Brooks® Series 3520C and 3580C Magnetic Flow Meters

Tank Farm Maintenance Procedure Effluent Treatment Facility

USQ Not Required – ETF is a <Hazard Category 3 Radiological Facility>

<table>
<thead>
<tr>
<th>CHANGE HISTORY (≤ LAST 5 REV-MODS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rev-Mod</td>
</tr>
<tr>
<td>---------</td>
</tr>
<tr>
<td>A-2</td>
</tr>
<tr>
<td>A-1</td>
</tr>
<tr>
<td>A-0</td>
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</tbody>
</table>

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1.0 PURPOSE AND SCOPE

1.1 Purpose

This procedure provides instructions for a safe, uniform method for calibration of Brooks® Series 3520C and 3580C magnetic flow meters. This includes both model 3523, 3583, and 3585 flow meters for use with 7400 or 7500 series flow heads.

1.2 Scope

This procedure applies to models 3523 and 3583 that have a blind local cover, no display or LOI, while model 3585 has a 2-line by 20-character LCD local display. Model 3585 may or may not have LOI (designated by LOI code in complete model number).

Models 3520C and 3580C are digitally adjusted at the factory using precision equipment to ensure accuracy. Normally a 4 to 20 mA trim is the only necessary field calibration. The 4 to 20 mA trim re-adjusts digital-to-analog converter analog output to compensate for calibration idiosyncrasies of peripheral instruments in the loop.

Electronics trim: Calibrates model 3580C digital electronics and requires a model 7798B flow tube simulator. If troubleshooting indicates adjustments other than the 4 to 20 mA trim are required, refer to vendor information.

2.0 INFORMATION

2.1 Terms and Definitions

- TX – Transmitter.
3.0 PRECAUTIONS AND LIMITATIONS

3.1 Radiation and Contamination Control

3.1.1 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.

3.2 Environmental Protection

3.2.1 In the event of a spill/leak/release, notify the SOM/FWS and respond per ETF-ERP-85B-003, Emergency Spill or Release at ETF.

4.0 PREREQUISITES

4.1 Special Tools, Equipment, and Supplies

NOTE - M&TE used to collect acceptance criteria data during performance of this procedure shall meet the following requirements:

- Be within its current calibration cycle as evidenced by an affixed calibration label
- Be capable of desired range
- Have an accuracy consistent with state-of-the-art limitations
- Accuracy is equal to or greater than M&TE tolerance specified on PM data sheet or is at least four times greater than specified device tolerance.

The following supplies may be needed to perform this procedure:

- Rosemount Model 268 smart family interface (optional if unit being calibrated is equipped with LOI)
- CMD.

4.2 Performance Documents

The following documents may be needed to perform this procedure:

- Vendor information: VI-1373-007-3050, Brooks Model 3580C Smart Electromagnetic Flow Meter Transmitter.
5.0 PROCEDURE

Special Instructions

Transmitters are calibrated using either a hardwired LOI or the Rosemount M268 interface. This instruction assumes use of the M268. If unit being calibrated is LOI-equipped, steps referring to M268 (except loop connection) are performed on the LOI. There may be minor differences between M268 (shown) and LOI menus. Users not familiar with operation of M268 or LOI should read Attachment 1 - Model 268 Smart Family Interface Operation.

Unused Model 268/LOI menu choices are not explained.

Figure 1 and Figure 2 provide M&TE connections and information.

5.1 Initial Setup

5.1.1 CONFIRM operations has configured loop for calibration.

5.1.2 LIFT negative loop lead at transmitter,

OR

IF transmitter is higher than six feet off ground, LIFT negative loop lead at the LCU.

5.1.3 CONNECT CMD (mADC) in series with lifted lead and terminal.

5.1.4 CONNECT M268 in parallel with loop.

5.1.5 TURN ON M268 AND

WAIT for unit to perform self-test.

- M268 gives a notice to upgrade software (no action required).

5.1.6 PRESS PROCEED.

- M268 asks whether to save or recall transmitter configuration data in Safe Memory.

5.1.7 PRESS SAVE or PROCEED.
5.2 As-Found Data, Calibration, and As-Left Data

5.2.1 CONFIRM top-level function screen appears.

NOTE - Off-line key only appears in M268 Rev. 4.0 or greater.

