NEXT GENERATION GAS SYSTEM (NGGS)

IEP SENSOR BRACKET CHECKOUT AND VERIFICATION PROCEDURE

870-PROC-623

Revision A

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Goddard Space Flight Center
Greenbelt, Maryland 20771

This is a non-hazardous test.

As run date: _____

Sensor Bracket P/N: _____

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Technical Services Division
5010 Herzel Place
Beltsville, Maryland 20705
V: 301-931-0388
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Prepared By: Kenneth J. McCaughey **Date:** 2-21-2002
Ken McCaughey / OSC
NGGS Electrical Engineer

Reviewed By: Bill Seidell **Date:** 2/25/02
Bill Seidell / OSC
NGGS Lead Technician

Approved By: Lissette Martinez **Date:** 2/22/02
Lissette Martinez / NASA - GSFC Code 565
NGGS Lead Electrical Engineer

Reviewed By: Fred Kreis **Date:** 2/25/02
Fred Kreis / Honeywell
System Assurance Manager

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1.0 SCOPE

This procedure tests the NGGS IEP sensor bracket assembly in a stand-alone configuration. This test is to be performed on the assembly prior to integration the next higher assembly. This procedure can also be used to retest the assembly as required.

1.1 PURPOSE

The goal of this procedure is to verify the electrical operation of the NGGS Sensor Bracket Assembly. The Sensor Bracket will be mounted to the NGGS IEP. The bracket contains a pressure transducer and a thermistor.

The pressure transducer is a modified, off the shelf Kavlico (p/n P155-30A-E2A) pressure transducer. A portion of this procedure will be to characterize the pressure transducer.

2.0 APPLICABLE DOCUMENTS

2.1 STANDARDS

Unless otherwise specified, the latest revision of the documents below should be used.

FED-STD-209B	Requirements for Cleanliness
MIL-STD-45662A	Calibration System Requirements
NASA-STD-8739.7	Requirements for Electrostatic Discharge Control

2.2 GAS PROGRAM REFERENCES

Unless otherwise specified, the latest revision of the documents below should be used.

2035521	Assembly, IEP Sensor Bracket, NGGS
2035524	Altered Part, Pressure Transducer, NGGS
2035503	Wiring Diagram, Standard IEP, NGGS
2035660	Assembly, Sensor Bracket EGSE
2035661	Assembly, Sensor Bracket Test Valve

3.0 QUALITY PROVISIONS

Stated below are the Quality Provisions for Quality Assurance (QA) as they relate to the assembly under test.

3.1 TEST CONDUCTOR

The performance of operations specified in this procedure does not require the supervision of the appropriate Quality Assurance representative. Notify QA in advance of the execution of this test procedure. QA has the option of monitoring test activities.

3.2 TEST PREREQUISITES

The Test Engineer shall certify the item is complete and ready for testing by verification of the following:

a) During performance of this test all special and general test equipment shall be within prescribed certification or calibration intervals as applicable.
b) Upon completion of the test, the resultant test data shall be attached or included within the item's build data.

3.3 FAILURE CRITERIA

The inability of the item to perform its required functions, as specified, during test operation, or mechanical degradation, which will impair its mounting and/or alignment, shall be considered a failure.

3.4 FAILURE REPORTS

Malfunction reporting shall be in accordance with the GSFC NCR System. Failure reporting shall be in accordance with ISO 9000.

3.5 TEST CONDITIONS

The test area shall comply with the following restrictions for bench level testing:

a) Relative Humidity: $50 \pm 20\%$.
b) Cleanliness: As defined by FED-STD-209B
c) ESD Protection: As defined by NASA-STD-8739.7

3.6 PROCEDURAL CHANGES

To facilitate the operation of this procedure, other procedures, or applicable parts may be performed out of sequence before this procedure. Deviations and/or redlines from this procedure during test shall be recorded on the appropriate page and approved prior to performance of the deviation by the Test Engineer and/or the Design Engineer. All redlines shall be initialed by the Test Engineer.

