SCC Inc.

Installation Instructions

Document No. FMC-1100

October 21, 2024

FMC Series

Gas Flow Meter Kit for Burner Commissioning

Product Information

The FMC109-800A and FMC112-800A gas flow meter kits measure and display the pressure / temperature compensated instantaneous flow of common fuel gases in standard cubic feet per hour (SCFH). Heat input can also be displayed. Fuel gases include: natural gas, propane, and biogas / digester gas. Air flow can also be measured.

The FMC109-800A meter has a 9” long probe and the FMC112-800A meter has a 12” long probe. The extra probe length is useful for entering the pipe thru a ball valve in some applications. Calibration of the meter can be automatically checked. Yearly re-calibrations are typically not required.

Recommended Installation Tools

1. PTFE tape
2. Tape measure
3. 1-1/2”, 1-1/4”, and 8mm open end wrenches or two 12” crescent wrenches
4. 2.5mm hex key

Components Supplied

Figure 1 shows all of the components that are supplied with the Gas Flow Meter Kit.

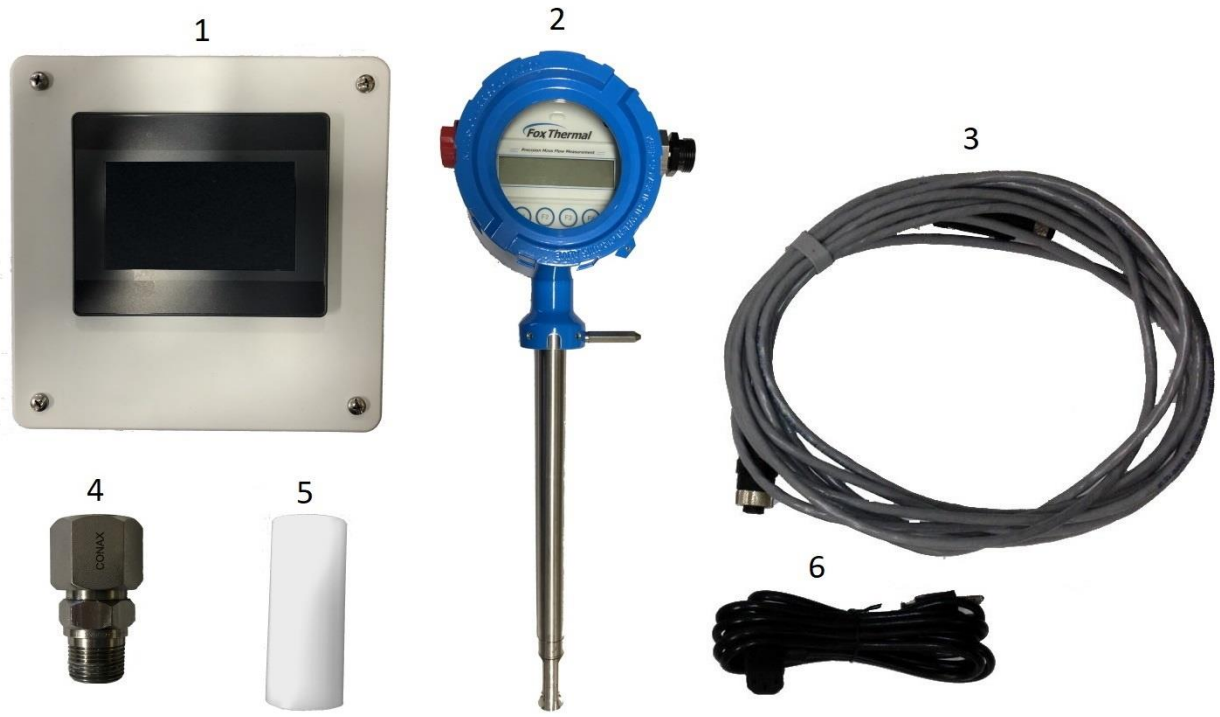

Figure 1: Components Included in the Gas Flow Meter Kit

1. Enclosure with touch screen and 120 VAC 5 amp convenience outlet
2. Insertion type flow meter – 1 ½" to 8" schedule 40 pipe
3. Interconnecting cable, 25 feet long
4. Stainless steel packing gland for 3/4" tube, 3/4" NPT connection
5. Probe protector for meter
6. 120 VAC power right angle power cord, 10 feet long, 10A max

Printed instructions and the meter calibration report are also included in the kit.

Installation Procedure

1. The gas flow meter may be mounted in horizontal or vertical piping. The flow meter must be mounted at least 15 pipe diameters downstream of disturbances (elbows, reducers, etc.) and at least 10 pipe diameters upstream of disturbances. See Figure 2 below for the necessary distance of straight pipe upstream and downstream of the meter. If the meter is not mounted per the requirements below, unstable and inaccurate flow readings are likely to result.

   Note: Proper upstream and downstream pipe diameters are critical to achieve accurate and stable flow readings.

   Note: Gas must be dry (non-condensing) – moisture droplets in the flow stream will also cause inaccurate and erratic flow readings.

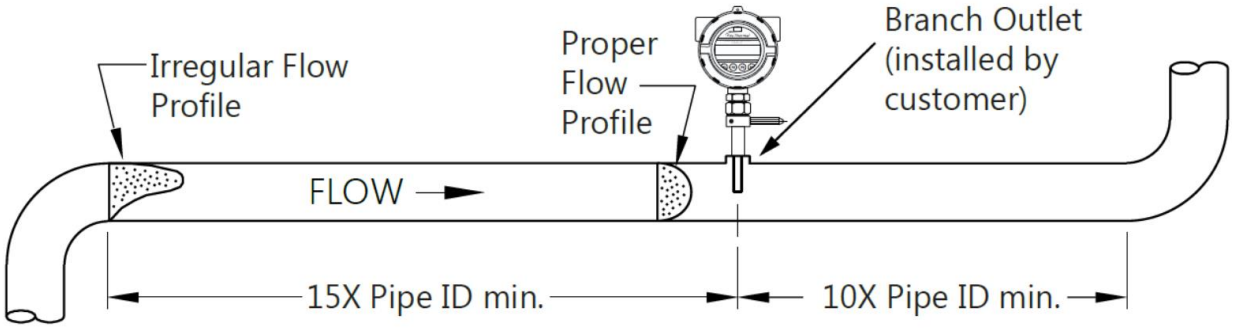

Figure 2: Necessary Amount of Straight Pipe for Mounting Flow Meter

2. Once a suitable location has been found, identify the pipe size and the pipe schedule. With this information, use Table 2 or 3 in Appendix A to verify that the gas velocity through the pipe in this location is less than 25,000 standard feet per minute.

Installation Procedure (continued)

3. Verify that the static pressure in the pipe is less than 150 PSIG and the gas temperature (when flowing) is between -10°F to 250°F.

