Wat-a-mat

Installation Instructions
and
Service Manual

Mark VH Water Meter
With Model K2 Controller
(No Automatic Blender)

THE FRED D. PFENING COMPANY
1075 W FIFTH AVE.
COLUMBUS, OHIO 43212
Phone: 614-294-5361
Fax: 614-294-1633

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GENERAL

The Pfening Mark VH is the most advanced and reliable flow meter available on the market today. The meter itself has a rugged, precision cast stainless steel housing and metering chamber with two moving part, a synthetic polymer metering piston and magnet wheel.

The Model K2 liquid meter controller is a microprocessor based unit that uses the latest electronic hardware and software developments to provide user-friendly, accurate, and reliable control. It uses advanced logic to provide manual and pre-set setpoints which are easy to access and adjust. The Model K2 controller includes sophisticated control logic to provide fully automatic water temperature control in conjunction with the optional Pfening Automatic Temperature Blender.

Manual water temperature blender assemblies are also available for this flow meter. Manual water temperature blending is achieved with a three-way manual blender. Each blender has a thermometer and a bypass valve so that water can be run to set the temperature before water is run through the meter to the mixer. A different service manual is provided with automatic blenders.

For oils or liquid sugars, the meter is normally provided with a stainless steel, air operated shut off valve. For water, a bronze solenoid valve is standard.


INSTALLATION

Install your new meter assembly in accordance with Figure 1, 2, or 3, whichever applies. Wire the controller and solenoid valve in accordance with Figures 4 and 5. Mount the Model K2 Controller box in a place convenient for the operator, avoiding excessively wet locations. The Model K2 controller can be mounted remotely, up to 100' from the water meter. Also avoid locations subject to vibration, such as the side of a mixer. Also, observe the following information for any of these installations:

1. Use a receptacle (120 volt single phase) of the grounding type and ground properly before using the meter.

2. Water is to flow through the meter and solenoid valve in one direction only. The inlet is at the back of the meter case while the outlet is centered on the side. Mount the meter and solenoid valve in a horizontal line with the removable cover of the meter in a vertical plane and the head of the solenoid valve upright as shown in the figures.

3. A strainer with 30 mesh (.02" screens opening) ahead of the meter is recommended. This protects the meter and solenoid valve from foreign particles. If a three-way blender is being used, a separate strainer will not be necessary as this blender has a built in strainer.

4. If a blender is being used, place a check valve in each of the lower pressure water lines (usually the hot water and/or ice water lines). This is to prevent water from the highest pressure line backing up into the lower pressure lines. To secure accurate blending results, all water supplies should be within 10 psi of the same pressure when the water is flowing through the meter. Pressure regulators in each line or a booster pump on the lowest pressure line may be necessary if there is a wide pressure differential between the lines. You can tell if you have balanced

pressure by checking the rate of water flow from each line individually through the meter. When the rates are the same, the pressures are balanced.

5. The maximum static pressure to which the meter is to be exposed is 100 psi. The flow rate should be within the range shown on the graph below. Liquid temperature may be from 32 °F degrees to 150 °F. (0-65 °C).