4.0 REQUIREMENTS

4.1 GENERAL REQUIREMENTS

The following general requirements shall be followed while performing this procedure.

4.1.1 Test Responsibility

a) The Test Engineer has authority over the execution of the test and is responsible for approving or disapproving any deviations from this procedure.
b) The Test Conductor is responsible for adhering to the test procedure, conducting the test, recording all test data, and writing deviation, as required.

4.1.2 Precautions and Operating Instructions

! CAUTION ! - USE EXTREME CAUTION WHEN PROBING FLIGHT HARDWARE

a) The requirements of handling flight hardware properly shall be followed. Personnel handling the flight hardware shall be ESD certified.
b) All breast pockets shall be emptied, and badges tucked in or put away, prior to working above the flight hardware.
c) Extreme caution shall be used when handling the flight hardware to prevent damage to thermal surfaces, finishes, or electrical parts.
d) The test area shall be kept as clean and neat as possible during the test.

4.1.3 Test Records

a) All data shall be recorded in pen.
b) All major steps are verified complete by the test conductor initialing where indicated by the "Verify:" blank at the end of the step.
c) All data taken during this test shall be recorded in, and/or attached to this procedure.
d) All hardcopies of waveform plot shall be labeled with the date, time, plot number, this procedure number, test section number, and the unit under test serial number. All waveform traces shall be labeled.
e) If deemed necessary by the Test Engineer, a summary report highlighting significant data should be generated and attached to this procedure.

4.2 TEST PERSONNEL

Indicate the personnel participating in this test.

Name	*Initials*

4.3 TEST EQUIPMENT

The following list of test equipment is required to perform this procedure. The equipment shall be in accordance with MIL-STD-45662A or equivalent. If additional equipment is used during the procedure, record the information to the list.

Table 4-1 – Equipment List

Nomenclature	*Manufacturer*	*Model No.*	*ECN*	*Cal Due*
DMM #1				
DMM #2				
Power supply (+9 to 12V)				
Control pressure transducer	Sensotec	990607RA0900		
Sensor bracket EGSE	GSFC	2035660	N/A	N/A
Break out box, DB9	N/A	N/A	N/A	N/A
DB9 straight cable	N/A	N/A	N/A	N/A
Wire leads and jumpers	N/A	N/A	N/A	N/A
Thermometer	N/A	N/A	N/A	N/A
Heat gun	N/A	N/A	N/A	N/A
Freeze Spray	N/A	N/A	N/A	N/A
Pressure/vacuum chamber			N/A	N/A
Vacuum pump			N/A	N/A
Pressure source			N/A	N/A
Pressure Sensor GSE	GSFC	2035661	N/A	N/A

4.4 PRE-POWER UP VISUAL TEST

a) A visual check shall be performed on the item under test to ensure each of the required steps (as listed on the WOA) to prepare the unit for test has been implemented correctly.
b) A visual check shall be performed to ensure the item to be tested is free of defects, foreign objects or debris, and in the proper configuration for this test.

4.5 TEST PREPARATION

4.5.1 Record the sensor bracket assembly information below. Verify: _____

Assembly Part Number: _____

Assembly Revision Level: _____

Assembly Serial Number: _____

Pressure Transducer Manufacturer: _____

Pressure Transducer Part Number: _____

Pressure Transducer Serial Number: _____

Work Order Number: _____ (OSC / SAI / GSFC)

Work Order Event Number: _____

5.0 ISOLATION AND CONTINUITY

This section should be performed prior to the first power up of the assembly.

