Engineering Specification
VV Flow Meters

Overview

The flow meter, originally designed for the Volumetric Valve, is used to accurately measure the amount of water being dispensed. In lab testing, it typically provides readings with a repeatability of + 1.0%.

Water passes through the flow meter where a rotor with 6 paddles on it “samples” the flow. As the rotor turns, the paddles interrupt an infrared LED beam. The detector outputs an electrical pulse whenever the beam is interrupted. A faster flow rate will result in a faster pulse rate at the output.

In Lancer’s applications, the water flow rates range from 1.50 fl-oz/s to 3.00 fl-oz/s. That results in pulses at approximately 225 – 450 Hz. The electronics triggers on both the leading and trailing edges of a pulse to double the resolution. The relationship between flow rate and pulse count is often called the K-factor, expressed as number of pulses per quantity measured. In Lancer’s applications this is the Counts Per Ounce (CPO). Typical CPO values are 350 to 450.

Regulatory and Agency Compliance

Supplier must provide certificates of conformance, and/or declarations for the following:

1. Plastic Resin — Dupont Zytel FG151L NC010, NSF 61, EC1935, Low Lead
2. Wire — UL ZPFW2 Wiring Harnesses – Component
UL ZPFW8 Wiring Harnesses Certified for Canada - Component
3. RoHS — European Parliament Directive 2002/98/EC

Tests Required for Qualification OR Failure Analysis (performed by Lancer)

Pressure Vessel

Because the Flow Meter is part of the “pressure vessel” (valve), it must be capable of withstanding five times the operating pressure. For the water, the maximum static pressure is 120 psi. To meet pressure vessel requirements of UL Standard 471, the Flow Meter installed on the valve must withstand 600 psi being applied five times. See appendix A & B for drawings of the adapter block needed to perform this test.

Temperature Cycling & Water Ingress

Output levels of the assemblies are tested prior to water ingress testing (IEC 60529).

Flow Meters see rapid cooling when 33°F water is dispensed. The Flow Meter then gradually begins to warm-up to the ambient air temperature. This condition can be simulated by submerging the Flow Meter 3” in cold water (33°F - 41°F) for 10 seconds, and then suspending it in ambient air (68°F - 78°F) for at least 15 minutes to warm it. This cycle must be repeated at least 100 times to demonstrate the reliability of the electronics and potting.

Perform an Output Level Test upon completion to verify operation.

Functional Test

To test the Flow Meter, output pulses are counted during a water pour. The water is collected and measured by weighing to get an accurate measurement. Weights are converted into fluid ounces using a conversion factor of 29.57 grams/fluid ounce. The counts are divided by the volume to get the Counts Per Ounce (CPO).

Requires:

- Dispenser suitable for the Volumetric Valve
- Chilled Carbonated Water (33°F - 41°F)
- Chilled Plain Water (33°F - 41°F)
- Volumetric Valve
- Volumetric Hand-held Programmer
- Digital Oscilloscope
- Bearings and rotor

Test Setup:

- Install rotor and bearings in the flow meter body to be tested.
- Install the flow meter assembly on the volumetric valve
- Install the flow washer on the volumetric valve (check for each test step)
- Install on the dispenser.
- Select carbonated or non-carbonated water.
- Setup the oscilloscope to capture the flow meter output to the control board.

Test:

For each of the test conditions in Table 1, perform a 5 second timed dispense.

While pouring:

- Monitor the oscilloscope output to verify that signal levels meet or exceed limits.
- Capture and store an example waveform
- Record high and low output levels.

After completion:

- Record the counts displayed on the hand-held programmer
- Record the weight of the water dispensed
- Calculate and record the dispensed volume and CPO

TABLE 1

Test Condition		**Measured Results**				**Calcuated Results**	
Water	*Flow Rate*	*VOH*	*VOL*	*Counts*	*Weight*	*Volume*	*CPO*
Carb	1.25						
Plain							
Carb	2.50						
Plain							
Limit ->		VOH > 4.8V	VOL < 0.3V				

Manufacturer End-of-Line Acceptance Test - 100%
Lancer Incoming Acceptance Test - As Required by Quality Directives