6. If it is necesssary to extend any of the cables supplied with the meter, use only uncut runs of shielded cable. Do not splice cables. Ground the shields at the controller end only, as shown on the Wiring Diagram, Fig. 5.
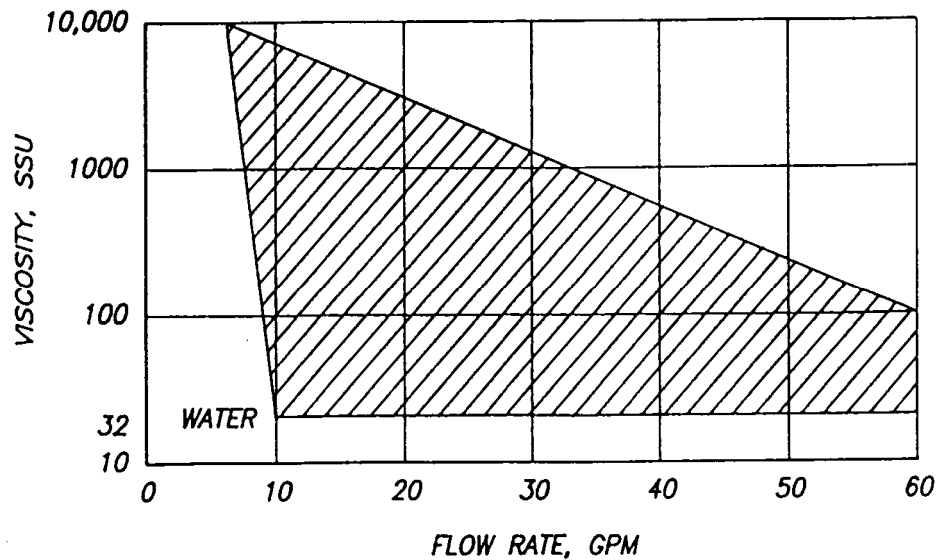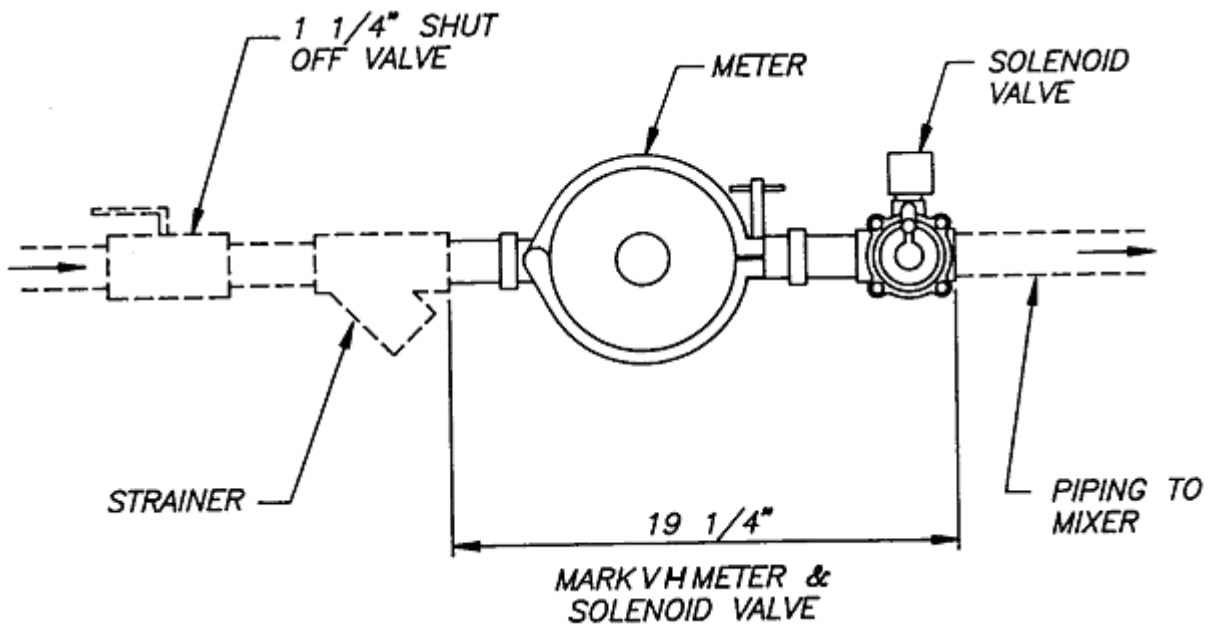
FIG. 1 MARK VH METER ONLY
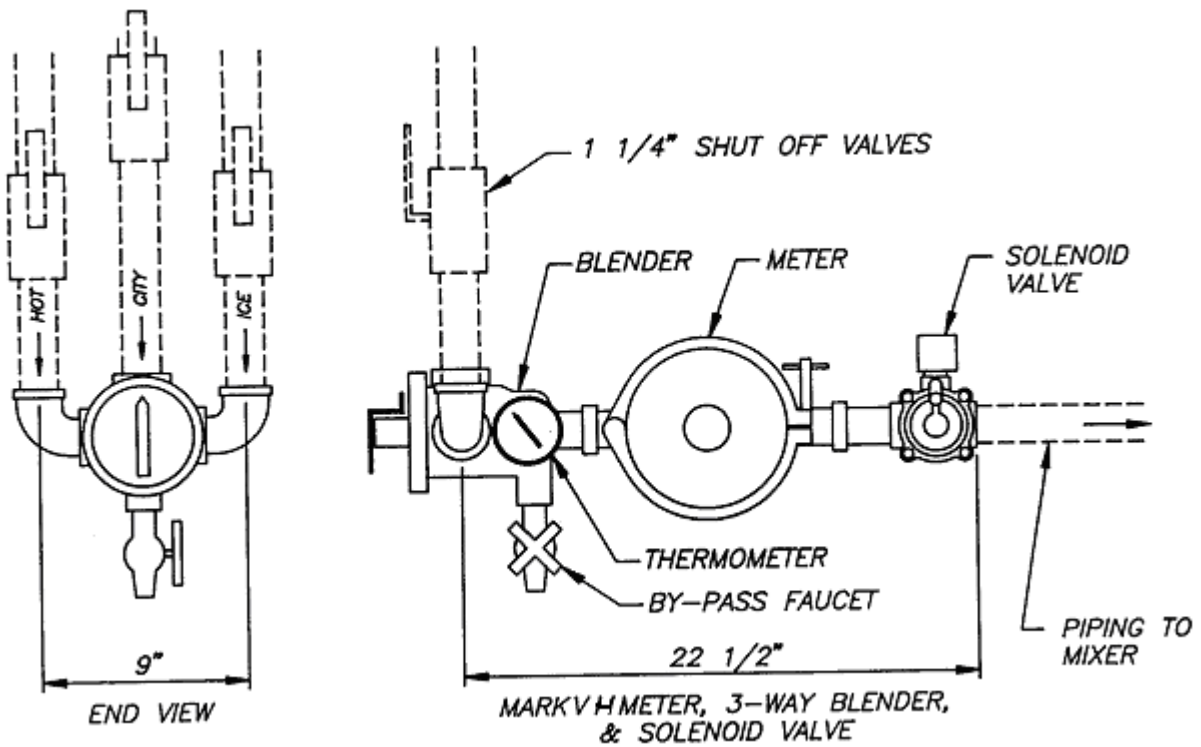
FIG. 2 MARK VH METER & 3-WAY MANUAL BLENDER
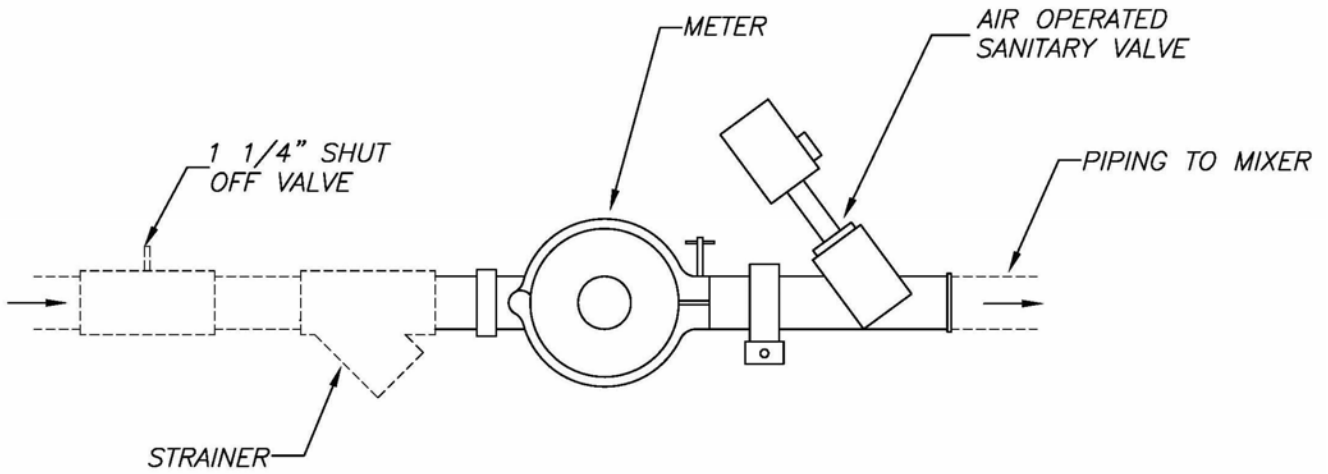
FIG. 3 MARK VH WITH SANITARY VALVE
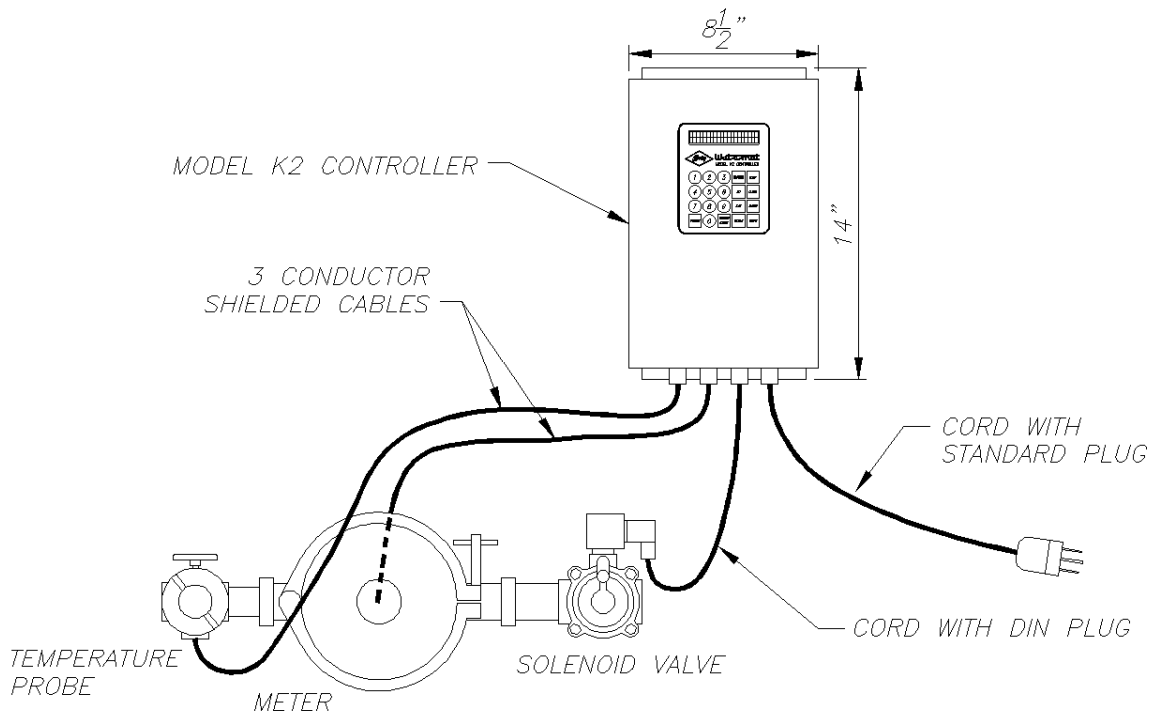
FIG. 4 CABLE IDENTIFICATION
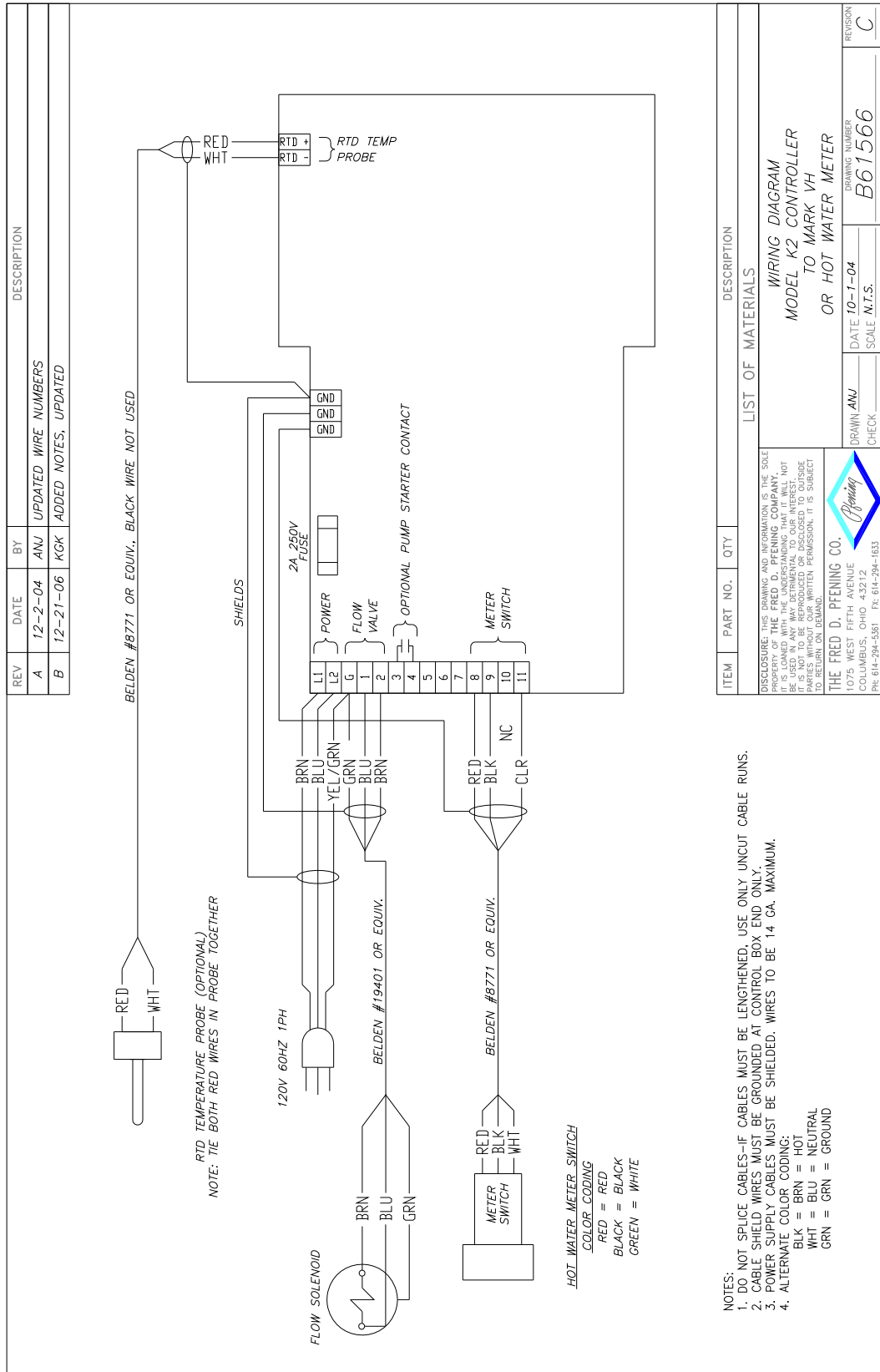
FIG. 5 WIRING DIAGRAM