5.1.1 Connect the 9-pin break-out-box to the sensor bracket J301. Verify: _____

5.1.2 Using DMM #1, measure and record the isolation and continuity resistance measurements in the Table 5-1 below. Verify: _____

5.1.3 Verify that all signals are isolated from chassis. Do not proceed any further if any of the isolation measurements have failed. Verify: _____

Table 5-1 – J301 Isolation & Continuity Measurements

Measurement		*Expected Value*	*Measured Value*	*Pass/Fail*
Plus Lead	*Minus Lead*			
Chassis	Pin-1, Therm RTN	> 10 M Ohms	Ω	
Chassis	Pin-2, IEP Therm	> 10 M Ohms	Ω	
Chassis	Pin-3, IEP Press	> 10 M Ohms	Ω	
Chassis	Pin-4, IEP RTN	> 10 M Ohms	Ω	
Chassis	Pin-5, Sensor PWR	> 10 M Ohms	Ω	
Pin-1, Therm RTN	Chassis	> 10 M Ohms	Ω	
Pin-2, IEP Therm	Chassis	> 10 M Ohms	Ω	
Pin-3, IEP Press	Chassis	> 10 M Ohms	Ω	
Pin-4, IEP RTN	Chassis	> 10 M Ohms	Ω	
Pin-5, Sensor PWR	Chassis	> 10 M Ohms	Ω	
Pin-2, IEP Therm	Pin-1, Therm RTN	10.5KΩ +/- 2KΩ *	Ω	
Pin-5, Sensor PWR	Pin-4, IEP RTN	10.5KΩ +/- 2KΩ	Ω	
Pin-3, IEP Press	Pin-4, IEP RTN	35KΩ +/- 3KΩ	Ω	

** Varies with temperature.*

6.0 GSE SETUP

The sensor bracket EGSE is used for the remainder of the tests in this procedure.

6.1.1 Refer to Figure 6-1 below for the electrical GSE setup using the sensor bracket EGSE P/N 2035660. Verify: _____

6.1.2 Set the power supply to 10VDC and then verify the power supply is turned **OFF**. Connect the power supply to the Sensor Bracket EGSE. Verify: _____

6.1.3 Connect DMM #2 setup to measure current across **TP1** (+) and **TP2** (-). Set the current monitor switch to **ON**. Verify: _____

6.1.4 Connect DMM #1 setup to measure voltage. Connect the minus lead to **TP5** (-). The plus lead will be connected to either **TP3** or **TP4** to measure the pressure or thermistor voltages respectively. Verify: _____

