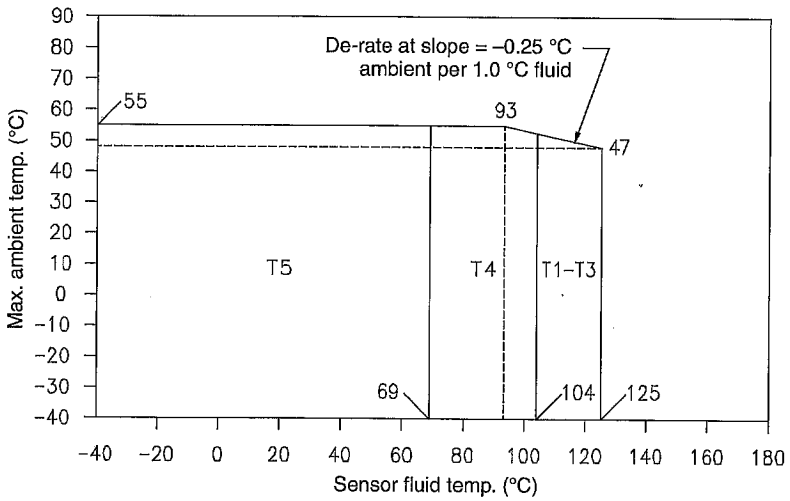
CSA

Class I, Div. 1, Groups C and D
Class I, Div. 2, Groups A, B, C, and D
Class II, Div. 1, Groups E, F, and G

ATEX

EEx ib IIC T1–T5(1)

Allowable CNG050 sensor temperature rating with core processor or integrally mounted transmitter



(1) The "T" rating is defined as the maximum surface temperature of the flowmeter. The "T" rating of the hazardous area, and ambient temperatures above 47 °C, restrict the allowable temperature of the process fluid as shown in the graph above.

Materials of construction

Wetted parts[1]	316L stainless steel
Sensor housing	304L stainless steel
Core processor housing	CF-3M stainless steel or epoxy-painted aluminum; NEMA 4X (IP65)

(1) General corrosion guidelines do not account for cyclical stress, and therefore should not be relied upon when choosing a wetted material for your Micro Motion flowmeter. Please refer to Micro Motion's corrosion guide for material compatibility information.

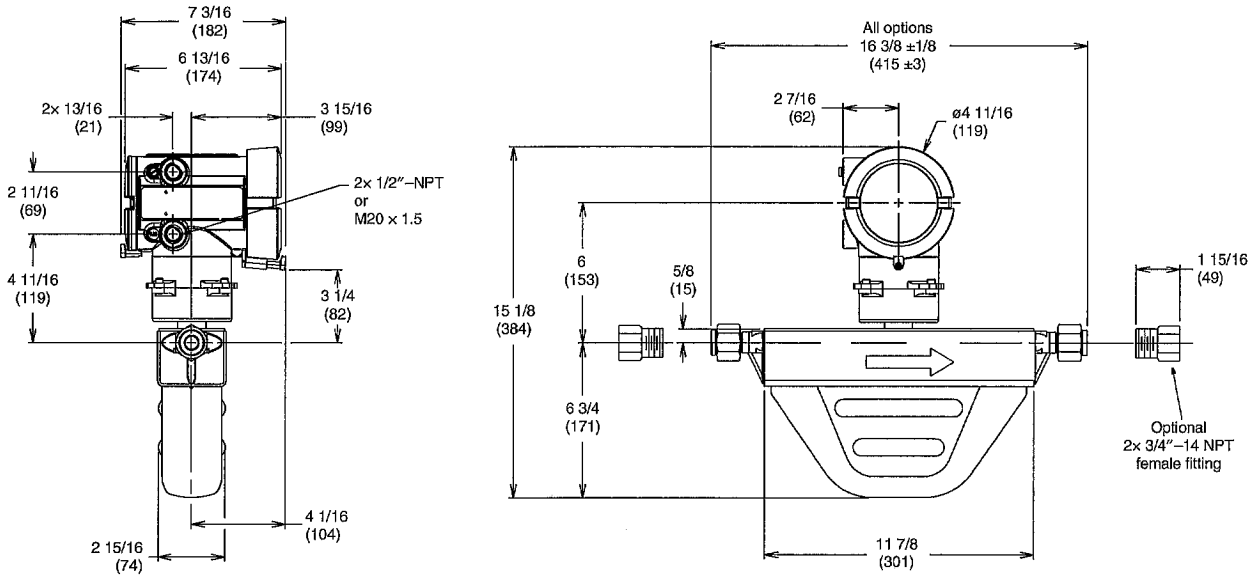
Weight

Sensor with core processor	16 lbs (7 kg)
Sensor with integrally mounted transmitter	18 lbs (8 kg)

