TECHNICAL MANUAL

CALIBRATION INSTRUCTIONS

FUEL PRESSURIZING & DUMP VALVE TEST STAND

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1 CALIBRATION

Read, review and become familiar with the entire procedure before beginning the Calibration Process.



Ensure that all fused equipment and/or removable cables comply with Air Force Technical Order 33-1-32.



Unless otherwise designated, and prior to beginning the Calibration Process, ensure that all test equipment voltage and/or current outputs are set to zero (0) and turned off, where applicable. Ensure that all equipment switches are set to the proper positions before making connections or applying power.

Calibration Description

Table - Test Method				
Test Instrument (TI) Characteristics	Performance Specifications	Test Method		
Pressure Gauges	See Table Calibration	Compare to Pressure Standard		
Temperature Indicator	See Table Calibration	Compare to Temperature Standard		
Turbine Flow Meter	See Table Calibration	Compare to a Flow Standard		
Flow Indicator	See Table Calibration	Compare to a Flow Characterization Table		

Note

The following components and gauges no longer are in used or need to be calibrated or aligned.

Item 3 Pressure Gage (0-30 PSI) Item 4 Pressure Gage (0-60 PSI)

Item E1 Flow Indicator (50-20,000 PPH)

Item 8 Specific Gravity Meter

Item 9 Viscosity Meter

Item 10 Temperature Indicator

Item 12 DIFF Drip Indicator

Table - Calibration Information

Equipment Tag Number	Nomenclature	Calibration Range	Required Accuracy*	Calibration Instrument Test to Accuracy Ratio Required (TAR)	Suggested Calibration Instrument*	Calibration Frequency
Item 1	Pressure Gauge	0 – 1000 psig	±0.5% FS	4:1	Ruska 7250XI	6 months
			\pm 5.0 psig			
Item 2	Pressure	0-400 psig	±0.5% FS	4:1	Ruska 7250XI	6 months
	Gauge		$\pm 2.0 \text{ psig}$			
Item 5	Pressure Gauge	0 – 400 psig	±0.5% FS	4:1	Ruska 7250XI	6 months
			$\pm 2.0 \text{ psig}$			
Item 6	Pressure Gauge	0 – 100 psig	±0.1% FS	4:1	Ruska 7250XI	6 months
			\pm 1.0 psig			
Item 7	Differential Pressure Gauge	0 – 500 psid	±1.5% FS	4:1	Ruska 7250XI	6 months
			\pm 7.5 psid			
Item 11	Temperature Indicator	50 - 150° F	± 2.0 ° F	4:1	HART Scientific 9105	6 months
FT-10	Flow Indicator	300 – 10,000 pph	±1.0% of Reading	4:1	HP 3325A	6 months
FT-10 Flow Me (ANC12)	Flow Meter	Meter 300 – 10,000 pph	±0.5% of Reading	4:1	See Section	6 months
					Calibration Procedure	

^{*} Calibration instrument accuracy must equal or exceed the listed requirement.

^{***} Environmental conditions unless otherwise noted are: 73.3°F ±9°F, <90% RH non-condensing.

^{****} All accuracies are calculated using the root sum squares method for all devices.

Calibration Procedure



Unless otherwise designated, and prior to beginning the Calibration Process, ensure that all test equipment voltage and/or current outputs are set to zero (0) and turned off, where applicable. Ensure that all equipment switches are set to the proper positions before making connections or applying power.

Connect test equipment to 115VAC, 60Hz power source, turn POWER switch to ON and allow sufficient warm-up time for each standard.



Each technician disconnecting and reconnecting low pressure and high pressure transducers for calibration purposes must be familiar with the applicable directions and safely precautions contained in T.O. 00-25-223. It is recommended that a protective shield be used during the pressurization of all transducers and oil lines not designed explosion proof over 500 psi.



Unless otherwise specified, verify the results of each test and take corrective action whenever the test requirement is not met, before proceeding.

Calibrating Pressures

Note

When using pressure standards on TIs with gages mounted above or below the standard, head pressure must be calculated. When using the Ruska 7250 enter the difference between the standard and gage under test into the head pressure menu of the 7250 then proceed with testing.

- 1. Connect regulated pressure source to the Primary Pressure Calibrator range of the TI.
- 1. Connect TI to output connection of the Calibration Standard.
- 2. Exercised pressure gage or transducer 3 times to FS.
- 3. Adjust pressure gage to zero.
- 4. Apply pressure to establish value equal to pressures near 25%, 50%, 75%, and 90% of full scale. Read pressure from standard to determine true pressure and OOT condition.
- 5. The TI must indicate the applied pressure \pm the limits as determined by the accuracies listed.
- 6. Repeat step 1 thru step 6 for all remaining pressure gages.
- 7. Disconnect TI from calibration equipment.