<table>
<thead>
<tr>
<th>Model: Magmeter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tag: xxxxxxxx</td>
</tr>
<tr>
<td>Off-line</td>
</tr>
</tbody>
</table>

5.2.2 PRESS FORMAT (F4).

5.2.3 CHECK M268 displays reminder to set loop to Manual.

5.2.4 CONFIRM loop status, PRESS PROCEED.

5.2.5 CHECK M268 displays top-level format screen.

<table>
<thead>
<tr>
<th>Format</th>
<th>Xmtr: Initial setup &amp; maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Othr Fcns</td>
<td>Char ize</td>
</tr>
</tbody>
</table>

5.2.6 PRESS DGPL TRIM (F3).

5.2.7 CHECK M268 displays main digital trim screen.

<table>
<thead>
<tr>
<th>Digital trim mode select option</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oput Trim</td>
</tr>
</tbody>
</table>

5.2.8 PRESS Oput TRIM (F1).

5.2.9 CHECK M268 4-20 trim screen offers choice of readout scale.

<table>
<thead>
<tr>
<th>4-20 Trim: Choose internal scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 to 20 mA</td>
</tr>
</tbody>
</table>
5.2 As-Found Data, Calibration, and As-Left Data (Cont.)

5.2.10 **PRESS** 4 to 20 mA (F1).

5.2.11 **CHECK** M268 instructs user to connect reference meter (no action required).

5.2.12 **PRESS** PROCEED (F4).

5.2.13 **CHECK** M268 indicates next action.

5.2.14 **WHEN** ready to read current, **PRESS** PROCEED (F4).

5.2.15 **CHECK** M268 displays value entry screen.

5.2.16 **RECORD** as-found CMD value on data sheet.

**NOTE** - <- and -> keys move M268 underline cursor.

- Pressing CLR (F3) clears number to start over.

5.2.17 **IF** different than 4.00, **KEY IN** (alphanumeric keys) current value displayed on CMD.

5.2.18 **PRESS** ENTR (F4).

5.2.19 **CHECK** M268 displays 4 mA transmitter versus CMD comparison screen.
5.2 As-Found Data, Calibration, and As-Left Data (Cont.)

5.2.20 IF transmitter output is equal to CMD reading:

5.2.20.1 RECORD as-found values in as-left column on data sheet.

5.2.20.2 PRESS YES (F4).

5.2.20.3 GO TO Step 5.2.22.

5.2.21 IF transmitter output is not equal to CMD reading:

5.2.21.1 PRESS NO (F1).

• Previous screen appears.

5.2.21.2 REPEAT Steps 5.2.15 through 5.2.20 until transmitter and CMD indications are equal.

5.2.21.3 RECORD as-left CMD value on data sheet.

5.2.22 CHECK M268 indicates next action.

About to set Xmtr
output to 20 mA

| Abort | Proceed |

5.2.23 WHEN ready to read current, PRESS PROCEED (F4).

5.2.24 CHECK M268 displays value entry screen.

Enter meter
value {20.00} mA

| <- | -> | Clr | Entr |

5.2.25 IF different than 20.00 mA, RECORD as-found CMD value on data sheet.

5.2.26 KEY IN (alphanumeric keys) current value displayed on CMD.

5.2.27 PRESS ENTR (F4).

5.2.28 CHECK M268 displays 20 mA transmitter versus CMD comparison screen.

XMTR OUTPT 20.00 mA
Equal to ref. metr?

| No | | Yes |
5.2 As-Found Data, Calibration, and As-Left Data (Cont.)

5.2.29 IF transmitter output is equal to CMD reading:

5.2.29.1 RECORD as-found CMD value in as-left column on data sheet.
5.2.29.2 PRESS YES (F4).
5.2.29.3 GO TO Step 5.2.31.

5.2.30 IF transmitter output is not equal to CMD reading:

5.2.30.1 PRESS NO (F1).
   • Previous screen appears.
5.2.30.2 REPEAT Steps 5.2.24 through 5.2.30 until transmitter and CMD indications are equal.
5.2.30.3 RECORD as-left CMD values on data sheet.