Dimensions

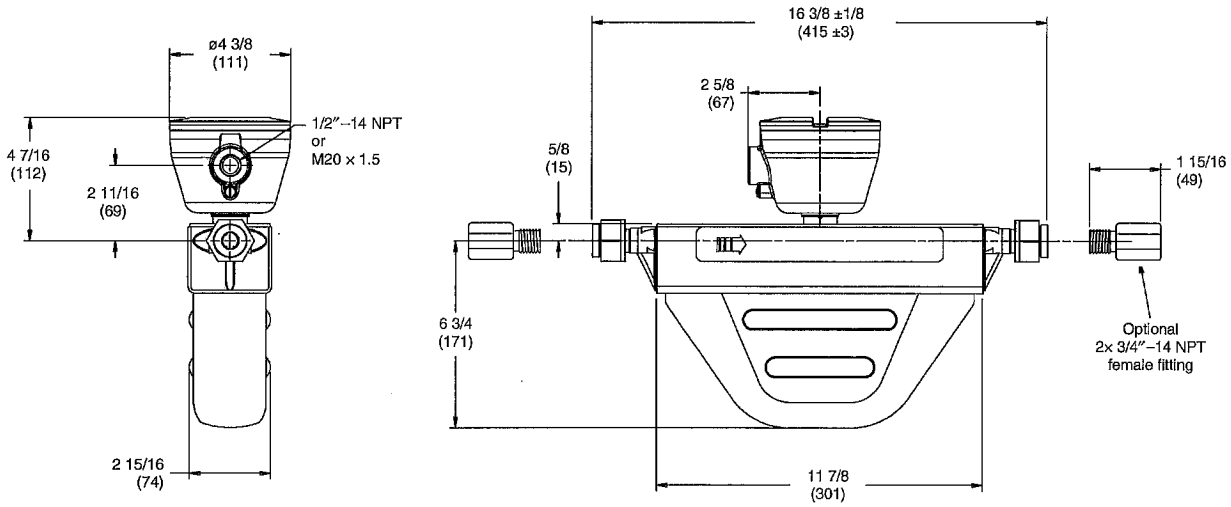
CNG050 sensor with integrally mounted Model 1700/2700 transmitter

Dimensions in inches (mm)



CNG050 sensor with core processor

Dimensions in inches (mm)



Ordering information

Model	Product Description
CNG050S	Micro Motion Coriolis CNG-Series sensor; 1/2-inch; 316L stainless steel
Code	**Process Connections**
239[1]	3/4-inch NPT-female adapter; CAJON compatible size 12 VCO union fitting
290[2]	CAJON compatible size 12 VCO union fitting
291[2]	Union size 12 SAE fitting (universal thread)
Code	**Case Options**
N	Standard
Code	**Electronics Interface**
Q	4-wire epoxy-painted aluminum integral core processor for remote mount transmitters
A	4-wire stainless steel integral core processor for remote mount transmitters
C	For integrally mounted 1700/2700 transmitter
W[3]	Epoxy-painted aluminum integral core processor for MVD Direct Connect installation
D[3]	Stainless steel integral core processor for MVD Direct Connect installation
Code	**Conduit Connections**
	Electronics Interface Codes Q, A, W and D
B	1/2-inch NPT — no gland
E	M20 — no gland
F	Brass/nickel cable gland (cable diameter 0.335 to 0.394 inches [8.5 to 10.0 mm])
G	Stainless steel cable gland (cable diameter 0.335 to 0.394 inches [8.5 to 10.0 mm])
	Electronics interface Code C (Integrally mounted 1700/2700)
A	No gland
Code	**Approvals[3]**
M	Micro Motion Standard (no approval)
N	Micro Motion Standard / PED compliant
C	CSA (Canada only)
A	CSA C-US (U.S.A. and Canada)
Z	ATEX - Equipment Category 2 (Zone 1) / PED compliant

Continued on next page

(1) 3/4-inch NPT female adapter to O-ring face seal adapter rated to 4600 psi (317 bar).

(2) Ready for face seal O-ring (not included).

(3) When electronics interface W or D is ordered with approval codes C, A, or Z, an MVD Direct Connect I.S. barrier is supplied. No barrier is supplied when ordered with approval codes M or N.

Ordering information *continued*

Code	Language
A	Danish Quick Reference Guide and English Manual
D	Dutch Quick Reference Guide and English Manual
E	English Quick Reference Guide and English Manual
F	French Quick Reference Guide and French Manual
G	German Quick Reference Guide and German Manual
H	Finnish Quick Reference Guide and English Manual
I	Italian Quick Reference Guide and English Manual
J	Japanese Quick Reference Guide and English Manual
N	Norwegian Quick Reference Guide and English Manual
O	Polish Quick Reference Guide and English Manual
P	Portuguese Quick Reference Guide and English Manual
S	Spanish Quick Reference Guide and Spanish Manual
W	Swedish Quick Reference Guide and English Manual
Code	**Future Option 1**
Z	Reserved for future use
Code	**Future Option 2**
Z	Reserved for future use
Code	**Factory Options**
Z	Standard product
R	Restocked product (if available)
Typical Model Number:	**CNG050S 290 N C A A E Z Z Z**

