Calibrate Alicat MCRW Series Mass Flow Controllers

Tank Farm Maintenance Procedure

USQ # Routine Maintenance

<table>
<thead>
<tr>
<th>Rev-Mod</th>
<th>Release Date</th>
<th>Justification</th>
<th>Summary of Changes</th>
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<tr>
<td>A-0</td>
<td>08/28/2018</td>
<td>Maintenance Request</td>
<td>New procedure.</td>
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This is a new revision. The First Time Use process as defined in TFC-OPS-OPER-C-13 can be used during the initial performance of this revision.

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1.0 PURPOSE AND SCOPE

1.1 Purpose

This procedure provides instructions to perform calibration of Alicat Whisper Series Mass Flow Control Valve.

1.2 Scope

This procedure applies to Alicat Mass Flow Controllers MCR Series, installed on Gas Effluent Monitoring System (GEMS) for POR126 and POR127. POR126 and POR127 exhausters will remain with a Citect/RTP configuration. Calibration of these flow control valves cannot be performed from the HMI or in the field. It is intended that these flow control valves will be replaced with calibrated devices at the regularly scheduled maintenance time period or removed for calibration and re-installed.

2.0 INFORMATION

2.1 Terms and Definitions

- GEMS - Gas Effluent Monitoring System
- HMI - Human Machine Interface
- CGA - Calibration, Grooming, Alignment.

2.2 General Information

This procedure works for Hasting’s upgrades and the UV-FTIR MCRS Mass Flow Meters.
3.0 PRECAUTIONS AND LIMITATIONS

3.1 Personnel Safety

Industrial Hygiene Monitoring and/or sampling will be conducted in accordance with IHSP-RETR-06.

3.2 Equipment Safety

CAUTION - An input flow signal to the valve should not exceed 2 minutes without starting a vacuum pump and establishing flow. This will heat the flow control valve up and eventually cause a premature failure.

3.3 Radiation and Contamination Control

3.3.1 When disconnecting, breaching or opening systems or system components that are currently or previously connected to waste tanks or waste transfer systems contamination surveys are required at system breach locations and when accessing previously unexposed areas.

3.3.2 Work in radiological areas will be performed using a radiological work permit following review by Radiological Control per ALARA Work Planning procedure, TFC-ESHQ-RP_RWP-C-03.

3.4 Environmental Compliance

The Central Shift Office must be notified in the event of a leak or a spill in accordance with TFC-ESHQ-ENV_FS-C-01, Environmental Notification.
4.0 PREREQUISITES

4.1 Special Tools, Equipment and Supplies

The following supplies may be needed to perform this procedure:

- Calibrated digital multimeter (voltmeter)
- Calculator
- Computer with RS232 communication capability and Alicat serial program
- Flexible tubing for connections
- Various tube fittings and clamps
- Sierra Flow Meter or equivalent
- 0 – 5 Vdc, Variable Power Supply
- DB9 connection for RS232 communication to the flow control valve. Refer to Section 5.2 for connection details.

4.2 Performance Documents

The following documents may be needed during the performance of this procedure.

- TO-060-126, Operate POR126 Portable Exhaust Ventilation System
- TO-060-127, Operate POR127 Portable Exhaust Ventilation System
- H-14-108927, Sh. 2, Exhauster Train POR127 P&ID
- H-14-108926, Sh. 2, Exhauster Train POR126 P&ID
- Applicable Data Sheets.
5.0 PROCEDURE

Special Instructions

Sections 5.1 through 5.4 may be worked in a logical order as required to fine tune the flow control valve. Section 5.2 must be completed prior to calibration start to establish connection to the flow control valve for reading and writing register values needed to calibrate the flow controller.

Both exhausters utilize 500 series numbers (e.g., FCV-555).

5.1 Calibration

5.1.1 ENSURE exhauster is shut down.
5.1.2 CLOSE isolation valve (V-553) for Record Sampler.
5.1.3 CLOSE isolation valve (V-554) for CAM.
5.1.4 REMOVE FCV AND RETURN to shop.
5.1.5 CONNECT M&TE to the new FCV or retrieved FCV per Figure 1 and Figure 2.

CAUTION
An input flow signal to the valve should not exceed 2 minutes without starting a vacuum pump and establishing flow. This will heat the flow control valve up and eventually cause a premature failure.