4. Verify that the gas piping into which the meter is going to be inserted is depressurized. If not, close the upstream gas valve and bleed off any residual trapped gas in a safe manner. If welding on the pipe is to be done, the piping must be thoroughly purged with an inert gas.

5. If a 3/4" NPT or larger half coupling is not available in a suitable location, one will need to be welded onto the pipe with a 13/16" (0.813") or larger hole drilled through the pipe wall in the center of the half coupling. The coupling must be parallel to the pipe centerline, as shown in Figure 3, so that the probe can be inserted into the center of the pipe at a later step. The pipe should look similar to Figure 4 before the packing gland and the meter probe are installed.

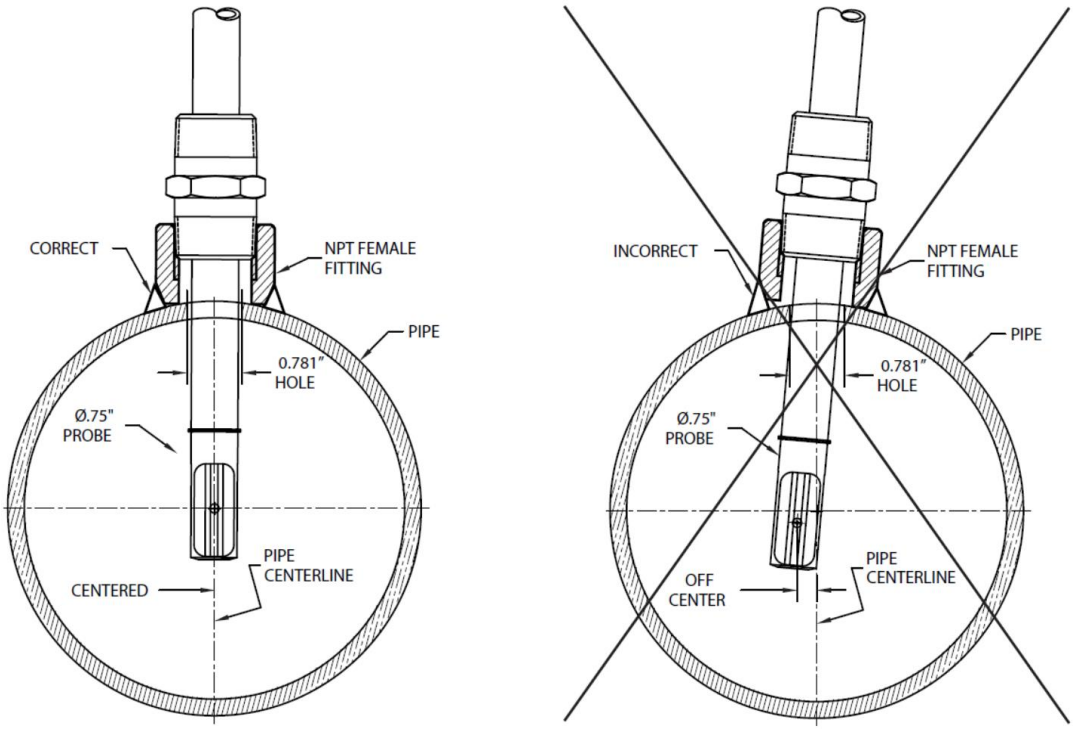

Figure 3: Mounting of a 3/4" NPT Half Coupling on the Pipe Centerline

Installation Procedure (continued)

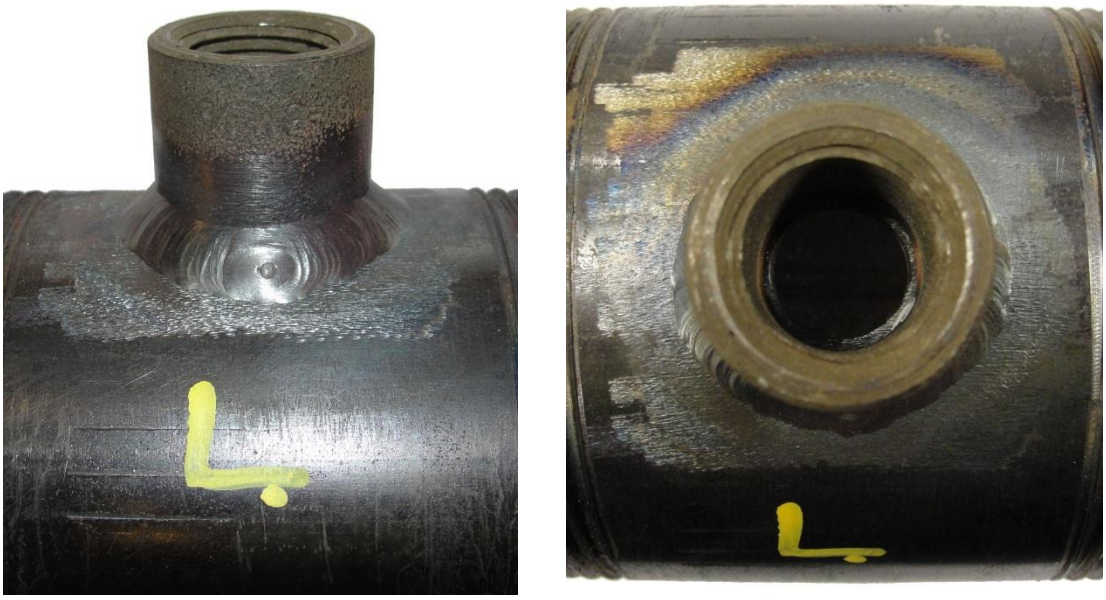

Figure 4: 3/4" NPT Half Coupling Welded to Pipe with 13/16" Hole Drilled Through Center

Notes:

- **One method to ensure that the 13/16" or larger hole is concentric with the 3/4" female NPT thread is to use a 2.5" long schedule 40 pipe nipple as a drill bit guide. A 53/64" (0.828") drill bit fits snugly inside the 3/4" Schedule 40 pipe nipple. This drill bit can be used to accurately mark the center of the thru hole so a smaller, concentric pilot hole can be drilled. If using this method, the half coupling must be welded to the pipe before the hole is drilled.**
- **Inside of thru hole must be burr free – burrs can cause a disruption in the flow.**
- **A larger half coupling with a threaded reducing bushing can also be used if desired.**

6. Screw the packing gland into the 3/4" NPT half coupling and tighten with the 1-1/4" open end wrench (or crescent wrench). PTFE tape should be used to seal the NPT threads of the packing gland.

Installation Procedure (continued)

7. Insert the meter sensing tube into the packing gland. Using Table 1 and Figure 5, center the meter's sensing element in the pipe by setting distance "X" (distance from the outer diameter of the pipe to the bottom of the pointer edge). This can be done carefully with a tape measure. Ensure that the pointer on the flow meter is pointing in the direction of flow.