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For the latest Micro Motion product specifications, view the PRODUCTS section of our web site at www.micromotion.com

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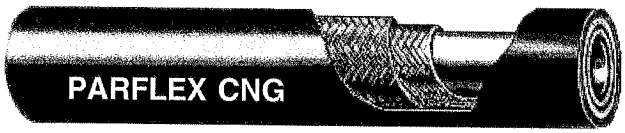
Micro Motion™ — EMERSON. Process Management

~ CNG ~ - Electrically Conductive Compressed Natural Gas Hose 3600 to 5000 psi working pressure



A

C US

Part Number #	I. D. in.	Max. O. D. in.	Max. Working Pressure psi (bar)	Min. Burst Pressure psi (bar)	Min. Bend Radius in.	Weight per 100 ft. lbs.	Wire Spring Guard Part Number* #	Thermoplastic Guard Part Number #	Crimp Fitting Series
3CNG-4	1/4	0.52	3600 (248)	14400 (993)	2	6.2	3PSG-4	CNGG3-4-KIT	55
3CNG-6	3/8	0.77	3600 (248)	14400 (993)	2-1/2	15.0	5PSG-6	CNGG3-6-KIT	58
4CNG-6	3/8	0.77	4000 (276)	16000 (1100)	2-1/2	15.0	5PSG-6	CNGG3-6-KIT	58
5CNG-3	3/16	0.43	5000 (345)	20000 (1379)	1-1/2	5.0	3PSG-3	CNGG5-3-KIT	55
5CNG-4	1/4	0.62	5000 (345)	20000 (1379)	2	11.0	5PSG-4	CNGG5-4-KIT	58
5CNG-6	3/8	0.77	5000 (345)	20000 (1379)	3	17.0	5PSG-6	CNGG3-6-KIT	58
5CNG-8	1/2	0.89	5000 (345)	20000 (1379)	4	20.5	5PSG-8	CNGG5-8-KIT	58
5CNG-12	3/4	1.15	5000 (345)	20000 (1379)	7-1/2	24.1	–	CNGG5-12-KIT	58H
5CNG-16	1	1.59	5000 (345)	20000 (1379)	10	35.8	–	CNGG5-16-KIT	58H

*Wire spring guards must be used on ANSI/CSA design certified CNG dispenser fill hose assemblies. Covers hose sizes -3 through -8; single and multi-line bonded assemblies.

Conforms to NFPA 52, ANSI/IAS NGV 4.2-1999 • CSA 12.52-M99.

Construction: Electrically conductive polymer core tube, two or more layers of fiber reinforcement, and abrasion-resistant urethane cover. Standard cover is perforated for use with fuel.

Standard Colors: Red for 3CNG, 4CNG, 5CNG. Optional green for 5CNG-X-GRN.

Applications: Refueling hose specially designed for conveying compressed natural gas. High-strength conductive polymer core tube formulated to dissipate static electrical buildup. (Note: Each hose assembly must be properly grounded; refer to CNG Hose Assembly Instructions). Thick urethane cover for abrasion and wear resistance.

Temperature Range: -40°F to +180°F (-40°C to 82°C).

Twin-line or multi-line constructions available.

Note: All hose assemblies must be proof tested and electrically tested per NFPA 52. Each CNG kit includes a warning tag and thermoplastic hose guards. (Refer to CNG Hose Assembly Instructions (Bulletin No. 4660-CNG-PFD-2). Wire spring guards required for AGA certification in CNG dispenser applications except 5CNG-12, 5CNG-16. See "Tooling Accessories" section in this catalog for special PSG wire spring guards.

Available as factory made assemblies only through ANSI/CSA certified Parker distributors.

Not for use in airless paint spray applications.

Note: CNG hose must be assembled at an approved and audited facility.

CSA INTERNATIONAL

Certificate of Compliance

Certificate: 209588 (112236M)

Project: 1175927 **Date Issued:** February 14, 2001

Issued to: **Tulsa Gas Technologies**
4809 South 101 East Avenue
Tulsa, OK 74146
U.S.A.
Attention: Mr. Tom Sewell

The products listed below are eligible to bear the CSA Mark shown with adjacent indicators 'C' and 'US'

C US

Issued by: Jennifer Cale

Authorized by: George Gruss
Operations Manager

PRODUCTS

3313-02 HOSES (GAS)
Compressed Natural Gas

Model Number	Type of Component	Temperature Range	Sizes	Pressure
5CNG-4-BLU-TG	Thermoplastic Hose	-40°F to 180°F	¼"	5,000 psi
5CNG-6-BLU-TG	Thermoplastic Hose	-40°F to 180°F	3/8"	5,000 psi
5CNG-6-BLU-TG	Thermoplastic Hose	-40°F to 180°F	½"	5,000 psi

The'C' and 'US' indicators adjacent to the CSA Mark signify that the product has been evaluated to the applicable CSA and ANSI/UL Standards, for use in Canada and the U.S., respectively. This 'US' indicator includes products eligible to bear the 'NRTL' indicator. NRTL, i.e. National Recognized Testing Laboratory, is a designation granted by the U.S. Occupational Safety and Health Administration (OSHA) to laboratories which have been recognized to perform certification to U.S. Standards.