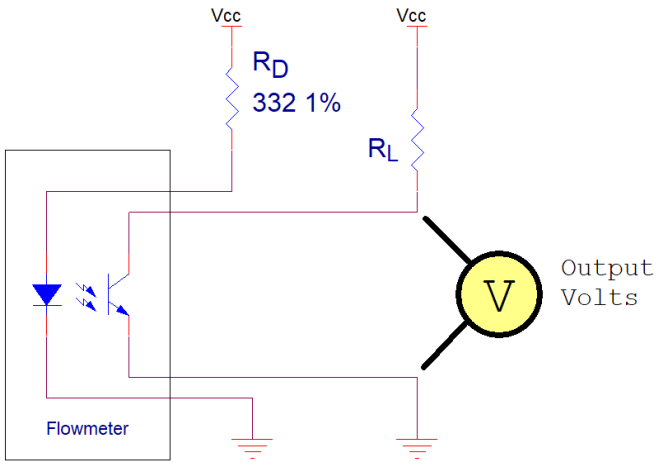
Output Level Test

Verify that the Output Voltage in the Blocked and Unblocked conditions meet requirements of the Flowmeter Electrical Characteristics (below).

Electrical Characteristics

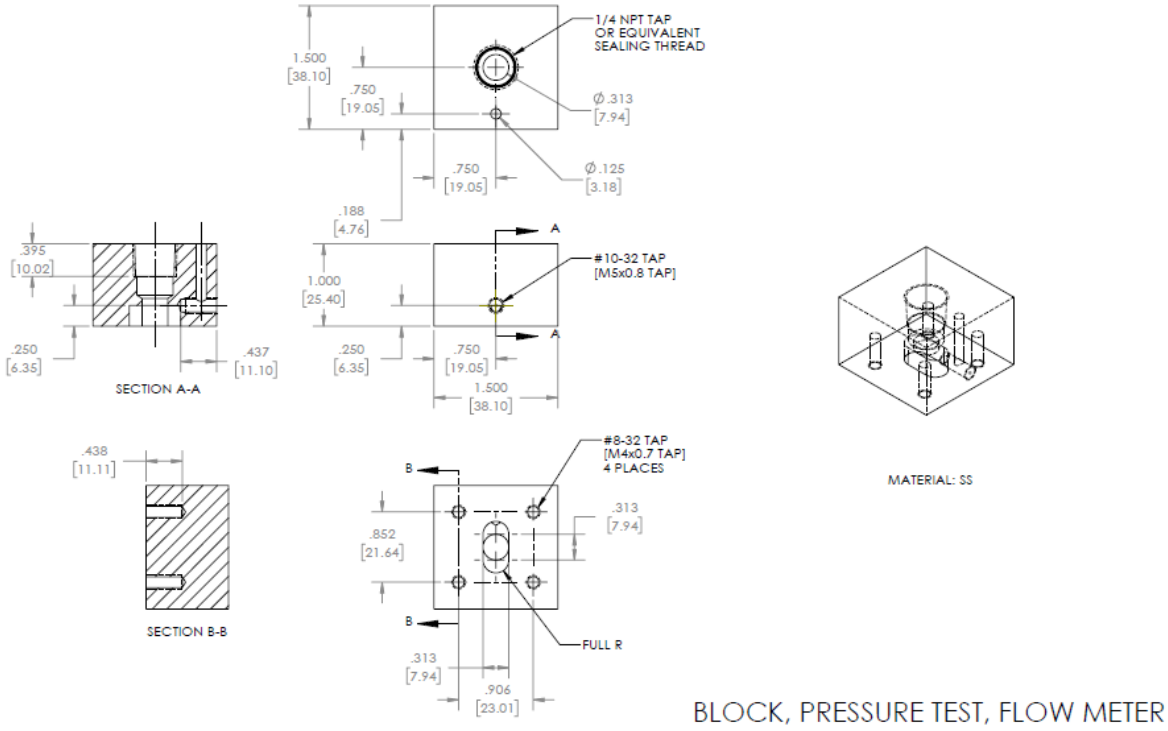
Parameter	Conditions	Min	Typ.	Max	Unit
Emitter reverse voltage				5	V
Emitter Forward current (1)	R_D = 332 Ω	10	12	13	mA
Emitter Beam Angle		20		25	Degrees
Detector View Angle		20		25	Degrees
Detector C-E Voltage				30	V
Detector E-C Voltage				5	V
Wavelength (matched)		880		940	nm
Operating Temperature		0		85	C
Storage Temperature		-25		85	C
Output Voltage (unblocked) (1)(2)	V_{CC} = 5.0V R_D = 332 Ω R_L = 4.7 K Ω			300	mV
Output Voltage (blocked sensor) (1)(3)	V_{CC} = 5.0V R_D = 332 Ω R_L = 10 K Ω	V_{CC} - 0.2V			V
Operation Life (1)	V_{CC} = 5.0V R_D = 332 Ω R_L = 4.7 K Ω	80,000			Hours