6.1.5 Using a DB-9 straight cable, connect the Sensor Bracket EGSE to the sensor bracket. Verify: _____

6.1.6 Setup and power on the calibrated pressure transducer. Verify: _____

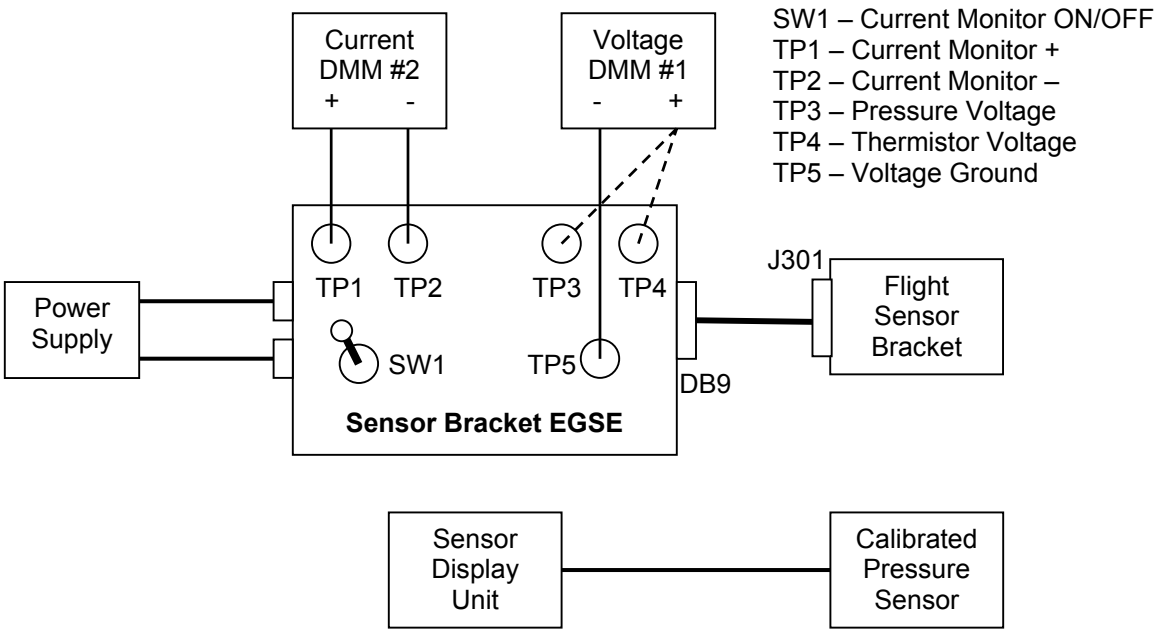

Figure 6-1 - Sensor Bracket Electrical GSE Setup

7.0 THERMISTOR ALIVENESS TEST

This section verifies the general operation of the sensor bracket thermistor. The thermistor is a YSI-44006. This test is not a characterization or calibration of the performance of the thermistor.

7.1 AMBIENT TEST

7.1.1 Turn **ON** the GSE power supply. Verify: _____

7.1.2 Record the ambient temperature using a thermometer in Table 7-1 below. Verify: _____

7.1.3 Record the thermistor voltage observed in Table 7-1 below. Verify: _____

7.1.4 Using the chart in Figure 7-1 and the thermistor voltage, determine the thermistor temperature and record it in Table 7-1 below. Verify: _____

7.1.5 Turn **OFF** the GSE power supply. Verify: _____

7.2 HOT TEST

This test requires the use of the heat gun.

7.2.1 Turn **ON** the GSE power supply. Verify: _____

7.2.2 Apply heat to the thermistor, being careful not to over heat the unit. Verify: _____

7.2.3 Verify that the thermistor voltage is decreasing. It is not necessary to make the voltage drop more than 1V. Verify: _____

7.2.4 Record the minimum thermistor voltage observed in Table 7-1 below. Verify: _____

7.2.5 Using the chart in Figure 7-1 and the thermistor voltage, determine the thermistor temperature and record it in Table 7-1 below. Verify: _____

7.2.6 Turn **OFF** the GSE power supply. Verify: _____

7.3 COLD TEST

This test requires the use of the freeze spray.

Note: The freeze spray will make the affected suface cold in a short amount of time. Use in a well ventilated area.

7.3.1 Turn **ON** the GSE power supply. Verify: _____

7.3.2 Apply freeze spray to the thermistor, being careful not to over freeze the unit. Verify: _____

7.3.3 Verify that the thermistor voltage is increasing. It is not necessary to make the voltage increase more than 1V. Verify: _____

7.3.4 Record the maximum thermistor voltage observed in Table 7-1 below. Verify: _____

7.3.5 Using the chart in Figure 7-1 and the thermistor voltage, determine the thermistor temperature and record it in Table 7-1 below. Verify: _____

7.3.6 Turn **OFF** the GSE power supply. Verify: _____

Table 7-1 – Thermistor Aliveness Test Data

Measurement		*Expected Value*	*Measured Value*	*Pass/Fail*
Amb.	Thermometer temperature	N/A	°C	N/A
	Thermistor Voltage – DMM #1	N/A	VDC	N/A
	Thermistor temperature	Thermometer +/-2°C	°C	
Cold Test	Thermistor Voltage – DMM #1	0V < V < Amb. Volt.	VDC	
	Thermistor temperature	< Thermometer	°C	
Hot Test	Thermistor Voltage – DMM #1	Amb. Volt. < V < 5V	VDC	
	Thermistor temperature	> Thermometer	°C	