DQD 507WD 2000/11/30

CSA INTERNATIONAL

Certificate: 209588
Project: 1175927

Date: February 14, 2001

3313-82 HOSES (GAS)
Compressed Natural Gas

Model Number	Type of Component	Temperature Range	Sizes	Pressure
5CNG-4-BLU-TG	Thermoplastic Hose	-40°F to 180°F	¼"	5,000 psi
5CNG-6-BLU-TG	Thermoplastic Hose	-40°F to 180°F	3/8"	5,000 psi
5CNG-6-BLU-TG	Thermoplastic Hose	-40°F to 180°F	½"	5,000 psi

APPLICABLE REQUIREMENTS

ANSI/CSA NGV4.2-1999•CSA 12.52-M99 Hoses for Natural Gas Vehicles and Dispensing Systems

MARKINGS

All markings and printed instructions are in compliance with the above mentioned requirements. Samples are contained in the main certification report.

CSA INTERNATIONAL

Supplement to Certificate of Compliance

Certificate: 209588 (112236M)

The products listed, including the latest revision described below, are eligible to be marked in accordance with the referenced Certificate.

Product Certification History

Project	Date	Description
1175927	February 14, 2001	Original Certification. Model comparison for Parker Hannifin Corporation. Report No. 160705-1175927.

Parker Hannifin	Tulsa Gas Technologies
5CNG-4	5CNG-4-BLU-TG
5CNG-6	5CNG-6-BLU-TG
5CNG-8	5CNG-8-BLU-TG

⚠ Parker Safety Guide for Selecting and Using Hose, Tubing, Fittings and Related Accessories

Parker Publication No. 4400-B.1
Revised: May, 2002

WARNING: Failure or improper selection or improper use of hose, tubing, fittings, assemblies or related accessories ("Products") can cause death, personal injury and property damage. Possible consequences of failure or improper selection or improper use of these Products include but are not limited to:

- Fittings thrown off at high speed.
- High velocity fluid discharge.
- Explosion or burning of the conveyed fluid.
- Electrocution from high voltage electric powerlines.
- Contact with suddenly moving or falling objects that are controlled by the conveyed fluid.
- Injections by high-pressure fluid discharge.
- Dangerously whipping Hose.
- Contact with conveyed fluids that may be hot, cold, toxic or otherwise injurious.
- Sparking or explosion caused by static electricity buildup or other sources of electricity.
- Sparking or explosion while spraying paint or flammable liquids.
- Injuries resulting from inhalation, ingestion or exposure to fluids.

Before selecting or using any of these Products, it is important that you read and follow the instructions below. Only Hose from Parker's Stratoflex Products Division is approved for in flight aerospace applications, and no other Hose can be used for such in flight applications.

1.0 GENERAL INSTRUCTIONS

1.1 Scope: This safety guide provides instructions for selecting and using (including assembling, installing, and maintaining) these Products. For convenience, all rubber and/or thermoplastic products commonly called "hose" or "tubing" are called "Hose" in this safety guide. All assemblies made with Hose are called "Hose Assemblies". All products commonly called "fittings" or "couplings" are called "Fittings". All related accessories (including crimping and swaging machines and tooling) are called "Related Accessories". This safety guide is a supplement to and is to be used with, the specific Parker publications for the specific Hose, Fittings and Related Accessories that are being considered for use.

1.2 Fail-Safe: Hose, and Hose Assemblies and Fittings can and do fail without warning for many reasons. Design all systems and equipment in a fail-safe mode, so that failure of the Hose or Hose Assembly or Fitting will not endanger persons or property.

1.3 Distribution: Provide a copy of this safety guide to each person that is responsible for selecting or using Hose and Fitting products. Do not select or use Parker Hose or Fittings without thoroughly reading and understanding this safety guide as well as the specific Parker publications for the products considered or selected.

1.4 User Responsibility: Due to the wide variety of operating conditions and applications for Hose and Fittings, Parker and its distributors do not represent or warrant that any particular Hose or Fitting is suitable for any specific end use system. This safety guide does not analyze all technical parameters that must be considered in selecting a product. The user, through its own analysis and testing, is solely responsible for:

- Making the final selection of the Hose and Fitting.
- Assuring that the user's requirements are met and that the application presents no health or safety hazards.
- Providing all appropriate health and safety warnings on the equipment on which the Hose and Fittings are used.
- Assuring compliance with all applicable government and industry standards.

1.5 Additional Questions: Call the appropriate Parker technical service department if you have any questions or require any additional information. See the Parker publication for the product being considered or used, or call 1-800-CPARKER, or go to www.parker.com, for telephone numbers of the appropriate technical service department.