OPERATION

The auto blender assembly is equipped with a Model K2 controller, which has been programmed and calibrated at the factory. A non-volatile memory ensures that program settings will not be lost if power is interrupted.   The display has four lines of text; the top two lines usually display operating information while the bottom two lines display operator instructions.

FIG. 6 KEYPAD AND DISPLAY

The controller settings may be changed by the operator. Figure 6 shows the operator keypad and display. See pages 13-19 for programming and calibration procedures.

Powering Up the Controller

When the Model K2 controller is first powered up, the display will show:

```
PFENING K2      V1.01
   MARK VH:   WATER-LB


```

The top line shows the software version and the second line shows a summary of the current programming.

Running a Manual Batch

Once the autoblender assembly and Model K2 controller are installed and power is applied, then display should appear as shown:

```
ACTUAL        0 LB
 MANUAL       60 LB

Push START to run
```

The actual amount of the last batch is displayed on the top line. The second line shows the manual setpoint. In this example the manual setpoint is 60 lbs. of water.

To program a batch amount, simply enter the amount using the number keys. If you make a mistake, press CLEAR and start over. If you entered a setpoint of 125 LB, the display will look like this:

```
ACTUAL        0 LB
 MANUAL     125 LB
Push ENTER to save,
CLEAR for old value.
```

Press ENTER when the amount is correct or press CLEAR to bring back the previous value. The unit will automatically save after five seconds. After the setpoint is saved the display will appear as shown:

```
ACTUAL        0 LB
 MANUAL     125 LB

Push START to run
```

To run the batch, press START and the display will show:

```
ACTUAL        0 LB
MANUAL    125 LB
BATCH STARTED
Push STOP to abort
```

The actual amount of water delivered is shown on the top line. When the actual amount reaches the preset amount, the flow solenoid valve will close.