5.2.31 CHECK M268 displays 4-20 trim screen.

<table>
<thead>
<tr>
<th>Select output trim type</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>4 to 20 mA</td>
<td>Othr Scal</td>
<td>Abort</td>
</tr>
</tbody>
</table>

5.2.32 PRESS ABORT (F4).

5.2.33 CHECK M268 displays main digital trim screen.

<table>
<thead>
<tr>
<th>Digital trim mode select option</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Oput Trim</td>
<td>Elec Trim</td>
<td>Auto Zero</td>
</tr>
</tbody>
</table>

5.2.34 PRESS END (F4).

5.2.35 CHECK M268 displays top-level format screen.

<table>
<thead>
<tr>
<th>Format</th>
<th>Xmtr: Initial setup &amp; maintenance</th>
<th>Othr Fcns</th>
<th>Charize</th>
<th>Dgatl Trim</th>
<th>Exit</th>
</tr>
</thead>
</table>

Type | Document No. | Rev/Mod | Release Date | Page |
--- | --- | --- | --- | --- |
REFERENCE | ETF-EL18068 | A-2 | 06/28/2017 | 8 |
5.2 As-Found Data, Calibration, and As-Left Data (Cont.)

5.2.36 PRESS EXIT.

5.2.37 CHECK M268 displays reminder to return loop to automatic control (no action required).

5.2.38 PRESS PROCEED (F4).

5.2.39 CHECK M268 displays top-level function screen.

```
Model: Magmeter
Tag: xxxxxxxx
Off-line Test Config Format
```

5.2.40 PRESS CONFIG (F3).

5.2.41 CHECK M268 displays top-level configuration screen.

```
Config Mode select option
Ofln Data Chng I/O Xmtr Info Send Data
```

NOTE - Failure to SEND data will result in no calibration change to transmitter.

5.2.42 PRESS SEND DATA (F4).

5.2.43 CHECK M268 displays a warning that control loop should be in manual control.

5.2.44 PRESS PROCEED.

5.2.45 CHECK M268 asks if user “want to send work Reg to XMTR Mem.”

NOTE - If changes were made, data will be sent; otherwise a message “No data modified to send” appears.

- After data is sent to transmitter, M268 displays reminder to return loop to automatic control (no action required) then returns to top-level function screen.

5.2.46 PRESS SEND DATA (F4).
5.3 Restoration

5.3.1 RETURN system to as-found condition.

5.3.2 ENSURE alarms are reset or cleared.

5.3.3 CONFIRM indication(s) are consistent with existing process conditions.

5.3.4 INFORM SOM test is complete and instrument/equipment/system may be returned to service.

5.4 Acceptance Criteria

Acceptance criteria has been met when steps in this procedure have been satisfactorily performed and results are recorded on the data sheet(s).

5.5 Review

5.5.1 INFORM FWS test is complete.

5.5.2 (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 the Comments/Remarks section of the data sheet.

5.6 Records

This procedure is performed within a work package, as such, the procedure in its entirety will be maintained as a record per the Work Control process.

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 - Model 268 Interface
Figure 2 - Loop Test Connections

MODEL 288 MAY BE CONNECTED AT ANY "TERMINATION POINT" IN THE SIGNAL LOOP.
SIGNAL LOOP MUST HAVE 250 OHMS MINIMUM LOAD FOR COMMUNICATIONS.

SIGNAL LOOP MAY BE GROUNDED AT ANY POINT OR LEFT UNGROUNED.
Attachment 1 - Model 268 Smart Family Interface Operation

GENERAL
The Rosemount Model 268 Smart Family Interface provides a common communications link to the Rosemount Smart Family of microprocessor-based instruments. Model 268 can communicate with any Rosemount Smart instrument from any wiring termination point in the loop.

The Model 268 communicates with Smart Family instrument via Bell 202 frequency shift keying. Frequency shift keying uses high frequency digital communication signals superimposed over the standard 4 to 20 mA instrument output. Information is communicated by varying frequency of the signals. Because net energy added to the loop is zero, communication does not disturb the 4 to 20 mA signal.

NOTE - Transmitter (TX) refers to any Rosemount Smart Family instrument.

This section introduces the M268 display, keypad, and the different memory locations in the TX and M268.

M268 DISPLAY
The display is a four-line by 20-character LCD that allows flexible, easy communication between the TX and the user. Top two lines display user prompts, information about the communication session, and user-entered values. Bottom two lines usually display dynamic labels for F1-F4 keys directly below display. These labels reflect currently available choices, and lead user through operation sequences involved in communication between M268 and TX.

KEYPAD FUNCTIONS
M268 contains a complete alphanumeric keypad, six pink (salmon) dedicated keys, and four green software-defined keys. Dedicated key functions are always the same while software-defined key functions vary with the current task.

DEDICATED KEYS
ON/OFF
Turns M268 on/off. When turned ON, M268 displays its software revision level and performs self-diagnostic routines. M268 then searches for TX on the loop. If no Smart TX is found, M268 offers opportunity to try again (F1) or to perform other off-line operations.