5.1.6 APPLY input values per Data Sheet
5.1.7 RECORD As-Found values on Data Sheet.
5.1 Calibration (Cont.)

5.1.8 IF As-Found values are NOT within specified tolerance, or deemed marginal, and optimization is desired, **GO TO** Section 5.2 for fine tuning.

5.1.9 IF As-Found values are within specified tolerance, **RECORD** As-Found values in As-Left column of Data Sheet.

5.1.10 **PERFORM** the following:

5.1.10.1 **REINSTALL** FCV in field.

5.1.10.2 **OPEN** isolation valve (V-553) for Record Sampler.

5.1.10.3 **OPEN** isolation valve (V-554) for CAM.

5.1.10.4 **GO TO** Step 5.4 for Record Sampler FCV

**OR**

**GO TO** Step 5.5 for CAM Sampler FCV.
5.2 Computer Connection

Special Instructions

Once the electrical connections have been established, make sure the unit is powered off and prepare the computer for communications setup.

5.2.1 CONNECT custom cable with pin-out as identified in Attachment 1 to any USB port.

5.2.2 OPEN Alicat Serial program.

5.2.3 ENTER assigned com number listed above the com prompt AND PRESS ENTER.

5.2.4 ENTER 19200 at baud rate prompt AND PRESS ENTER.

5.2.5 VERIFY serial connection has successfully opened AND PROCEED to Section 5.3
5.3 Linearity and Gain Adjustment

Special Instructions

It is best to adjust your gain to a perfect quarter scale reading, then solely use linearity to adjust at the full scale reading; if necessary, going back to quarter scale/gain to make another adjustment and then full scale/linearity adjust etc. until you are satisfied.

Linearity is adjusted by changing address 43. Type *R43 <ENTER> and record the current value. **32768 is NO LINEARITY**, no plus and no minus hooking. You can swing it from 0-65535, 32768 being the middle as stated. Increasing it to 65535 will cause the upper end to read much higher on the full scale end than normal, and conversely, setting it to zero will cause the high end to show much less. The effectiveness decreases as the flow rate decreases, that’s why we want to set the gain at quarter scale and the linearity at full scale if the valve is not within tolerance.

**CAUTION**

An input flow signal to the valve should not exceed 2 minutes without starting a vacuum pump and establishing flow. This will heat the flow control valve up and eventually cause a premature failure.

Linearity

5.3.1 TYPE *R26 <ENTER>.

5.3.2 RECORD the value on Data sheet (valid rage is 0-65535. This represents a gain of 0-3).

5.3.3 TYPE *R43 <ENTER>.

5.3.4 RECORD the value on Data sheet (valid rage is 0-65535).

5.3.5 START vacuum pump.

5.3.6 SET input voltage to 1.25vdc.
5.3 Linearity and Gain Adjustment (Cont.)

Linearity (Cont.)

5.3.7 ADJUST register 26 as needed by *W26=(number desired to set flow to 1.00 scfm) followed by <ENTER>.

5.3.8 SET input voltage to 5.00vdc.

5.3.9 ADJUST register 43 as needed by *W43=(number desired to set flow to 4.00 scfm) followed by <ENTER>.

5.3.10 REPEAT steps 5.3.6 through 5.3.9 as needed to obtain linearity of the flow valve as specified on calibration data sheet.

5.3.11 RECORD As-Left values on Data Sheet.

5.3.12 RETURN TO Step 5.1.10.1 to reinstall FCV.
5.4 Record Sample Flow Proportionality

NOTE - This section only applies to record sampler flow control valves.
- This section is not applicable to first time calibration (CGA).

5.4.1 CONFIRM record sample FCV is calibrated.

5.4.2 CONFIRM exhaust train is running per one of the following Operating Procedures:
- TO-060-126, Operate POR126 Portable Exhaust Ventilation System
- TO-060-127, Operate POR127 Portable Exhaust Ventilation System.