1. Test circuit:

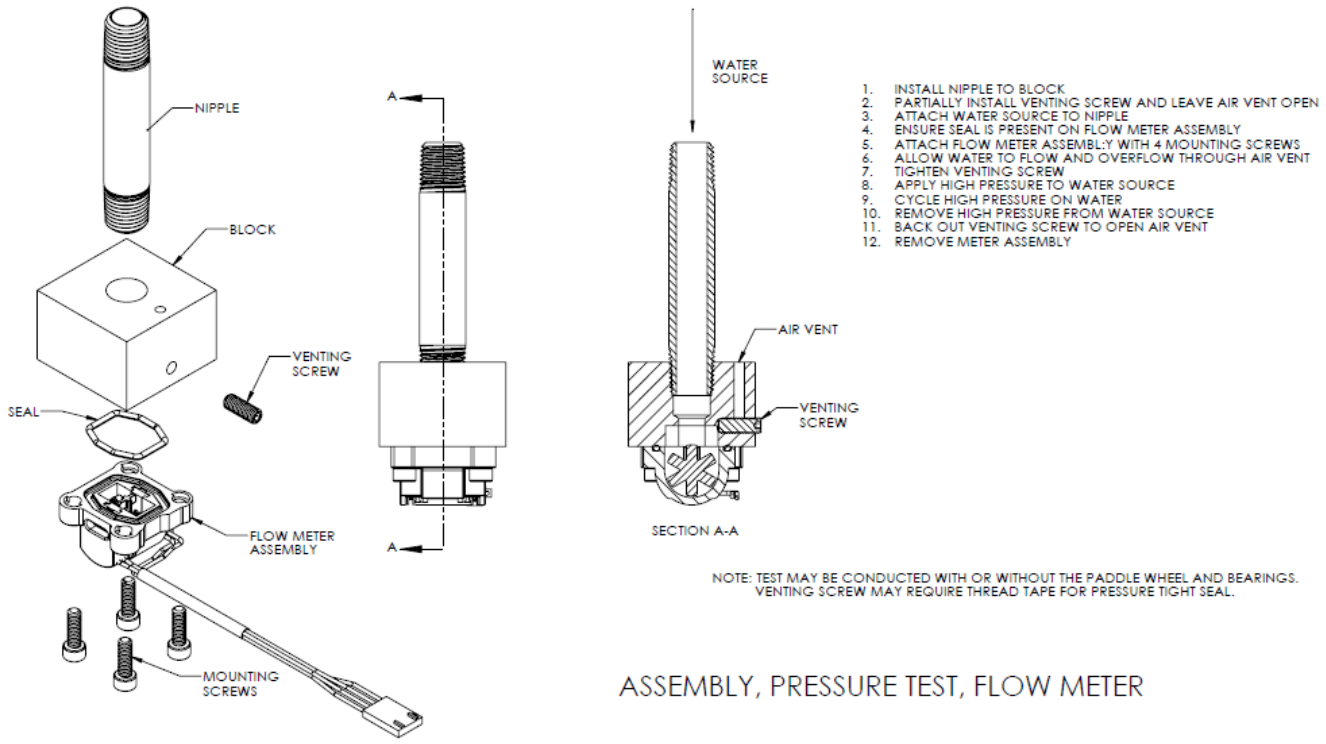


2. Unblocked Sensor:
   - No obstructions in the paddle wheel slot
   - No ambient light
3. Blocked Sensor:
   - Light beam between emitter and detector blocked with 3.0 mm diameter rod
   - No ambient light

Appendix A



Appendix B



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