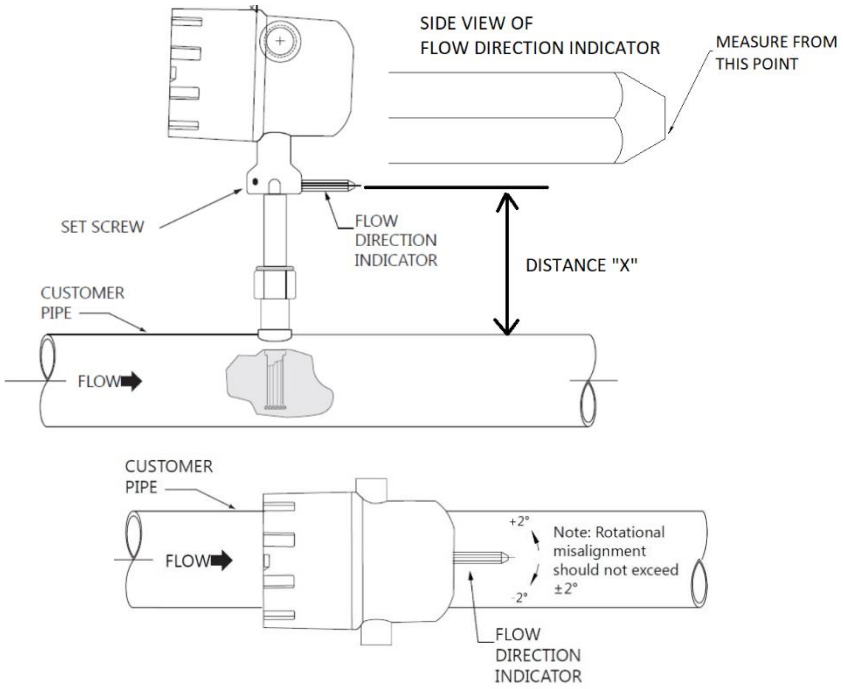

Figure 5: Meter Inserted into Pipe

Table 1: Meter Insertion Distance

Pipe Size (SCH40 & 80)	FMC109 -9" Probe Distance "X"	FMC112 -12" Probe Distance "X"
1-1/2"	8.55"	11.55"
2"	8.31"	11.31"
2-1/2"	8.06"	11.06"
3"	7.75"	10.75"
4"	7.25"	10.25"
5"	6.72"	9.72"
6"	6.19"	9.19"
8"	5.19"	8.19"

Installation Procedure (continued)

Note: To get the insertion distance for other pipe outer diameters, simply divide the outer diameter of the pipe by 2 and subtract this number from 9.5" for the FMC109 and 12.5" for the FMC112.

8. After the meter is inserted to the correct depth with the pointer in the direction of flow (+/- 2 degrees), tighten the packing gland nut with the 1-1/2" open end wrench (or crescent wrench). Use the 1-1/4" open end wrench (or the second crescent wrench) as a back-up wrench on the packing gland. Tighten to approximately 55 ft*lb of torque. This will cause the Viton sealant in the packing gland to compress around the meter's sensing tube.

   Note: To rotate the housing of the flow meter relative to the flow direction indicator, loosen the set screw and unscrew (remove) the flow direction indicator. Rotate the housing +/- 90 degrees or 180 degrees. Do not spin the housing around completely (360 degrees repeatedly) due to wires connecting the probe to the housing. Re-install the flow indicator and then tighten set screw.

9. Connect the interconnecting cable to the flow meter and to the enclosure. The male end of the cable connects to the enclosure and the female end connects to the flow meter.

10. Plug the power cord into the side of the enclosure. The meter and the remote display should power up after the power cord is plugged in. After this step, the meter and enclosure should look like Figure 6.

Figure 6: Flow Meter Connected to Remote Display

Installation Procedure (continued)

11. Plug in the flow meter's power cord to 120 VAC power. The display on the flow meter and the touch screen should power up. After both have initialized (booted), the configuration screen should look like Figure 7 below.

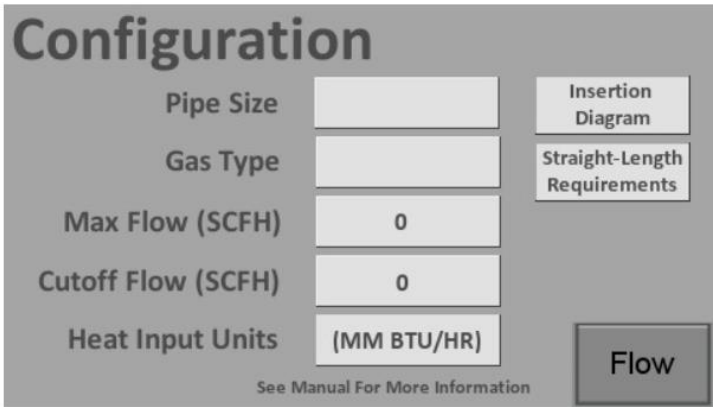

Figure 7: Configuration Screen on Meter Power-up

12. Tap the button beside "Pipe Size". The following menu should pop-up as shown in Figure 8 below.

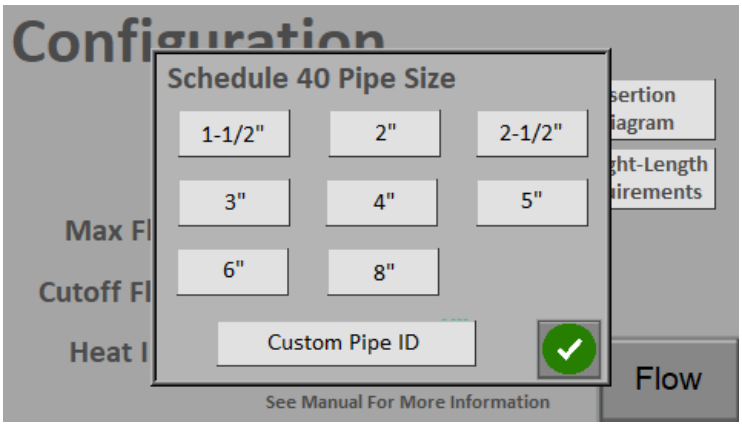

Figure 8: Schedule 40 Pipe Size Pop-up Window

13. Select the correct trade size of Schedule 40 pipe. The pipe I.D. associated with these trade sizes will be entered into the meter. If a Schedule 80 pipe or some other odd size pipe is encountered and the I.D. of the pipe is known, this can be entered in by using the "Custom Pipe ID" button. Note that the I.D. of some common sizes of Schedule 80 pipe can be found in Appendix A.

Note: For custom pipe I.D. the minimum value is 1.5" and the maximum value is 10".

