DREXELBROOK
Engineering Company

RF Level and Flow Controls

Installation and Operating Instructions

for
Drexelbrook 303-300 Series Open Channel Flowmeters with 408-6200 Series Electronics and 700-700 Series Flush Sensing Elements

For factory service, call toll free
1-800-527-6297

205 Keith Valley Road • Horsham, PA 19044 • 215-674-1234

303-300-LM
EDO #1-93-248

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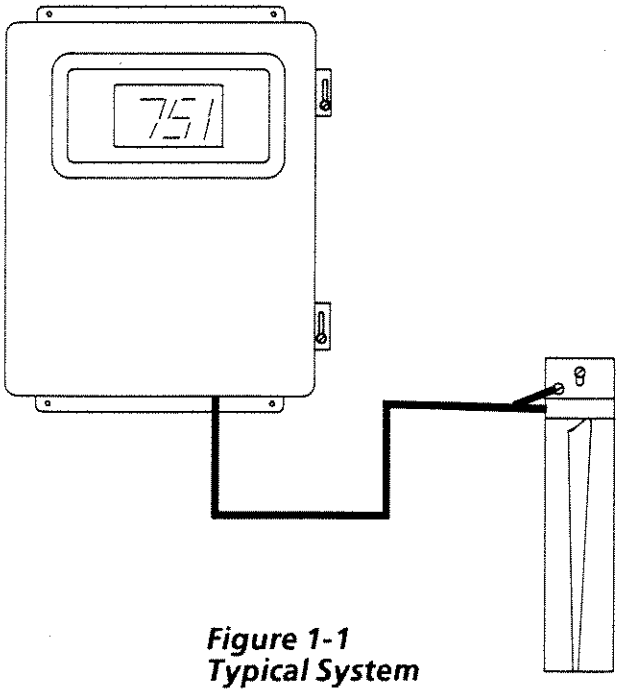


Figure 1-1
Typical System

1.0 Introduction

The instructions in this manual are for the Drexelbrook 303-300 Series open channel flowmeters.

1.1 Basics of Open Channel Flow

Open channel flow is flow in any type of channel where the liquid flows with a free surface. Rivers, canals, culverts, sewers, and partially filled pipes are examples of open channel flow.

The most common method of open channel flow measurement is to direct the stream through a primary measuring device. The primary measuring device conditions the stream to create a variable liquid head height that has a known and definite relationship to flow. The height or level of the liquid is measured at a mathematically defined point in or near the primary element. It is critical that the sensing element be mounted at this location. That level measurement is then used to calculate the flow rate of the stream.

Primary measuring devices, i.e. flumes and weirs, are carefully engineered and manufactured to close dimensional tolerance. It is important that the primary measuring device be carefully installed according to manufacturer's instructions. That will ensure the flow rate versus liquid head height relationship follows the published data.

1.2 System Description

There is a Drexelbrook open channel flowmeter for nearly every type and size of flume or weir. Each system consists of a 408-62XX Series electronic unit, a 700 Series flush mounted sensing element, and a 380 Series measuring cable. See Figure 1-1. The transmitter output is a standard 4-20 mAdc signal and is directly proportional to the flowrate. The sensing element is specifically sized and characterized, using flow as a function of level, for each type and size of flume or weir. It has no moving parts, is nonintrusive, and is intrinsically safe.

1.3 Models Available

1.3.1 Electronic Packages

303-301-XXX* (See Fig. 1-2):
Basic flow transmitter with 408-62XX Series electronic unit in standard 6" x 8" weatherproof housing, and a 700 series sensing element with integral coax. cable.

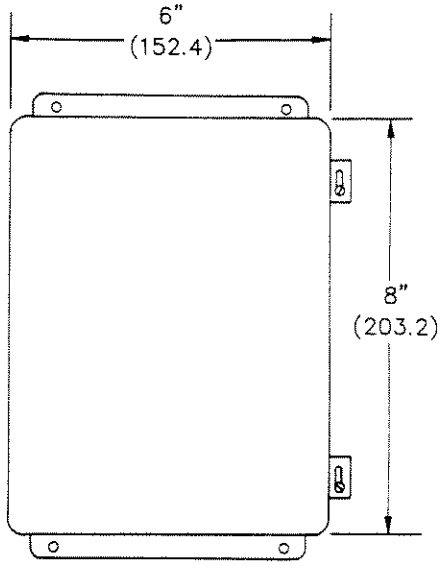


Figure 1-2
303-301 Series
Flowmeter

303-311-XXX* (See Fig. 1-3):
Indicating flow transmitter with 408-62XX Series electronic unit and digital meter in a 10" x 12" weatherproof housing, and a 700 series sensing element with integral coax. cable

***XXX** -indicates sensing element reference number.

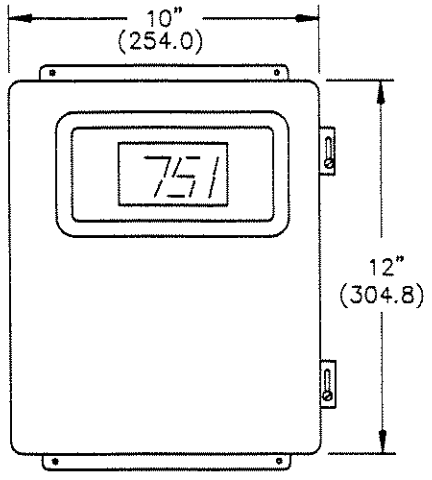


Figure 1-3
303-311 Series
Flowmeter

303-321-XXX* (See Fig. 1-4):
Line-powered indicating flow transmitter with 408-62XX Series electronic unit, digital meter, and 24 Vdc power supply in a 10" x 12" weatherproof housing, and a 700 series sensing element with integral coax. cable.