2.0 HOSE AND FITTING SELECTION INSTRUCTIONS

2.1 Electrical Conductivity: Certain applications require that the Hose be nonconductive to prevent electrical current flow. Other applications require the Hose and the Fitting and the Hose/Fitting interface to be sufficiently conductive to drain off static electricity. Extreme care must be exercised when selecting Hose and Fittings for these or any other applications in which electrical conductivity or nonconductivity is a factor.

The electrical conductivity or nonconductivity of Hose and Fittings is dependent upon many factors and may be susceptible to change. These factors include but are not limited to the various materials used to make the Hose and the Fittings, Fitting finish (some Fitting finishes are electrically conductive while others are nonconductive), manufacturing methods (including moisture control), how the Fittings contact the Hose, age and amount of deterioration or damage or other changes, moisture content of the Hose at any particular time, and other factors.

The following are considerations for electrically nonconductive and conductive Hose. For other applications consult the individual catalog pages and the appropriate industry or regulatory standards for proper selection.

2.1.1 Electrically Nonconductive Hose: Certain applications require that the Hose be nonconductive to prevent electrical current flow or to maintain electrical isolation. For these applications that require Hose to be electrically nonconductive, including but not limited to applications near high voltage electric lines, only special nonconductive Hose can be used. The manufacturer of the equipment in which the nonconductive Hose is to be used must be consulted to be certain that the Hose and Fittings that are selected are proper for the application. Do not use any Parker Hose or Fitting for any such application requiring nonconductive Hose, including but not limited to applications near high voltage electric lines, unless (i) the application is expressly approved in the Parker technical publication for the product, (ii) the Hose is marked "nonconductive", and (iii) the manufacturer of the equipment on which the Hose is to be used specifically approves the particular Parker Hose and Fitting for such use.

2.1.2 Electrically Conductive Hose: Parker manufacturers special Hose for certain applications that require electrically conductive Hose.

Parker manufactures special Hose for conveying paint in airless paint spraying applications. This Hose is labeled "Electrically Conductive Airless Paint Spray Hose" on its layline and packaging. This Hose must be properly connected to the appropriate Parker Fittings and properly grounded in order to dissipate dangerous static charge buildup, which occurs in all airless paint spraying applications. Do not use any other Hose for airless paint spraying, even if electrically conductive. Use of any other Hose or failure to properly connect the Hose can cause a fire or an explosion resulting in death, personal injury, and property damage.

Parker manufactures a special Hose for certain compressed natural gas ("CNG") applications where static electricity buildup may occur. Parker CNG Hose assemblies comply with AGA Requirements 1-93, "Hoses for Natural Gas Vehicles and Fuel Dispensers". This Hose is labeled "Electrically Conductive for CNG Use" on its layline and packaging. This Hose must be properly connected to the appropriate Parker Fittings and properly grounded in order to dissipate dangerous static charge buildup, which occurs in, for example, high velocity CNG dispensing or transfer. Do not use any other Hose for CNG applications where static charge buildup may occur, even if electrically conductive. Use of other Hoses in CNG applications or failure to properly connect or ground this Hose can cause a fire or an explosion resulting in death, personal injury, and property damage. Care must also be taken to protect against CNG permeation through the Hose wall. See section 2.6, Permeation, for more information. Parker CNG Hose is intended for dispenser and vehicle use at a maximum temperature of 180°F. Parker CNG Hose should not be used in confined spaces or unventilated areas or areas exceeding 180°F. Final assemblies must be tested for leaks. CNG Hose Assemblies should be tested on a monthly basis for conductivity per AGA 1-93.

Parker manufacturers special Hose for aerospace in flight applications. Aerospace in flight applications employing Hose to transmit fuel, lubricating fluids and hydraulic fluids require a special Hose with a conductive inner tube. This Hose for in flight applications is available only from Parker's Stratoflex Products Division. Do not use any other Parker Hose for in flight applications, even if electrically conductive. Use of other Hoses for in flight applications or failure to properly connect or ground this Hose can cause a fire or an explosion resulting in death, personal injury , and property damage. These Hose assemblies for in flight applications must meet all applicable aerospace industry, aircraft engine, and aircraft requirements.

2.2 Pressure: Hose selection must be made so that the published maximum recommended working pressure of the Hose is equal to or greater than the maximum system pressure. Surge pressures or peak transient pressures in the system must be below the published maximum working pressure for the Hose. Surge pressures and peak pressures can usually only be determined by sensitive electrical instrumentation that measures and indicates pressures at millisecond intervals. Mechanical pressure gauges indicate only average pressures and cannot be used to determine surge pressures or peak transient pressures. Published burst pressure ratings for Hose is for manufacturing test purposes only and is no indication that the Product can be used in applications at the burst pressure or otherwise above the published maximum recommended working pressure.

2.3 Suction: Hoses used for suction applications must be selected to insure that the Hose will withstand the vacuum and pressure of the system. Improperly selected Hose may collapse in suction application.