Installation Procedure (continued)

14. Next, tap the button beside “Gas Type”. Common fuel gases can be selected, and a custom heating value for that gas can be entered if known. In Figure 9 below, “Natural Gas” has been selected, and a standard heating value of 1000 BTU / SCF has been automatically entered. If the “Heating Value” button is tapped, a different natural gas heating value can then be entered.

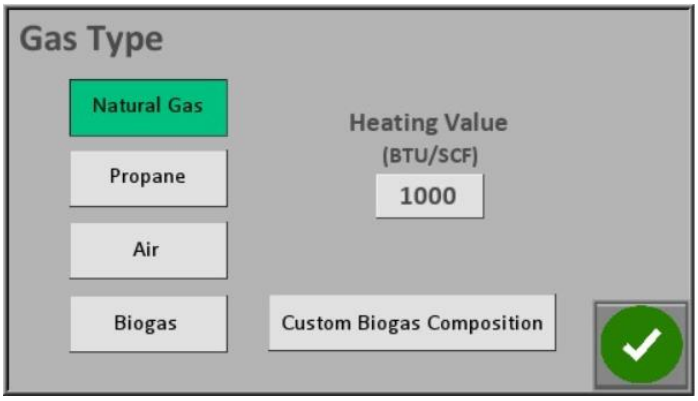

Figure 9: Gas Type Pop-up Window

Note: Always select the proper fuel gas since this affects the gas density calculations in the flow meter. The heating value is only used to show the burner’s heat input, and will not adjust the gas density.

Installation Procedure (continued)

15. If biogas / digester gas is being used, a custom biogas composition can be entered. To do this, tap the “Custom Biogas Composition” button and the screen shown below in Figure 10 should appear.

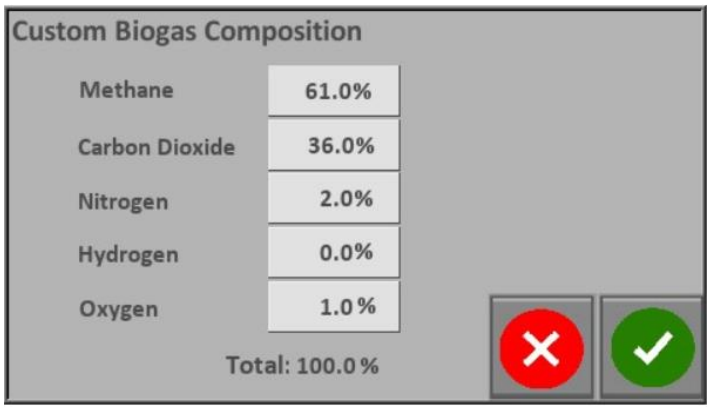

Figure 10: Custom Biogas Pop-up Window

16. If a custom biogas composition is entered, all the components must add up to 100% or the new composition will not be accepted. The red “X” on the screen can be used to exit the screen and use the default biogas composition.

17. After the “Pipe Size” and “Gas Type” are entered the screen should appear as is seen in Figure 11 below. The “Max Flow” and “Cutoff Flow” are auto filled based on the pipe size that was previously selected.

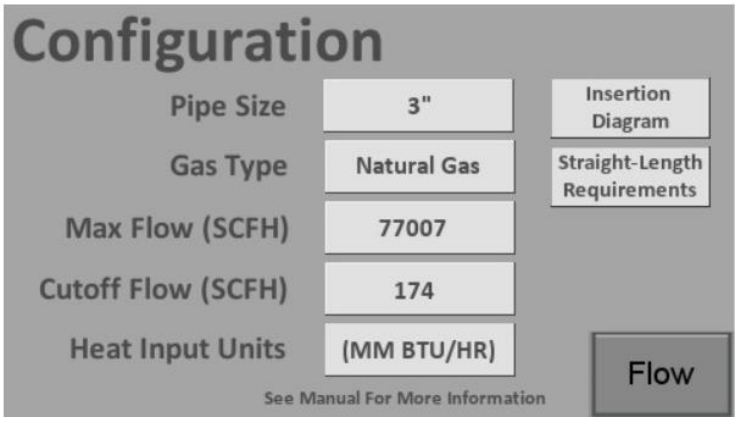

Figure 11: Completed Configuration Screen

Installation Procedure (continued)

18. The “Max Flow” button is auto filled based on the maximum gas velocity for the meter which is 25,000 Standard Feet Per Minute (SFPM). This can also be adjusted to a lower number that is closer to the actual flow in the application, if desired. The “Cutoff Flow” is the flow at which the meter display will drop to 0 SCFH. This can also be adjusted to a higher or lower number if desired.

    Note: The “Max Flow” setting and the “Cutoff Flow” setting have no impact on the calibration of the meter. If the value for “Max Flow” is exceeded, a “Max Flow Exceeded” warning will pop-up on the flow screen.

19. At this point, the meter settings should be correct for the application. For convenience, the insertion distance for the selected pipe size is also available on the touch screen. To access this screen, tap the “Insertion Diagram” button. See Figure 12 below that displays the correct insertion distance for 3” pipe.

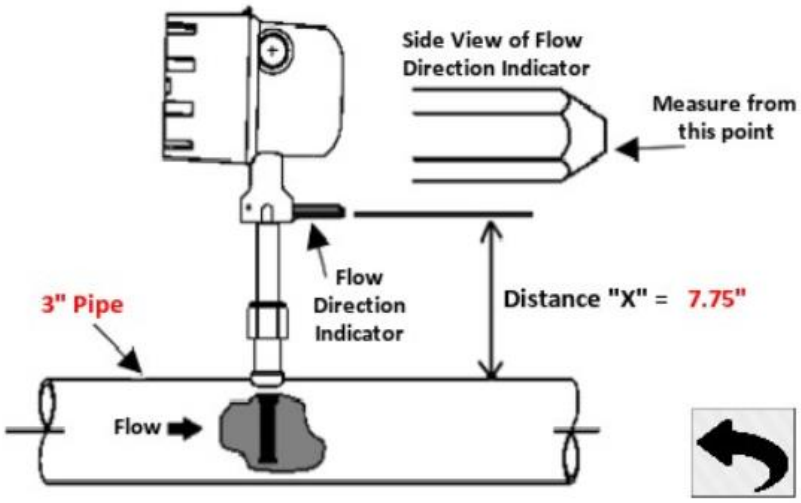

Figure 12: Meter Insertion Distance (3 inch pipe shown)

Note: Schedule 40 and Schedule 80 pipe have the same O.D. so the insertion distance is valid for both schedules of pipe. For a custom pipe O.D. distance “X” can be found by simply dividing the outer diameter of the pipe by 2 and subtracting this number from 9.5” for the FMC109 and 12.5” for the FMC112.