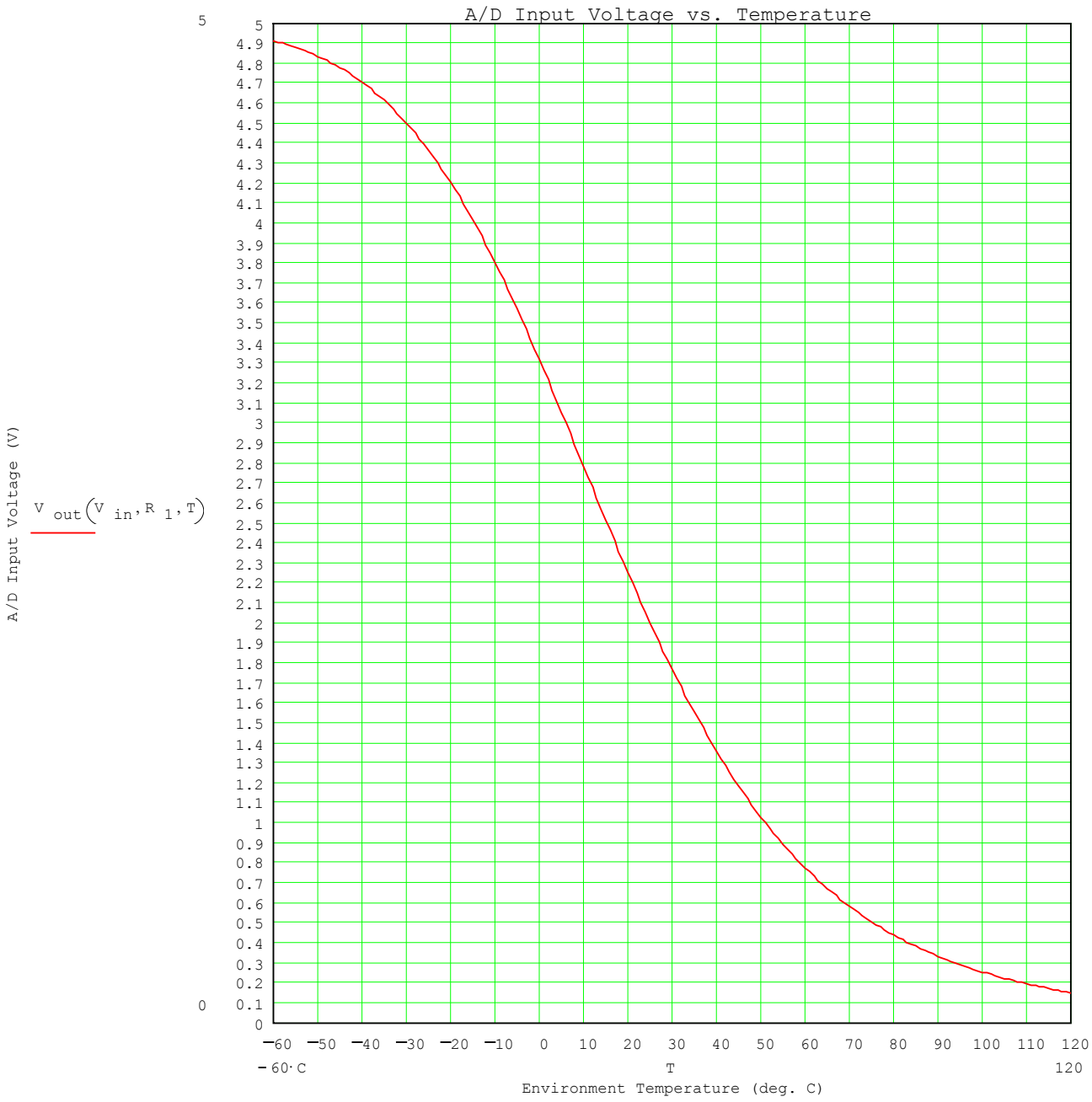

Figure 7-1 – YSI-44006 Thermistor Temperature Conversion

8.0 PRESSURE TRANSDUCER ALIVENESS TEST

This section performs an aliveness test on the pressure transducer. This is not a calibration or characterization test.

8.1 AMBIENT PRESSURE TEST

8.1.1 Use the control pressure transducer then measure and record the ambient pressure in Table 8-1 below. Verify: _____

8.1.2 Turn **ON** the GSE power supply. Verify: _____

8.1.3 Record the sensor current on DMM #2 and the sensor output voltage on DMM #1 in Table 8-1 below. Verify: _____

8.1.4 Turn **OFF** the GSE power supply. Verify: _____

8.2 LOW PRESSURE TEST

This test requires the use of a vacuum source. The control pressure transducer and the sensor bracket must see the same vacuum. This can be accomplished with plumbing or by using a small vacuum chamber.