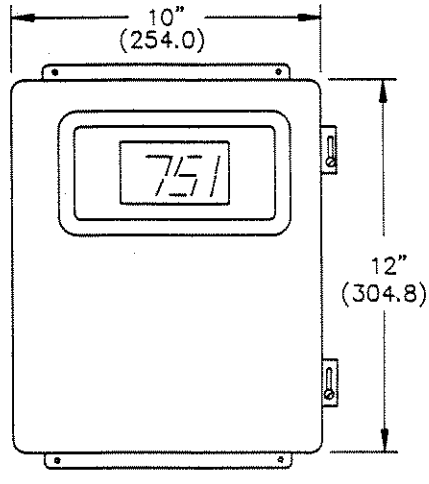


Figure 1-4
303-321 Series
Flowmeter

*XXX -indicates sensing element reference number.

303-331-XXX* (See Fig. 1-5):
Line-powered totalizing flow transmitter with 408-62XX Series electronic unit, digital meter, 45 Vdc power supply, integrator with 7-digit non-resettable totalizer, in a 14" x 16" weatherproof housing, and a 700 Series sensing element with integral coax. cable.

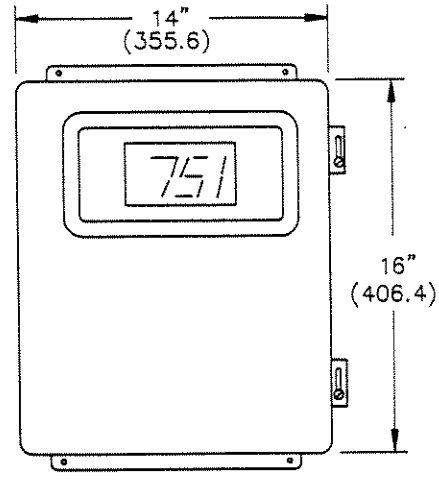


Figure 1-5
303-331 Series
Flowmeter

303-341-XXX* (See Fig. 1-6):
Line-powered totalizing/sampler activating flow transmitter with 408-62XX Series electronic unit, digital meter, 45 Vdc power supply, integrator with 7-digit non-resettable totalizer, sampler activator, in a 14" x 16" weatherproof housing, and a 700 Series sensing element with integral coax. cable.

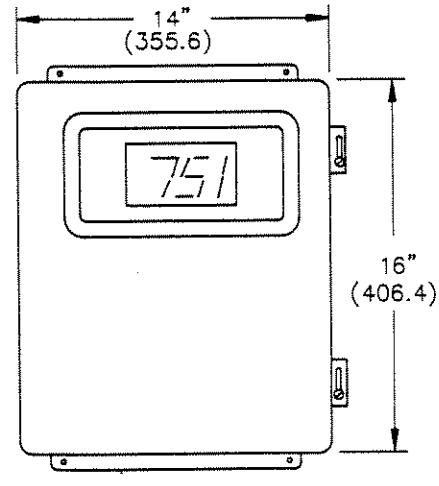


Figure 1-6
303-341 Series
Flowmeter

303-351-XXX* (See Fig. 1-7):
Portable battery-operated flow transmitter with 408-61XX Series electronic unit (.25-1.25 mAdc), analog meter, 12 Vdc battery, integrator with 6-digit resettable totalizer, a 2 1/2" strip chart recorder in a 14" x 16" weatherproof housing, and a 700 Series sensing element with integral coax. cable.

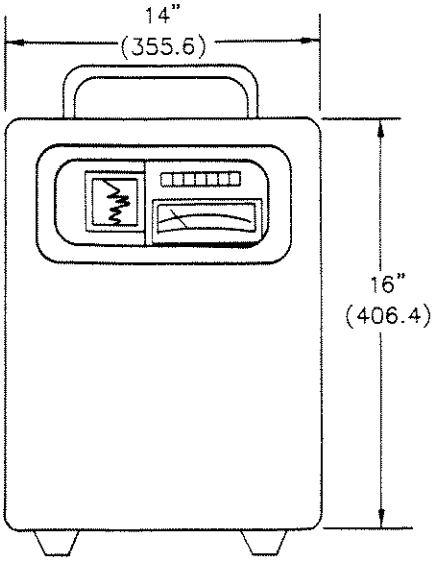


Figure 1-7
303-351 Series
Flowmeter

***XXX** -indicates sensing element reference number.

Options:

- NEMA 4 Epoxy Coated Housing
- NEMA 4X fiberglass Housing
- Analog Meter
- Special Analog Meter Scale
- Time Delay (0-30 Sec.)
- Resettable Totalizers (Models 303-331-XXX, 303-341-XXX only)
- 2 1/2" Strip-Chart Recorder (Models 303-331-XXX, 303-341-XXX only)
- Radio Frequency Interference (RFI) Filters

1.3.2 Sensing Elements

Each flush sensing element for open channel flow measurement includes a 25-foot integral measuring coax. cable. The cable length can be extended to 100 feet with a Drexelbrook "long cable kit". The sensing element can also be purchased with integral cable up to 100 feet.

Standard sensing elements are available for use with any flume or weir having the appropriate power law of flow rate vs. level.

700-701-XXX*:
Flush sensing element, linear non-characterized for level measurement in flumes and weirs.

700-702-XXX*:
Flush sensing element characterized for open channel flow measurement in Leopold-Lagco® flumes.

700-703-XXX*:
Flush sensing element characterized for open channel flow measurement in Parshall flumes, Cipolletti (trapezoidal) and Rectangular weirs.

700-704-XXX*:
Flush sensing element characterized for open channel flow measurement in Palmer Bowlus flumes.

700-705-XXX*:
Flush sensing element characterized for open channel flow measurement in "V" notch weirs.

***XXX** indicates sensing element reference number for specific flume/weir size and flow rate.

Note: Characterized, flush sensing elements are available for open channel flow nozzles and other primary measuring devices not listed above. Consult factory for details.