20. For convenience, a diagram showing straight length requirements of the meter is also provided. To view this, tap the “Straight Length Requirements” button on the touch screen. This screen should look identical to Figure 2 in this literature.

Installation Procedure (continued)

21. The “Heat Input Units” can also be selected. Choices are thousands of BTU per hour (M BTU / HR) or millions of BTU per hour (MM BTU / HR).

22. Now that the configuration, the insertion distance, and the straight length requirements of the meter are verified the meter is ready to use. Tap the “Flow” button to access the flow screen.

    Note: The Modbus points for the configuration are written to the meter when the “Flow” button is tapped.

23. The flow screen is shown in Figure 13 below. Flow in SCFH is shown in white at the top, and the heat input into the system is shown in red at the bottom. The heat input is calculated using the flow and multiplying this number by the heating value and adjusting for the appropriate heat input unit. Critical meter settings are read back from the meter’s Modbus registers and are displayed at the bottom of the screen.

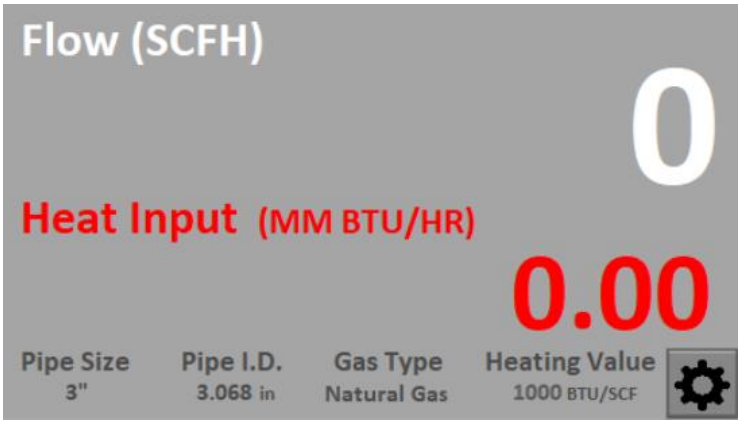

Figure 13: Flow Screen – Normal Operation

24. A convenience outlet is provided on the side of the enclosure for up to 5A of load. This is typically used to plug in an external combustion analyzer or a laptop computer. The remote display can also be hung by eyelets provided on the back of the enclosure. Strong magnets with hooks (not provided) can be used to hang the enclosure on the side of a steel skinned boiler or on a steel control panel.

Installation Procedure (continued)

25. After use, remove all power from the enclosure prior to de-pressurizing the gas piping. Remove the flow meter and packing gland. Plug the now open half coupling. Place the flow meter and accessories back into the plastic case. When all components are put back into the case, the flow meter kit should appear as shown in Figure 14.

Figure 14: Flow Meter Kit Packaged in Case

Calibration Validation Procedure

The Fox Thermal FT1 has the ability to validate its own calibration, thus significantly reducing the number of re-calibrations over the life of the meter. This calibration validation is referred to as Zero CAL-CHECK®, and the procedure to do this is outlined below.

1. Visually inspect the meter's probe for damage and / or significant dirt build up. The probe should look like Figure 15.

Figure 15: Clean Undamaged Probe

2. The gas flow meter probe must be in an area of zero gas velocity for the calibration validation. It is recommended to remove the meter from the pipe and install the meter probe protector over the probe to ensure zero gas velocity across the probe.

3. The meter cover must be unscrewed, and buttons F1 thru F4 must be used to navigate down through the menus to reach the Zero CAL-CHECK®.

4. With the screen in normal running mode, press the F1 key and the following screen should appear:

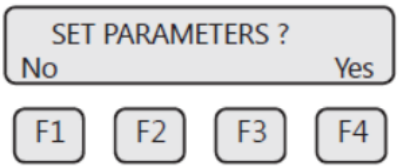

Figure 16: Set Parameters Menu

Calibration Validation Procedure (continued)

5. Press Yes (F4) and the next screen will prompt the user to enter a password. The default password is “1234”. Press OK (F4) after the password is entered

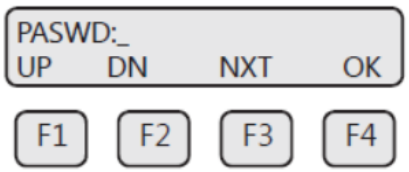

Figure 17: Password Menu

6. After this, follow the menu path below to execute the Zero CAL-CHECK®

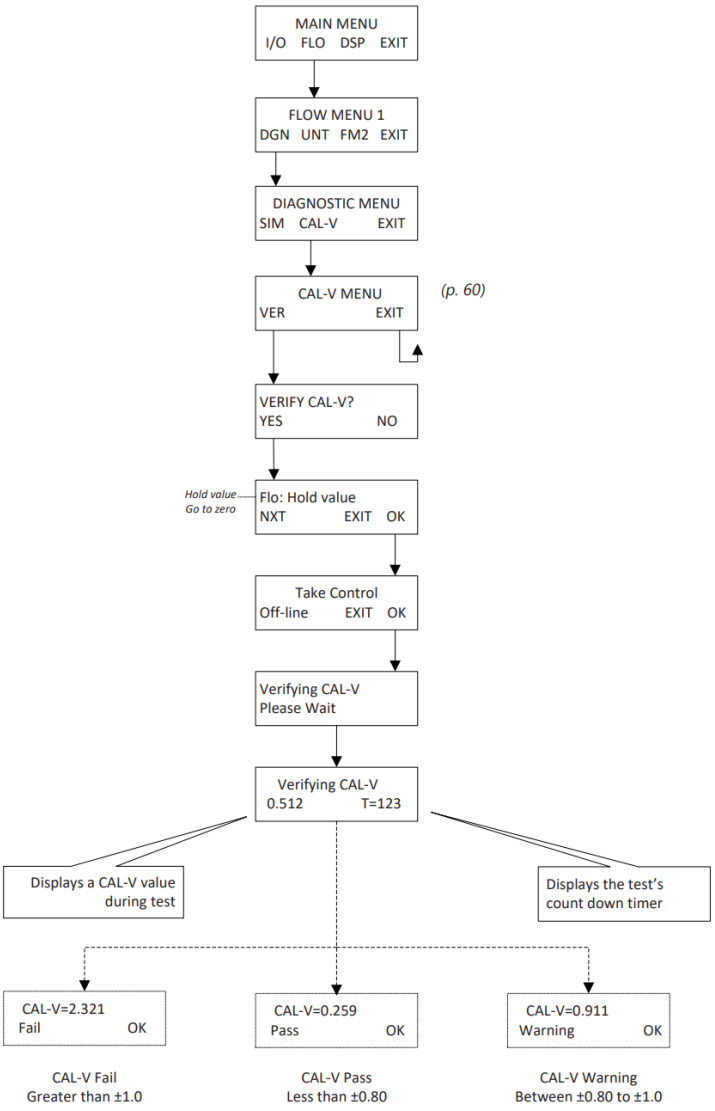

Figure 18: Zero Cal Menu Path

Calibration Validation Procedure (continued)

7. If the result of “Warning” or “Fail” is displayed, clean the sensor with a soft bristle (non-metallic) brush with water or denatured alcohol. Let the sensor dry thoroughly (at least 10 minutes), re-install the probe cover, and run the calibration validation again.