8.2.1 Pull a slight vacuum (~3 psia) on the system. Verify: _____

8.2.2 Using the control pressure transducer, verify that the chamber is holding the pressure and that the reading has settled out. This may take a few minutes. Verify: _____

8.2.3 Use the control pressure transducer then measure and record the pressure in Table 8-1 below. Verify: _____

8.2.4 Turn **ON** the GSE power supply. Verify: _____

8.2.5 Record the sensor current on DMM #2 and the sensor output voltage on DMM #1 in Table 8-1 below. Verify: _____

8.2.6 Verify that the sensor output voltage is less than the ambient voltage. Verify: _____

8.2.7 Turn **OFF** the GSE power supply. Verify: _____

8.3 HIGH PRESSURE TEST

This test requires the use of a pressure source. The pressure presented to the sensor must never exceed 31 psia or permanent damage to the unit will result. The control pressure transducer and the sensor bracket must see the same pressure. This can be accomplished with plumbing or by using a small pressure chamber.

8.3.1 Increase the pressure (~3 psia) on the system. Verify: _____

8.3.2 Using the control pressure transducer, verify that the system is holding the pressure and that the reading has settled out. This may take a few minutes. Verify: _____

8.3.3 Use the control pressure transducer then measure and record the pressure in Table 8-1 below. Verify: _____

8.3.4 Turn **ON** the GSE power supply. Verify: _____

8.3.5 Record the sensor current on DMM #2 and the sensor output voltage on DMM #1 in Table 8-1 below. Verify: _____

8.3.6 Verify that the sensor output voltage is greater than the ambient voltage. Verify: _____

8.3.7 Turn **OFF** the GSE power supply. Verify: _____

Table 8-1 – Pressure Transducer Aliveness Test Data

Measurement		***Expected Value***	***Measured Value***	***Pass/Fail***
Amb.	Calibrated pressure sensor	N/A	psia	N/A
	Current – DMM #2	3.0 mA +/- 0.5 mA	mA	
	Sensor output voltage – DMM #1	N/A	VDC	N/A
Low Press	Calibrated pressure sensor	N/A	psia	N/A
	Current – DMM #2	3.0 mA +/- 0.5 mA	mA	
	Sensor output voltage – DMM #1	N/A	VDC	N/A
High Press	Calibrated pressure sensor	N/A	psia	N/A
	Current – DMM #2	3.0 mA +/- 0.5 mA	mA	
	Sensor output voltage – DMM #1	N/A	VDC	N/A

9.0 PRESSURE TRANSDUCER CHARACTERIZATION

This section performs a detailed characterization test on the pressure transducer over its operational range. The control pressure transducer and the sensor bracket must see the same pressure.

9.1 PLUMBING SETUP

Electrically the setup is the same as in section 6.0. Below is the plumbing setup recommended for this test. The leak valve in combination with the flow valve is used to control the system pressure. The plumbing uses the Sensor Bracket Test Valve Assembly GSE P/N 2035661.