2.0 Electrical Specifications

A. **Power Requirement**
24 to 100 Vdc std.
120 ± 25 Vac 50/60 Hz for line powered units.

B. **Input Range**

408-6200 : 8.0 to 40,000 pF
408-6230 : 12.0 to 40,000 pF.

C. **Output Range**
4-20 mAdc

D. **Linearity**
± 0.5%

E. **Load Resistance**
$\frac{Vs^* - 13}{.02}$ = ohms (i.e. 550 ohms @ 24 Vdc
1600 ohms @ 45 Vdc)

*Vs = Power Supply Voltage

F. **Temperature Effect**
± 0.5% per 30°F or
±0.15pF whichever is larger

G. **Supply Voltage Effect**
.5% max per 10 volt change in dc power supply.

H. **Effect of Load Resistance**
0.2% or less for full resistance range at 24 Vdc supply.

I. **Response to Step Change**
20 milliseconds, std. (to 90% of final value).
0-30 seconds available in time delay units.

J. **Ambient Temperature**
-40° to + 140°F (-40 to 60C).

K. **Calibration Adjustments**
Step Zero, Fine Zero, Step Span, Fine Span

L. **Lowest permitted resistance** (sensing element to ground): 100KΩ

M. **Sensing Element Max. Temperature Rating**
175°F (80°C)

N. **Measuring Cable**
Three-terminal guarded coaxial cable.
.51" O.D. at largest point.
160°F temp limit.

O. **Intrinsic Safety**
Sensing element and cable are intrinsically safe for Class I, Groups A,B,C, and D; Class II, Groups E,F, and G (Div. 1 and 2).

Electronic unit and signal wires are intrinsically safe for Class I, Groups C and D; Class II, Groups E, F, and G (Div. 1) when powered by an intrinsically safe power supply. Non-incendive for Class I, Groups A,B,C and D; Class II, Groups E,F, and G (Div. 2).

3.0 Theory of Operation

The Drexelbrook 303-300 Series Open Channel Flowmeter consists of an electronic unit and a characterized, flush sensing element with integral coax. cable. The sensing element is attached flush to the channel wall by means of a mounting track, and connected to the electronic unit by the integral coax. cable. The output of a low-voltage radio-frequency oscillator is applied to the sensing element via the cable.

Level variations in the channel, corresponding to changes in flow in the stream, will cause a very small amount of current to flow between the sensing element and ground. The sensing element is designed to the characteristics of the channel, so that its output current is linear with flowrate. The admittance - both capacitive and resistive components of the current - is measured in the electronic unit by comparing the sensing element with a standard supply across a wide range bridge circuit. Cable characteristics have no effect on calibration.

The bridge output voltage is applied to a detector circuit and then to a feedback amplifier. The resulting output current is directly proportional to the flowrate. The current is compatible with standard readout devices such as meters, recorders, alarm circuits, and electro-pneumatic transducers.

4.0 Installation

4.1 Unpacking

Carefully remove the contents of the shipping carton and check each item against the packing list before destroying any packing materials. If there is any shortage or damage, report it immediately to the factory.

4.2 Mounting The Electronic Unit

The Drexelbrook open channel flow electronic units are designed for field mounting, but should be installed in a location that is as free as possible from vibration, corrosive atmospheres, and the possibility of mechanical damage. Ambient temperatures should be between -40°F and + 140°F. For convenience at start-up, it is best to install the instrument in a reasonably accessible location. For mounting dimensions, see Figure 4-1, 4-2, and 4-3.