8. If the calibration still fails, contact Fox Thermal (service@foxthermal.com). The meter will need to be sent back for repair. If the meter is sent back, see the next section on how to return it to operable condition after calibration.

Post-Calibration Configuration

If the meter is sent back to Fox Thermal for calibration, a few items need to be addressed before the meter can be put in service after it has been returned by Fox Thermal.

1. Remove the outer cover of the meter.

Figure 19: Outer Cover Removed

2. Loosen the top two Phillips head screws. The meter display will hinge out on the lower right-hand side.

Figure 20: Phillips Head Screws to Remove Display

Post-Calibration Configuration (continued)

3. Locate the wires inside the meter and wire them the following way:

   Blue - Power (+)
   White - Power (–)
   Brown - Tx/Rx (+)
   Black - Tx/Rx (-)
   Green - Ground Lug/Screw

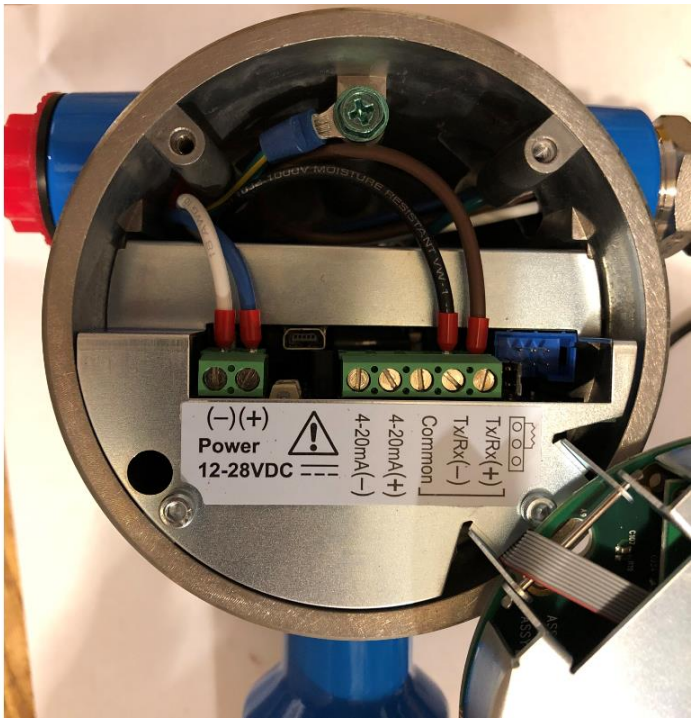

Figure 21: Wires Connected Inside the Meter

4. Reattach the meter display and tighten the screws previously loosened in step 2. Connect it to the remote display unit and apply power to the unit.

5. Once the display is illuminated, press the F1 button. The screen will now display the message “Set Parameters?”.

6. Press Yes (F4 button). The screen will now display “PASWD: ”

7. Enter “1234” and press OK (F4 button). See Figure 22.

Post-Calibration Configuration (continued)

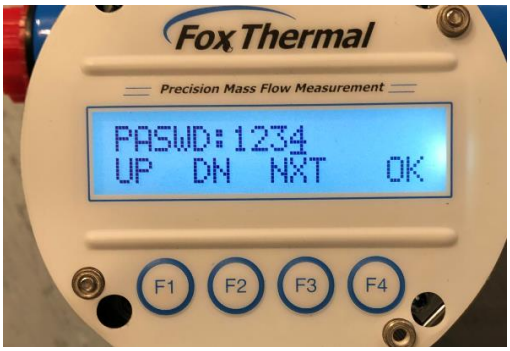

Figure 22: Password Entered In

8. See Figure 23 below for the menu path to the baud rate. Navigate to the baud rate by using the F1-F4 buttons. Change the baud rate to 115200.

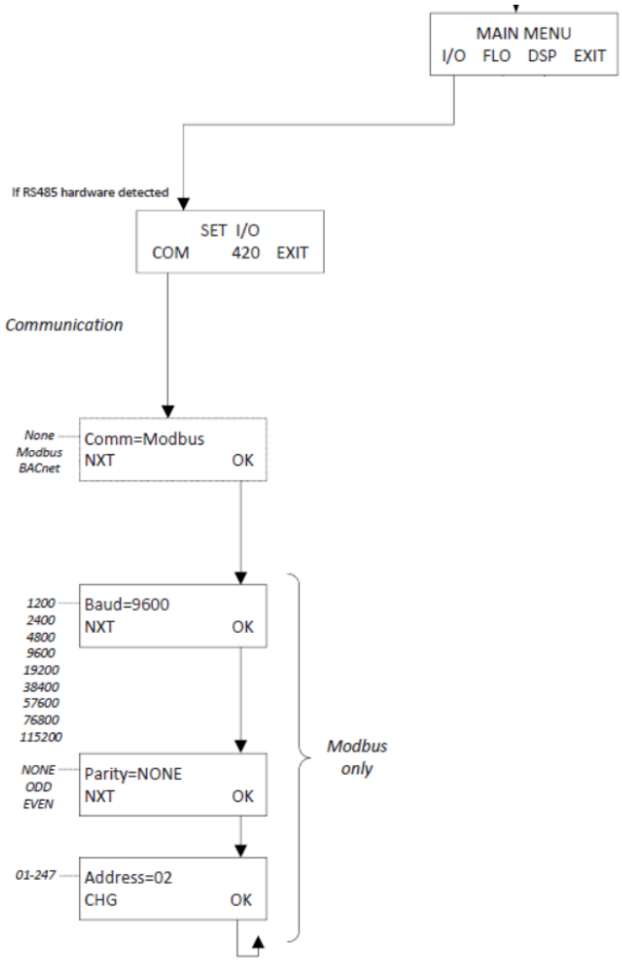

Figure 23: Baud Rate Menu Path

Post-Calibration Configuration (continued)