Press START again to run additional batches of the same size.

Stopping a Batch

Press STOP at any time to stop a batch. If you stopped a batch at 66 lbs, the display would appear as shown:

```
ACTUAL     66 LB
MANUAL    125 LB
BATCH STOPPED
Push START to run
```

Pressing START will restart the batch where it left off. Pressing CLEAR will reset it to zero.

Using the Presets

The controller will store up to five setpoints. Press the PRESET key to see SETPT1. Press PRESET again to see SETPT2. Press PRESET a third time to see SETPT3, and so on. To run a batch using a preset, simply press PRESET until the correct setpoint is shown. For example, if you want to run SETPT2, which is 45 LB, the display would appear as shown:

```
ACTUAL        0 LB
SETPT2       45 LB
Push NO for new
Value, START to run
```

See below for directions about how to change the presets. After five seconds the display will revert to:

```
ACTUAL        0 LB
SETPT2       45 LB

Push START to run
```

To run the batch, press START.

Changing the Presets

To change the preset weight, press NO. The display will show:

```
┌─────────────────────────────┐
│      ENTER AMOUNT           │
│      SETPT2        67 LB    │
│    Push ENTER to save,      │
│   CLEAR for old value.      │
└─────────────────────────────┘
```

Use the number keys to enter the desired water amount, then press ENTER. Press CLEAR to go back to the old value. The unit will automatically save after five seconds.

BATCH, TOTAL, AND RATE DISPLAYS

To see the total number of batches ran, press TOTALS. The display will appear as shown:

```
┌─────────────────────────────┐
│      BATCH COUNT            │
│       44 BATCH              │
│                             │
│    Push CLEAR to reset      │
└─────────────────────────────┘
```

This display says that 44 batches have been run since the last time the count was reset to zero. The display will revert back to the normal display in three seconds. To reset the batch count to zero, hold in the CLEAR button for three seconds. The batch count will flash 3 times and then reset.

Press TOTALS a second time to see the total amount of liquid ran. The display will appear as shown:

```
┌─────────────────────────────┐
│      TOTAL AMOUNT           │
│       1278 LBS              │
│                             │
│    Push CLEAR to reset      │
└─────────────────────────────┘
```

This display says that 1278 lbs. of liquid have been run since the last time the count was reset to zero. To reset the total amount, hold in the CLEAR button for three seconds. The total amount will flash 3 times and then reset.

To see the rate, at which liquid is flowing through the meter, press TOTALS while the liquid is flowing. The display will appear as shown:

```
┌─────────────────────────────┐
│       FLOW RATE             │
│      166 LB/MIN             │
│                             │
│                             │
└─────────────────────────────┘
```

This says that the rate of liquid flow is 166 lbs. per minute. This display will read zero if no liquid is flowing.

ALARMS

If the START button is pressed, but the controller receives no count input for seven seconds, the solenoid is automatically closed and the display shows:

```
   NO FLOW DETECTED
  SETPT2      45 LB
  Automatic Shutoff
  Push CLEAR to reset
```

This is intended to prevent overfilling of the mixer when the valve is open, but no pulses are reaching the controller. Correct the problem before attempting to run. See the troubleshooting section on page 22. Press CLEAR to reset the alarm.

If the actual count of liquid goes over the setpoint amount, the display will show:

```
   ACTUAL      52 LB
   SETPT2      45 LB
  **OVERFLOW detected*
  Push CLEAR to reset
```

Press CLEAR to reset the alarm. The display will show the actual amount of liquid delivered.

The overflow alarm will also be shown when pulses reach the controller when none should. For instance, if the shutoff valve is leaking and water is dribbling through the meter, the overflow alarm will be shown. Correct the problem and press CLEAR to clear the alarm.

If someone attempts to enter a zero setpoint, the zero setpoint alarm will come up, as follows:

```
   ACTUAL       0 LB
   MANUAL       0 LB
  ZERO SETPOINT ERROR
  Enter setpoint value
```

Use the number keys to enter a setpoint.

PROGRAMMING

Current programming: Upon power-up, the controller screen looks like this for three seconds:

```
PFENING K2    V1.01
MARK VH:   WATER-LB
```

The upper line shows the software version number. The lower line shows a summary of the current programming. In this example, the controller is programmed for a Mark VH water meter, in lbs.

Controller programming: The controller has been programmed at the factory and reprogramming should not be necessary. If you have a problem, work through the troubleshooting section on page 22 before changing the programming. If you suspect that the programming has been changed, the original factory programming may be restored as described below.

Numeric code: To use this method, a six-digit number is created using Table 1 on page 24. Work through this and write down the number. Then unplug the controller for 10 seconds, then hold in the 5 key, and plug the unit back in with the 5 key held in. The controller will show this:

```
  Enter six digit
  programming code:
         0
Push ENTER when done
```

If you enter an invalid code, the screen will show:

```
     CODE ERROR
 Must be from 111111
 to 433424.   EXIT to
 exit, CLEAR to retry
```

Program Mode

Programming is done through the keypad. To enter the program mode, first make sure the meter is stopped (press STOP if necessary), then press the PROGRAM key. The display will show:

```
  ..PROGRAM MODE..
      PASSWORD
  To enter Program
Mode, enter PASSWORD
```

The password is **5354**. Use the keyboard to enter the password. The numbers will not be displayed on the screen. Press ENTER. If you enter the password wrong, it will ask you to try again. If you have

entered it correctly, the display will appear as shown:

```
┌─────────────────────────┐
│    ..PROGRAM MODE..      │
│     PROGRAM UNIT         │
│  NO for choice,ENTER     │
│   to select, or EXIT     │
└─────────────────────────┘
```

At this point you can continue into the program mode by pressing ENTER or else press NO for access to the CALIBRATION MODE or MAINTENANCE MODE. Calibration and maintenance modes are discussed on pages 18-19 respectively. Press ENTER to continue into the PROGRAM MODE.

```
┌─────────────────────────┐
│    ..PROGRAM MODE..      │
│  SELECT UNITS      LB    │
│  NO for choice,ENTER     │
│   to select, or EXIT     │
└─────────────────────────┘
```

To leave the programming mode at any time, press EXIT. The controller will save any changes made up to that point. To view the programming choices, press the NO key. In this case, the units can be LB (pounds), KG (kilograms), LT (liters), or GA (gallons). When the correct units are displayed, press ENTER to advance to the next step. The display will look like this.

```
┌─────────────────────────┐
│    ..PROGRAM MODE..      │
│  SELECT DEC PT  000.0    │
│  NO for choice,ENTER     │
│   to select, or EXIT     │
└─────────────────────────┘
```

Press NO to see the choices available, which is none, one, two, or three decimal places. Please note that displaying more decimal places does not make the meter more accurate and may be misleading. When the correct number of decimal point places is displayed, press ENTER to advance to the next step. The display will look like this.