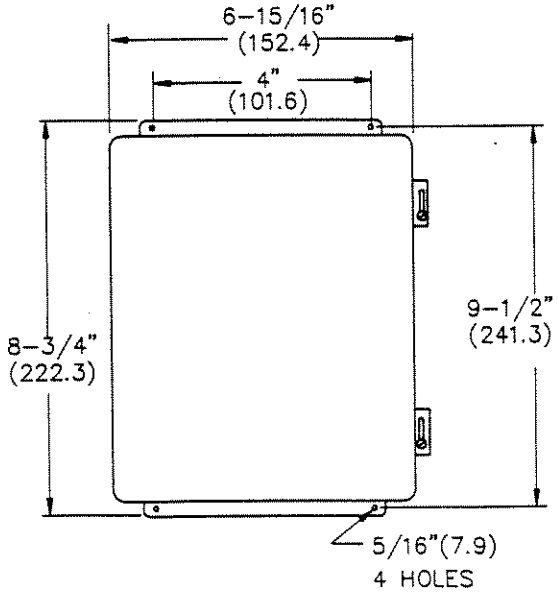


Figure 4-1
Mounting Dimensions of 303-301 Series Electronic Housing

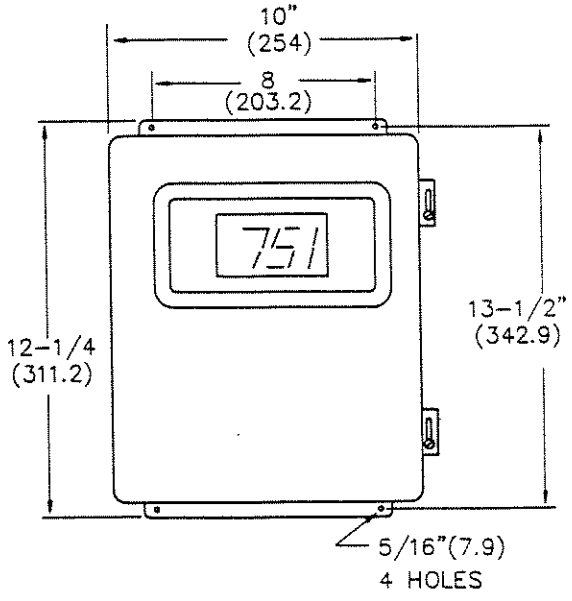


Figure 4-2
Mounting Dimensions of 303-311 and 321 Series Electronic Housing

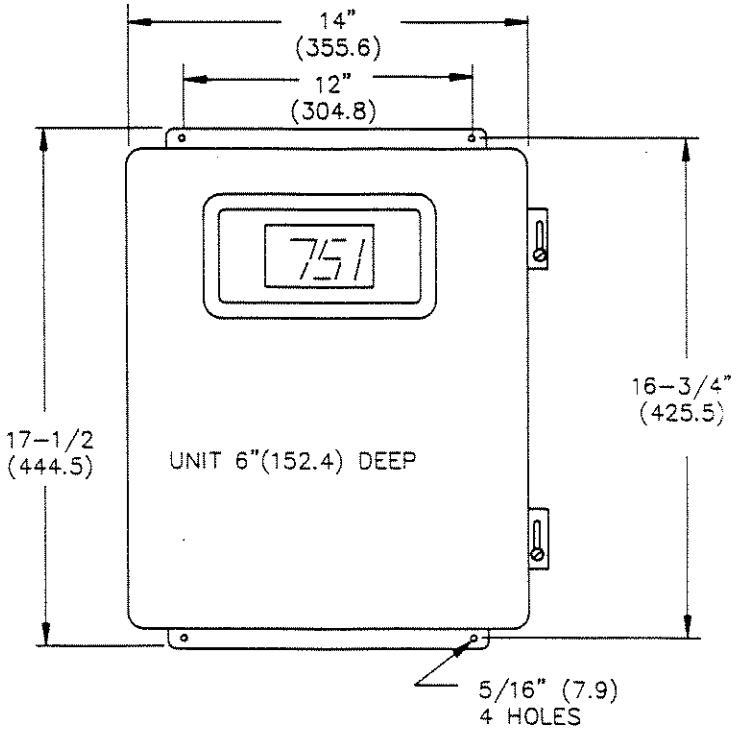


Figure 4-3
Mounting Dimensions of 303-331and 341 Series Electronic Housing

4.3 Mounting The Sensing Element

4.3.1 The Mounting Track

Drexelbrook open channel flow sensing elements are thin and flexible and will slide easily into the mounting track on the wall of the primary measuring device or flow channel. Several flume manufacturers provide flumes with tracks premolded into the flume wall. For flumes or weirs without mounting provisions, Drexelbrook can provide a mounting track that attaches to the weir or flume wall.

The track is mounted to the wall of the primary measuring device using the drive rivets supplied. Mark the rivet holes by using the mounting track as a template and drill the holes 1/4 inch in diameter approximately one inch deep. The number of holes needed depends on the mounting track supplied. For positioning of the sensing element mounting track in the primary measuring device, see one of the following sections 4.3.3 to 4.3.5 pertaining to the appropriate flume or weir.

Once the track is in place, slide the sensing element into the track with the scale side facing the open stream. See Figure 4-4. Mount the angle bracket to the top edge of the flume or weir as shown in Figure 4-4. With the angle bracket properly in place, fasten the sensing element to the angle bracket with the lock down bolt. This will secure the sensing element in the mounting track. To ensure proper vertical positioning of the sensing element, loosen the nut on the positioning bushing. Adjust the sensing element to position the tip of the sensor at the zero flow level. The positioning bushing will move up and down in its slot. Retighten the nut on the positioning bushing and check that the tip of the sensing element is still at the zero flow level.

For high walled flumes and weirs, when the angle bracket is not used, drill a 1/2 inch hole using the sensing element slot for the lockdown bolt as a template. See Figure 4-5. Install the expanding wall anchor supplied to the wall of the flow channel. Secure the sensing element in place by fastening the lockdown bolt to the wall anchor as shown in Figure 4-6.

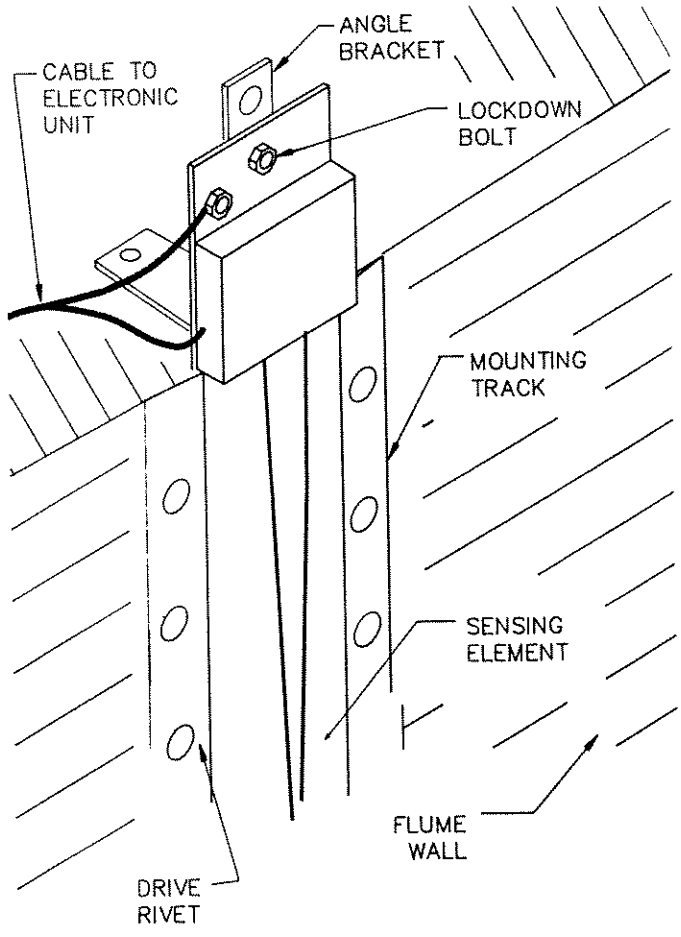


Figure 4-4
Standard Mounting of the Sensing Element and Track

To remove the sensing element, unscrew the lockdown bolt and lift up gently on the head of the sensing element to slide it out of the mounting track. This allows for replacement of the sensing element without readjusting for zero flow.