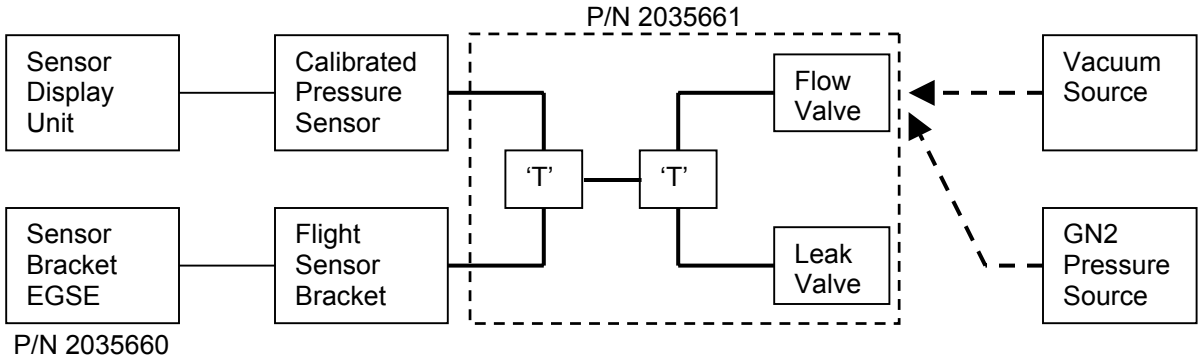

Figure 9-1 – Plumbing Setup

9.2 LOW PRESSURE TEST

This test requires the use of a vacuum source. The control pressure transducer and the sensor bracket must see the same vacuum.

9.2.1 Pull a vacuum on the system until is minimal pressure is reached. This may take a few minutes to 1 hour depending on the setup and equipment used. Verify: _____

9.2.2 Using the control pressure transducer, verify that the system is holding the pressure and that the reading has settled out. This may take a few minutes. Verify: _____

9.2.3 Turn **ON** the GSE power supply. Verify: _____

9.2.4 Adjust the system pressure using a valve to create a slow leak to allow the system to slow increase in pressure. Adjust the system pressure (as read on the control pressure transducer) as close as possible to each of the target pressures listed in Table 9-1 below. Verify: _____

9.2.5 At each target pressure measure and record the control pressure transducer, the sensor current on DMM #2, and the sensor output voltage on DMM #1 in Table 9-1 below. Verify: _____

9.2.6 Turn **OFF** the GSE power supply. Verify: _____

9.3 HIGH PRESSURE TEST

This test requires the use of a pressure source. The pressure presented to the sensor must never exceed 31 psia or permanent damage to the unit will result.

9.3.1 Place the system under pressure until maximum pressure of 30 psia is reached. ***DO NOT EXCEED 31 PSIA.*** Verify: _____

9.3.2 Using the control pressure transducer, verify that the system is holding the pressure and that the reading has settled out. This may take a few minutes. Verify: _____

9.3.3 Turn **ON** the GSE power supply. Verify: _____

9.3.4 Adjust the system pressure using a valve to create a slow leak to allow the system to slow decrease in pressure. Adjust the system pressure (as read on the control pressure transducer) as close as possible to each of the target pressures listed in Table 9-1 below. Verify: _____

9.3.5 At each target pressure measure and record the control pressure transducer, the sensor current on DMM #2, and the sensor output voltage on DMM #1 in Table 9-1 below. Verify: _____

9.3.6 Turn **OFF** the GSE power supply. Verify: _____

Table 9-1 – Pressure Transducer Characterization Test Data

Target Pressure +/- 0.5 psia		*Calibrated Pressure Sensor Measurement*	*Sensor Current DMM #1*	*Sensor Voltage DMM #1*
Low Press	1.0 psia	psia	mA	VDC
	3.0 psia	psia	mA	VDC
	6.0 psia	psia	mA	VDC
	9.0 psia	psia	mA	VDC
	12.0 psia	psia	mA	VDC
	14.7 psia	psia	mA	VDC
High Press	27.0 psia	psia	mA	VDC
	24.0 psia	psia	mA	VDC
	21.0 psia	psia	mA	VDC
	18.0 psia	psia	mA	VDC
	14.7 psia	psia	mA	VDC