Note: If you want to go back, press PROGRAM to go back to the first step, press ENTER to go forward.

```
┌─────────────────────────┐
│    ..PROGRAM MODE..      │
│  SELECT LIQUID- WATER    │
│  NO for choice,ENTER     │
│   to select, or EXIT     │
└─────────────────────────┘
```

Use the NO key to see the choices, which are water, oil, and sugar (liquid sugar). When one of these is chosen, the controller will automatically adjust the scale factor for the density of the liquid being metered. Press ENTER when the correct liquid is displayed. The display will go to the next step and the display will look like this:

```
  ..PROGRAM MODE..
NO FLOW ALARM -   ON
NO for choice,ENTER
 to select, or EXIT
```

Use the NO key to turn the no flow alarm on or off. In general, we recommend that it be ON at all times. The no flow alarm shuts off the liquid flow if no pulses are being received at the controller when the valve is open. Press ENTER to advance to the next step and the display will look like this:

```
  ..PROGRAM MODE..
  TEMPERATURE OFF
NO for choice,ENTER
 to select, or EXIT
```

There are three possible settings for the temperature control: ON, OFF, and DISPLAY ONLY. This setting should be set to OFF, unless you have a RTD temperature probe, in which case, set this setting to DISPLAY ONLY. If you have an automatic temperature blender please refer to the automatic temperature blender manual. If DISPLAY ONLY was chosen the unit will show:

```
  ..PROGRAM MODE..
SELECT TEMP UNITS_°F
NO for choice,ENTER
 to select, or EXIT
```

The units may be ºF or ºC. Press NO to make changes and ENTER to choose. The display will look like this:

```
  ..PROGRAM MODE..
 END BASIC PROGRAM?
Push  ENTER to end,
NO  for Adv Program
```

This screen allows you to either complete the basic unit programming or enter the advanced programming section. The basic unit programming is all that most users will need. The advanced programming section allows you to manually change the numeric values in the program. This should only be attempted by qualified personnel.

To complete the basic programming, press ENTER. The screen will look like this.

```
  ..PROGRAM MODE..
 SELECT METER-MARK VH
NO for choice,ENTER
  to select, or EXIT
```

Use the NO key to select which meter you have. A quick identification guide is:

- Mark I has ¾" pipe connections and is natural brass finish
- Mark II has 1" pipe connections and has a silver finish
- Mark VH has 1 ½" clamp connections and is stainless steel
- HW (Hot Water) meter has clear plastic top.

Press ENTER when the display shows the correct meter. The controller will select the scale factor, which is correct for your meter. The controller will save the data and after five seconds the display will revert to the display that was present before entering the program mode.

ADVANCED PROGRAMMING

To enter the advanced programming mode, when the display shows:

```
..PROGRAM MODE..
 END BASIC PROGRAM?
 Push  ENTER to end,
 NO  for Adv Program
```

Press NO and the display will change to:

```
..ADV PROGRAM MODE..
  ADVANCED PROGRAM
 ENTER  for Adv Prog
 EXIT  to abort Prog
```

Press ENTER to enter the advanced programming mode. The display will look like this:

```
..ADV PROGRAM MODE..
 SCALER    0.50000

 Key in a new value.
```

The number 0.50000 is an example only; it may be different for your meter. See Table 2 on page 25 for factory programmed values.

The SCALER is the amount of liquid metered for each change of state of the pickup switch in the water flow meter. The controller counts both the rise and fall of each pulse, so there are two changes of state for each pulse. Use the numeric keys to enter the scaler you wish. The maximum value of the scaler is 99.99999. If you are calibrating a meter, read the Calibration section on page 18. If you make a mistake, key in zeroes until the display is cleared, then start over. When the correct value is displayed, press ENTER to advance to the next step. The display will show:

```
..ADV PROGRAM MODE..
PREACT AUTO     0.600
NO for choice,ENTER
 to select, or EXIT
```

The PREACT is the amount of liquid which passes through the valve between the time the coil is de-energized and the when the valve actually closes. There are two methods available: a fixed value and an automatic preact in which the controller continuously monitors the overshoot and uses 10% of the overshoot to correct the preact for the next batch. Most users should choose the automatic preact. The factory preact values are shown in Table 2 on page 25. To change the fixed preact, use the numeric keys, then press ENTER.

To select the automatic preact, press NO then ENTER to advance to the next step. The display will look like this:

```
..ADV PROGRAM MODE..
NO OF ACTIVE SETPT 6
NO for choice,ENTER
 to select, or EXIT
```

The number of active setpoints may be from one to six. Press NO to change the number. If set at one, only the MANUAL setpoint is available. If set at two, the MANUAL setpoint plus 1 PRESET is available, and so so on. When set at six, the MANUAL setpoint plus all five PRESETS are active. This feature is provided so that if only some of the PRESETS are in use, the others may be turned off so they do not confuse the operator. Press ENTER when the display shows the correct number of presets. The display will show:

```
..PROGRAM MODE..
  PROGRAM UNIT
NO for choice,ENTER
 to select, or EXIT
```

If you are finished programming, press EXIT and the display will show:

```
     SAVING
PROGRAM IN MEMORY

   Please wait!
```

The controller saves the data and reverts to the previous display.

CALIBRATION MODE – AUTOMATIC CALIBRATION

Press the program button and after entering the PASSWORD (see page 14), the user may choose to enter the CALIBRATION MODE. With the screen showing this:

```
   ..PROGRAM MODE..
     PROGRAM UNIT
 NO for choice,ENTER
  to select, or EXIT
```

Press NO until the screen shows:

```
   ..PROGRAM MODE..
     CALIBRATE UNIT
 NO for choice,ENTER
  to select, or EXIT
```

Press ENTER and the display will show:

```
 ..CALIBRATION MODE..
   SCALER    0.50000
  Push ENTER to cali-
   brate, NO to skip.
```

The number 0.50000 is an example – your number may be different. Press ENTER to enter the calibration mode and the unit will show:

```
 ..CALIBRATION MODE..
   AMOUNT          0
 Enter test amount to
  run and press ENTER
```

Ideally, the flow meter will be calibrated at approximately the batch size most commonly used. If this is impractical, we suggest a minimum calibration amount of 100 lbs. A container large enough to hold the batch amount and a scale for weighing it are required. Water weights 8.35 lbs/gal. For example, if you entered 100 lbs and pressed ENTER, the display will show:

```
 ..CALIBRATION MODE..
   AMOUNT        100
  Push START if catch
    bucket in place.
```

Press START and water will run until the test amount is metered out. The display will then show:

```
..CALIBRATION MODE..
 ACTUAL             0
 Weigh test amt, key
 in wt, press ENTER
```

If the 100 lb test batch actually weighs 102 lbs, key in 102 and the display will show:

```
..CALIBRATION MODE..
 ACTUAL           102
 Weigh test amt, key
 In Wt, press ENTER
```

Next, press ENTER and the controller will automatically calculate a new scaler and display as follows:

```
..CALIBRATION MODE..
 OLD SCALER   0.50000
 NEW SCALER   0.51000
 Push ENTER to accept
```

Press ENTER to accept the new scaler, NO to revert to the old value. Press EXIT to exit setup.