When it is not possible to drill holes in the wall of the primary element, the track can be mounted to a stiff piece of fiberglass sheet which is pressed against the wall and fastened at the top.

4.3.2 The Ground Reference Plate

(See 290-1000-XXX-CD in 9.0 Appendix)

Drexelbrook recommends installing a metal ground reference plate (in most applications) in the flow channel. The ground plate provides a stable reference for the sensing element to "see" and minimizes fluctuations in output signal due to variations in material conductivities. It should be at least 12 inches wide, and as long as the total

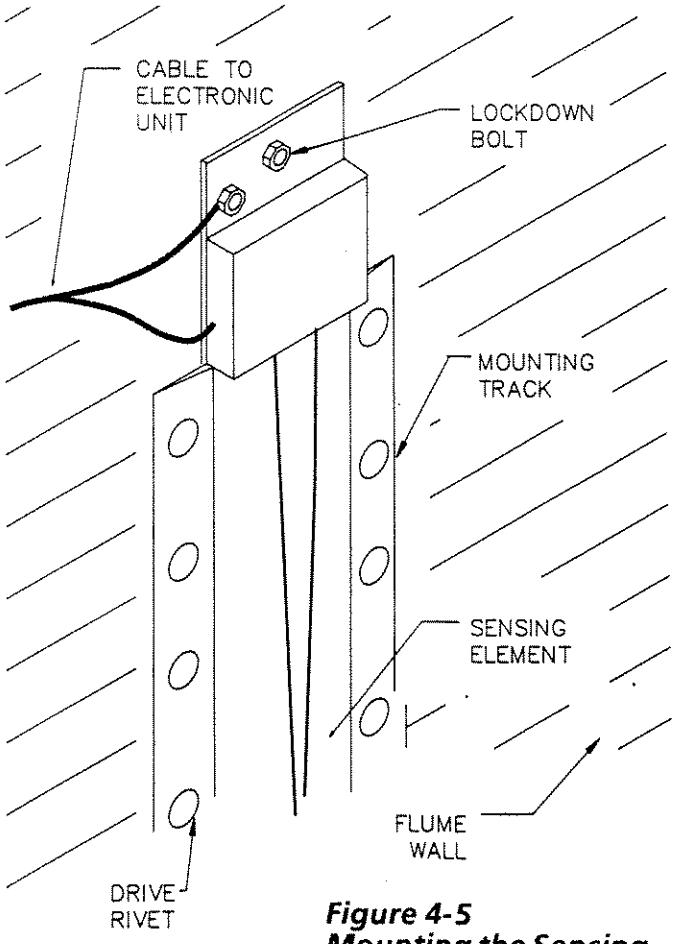


Figure 4-5 Mounting the Sensing Element in High-Walled Flumes

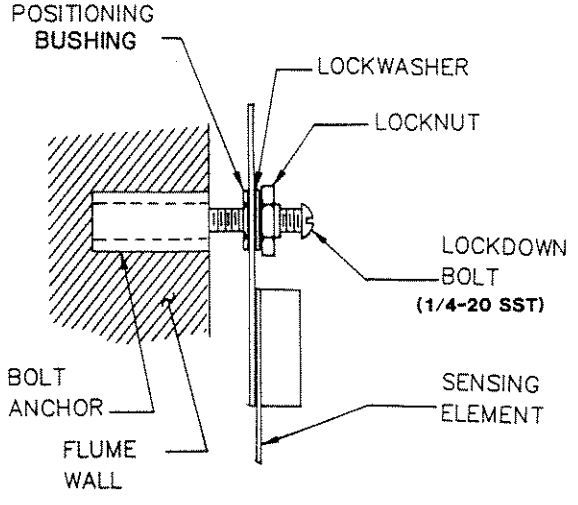


Figure 4-6 Anchoring the Sensing Element in a High-Walled Flume

insertion length of the sensing element. The ground plate should be made of non-corroding metal, such as stainless steel, and be mounted per the installation drawing included with the flowmeter. In all cases, the plate should reach low enough into the flow channel to be in contact with the stream at all times, even during low flow conditions. Make sure that the plate does not cause turbulence or change the flow characteristics of the channel. Finally, connect the stainless steel ground wire from the ground plate to the ground screw on the sensing element. A Series 290 ground plate is available from Drexelbrook.

4.3.3 Mounting in a Parshall Flume

The sensing element and mounting track for a Parshall Flume should be attached flush to the wall of the converging section of the flume, at a location of 2/3A. See Figure 4-7. The sensing element should be inserted into the mounting track with the tip of the sensing element at the zero reference level of the flume. Consult factory for "Submerged Flow" installation.

4.3.4 Mounting in Palmer Bowlus and Leopold Lagco® Flumes

The sensing element for Palmer Bowlus flumes should be mounted at a distance one-half D (pipe diameter or channel width) upstream from the end of the throat section. For the Leopold Lagco® flumes, it should be mounted on a 5-inch straight section, 0 to 3 inches ahead of the input end of the flume. See Figure 4-8A and 4-8B. Using the positioning bushing on the backside of the sensing element lockdown bolt, adjust the sensor so the tip is 1/4 inch below the zero flow level. Tighten the positioning bushing to secure the position of the sensing element.

4.3.5 Mounting in Weirs

The sensing elements for V-notch, rectangular and Cipolletti weirs should be mounted to the inside of the weir wall, at a distance of 4 times the maximum expected head height of the stream from the edge of the weir plate. See Figure 4-9A, 4-9B, and 4-9C. In this position, the sensing element will not be affected by the "drawdown" of the stream as it falls over the edge. The tip of the sensing element should be on the same plane as the bottom of the weir opening (zero flow).