In Rev. 4.0+, user can either press RETRY (F1), try connection under another address using multidrop function (F2), or perform off-line functions (F4).

If no key is pressed for 20 min. (Rev. 4.0+), M268 automatically shuts OFF. Shutoff function disabled if displaying process variable or error message.

PROCESS VARIABLE (PV)
Displays up-to-date PV readings from TX in engineering units and as percentage of calibrated span. Displayed PV is updated on ~1 sec. intervals.

M268 can also display currently selected 4 and 20 mA range points for connected TX via menu item on PV display.

REVIEW
Allows user to step through all information currently held in the four memory locations in the TX and M268; SAFE MEM, CONF MEM, WORK REG, and XMTR MEM. Memory locations described later.
Attachment 1 - Model 268 Smart Family Interface Operation (Cont.)

HELP
Explains software-defined key functions (F1-F4) in order. HELP CONT steps through help screens. HELP END cancels help and returns to original screen.

RESTART
Initiate communication with a Smart TX while M268 is still turned on. Upon connection to a new TX, pressing this key loads information from new TX into M268 Working Register.

PREVIOUS FUNCTION
Return to last decision level and select different function. (i.e., user wants to configure TX but accidentally presses TEST on top-level screen. Pressing PREVIOUS FUNCTION returns to top-level screen for new choice). Also useful for returning to familiar screen if user loses place in unfamiliar operation.

SOFTWARE-DEFINED KEYS
Software-defined keys (F1 through F4) just below the screen of M268 are used for functions appropriate to current screen. This allows M268 to perform many functions with only a few keys and a minimum of confusion. (See HELP key).

ALPHANUMERIC KEYS
Alphanumeric keys are used to enter information into M268 when updating TX parameters. Pressing key by itself enters numeric value of that key. To enter a letter, first press shift key associated with letter position on the alphanumeric key, then press the alphanumeric key (i.e., to enter letter R, press right-hand shift key, then press “6” key. Do not press keys simultaneously; press one, then the other).

MEMORY LOCATIONS
Together, TX and M268 have four memory locations (three in M268, one in TX). Only direct data path between M268 and TX Memory is Working Register.
SAFE MEM

Memory location in M268 where existing TX information parameters can be saved upon start-up. If user wants to “undo” changes to TX configuration, information from Safe Memory can be recalled to return TX to original configuration. Safe Memory can be used only to restore data to same TX from which it was obtained. Safe Memory is nonvolatile: data remains even if M268 is turned OFF. If M268 battery pack is discharged or removed, contents of Safe Memory will be lost.

OFLN MEM

Off-line Memory stores configuration information that was entered into the M268 off-line for later downloading to a TX. This location can also be used to clone a TX by uploading its configuration data, and then downloading it to a number of other TXs. Off-line Memory is nonvolatile.
WORK REG

NOTE - Be sure to enter TX serial number. M268 uses serial number to distinguish one TX from another. If two TXs have no serial number entered, M268 has no way of distinguishing between them and may allow data from Working Register of one to be transferred to the other. This would send calibration values for one TX to the other, causing serious measurement errors.

Working Register is memory location in M268 that stores data as it is being entered. It receives TX’s configuration data upon start-up or restarting. Configuration changes are first made in the Working Register. Data in Working Register not automatically sent to TX must be transferred with SEND DATA key.

XMTR MEM
Nonvolatile memory in TX. TX uses contents of this memory to determine how it operates. Data in TX Memory is never accessed directly; must be uploaded into Working Register before it may be reviewed or changed. TX Memory information may be different from that in Working Register, since Working Register may contain changed data not yet sent to TX. Therefore, M268 warns that REVIEWing TX memory erases information currently held in M268 Working Register.

M268 CONNECTIONS
M268 can communicate with TX from control room, TX site, any other wiring termination point in loop. M268 must be connected in parallel with TX. For M268 to function properly, loop must have 250 ohms resistance minimum.

POWER SUPPLY

M268 comes with battery pack for five “AA” alkaline cells or with rechargeable nickel-cadmium power pack.

Battery life: alkaline, approximately 150 hours nickel-cadmium, approximately 60 hours

“LB” (low-battery) appears in lower right-hand corner of display when there is approximately one-half hour of battery life remaining.

To conserve battery life, M268 automatically shuts itself OFF after 20 minutes (Rev. 4.0+) without a keystroke.