Manual Calibration

The meter is factory calibrated and should require no adjustments for many years. However, should calibration be necessary, the following procedure may be followed:

1. Obtain a scale and a container capable of holding at least 100 lbs. of water.
2. Weigh the empty container and record the weight.
3. Set the meter for 100 lbs. and run the water into the container. Allow the hose to drain.
4. Weigh the container and water, then subtract out the weight of the container.
5. Calculate an adjustment factor:

$$\frac{\text{Actual Weight of water}}{100 \text{ lbs.}} = \text{Factor}$$

   i.e. If actual Weight of water is 102 lbs, then $\frac{102 \text{ lbs.}}{100 \text{ lbs.}} = 1.02$

6. Go to the programming section on pages 13-17. Follow the instructions (including entering advanced programming) and find the scaler.
7. Multiply the scaler by the factor found above.
        New Scaler = Old Scaler x factor

   i.e. If the old scaler is 0.50000 and the factor is 1.02, then:
                0.50000 x 1.02 = 0.51000

8. Enter the new scaler and press EXIT to return to the normal display.
9. Note: If the adjustment to the scaler is more than five percent, there is a serious problem with the meter. See the "Not Metering Accurately" in the troubleshooting section on page 22.

MAINTENANCE MODE

After entering the PASSWORD (see page 14), the user may choose to enter the MAINTENANCE MODE. With the screen showing this:

```
 ..PROGRAM MODE..
   PROGRAM UNIT
 NO for choice,ENTER
  to select, or EXIT
```

Press NO until the screen shows:

```
 ..PROGRAM MODE..
  MAINTENANCE MODE
 NO for choice,ENTER
  to select, or EXIT
```

Calibration is discussed on page 18. Press ENTER to continue into the MAINTENANCE MODE. The screen will show:

```
----ACTUAL       0 LB
 POT VOLTAGE     0.54
 BLNDR POSITION   39°
 BLNDR SETTING=MANUAL
```

The displayed values are:
1.   Top line: actual volume of liquid drawn.
2.   Second line: position potentiometer voltage reading.
3.   Third line: blender valve angular position.
4.   Bottom line: blender valve setting – use NO to toggle between MANUAL, BLEND, HOT, CITY and ICE.

(Note: Automatic blending unit is required for items 2 through 4. See automatic blender manual.)

Maintenance controls are provided to easily test the flow valve. Press START to open and STOP to close.

ZERO CROSSING PARAMETER

After entering the PASSWORD (see page 14), the user may choose to change the zero crossing parameter. With the screen showing this:

```
..PROGRAM MODE..
   PROGRAM UNIT
NO for choice,ENTER
 to select, or EXIT
```

Press NO until the screen shows:

```
..PROGRAM MODE..
 MAINTENANCE MODE
NO for choice,ENTER
 to select, or EXIT
```

Press ENTER to continue into the MAINTENANCE MODE. The screen will show:

```
----ACTUAL       0 LB
 POT VOLTAGE     0.54
BLNDR POSITION    39°
BLNDR SETTING=MANUAL
```

Press ENTER to continue to change the zero crossing parameter. The screen will show:

```
   ZERO CROSSING
   TIME CONSTANT   4

ENTER VALUE  1 to 8
```

In order to reduce wear on the relay contacts, the controller attempts to operate the relay as the AC voltage crosses zero (hence "zero crossing"). In order to do that, it must de-energize the coil 1 to 8 milliseconds early. The default value is 8 ms, but can be changed if necessary.

If you receive a zero crossing error at the end of the draw, change the time constant up or down 2 ms. If this does not correct the zero crossing problem, the circuit board my need to be replaced.

CAUTION: Changing this to an erroneous value may cause the unit to stop working.

TROUBLESHOOTING

Water runs, but there is no count:

Switch is loose: Open the top cover of the meter and make sure that the pick-up switch is tightly held against the top of the meter casing by the retainer plate. Turn the retainer plate counter-clockwise to tighten it down.

Switch wires loose or broken: Check that the wires from the controller to the switch are not broken or loose.

Switch defective: To check for a defective switch, open the top cover of the meter and disconnect the three wires. Touch the black and white wires together rapidly. The counter should count (the count may be very erratic). This shows that the counter is working.

Another way to check switch operation is to remove the switch and leave the wires hooked up. Find a small magnet and determine where the poles are (this must be loose magnet, not one in a holder, such as a screwdriver handle). The switch is only sensitive to the south pole of the magnet. Touch one pole of the magnet to the bottom center of the aluminum switch housing. The controller should count one pound for every two touches of the magnet. If it does not count, try the other end of the magnet. If you have a high resolution meter, the controller should count one pound for every sixteen touches of the magnet.

If the switch appears to be defective, open up the controller and check the voltage between terminals 9 and 10 on the back of the controller. It should be 5 VDC. Next, check the voltage between terminals 9 and 11. Take the magnet and touch the bottom of the switch, alternating the poles with each touch. It should alternate between 0 and 4.5 VDC. If the switch is defective, install a new one. See page 7 for wiring schematic.

Controller defective: If the controller does not count when the black and white wires are touched, check the voltage between the red and black wires. It should be 5 VDC. If not, check the wires and check that 5 VDC is present between terminals 9 and 10 on the back of the controller. If voltage is present, but the unit still does not count, touch a jumper wire between terminals 9 and 11. If the unit counts, the problem is in the wiring, if not, the problem is in the controller. Replace the controller board. See page 7 for wiring schematic.

Scale factor set near zero: If the meter has been re-calibrated in the field, it is possible for the scale factor to be set very low, which will appear to not register. See page 13 for reprogramming.

Meter internals not moving: If the piston inside the meter is not moving, no pulses will be generated. Open the meter housing and determine what is preventing rotation. Foreign matter in the meter is the most likely cause. If the meter internals show considerable wear or scoring, replace the internals.

The unit is plugged in and power is on, but nothing happens:

Wiring: Check that all wires on the back of the controller board are firmly connected.
Power: Check that 120VAC power is present at terminals L1 and L2 on the back of the controller.

<u>Fuse</u>: Check that the fuse on the circuit board is not blown. If it is, replace it with 2.0A, 250V fuse.

<u>Controller</u>: If power is supplied to the controller and the fuse is good, but the display is dark or meaningless, the controller board should be replaced.

<u>Solenoid valve</u>: Check to see that the solenoid valve is receiving power when the START button is pushed. If it is getting power but does not open, check the solenoid valve coil. See page 29 for solenoid valve assembly diagram.

Not metering accurately:

<u>Scale factor changed</u>: If the liquid amount is off proportionately the same amount each time, the scale factor may have been changed. See the programming section on page 13.

<u>Meter internals worn</u>: If the scale factor is correct, but a proportional error of more than 5% is present, the meter internal parts may be worn, broken, or improperly installed. Disassemble the meter and inspect. Reassembly should be done on a workbench.