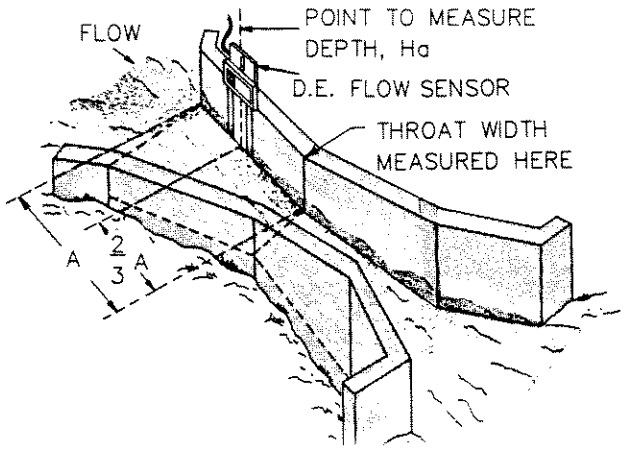


Figure 4-7
Mounting the Sensing Element in a Parshall Flume

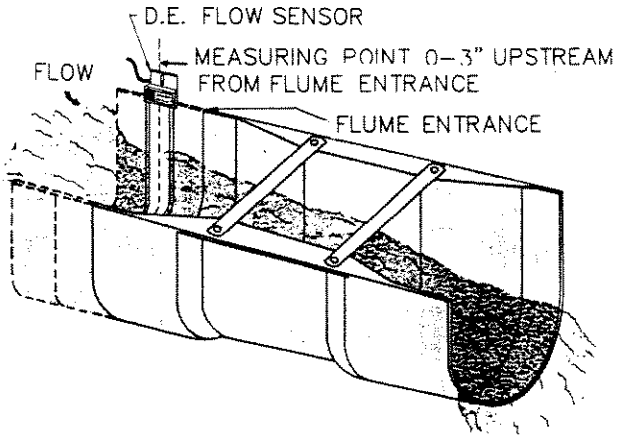
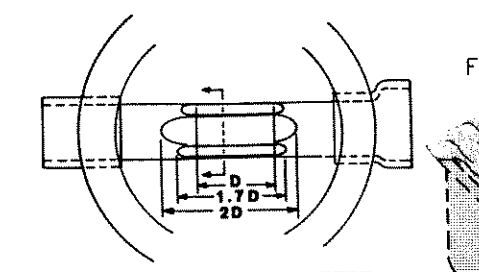
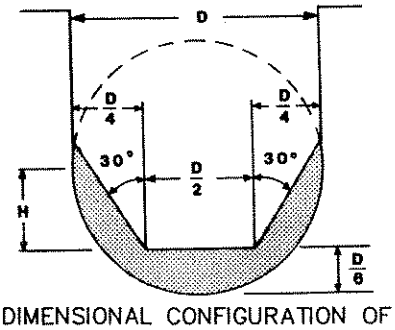