2.4 Temperature: Be certain that fluid and ambient temperatures, both steady and transient, do not exceed the limitations of the Hose. Temperatures below and above the recommended limit can degrade Hose to a point where a failure may occur and release fluid. Properly insulate and protect the Hose Assembly when routing near hot objects (e.g. manifolds). Do not use any Hose in any application where failure of the Hose could result in the conveyed fluids (or vapors or mist from the conveyed fluids) contacting any open flame, molten metal, or other potential fire ignition source that could cause burning or explosion of the conveyed fluids or vapors.

2.5 Fluid Compatibility: Hose Assembly selection must assure compatibility of the Hose tube, cover, reinforcement, and Fittings with the fluid media used. See the fluid compatibility chart in the Parker publication for the product being considered or used. This information is offered only as a guide. Actual service life can only be determined by the end user by testing under all extreme conditions and other analysis.

Hose that is chemically compatible with a particular fluid must be assembled using Fittings and adapters containing likewise compatible seals.

2.6 Permeation: Permeation (that is, seepage through the Hose) will occur from inside the Hose to outside when Hose is used with gases, liquid and gas fuels, and refrigerants (including but not limited to such materials as helium, diesel fuel, gasoline, natural gas, or LPG). This permeation may result in high concentrations of vapors which are potentially flammable, explosive, or toxic, and in loss of fluid. Dangerous explosions, fires, and other hazards can result when using the wrong Hose for such applications. The system designer must take into account the fact that this permeation will take place and must not use Hose if this permeation could be hazardous. The system designer must take into account all legal, government, insurance, or any other special regulations which govern the use of fuels and refrigerants. Never use a Hose even though the fluid compatibility is acceptable without considering the potential hazardous effects that can result from permeation through the Hose Assembly.

Permeation of moisture from outside the Hose to inside the Hose will also occur in Hose assemblies, regardless of internal pressure. If this moisture permeation would have detrimental effects (particularly, but not limited to refrigeration and air conditioning systems), incorporation of sufficient drying capacity in the system or other appropriate system safeguards should be selected and used.

2.7 Size: Transmission of power by means of pressurized fluid varies with pressure and rate of flow. The size of the components must be adequate to keep pressure losses to a minimum and avoid damage due to heat generation or excessive fluid velocity.

2.8 Routing: Attention must be given to optimum routing to minimize inherent problems (kinking or flow restriction due to Hose collapse, twisting of the Hose, proximity to hot objects or heat sources).

2.9 Environment: Care must be taken to insure that the Hose and Fittings are either compatible with or protected from the environment (that is, surrounding conditions) to which they are exposed. Environmental conditions including but not limited to ultraviolet radiation, sunlight, heat, ozone, moisture, water, salt water, chemicals, and air pollutants can cause degradation and premature failure.

2.10 Mechanical Loads: External forces can significantly reduce Hose life or cause failure. Mechanical loads which must be considered include excessive flexing, twist, kinking, tensile or side loads, bend radius, and vibration. Use of swivel type Fittings or adapters may be required to insure no twist is put into the Hose. Unusual applications may require special testing prior to Hose selection.

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2.11 **Physical Damage:** Care must be taken to protect Hose from wear, snagging, kinking, bending smaller that minimum bend radius, and cutting, any of which can cause premature Hose failure. Any Hose that has been kinked or bent to a radius smaller than the minimum bend radius, and any Hose that has been cut or is cracked or is otherwise damaged, should be removed and discarded.

2.12 **Proper End Fitting:** See instructions 3.2 through 3.5. These recommendations may be substantiated by testing to industry standards such as SAE J517 for hydraulic applications, or MIL-A-5070, AS1339, or AS3517 for Hoses from Parker's Stratoflex Products Division for aerospace applications.

2.13 **Length:** When establishing a proper Hose length, motion absorption, Hose length changes due to pressure, and Hose and machine tolerances and movement must be considered.

2.14 **Specifications and Standards:** When selecting Hose and Fittings, government, industry, and Parker specifications and recommendations must be reviewed and followed as applicable.

2.15 **Hose Cleanliness:** Hose components may vary in cleanliness levels. Care must be taken to insure that the Hose Assembly selected has an adequate level of cleanliness for the application.

2.16 **Fire Resistant Fluids:** Some fire resistant fluids that are to be conveyed by Hose require use of the same type of Hose as used with petroleum base fluids. Some such fluids require a special Hose, while a few fluids will not work with any Hose at all. See instructions 2.5 and 1.5. The wrong Hose may fail after a very short service. In addition, all liquids but pure water may burn fiercely under certain conditions, and even pure water leakage may be hazardous.

2.17 **Radiant Heat:** Hose can be heated to destruction without contact by such nearby items as hot manifolds or molten metal. The same heat source may then initiate a fire. This can occur despite the presence of cool air around the Hose.

2.18 **Welding or Brazing:** When using a torch or arc-welder in close proximity to hydraulic lines, the hydraulic lines should be removed or shielded with appropriate fire resistant materials. Flame or weld spatter could burn through the Hose and possibly ignite escaping fluid resulting in a catastrophic failure. Heating of plated parts, including Hose Fittings and adapters, above 450°F (232°C) such as during welding, brazing, or soldering may emit deadly gases.