9.3.7 Plot the data collected in Table 9-1 on the graph in Figure 9-2 below. Verify: _____

P/N: _____ Rev: _____ S/N: _____ Date: _____

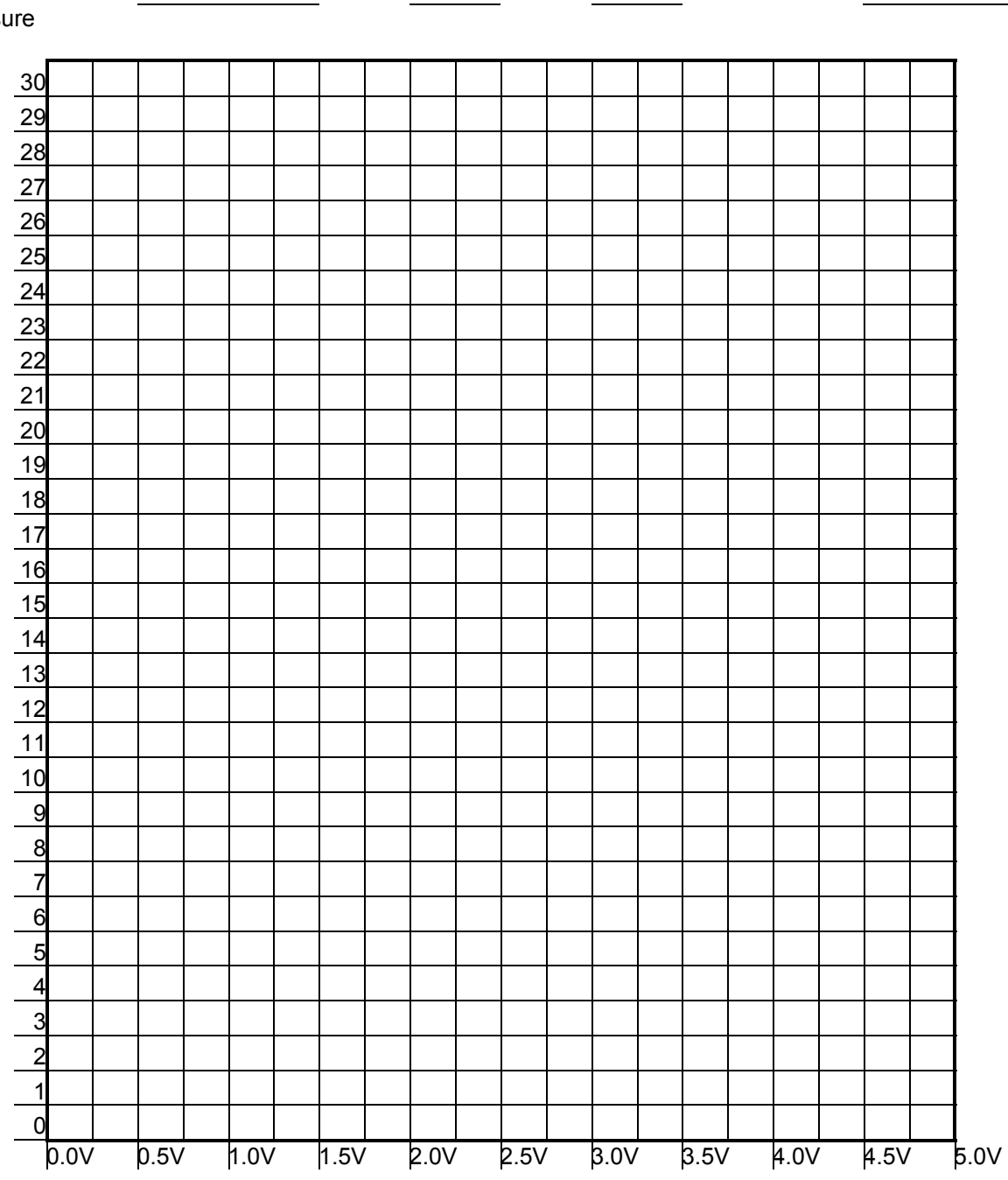

Figure 9-2 – Voltage vs. Pressure

10.0 END OF TEST

10.1.1 Turn **OFF** all power supplies. Verify: _____

10.1.2 Disconnect the test setup. Verify: _____

10.1.3 If hardcopy plots of waveforms were generated, attach them to this procedure. If files were made, print out hardcopies and attach them to this procedure. Verify: _____

10.1.4 The test conductor shall sign below indicating that this procedure has been completed. QA shall review the 'as run' procedure and sign below.

_____	_____
Test conductor	Date
_____	_____
Quality Assurance	Date