Figure 4-8B
Mounting the Sensing Element in a Leopold Lagco Flume





DIMENSIONAL CONFIGURATION OF
STANDARD PALMER–BOWLUS FLUME
TRAPEZIODAL THROAT CROSS–SECTION

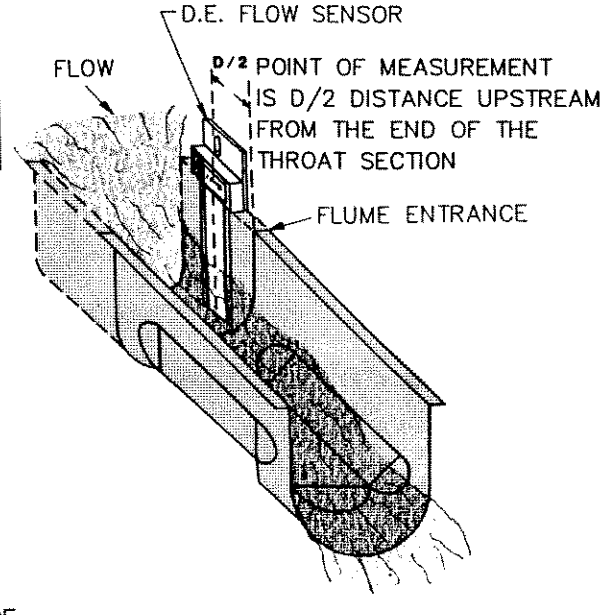


Figure 4-8A
Mounting the Sensing Element in a Palmer Bowlus Flume

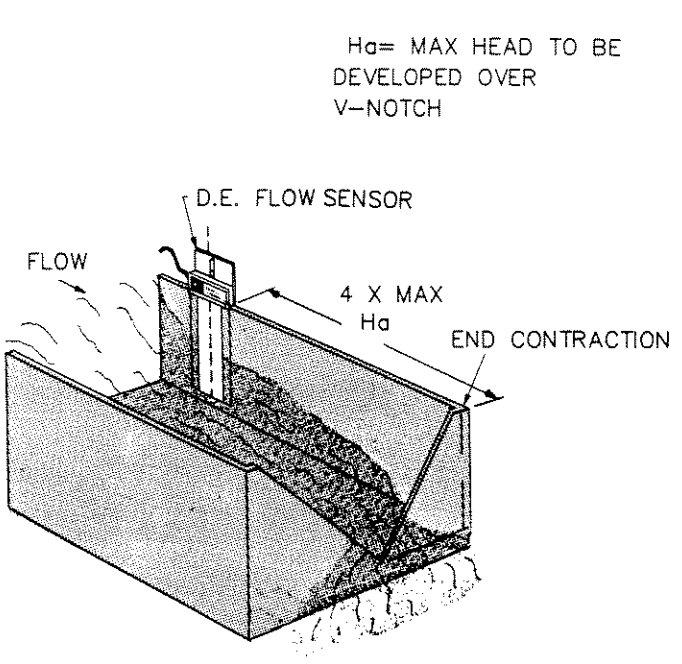


Figure 4-9A
Mounting the Sensing Element In a V-Notch Weir

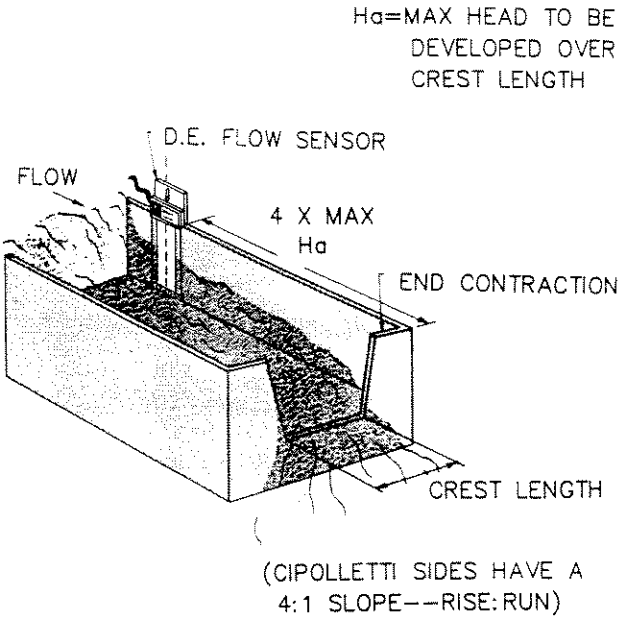


Figure 4-9C
Mounting the Sensing Element in a Cipolletti Weir

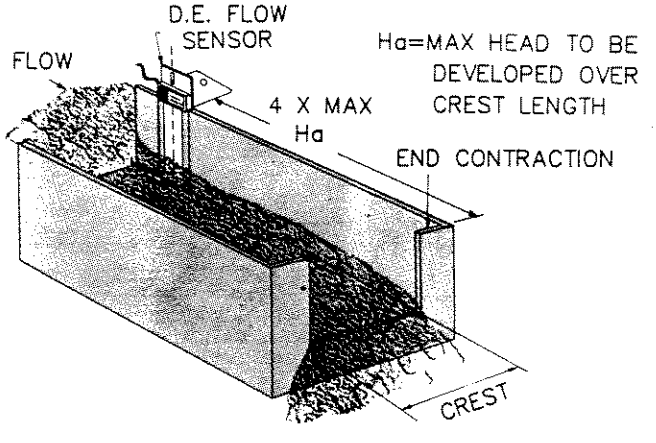


Figure 4-9B
Mounting the Sensing Element in a Rectangular Weir

4.4 Wiring the Electronic Unit

Due to low power consumption, the dc signal wires on 303-301 and -311 Series transmitters need only be light gauge. Twisted, shielded pairs are recommended. The wiring need not be in conduit. However, if it is run in conduit or wire trays, be sure it is not in close proximity to high voltage or high current lines. See Figures 4-10 and 4-11.

The ac wiring to 303-321, -331, and -341 Series transmitters should be done in accordance with local or national wiring codes. For connections, see Figures 4-12, 4-13, and 4-14.

The cable from the sensing element is connected to the terminal strip on the electronic unit chassis. See Figure 4-15. The cable connections are center wire (CW), ground (gnd) and shield (SH), which are terminated respectively to term. #9 (CW), term. #7 (gnd), and term. #8 (SH) of the electronic unit. Only coaxial cables supplied by Drexelbrook Engineering Company should be used to connect the electronic unit to the sensing element. Use of other cables can result in unstable calibration.