2.19 **Atomic Radiation:** Atomic radiation affects all materials used in Hose assemblies. Since the long-term effects may be unknown, do not expose Hose assemblies to atomic radiation.

2.20 **Aerospace Applications:** The only Hose and Fittings that may be used for in flight aerospace applications are those available from Parker's Stratoflex Products Division. Do not use any other Hose or Fittings for in flight applications. Do not use any Hose or Fittings from Parker's Stratoflex Products Division with any other Hose or Fittings, unless expressly approved in writing by the engineering manager or chief engineer of Stratoflex Products Division and verified by the user's own testing and inspection to aerospace industry standards.

2.21 **Unlocking Couplings:** Ball locking couplings or other couplings with disconnect sleeves can unintentionally disconnect if they are dragged over obstructions or if the sleeve is bumped or moved enough to cause disconnect. Threaded couplings should be considered where there is a potential for accidental uncoupling.

3.0 HOSE AND FITTING ASSEMBLY AND INSTALLATION INSTRUCTIONS

3.1 **Component Inspection:** Prior to assembly, a careful examination of the Hose and Fittings must be performed. All components must be checked for correct style, size, catalog number, and length. The Hose must be examined for cleanliness, obstructions, blisters, cover looseness, kinks, cracks, cuts or any other visible defects. Inspect the Fitting and sealing surfaces for burrs, nicks, corrosion or other imperfections. Do NOT use any component that displays any signs of nonconformance.

3.2 **Hose and Fitting Assembly:** Do not assemble a Parker Fitting on a Parker Hose that is not specifically listed by Parker for that Fitting, unless authorized in writing by the engineering manager or chief engineer of the appropriate Parker division. Do not assemble a Parker Fitting on another manufacturers Hose or a Parker Hose on another manufacturers Fitting unless (i) the engineering manager or chief engineer of the appropriate Parker division approves the Assembly in writing or that combination is expressly approved in the appropriate Parker literature for the specific Parker product, and (ii) the user verifies the Assembly and the application through analysis and testing. For Parker Hose that does not specify a Parker Fitting, the user is solely responsible for the selection of the proper Fitting and Hose Assembly procedures. See instruction 1.4.
The Parker published instructions must be followed for assembling the Fittings on the Hose. These instructions are provided in the Parker Fitting catalog for the specific Parker Fitting being used, or by calling 1-800-CPARKER, or at www.parker.com.

3.3 **Related Accessories:** Do not crimp or swage any Parker Hose or Fitting with anything but the listed swage or crimp machine and dies in accordance with Parker published instructions. Do not crimp or swage another manufacturers Fitting with a Parker crimp or swage die unless authorized in writing by the engineering manager of chief engineer of the appropriate Parker division.

3.4 **Parts:** Do not use any Parker Fitting part (including but not limited to socket, shell, nipple, or insert) except with the correct Parker mating parts, in accordance with Parker published instructions, unless authorized in writing by the engineering manager or chief engineer of the appropriate Parker division.

3.5 **Reusable/Permanent:** Do not reuse any field attachable (reusable) Hose Fitting that has blown or pulled off a Hose. Do not reuse a Parker permanent Hose Fitting (crimped or swaged) or any part thereof. Complete Hose Assemblies may only be reused after proper inspection under section 4.0. Do not assemble Fittings to any previously used hydraulic Hose that was in service, for use in a fluid power application.

3.6 **Pre-Installation Inspection:** Prior to installation, a careful examination of the Hose Assembly must be performed. Inspect the Hose Assembly for any damage or defects. Do NOT use any Hose Assembly that displays any signs of nonconformance.

3.7 **Minimum Bend Radius:** Installation of a Hose at less than the minimum listed bend radius may significantly reduce the Hose life. Particular attention must be given to preclude sharp bending at the Hose to Fitting juncture. Any bending during installation at less than the minimum bend radius must be avoided. If any Hose is kinked during installation, the Hose must be discarded.

3.8 **Twist Angle and Orientation:** Hose Assembly installation must be such that relative motion of machine components does not produce twisting.

3.9 **Securement:** In many applications, it may be necessary to restrain, protect, or guide the Hose to protect it from damage by unnecessary flexing, pressure surges, and contact with other mechanical components. Care must be taken to insure such restraints do not introduce additional stress or wear points.

3.10 **Proper Connection of Ports:** Proper physical installation of the Hose Assembly requires a correctly installed port connection insuring that no twist or torque is transferred to the Hose when the Fittings are being tightened or otherwise during use.

3.11 **External Damage:** Proper installation is not complete without insuring that tensile loads, side loads, kinking, flattening, potential abrasion, thread damage, or damage to sealing surfaces are corrected or eliminated. See instruction 2.10.

3.12 **System Checkout:** All air entrapment must be eliminated and the system pressurized to the maximum system pressure (at or below the Hose maximum working pressure) and checked for proper function and freedom from leaks. Personnel must stay out of potential hazardous areas while testing and using.