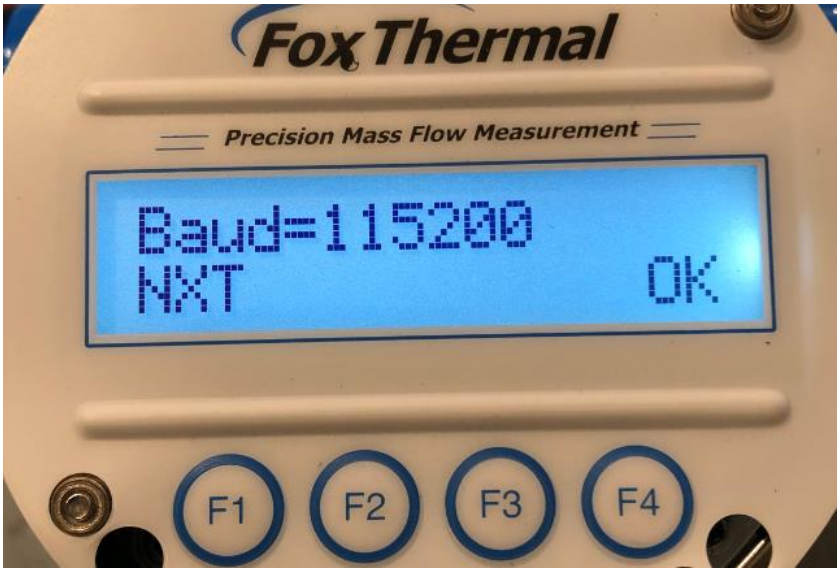

Figure 24: Baud Rate Parameter

9. Once the baud rate is set to 115200, hit OK to cycle through the menus. Once the “Set I/O” menu is displayed, hit exit (F4 button) twice to return to the main display.

10. Thread the outer cover back onto the meter. The meter is now ready to use.

Appendix A

Table 2: Maximum and Minimum Flow Rates by Pipe Size – Schedule 40

Pipe Size	Pipe I.D. SCH 40	Min Flow	Max Standard Velocity	Max Flow (AGA)	Max Boiler Output [1]	Max Boiler Output [2]
in	in	SCFH	SFPM	SCFH	BHP	LB/HR
1.5	1.61	47	25000	20758	527	17810
2	2.07	78		34215	869	29356
2.5	2.47	111		48818	1240	41885
3	3.07	171		75378	1914	64673
4	4.03	295		129803	3296	111368
5	5.05	464		203987	5180	175017
6	6.07	669		294577	7480	252741
8	7.98	1159		510095	12952	437651

Table 3: Maximum and Minimum Flow Rates by Pipe Size – Schedule 80

Pipe Size	Pipe I.D. SCH 80	Min Flow	Max Standard Velocity	Max Flow (AGA)	Max Boiler Output [1]	Max Boiler Output [2]
in	in	SCFH	SFPM	SCFH	BHP	LB/HR
1.5	1.50	41	25000	18019	458	15460
2	1.94	68		30109	765	25833
2.5	2.32	98		43215	1097	37078
3	2.90	153		67349	1710	57784
4	3.83	266		117227	2977	100578
5	4.81	422		185511	4711	159164
6	5.76	604		265694	6747	227960
8	7.62	1057		464994	11807	398955

Notes:

1. Boiler Horsepower numbers assume a heating value of 1000 BTU / SCF and a boiler efficiency of 85%.
2. Steam flow numbers assume 230^{o}F feed water and 100 PSIG steam.

Appendix A (continued)

Table 4: Schedule 40 Pipe Velocities and Flows

STANDARD VELOCITY			1 -1/2" FLOW		2" FLOW		2 -1/2" FLOW		3" FLOW	
STD FT/SEC	STD FT/MIN	STD FT/HR	GAS SCFH	STEAM BHP	GAS SCFH	STEAM BHP	GAS SCFH	STEAM BHP	GAS SCFH	STEAM BHP
0.0	**0**	0	0	0	0	0	0	0	0	0
16.7	**1000**	60000	830	21	1369	35	1369	35	3015	77
33.3	**2000**	120000	1661	42	2737	70	2737	70	6030	153
50.0	**3000**	180000	2491	63	4106	104	4106	104	9045	230
66.7	**4000**	240000	3321	84	5474	139	5474	139	12061	306
83.3	**5000**	300000	4152	105	6843	174	6843	174	15076	383
100.0	**6000**	360000	4982	127	8212	209	8212	209	18091	459
116.7	**7000**	420000	5812	148	9580	243	9580	243	21106	536
133.3	**8000**	480000	6643	169	10949	278	10949	278	24121	612
150.0	**9000**	540000	7473	190	12317	313	12317	313	27136	689
166.7	**10000**	600000	8303	211	13686	348	13686	348	30151	766
183.3	**11000**	660000	9134	232	15055	382	15055	382	33167	842
200.0	**12000**	720000	9964	253	16423	417	16423	417	36182	919
216.7	**13000**	780000	10794	274	17792	452	17792	452	39197	995
233.3	**14000**	840000	11625	295	19160	487	19160	487	42212	1072
250.0	**15000**	900000	12455	316	20529	521	20529	521	45227	1148
266.7	**16000**	960000	13285	337	21898	556	21898	556	48242	1225
283.3	**17000**	1020000	14116	358	23266	591	23266	591	51257	1302
300.0	**18000**	1080000	14946	380	24635	626	24635	626	54273	1378
316.7	**19000**	1140000	15776	401	26004	660	26004	660	57288	1455
333.3	**20000**	1200000	16607	422	27372	695	27372	695	60303	1531
350.0	**21000**	1260000	17437	443	28741	730	28741	730	63318	1608
366.7	**22000**	1320000	18267	464	30109	765	30109	765	66333	1684
383.3	**23000**	1380000	19098	485	31478	799	31478	799	69348	1761
400.0	**24000**	1440000	19928	506	32847	834	32847	834	72363	1837
416.7	**25000**	1500000	20758	527	34215	869	34215	869	75379	1914

Note:
Boiler Horsepower numbers assume a natural gas heating value of 1000 BTU / SCF and a boiler efficiency of 85%.

Appendix A (continued)

Table 4: Schedule 40 Pipe Velocities and Flows (continued)