5.4.3 WAIT for exhauster to stabilize (approx. 10 minutes).

5.4.4 RECORD Stack Flow (scfm) on Data Sheet, indicated on Exhauster Process Detail screen.

5.4.5 RECORD Record Sample Flow Rate on Data Sheet, indicated on HMI screen.

5.4.6 CALCULATE AND RECORD remaining items on Data Sheet.

5.4.7 IF % Difference on Data Sheet is greater than or equal to 10%, NOTIFY Engineering and FWS for resolution.

5.4.8 IF % difference on data sheet is less than 10%, GO TO Step 5.5.
5.5 Restoration

5.5.1 REPORT deviation or discrepancies to FWS/Shift Manager AND RECORD in Comments Section of Data Sheet.

5.5.2 RECORD Radiological Survey Report (RSR) number(s) or N/A.

<table>
<thead>
<tr>
<th>RSR Number</th>
<th>RSR Number</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<tr>
<td></td>
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</tbody>
</table>

5.6 Acceptance Criteria

Acceptance Criteria has been met when Steps in this procedure have been satisfactorily performed and As-Left values meet the specifications and tolerance(s) per the Data Sheet.

5.7 Review

5.7.1 INFORM FWS calibration is complete.

5.7.2 FWS REVIEW AND ENSURE the following:
- Completed Data Sheets meet the acceptance criteria
- Comments sections are filled out appropriately
- Work requests needed as a result of this procedure are identified and generated
- Work request number(s) of any work documents generated as a result of this procedure, are recorded in Comments/Remarks section of Data Sheet.

5.8 Records

The performance of this procedure generates no records. However PM Data Sheets associated with the procedure are records and are maintained in the work package as record material.

The record custodian identified in the Company Level Records Inventory and Disposition Schedule (RIDS) is responsible for record retention in accordance with TFC-BSM-IRM_DC-C-02.
Figure 1 – M&TE Connection (Example)
Figure 2 – Bench Test Setup
Attachment 1 – Trim Pot Location

DB15 Pin-Outs

If your instrument was ordered with a DB15 connection, be sure to check the Calibration Label on the device and reference the appropriate pin-out diagram.

The following pin-out chart describes the safest and generally compatible arrangement when connecting a non-Alicat DB15 wire to a DB15H equipped Alicat. Not all features may be available between brands, but the common denominators are featured in our DB15 offerings, along with some options for customization.

**DB15H – Pin-Out “Hastings H” Style**

![DB15 Pin-Out Diagram]

<table>
<thead>
<tr>
<th>Pin Number</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>N/C</td>
</tr>
<tr>
<td>2</td>
<td>RS-232 RX (receive) or RS-485 – *</td>
</tr>
<tr>
<td>3</td>
<td>N/C</td>
</tr>
<tr>
<td>4</td>
<td>N/C</td>
</tr>
<tr>
<td>5</td>
<td>Ground</td>
</tr>
<tr>
<td>6</td>
<td>Primary Analog Signal Output</td>
</tr>
<tr>
<td>7</td>
<td>Power Supply Common</td>
</tr>
<tr>
<td>8</td>
<td>N/C</td>
</tr>
<tr>
<td>9</td>
<td>N/C</td>
</tr>
<tr>
<td>10</td>
<td>Secondary Analog Signal Output / fixed 5.12Vdc</td>
</tr>
<tr>
<td>11</td>
<td>Power Supply (+Vdc)</td>
</tr>
<tr>
<td>12</td>
<td>Ground</td>
</tr>
<tr>
<td>13</td>
<td>N/C</td>
</tr>
<tr>
<td>14</td>
<td>Analog Tare (meters — when grounded)</td>
</tr>
<tr>
<td></td>
<td>Analog Set-Point Input (controllers)</td>
</tr>
<tr>
<td>15</td>
<td>RS-232 TX (send) or RS-465 + *</td>
</tr>
</tbody>
</table>

Check your device’s calibration certificate and user manual for the actual electrical input/output requirements, as all instruments are custom configured to some extent.

**NOTE:** Pins 5, 7 and 12 are connected together inside of the device and are common grounding points.

N/C = Not Connected/Open (can be used for custom pin assignments – please consult factory).

* Added to allow for full use of features on Alicat devices, may not be present on host wiring.
Attachment 2 – Computer Connection PINS

<table>
<thead>
<tr>
<th>PIN</th>
<th>DB15H</th>
<th>Signal</th>
<th>DB9</th>
<th>Signal</th>
</tr>
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<tbody>
<tr>
<td>2</td>
<td>RX(-)</td>
<td></td>
<td>3</td>
<td>TX(+)</td>
</tr>
<tr>
<td>15</td>
<td>TX(+)</td>
<td>2</td>
<td>RX(-)</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Gnd</td>
<td>5</td>
<td>Gnd</td>
<td></td>
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