3.13 **Routing:** The Hose Assembly should be routed in such a manner so if a failure does occur, the escaping media will not cause personal injury or property damage. In addition, if fluid media comes in contact with hot surfaces, open flame, or sparks, a fire or explosion may occur. See section 2.4.

4.0 HOSE AND FITTING MAINTENANCE AND REPLACEMENT INSTRUCTIONS

4.1 Even with proper selection and installation, Hose life may be significantly reduced without a continuing maintenance program. The severity of the application, risk potential from a possible Hose failure, and experience with any Hose failures in the application or in similar applications should determine the frequency of the inspection and the replacement for the Products so that Products are replaced before any failure occurs. A maintenance program must be established and followed by the user and, at minimum, must include instructions 4.2 through 4.7.

4.2 **Visual Inspection Hose/Fitting:** Any of the following conditions require immediate shut down and replacement of the Hose Assembly:

- Fitting slippage on Hose,
- Damaged, cracked, cut or abraded cover (any reinforcement exposed);
- Hard, stiff, heat cracked, or charred Hose;
- Cracked, damaged, or badly corroded Fittings;
- Leaks at Fitting or in Hose;
- Kinked, crushed, flattened or twisted Hose; and
- Blistered, soft, degraded, or loose cover.

4.3 **Visual Inspection All Other:** The following items must be tightened, repaired, corrected or replaced as required:

- Leaking port conditions;
- Excess dirt buildup;
- Worn clamps, guards or shields; and
- System fluid level, fluid type, and any air entrapment.

4.4 **Functional Test:** Operate the system at maximum operating pressure and check for possible malfunctions and leaks. Personnel must avoid potential hazardous areas while testing and using the system. See section 2.2.

4.5 **Replacement Intervals:** Hose assemblies and elastomeric seals used on Hose Fittings and adapters will eventually age, harden, wear and deteriorate under thermal cycling and compression set. Hose Assemblies and elastomeric seals should be inspected and replaced at specific replacement intervals, based on previous service life, government or industry recommendations, or when failures could result in unacceptable downtime, damage, or injury risk. See section 1.2.

4.6 **Hose Inspection and Failure:** Hydraulic power is accomplished by utilizing high-pressure fluids to transfer energy and do work. Hoses, Fittings, and Hose Assemblies all contribute to this by transmitting fluids at high pressures. Fluids under pressure can be dangerous and potentially lethal and, therefore, extreme caution must be exercised when working with fluids under pressure and handling the Hoses transporting the fluids. From time to time, Hose Assemblies will fail if they are not replaced at proper time intervals. Usually these failures are the result of some form of misapplication, abuse, wear, or failure to perform proper maintenance. When Hoses fail, generally the high-pressure fluids inside escape in a stream which may or may not be visible to the user. Under no circumstances should the user attempt to locate the leak by "feeling" with their hands or any other part of their body. High-pressure fluids can and will penetrate the skin and cause severe tissue damage and possibly loss of limb. Even seemingly minor hydraulic fluid injection injuries must be treated immediately by a physician with knowledge of the tissue damaging properties of hydraulic fluid.
If a Hose failure occurs, immediately shut down the equipment and leave the area until pressure has been completely released from the Hose Assembly. Simply shutting down the hydraulic pump may or may not eliminate the pressure in the Hose Assembly. Many times check valves, etc., are employed in a system and can cause pressure to remain in a Hose Assembly even when pumps or equipment are not operating. Tiny holes in the Hose, commonly known as pinholes, can eject small, dangerously powerful but hard to see streams of hydraulic fluid. It may take several minutes or even hours for the pressure to be relieved so that the Hose Assembly may be examined safely.
Once the pressure has been reduced to zero, the Hose Assembly may be taken off the equipment and examined. It must always be replaced if a failure has occurred. Never attempt to patch or repair a Hose Assembly that has failed. Consult the nearest Parker distributor or the appropriate Parker division for Hose Assembly replacement information.
Never touch or examine a failed Hose Assembly unless it is obvious that the Hose no longer contains fluid under pressure. The high-pressure fluid is extremely dangerous and can cause serious and potentially fatal injury.

4.7 **Elastomeric seals:** Elastomeric seals will eventually age, harden, wear and deteriorate under thermal cycling and compression set. Elastomeric seals should be inspected and replaced.

4.8 **Refrigerant gases:** Special care should be taken when working with refrigeration systems. Sudden escape of refrigerant gases can cause blindness if the escaping gases contact the eye and can cause freezing or other severe injuries if it contacts any other portion of the body.

4.9 **Compressed natural gas (CNG):** Parker CNG Hose Assemblies should be tested after installation and before use, and at least on a monthly basis per AGA 1-93 Section 4.2 "Visual Inspection Hose/Fitting". The recommended procedure is to pressurize the Hose and check for leaks and to visually inspect the Hose for damage.
Caution: Matches, candles, open flame or other sources of ignition shall not be used for Hose inspection. Leak check solutions should be rinsed off after use.