Calibrating Flow Meter

NOTE

Flowmeters are calibrated at the Tinker AFB Flow Laboratory in accordance with T.O. 33K6-4-900-1, every 365 days. The flow data sheets that accompany each flowmeter must be used to verify flow on stand.

- Remove flowmeters from test stand, fill out flow request form and deliver flowmeters to Tinker Flow Lab for certification.
- 2. Flowmeters are calibrated to ensure systems accuracies listed in Table Calibration Information. Repair flowmeter if K-factor does not repeat, or if K-factor versus frequency curves are abnormal.
- 3. Use appropriate flow straighteners upstream and downstream of flowmeter. Use minimum flow straighteners length of ten times the tubing diameter of same size tubing for upstream side. A similar section equal in length to five times the diameter shall be used on the downstream side.
- 4. Pickoff connections are as follows: A-24VDC. B-Common, C-Signal out. Connect approximately 680 ohms between pins A & C.
- 5. Use calibrating fluid, MIL-C-7024 Type 2.
- 6. Calibrate at 80.0 to ± 2.0 °F
- 7. With flowmeter set up for calibration, allow fluid to circulate for 5 minutes before starting calibration runs.
- 8. Run 10 equally spaced flow rates across the calibration range listed for each meter. Calculate accuracy IAW with TO 33K6-4-900-1.

Calibrating Flow Rate Indicator

Note

Before proceeding with calibration procedure, please read and become familiar with the Flow Rate Indicator User Manual HF112PEN_v0204_04 ATEX provided by the manufacturer.

- Go to the Flow Rate Indicator program menu by holding down the PROG/ENTER button for 10 seconds.
- 2. Use the SELECT button to toggle thru the menu until the FLOW RATE menu appears.
- 3. At the FLOWRATE menu use the CLEAR button to toggle thru the submenu.
- The submenus are as follows: Measurement Unit, Time Unit, Decimals, K-Factor, and Decimals K-Factor.
- 5. Measurement Unit: Enter the Unit of measurement for the flow meter (i.e. lbs, Gal.). Press the PROG/ENTER button to store the entered value.
- 6. Time Unit: Enter the Time Unit of measurement for the flow meter (i.e. Hr, Min, Sec.). Press the PROG/ENTER button to store the entered value.
- 7. Decimals: Enter the decimals to be displayed on the meter (depends on the measuring range of the unit). Press the PROG/ENTER button to store the entered value.
- 8. K-Factor: Enter the K-Factor for the flow meter obtained from the flow lab. (Ex. a K-Factor of 9.999999 would be entered as 9999999). Press the PROG/ENTER button to store the entered value.

NOTE

When choosing the K-Factor, calculate the average K-Factor or choose a K-Factor from the flow data that is in the linear region of the flow data. The entered K-Factor will be used as KF0 in the calculation of Meter Factors below.

- 9. Decimals K-Factor: Enter the decimal position of the K-Factor entered in step 8. (Ex. for the K-Factor example in step 8 the decimal position would be 6). Press the PROG/ENTER button to store the entered value.
- **10.** Use the SELECT button to toggle thru the menu until the LINEARISATION menu appears. A maximum of 15 linearisation-positions can be entered.

NOTE

The number of linearization points used and which points from the flow data sheet should be picked to best linearize the test stand flow range. Typically multiple points will be required at the lower flow range where the flow data is non linear.

11. For each linearisation position, the frequency and a Meter Factor (MF) must be entered.

NOTE

The Meter Factor for each frequency is calculated with following formula:

Where KF0 is the K-Factor entered in step 8.

- 12. Once all values for steps 5 thru 12 are entered press and hold the PROG/ENTER button to return to the display screen.
- 13. Connect a frequency generator to the flow meter's output wire connector and input each of the frequencies listed on the screen with 5V positive only amplitude square wave. Connect the positive pole of the function generator to Pin C on the connector and the negative pole of the function generator to Pin B on the connector.
- 14. Using the frequency generator and the flow calibration data obtained from the flow lab verify all flow points are within tolerance of Table Calibration Information for each frequency. If not, the Rate Indicator must be replaced.
- 15. Remove the frequency generator and reattach the wire connector to the flow meter pick-off.

- 2 Appendix A: Illustrated Parts Breakdown
- 3 Appendix B: Cut Sheets and Manuals

4 Appendix C: Drawings