STANDARD VELOCITY		4"		5"		6"		8"	
		FLOW		FLOW		FLOW		FLOW	
STD FT/SEC	STD FT/MIN	GAS SCFH	STEAM BHP	GAS SCFH	STEAM BHP	GAS SCFH	STEAM BHP	GAS SCFH	STEAM BHP
0.0	**0**	0	0	0	0	0	0	0	0
16.7	**1000**	5192	132	8160	207	11783	299	20404	518
33.3	**2000**	10384	264	16319	414	23566	598	40808	1036
50.0	**3000**	15576	396	24479	622	35349	898	61212	1554
66.7	**4000**	20768	527	32638	829	47132	1197	81615	2072
83.3	**5000**	25961	659	40798	1036	58915	1496	102019	2590
100.0	**6000**	31153	791	48957	1243	70698	1795	122423	3109
116.7	**7000**	36345	923	57117	1450	82482	2094	142827	3627
133.3	**8000**	41537	1055	65276	1657	94265	2394	163231	4145
150.0	**9000**	46729	1187	73436	1865	106048	2693	183635	4663
166.7	**10000**	51921	1318	81595	2072	117831	2992	204038	5181
183.3	**11000**	57113	1450	89755	2279	129614	3291	224442	5699
200.0	**12000**	62305	1582	97914	2486	141397	3590	244846	6217
216.7	**13000**	67498	1714	106074	2693	153180	3890	265250	6735
233.3	**14000**	72690	1846	114233	2901	164963	4189	285654	7253
250.0	**15000**	77882	1978	122393	3108	176746	4488	306058	7771
266.7	**16000**	83074	2109	130552	3315	188529	4787	326461	8290
283.3	**17000**	88266	2241	138712	3522	200312	5086	346865	8808
300.0	**18000**	93458	2373	146871	3729	212095	5386	367269	9326
316.7	**19000**	98650	2505	155031	3937	223879	5685	387673	9844
333.3	**20000**	103842	2637	163190	4144	235662	5984	408077	10362
350.0	**21000**	109035	2769	171350	4351	247445	6283	428481	10880
366.7	**22000**	114227	2900	179509	4558	259228	6582	448884	11398
383.3	**23000**	119419	3032	187669	4765	271011	6882	469288	11916
400.0	**24000**	124611	3164	195828	4972	282794	7181	489692	12434
416.7	**25000**	129803	3296	203988	5180	294577	7480	510096	12952

Note:
Boiler Horsepower numbers assume a natural gas heating value of 1000 BTU / SCF and a boiler efficiency of 85%.

Appendix A (continued)

Table 5: Schedule 80 Pipe Velocities and Flows

STANDARD VELOCITY			1 -1/2" FLOW		2" FLOW		2 -1/2" FLOW		3" FLOW	
STD FT/SEC	STD FT/MIN	STD FT/HR	GAS SCFH	STEAM BHP	GAS SCFH	STEAM BHP	GAS SCFH	STEAM BHP	GAS SCFH	STEAM BHP
0.0	**0**	0	0	0	0	0	0	0	0	0
16.7	**1000**	60000	721	18	1204	31	1729	44	2694	68
33.3	**2000**	120000	1441	37	2409	61	3457	88	5388	137
50.0	**3000**	180000	2162	55	3613	92	5186	132	8082	205
66.7	**4000**	240000	2883	73	4817	122	6914	176	10776	274
83.3	**5000**	300000	3604	92	6022	153	8643	219	13470	342
100.0	**6000**	360000	4324	110	7226	183	10372	263	16164	410
116.7	**7000**	420000	5045	128	8430	214	12100	307	18858	479
133.3	**8000**	480000	5766	146	9635	245	13829	351	21552	547
150.0	**9000**	540000	6487	165	10839	275	15557	395	24246	616
166.7	**10000**	600000	7207	183	12044	306	17286	439	26940	684
183.3	**11000**	660000	7928	201	13248	336	19015	483	29634	752
200.0	**12000**	720000	8649	220	14452	367	20743	527	32328	821
216.7	**13000**	780000	9370	238	15657	398	22472	571	35022	889
233.3	**14000**	840000	10090	256	16861	428	24200	615	37716	958
250.0	**15000**	900000	10811	275	18065	459	25929	658	40410	1026
266.7	**16000**	960000	11532	293	19270	489	27658	702	43104	1094
283.3	**17000**	1020000	12253	311	20474	520	29386	746	45798	1163
300.0	**18000**	1080000	12973	329	21678	550	31115	790	48492	1231
316.7	**19000**	1140000	13694	348	22883	581	32843	834	51185	1300
333.3	**20000**	1200000	14415	366	24087	612	34572	878	53879	1368
350.0	**21000**	1260000	15136	384	25291	642	36301	922	56573	1437
366.7	**22000**	1320000	15856	403	26496	673	38029	966	59267	1505
383.3	**23000**	1380000	16577	421	27700	703	39758	1010	61961	1573
400.0	**24000**	1440000	17298	439	28904	734	41487	1053	64655	1642
416.7	**25000**	1500000	18019	458	30109	765	43215	1097	67349	1710

Note:
Boiler Horsepower numbers assume a natural gas heating value of 1000 BTU / SCF and a boiler efficiency of 85%.

Appendix A (continued)

Table 5: Schedule 80 Pipe Velocities and Flows (continued)

STANDARD VELOCITY		4"		5"		6"		8"	
		FLOW		FLOW		FLOW		FLOW	
STD FT/SEC	STD FT/MIN	GAS SCFH	STEAM BHP	GAS SCFH	STEAM BHP	GAS SCFH	STEAM BHP	GAS SCFH	STEAM BHP
0.0	**0**	0	0	0	0	0	0	0	0
16.7	**1000**	4689	119	7420	188	10628	270	18600	472
33.3	**2000**	9378	238	14841	377	21256	540	37200	945
50.0	**3000**	14067	357	22261	565	31883	810	55799	1417
66.7	**4000**	18756	476	29682	754	42511	1079	74399	1889
83.3	**5000**	23445	595	37102	942	53139	1349	92999	2361
100.0	**6000**	28134	714	44523	1131	63767	1619	111599	2834
116.7	**7000**	32824	833	51943	1319	74394	1889	130198	3306
133.3	**8000**	37513	953	59363	1507	85022	2159	148798	3778
150.0	**9000**	42202	1072	66784	1696	95650	2429	167398	4251
166.7	**10000**	46891	1191	74204	1884	106278	2699	185998	4723
183.3	**11000**	51580	1310	81625	2073	116906	2968	204597	5195
200.0	**12000**	56269	1429	89045	2261	127533	3238	223197	5667
216.7	**13000**	60958	1548	96466	2449	138161	3508	241797	6140
233.3	**14000**	65647	1667	103886	2638	148789	3778	260397	6612
250.0	**15000**	70336	1786	111306	2826	159417	4048	278996	7084
266.7	**16000**	75025	1905	118727	3015	170044	4318	297596	7557
283.3	**17000**	79714	2024	126147	3203	180672	4588	316196	8029
300.0	**18000**	84403	2143	133568	3392	191300	4858	334796	8501
316.7	**19000**	89092	2262	140988	3580	201928	5127	353395	8973
333.3	**20000**	93782	2381	148409	3768	212555	5397	371995	9446
350.0	**21000**	98471	2500	155829	3957	223183	5667	390595	9918
366.7	**22000**	103160	2619	163249	4145	233811	5937	409195	10390
383.3	**23000**	107849	2739	170670	4334	244439	6207	427794	10863
400.0	**24000**	112538	2858	178090	4522	255067	6477	446394	11335
416.7	**25000**	117227	2977	185511	4711	265694	6747	464994	11807

Note:
Boiler Horsepower numbers assume a natural gas heating value of 1000 BTU / SCF and a boiler efficiency of 85%.