<u>Meter internals heat distorted</u>: The standard meter internals are limited to 150 degrees F operation. If water hotter than this is passed through the meter, the internal parts may become distorted, which will prevent proper operation. Distortion generally causes the meter to run slow, resulting in too much water.

If distortion is suspected, disassemble the meter and remove the metering chamber. The cylindrical sides of the metering chamber should be straight. If a straightedge shows them to be concave, replace the metering chamber. See page 28 for meter assembly diagram.

Additionally, the meter internals should turn freely. A small amount of air blown in the rectangular inlet on the side of the metering chamber should spin the internals, making a characteristic "wuk-wuk-wuk" sound.

Water won't shut off at setpoint:

<u>Solenoid Valve:</u> If the solenoid valve remains open when de-energized, it is stuck open (rapping it will sometimes make it close). Disassemble the valve and clean all the parts. If this does not fix the problem, install a new valve or rebuild the existing one.

Temperature setting on the Blender is too sensitive. Small setting changes cause big temperature changes:

This is generally the result of unbalanced water pressure in the lines. Run the unit with ice water only and check the rate in pounds per minute. Run the unit with city water only and check its rate. For good blender control, these rates should be about the same. This may be done with hot water providing it isn't more than 150 degrees F.
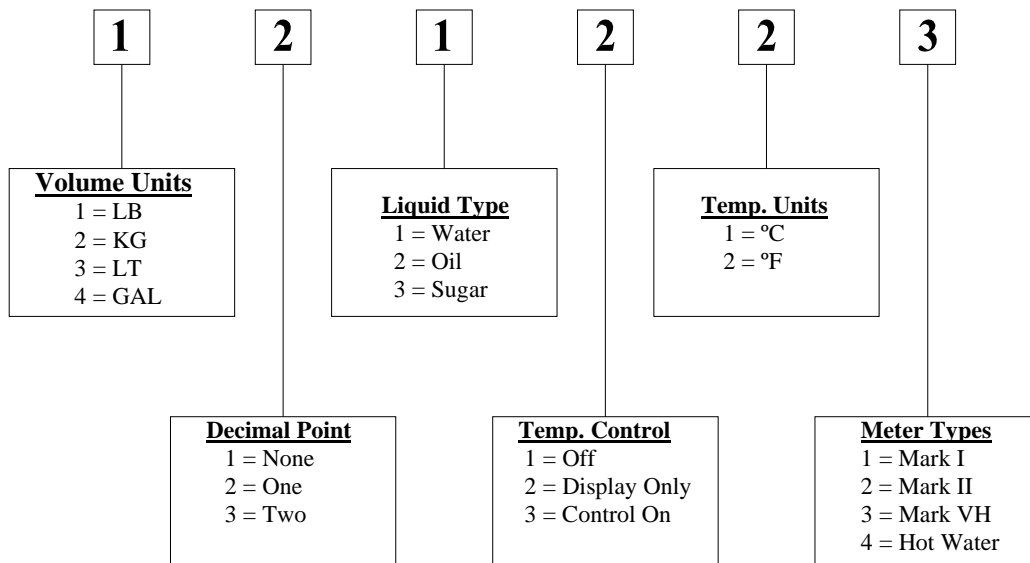
Pressure unbalance generally can be corrected by running a large pipe on the lower pressure line back to its source or in the case of ice water increasing the pump pressure. Regulators can also be used to reduce the higher pressure line's flow rates to match the lowest pressure line, but be sure that the resulting pressure doesn't reduce the flow rate to less than 100 lbs. per minute through the meter and solenoid valve.

Display Is Dim:

Over time the display may grow dim and hard to read. This is adjustable. Turn off the power and remove the front cover. The adjustment is a multi-turn potentiometer located on the back of the board, on the right side, about a quarter of the way down from the top. It is labeled "DISPL ADJ". Turn counterclockwise to brighten the display.

Zero Crossing Error:

This means that the unit is missing the zero crossing. The default value is 8 ms. See page 24 for explanation and setting. In general, this must be set for 7 or 8 ms. Other values may cause the unit to stop working.

1	**2**	**1**	**2**	**2**	**3**

Volume Units		**Liquid Type**		**Temp. Units**	
1 = LB		1 = Water		1 = °C	
2 = KG		2 = Oil		2 = °F	
3 = LT		3 = Sugar			
4 = GAL					

Decimal Point	**Temp. Control**	**Meter Types**
1 = None	1 = Off	1 = Mark I
2 = One	2 = Display Only	2 = Mark II
3 = Two	3 = Control On	3 = Mark VH
		4 = Hot Water

Table 1 – Numeric Code
(See Page 13 to understand how to use this feature.)

For example, if you have a Mark VH water meter, with a 1 decimal point weight accuracy displayed in pounds. The code that should be entered is 121223.

FACTORY DEFAULT VALUES

Mark VH Meter (Water)

Units	Pounds	Gallons	Liters	Kilograms
Preact	0.600	0.072	0.272	0.272
Decimal Point	None	None	None	None
Scaler	0.10000	0.01198	0.04535	0.04535
Alarm	On	On	On	On

Mark VH (Oil)

Units	Pounds	Gallons	Liters	Kilograms
Preact	0.540	0.065	0.245	0.245
Decimal Point	One	One	One	One
Scaler	0.09000	0.01078	0.04081	0.04081
Alarm	On	On	On	On

Mark VH (Sugar)

Units	Pounds	Gallons	Liters	Kilograms
Preact	0.798	0.096	0.362	0.362
Decimal Point	None	None	None	None
Scaler	0.13300	0.01593	0.06032	0.06032
Alarm	On	On	On	On

(These values are subject to change without notice.)
Table 2 – Factory Default Values

SCALERS FOR LIQUIDS OTHER THAN WATER
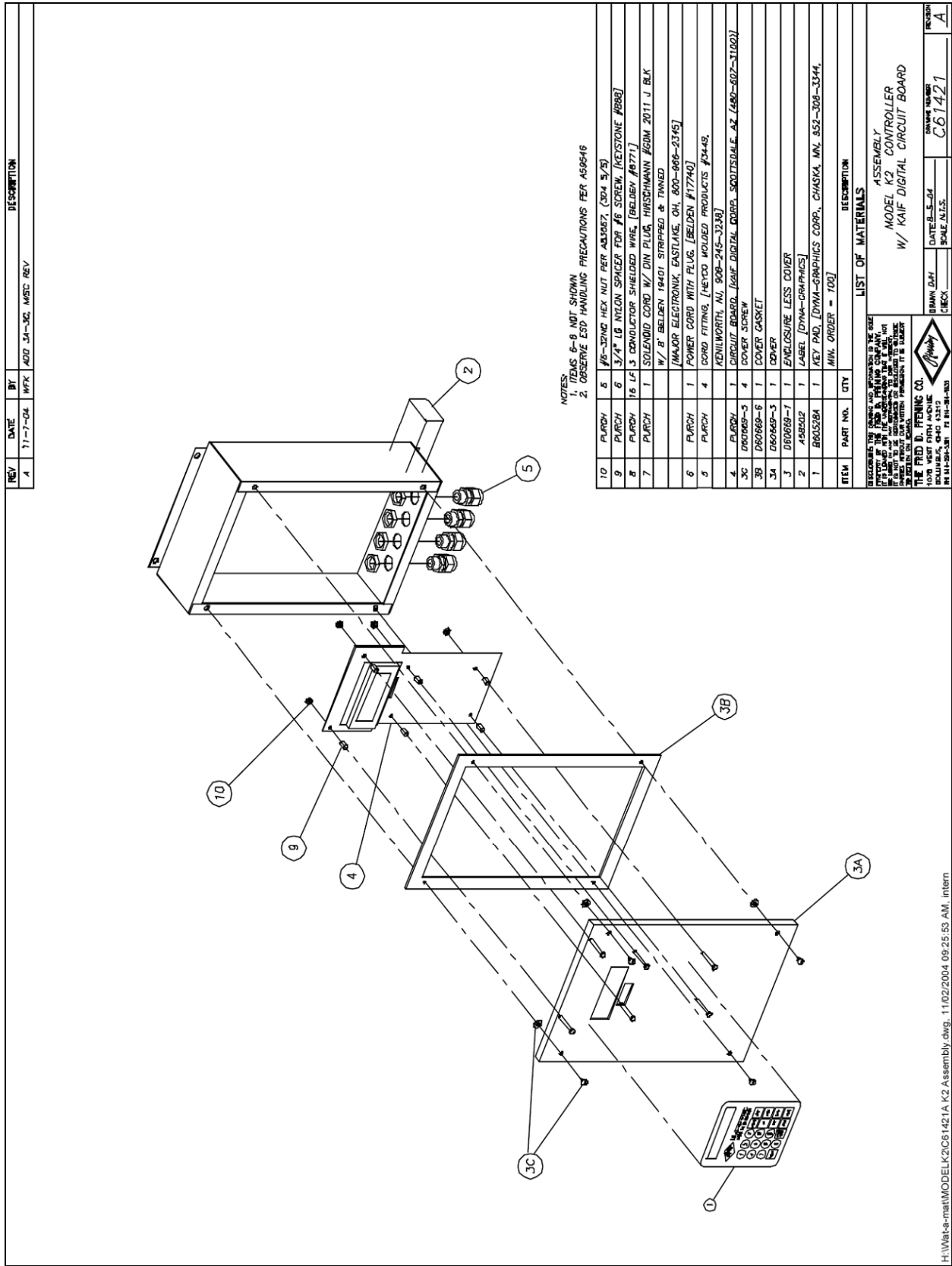
The specific gravity of water is 1.000. Other liquids will normally have a specific gravity, such as:

Soybean Oil   0.9000
Liquid Sugar (HFCS)   1.3300

You can compute the required scale by multiplying the water scaler by the specific gravity. Also, see the calibration section of this manual.

Note: Pfening Mark I and Mark II meters are intended for water only service. The stainless steel Mark VH meter may be used on other liquids.

FIG.6 - MODEL K2 ASSEMBLY

NOTE: MARK V SUPERSEDED BY
MARK VH AS OF JANUARY 2007

FLOW

FLOW

FIG.7 - MARK VH METER ASSEMBLY

ITEM	PART NO.	QTY	DESCRIPTION
17	C54343	1	MARK V HALL EFFECT SWITCH ASSY
16	C39025-16	1	METER GASKET O-RING
15	C39024-06	1	JUNCTION BOX COVER ASSEMBLY
13	C39025-13	1	COVER GASKET O-RING
12	C39025-12	1	COMPRESSION O-RING
11	C38951	1	CLAMP ASSEMBY - NOT SHOWN
10	C39024-04	1	PIN ASSEMBLY
9	C39024-02	1	MAGNET ASSEMBLY
7	C39024-01	1	PISTON GUIDE
6	C39023	1	PISTON
5	B38948	1	BODY
4	B38946	1	FRONT END PLATE
3	B38947	1	BACK END PLATE
2	C38950	1	COVER
1	D38949	1	HOUSING

LIST OF MATERIALS

ASSEMBLY & PARTS LIST
PFENING MARK V LIQUID METER
W/ HALL EFFECT SWITCH
- OBSOLETE -

THE FRED D. PFENING CO.
COLUMBUS, OHIO 43212

DRAWING NUMBER B39025
REVISION A

DRAWN T. L. WHITE
DATE 2-06-02
CHECKED
SCALE NONE

REVISIONS
A) Chg to unipolar 5/94

PFENING Mark VH Water Meter With Model K2 Controller V1.01   February 2007

METERING CHAMBER ASSEMBLY

SEE DETAIL AT RIGHT

Revision Table

REV	DATE	BY	DESCRIPTION
A	8-31-04	DJH	DRAWN ON CAD, ITEM 11 WAS C38951, REMOVED ITEM 14, ADD ITEM 19
B	9/13/05	KGK	DRAWN TO LOOK LIKE C39025

LIST OF MATERIALS

ITEM	PART NO.	QTY	DESCRIPTION
19	STOCK	1	∅0.7" O.D. x ∅0.425" I.D. x "0.16" THICK RUBBER WASHER
18	C51924-03	1	DRIVER PIN ASSEMBLY
17	C51924-01	1	SWITCH RETAINER PLATE ASSEMBLY
16	PURCH	1	"o" RING- 4 3/4" I.D. x 5" O.D. x 1/8" W NOMINAL SIZE BUNA N
15	C39024-05	1	JUNCTION BOX COVER ASSEMBLY
14			
13	PURCH	1	"O" RING- 6" I.D. x 6 1/4" OD. x 1/8" W NOMINAL SIZE BUNA N
12	PURCH	1	"O" RING- 7/16" I.D. x 13/16" O.D. x 3/16" W NOMINAL SIZE BUNA N
11	PURCH	1	CLAMP; VOSS #61221ZH-750-T - NOT SHOWN
10	C39024-04	1	PIN ASSEMBLY
9	C51924-02	1	MAGNET WHEEL
8	A50229	1	HALL EFFECT SWITCH
7	C39024-01	1	PISTON GUIDE
6	C39023	1	PISTON
5	B38948	1	BODY
4	B38946	1	FRONT END PLATE
3	B38947	1	BACK END PLATE; BORE CENTER 1.865" +/- .002"
2	C38950	1	COVER
1	D38949	1	HOUSING

LEFT OVER FROM SHORTER VALVE BEARINGS

ASSEMBLY & PARTS LIST
MARK VH HIGH RESOLUTION ASSEMBLY

DRAWN WFK   DATE 5-6-91

CHECK   SCALE N.T.S.

THE FRED D. PFENING CO.
1075 WEST FIFTH AVENUE
COLUMBUS, OHIO 43212
Ph. 614-294-5361   Fx. 614-294-1633

DRAWING NUMBER C51923   REVISION B

FIG.8 - MARK VH - HIGH RESOLUTION METER ASSEMBLY