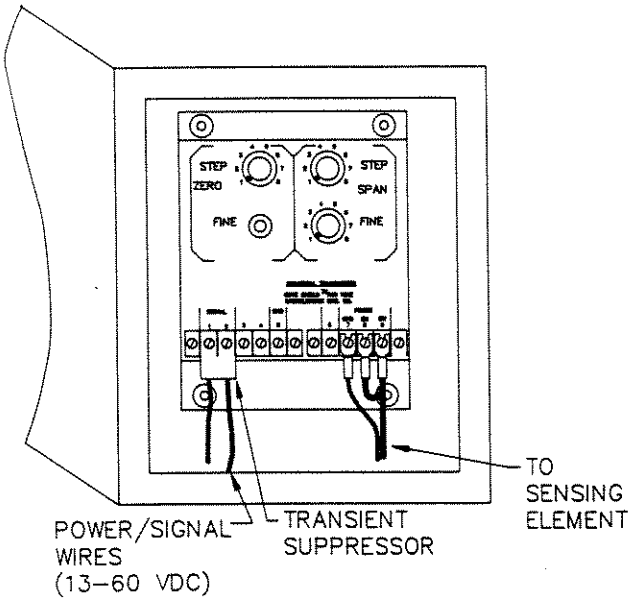


Figure 4-10
Power / Signal Connections to the 303-301 Series Flowmeter

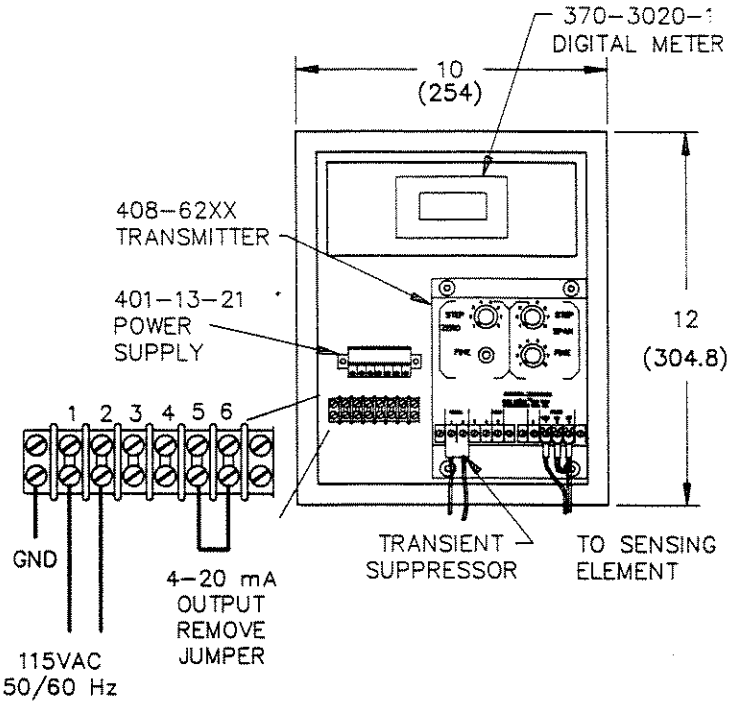


Figure 4-12
Power / Signal Connections to the 303-321 Series Flowmeter

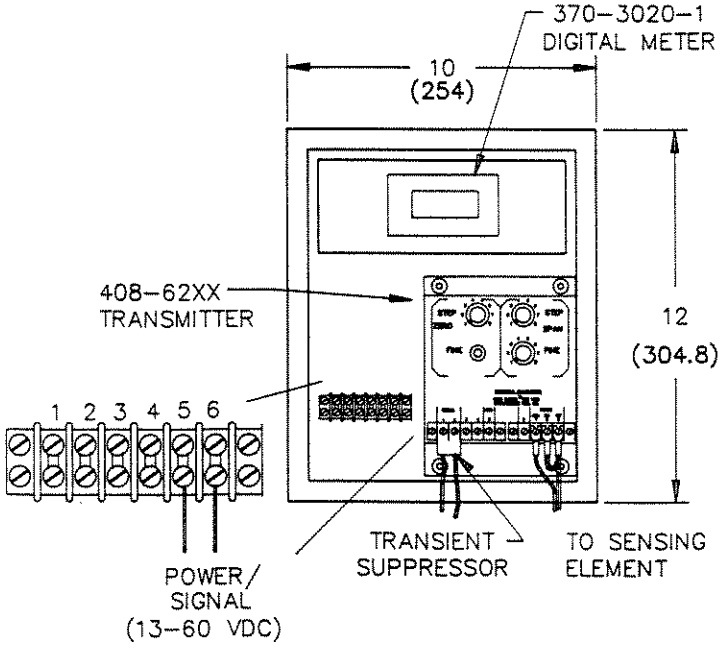


Figure 4-11
Power / Signal Connections to the 303-311 Series Flowmeter

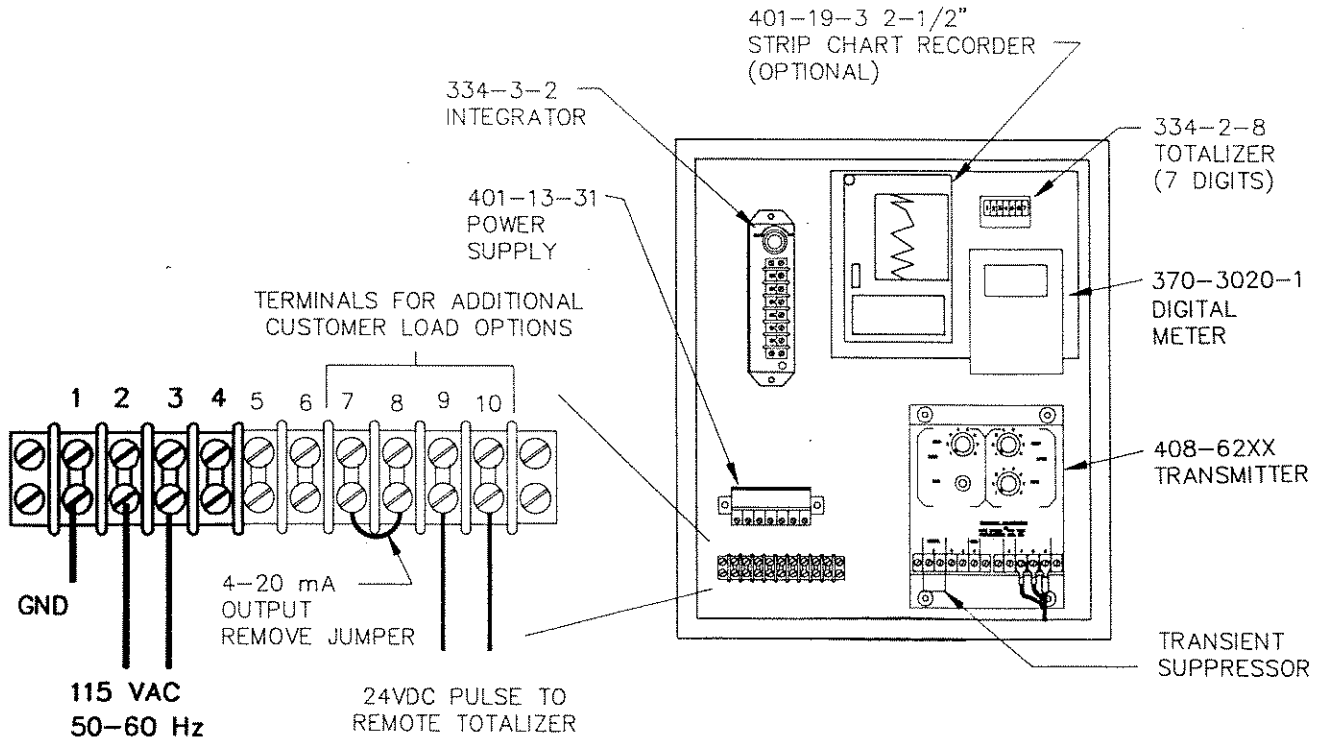


Figure 4-13
Power / Signal Connections to the 303-331 Series Flowmeter

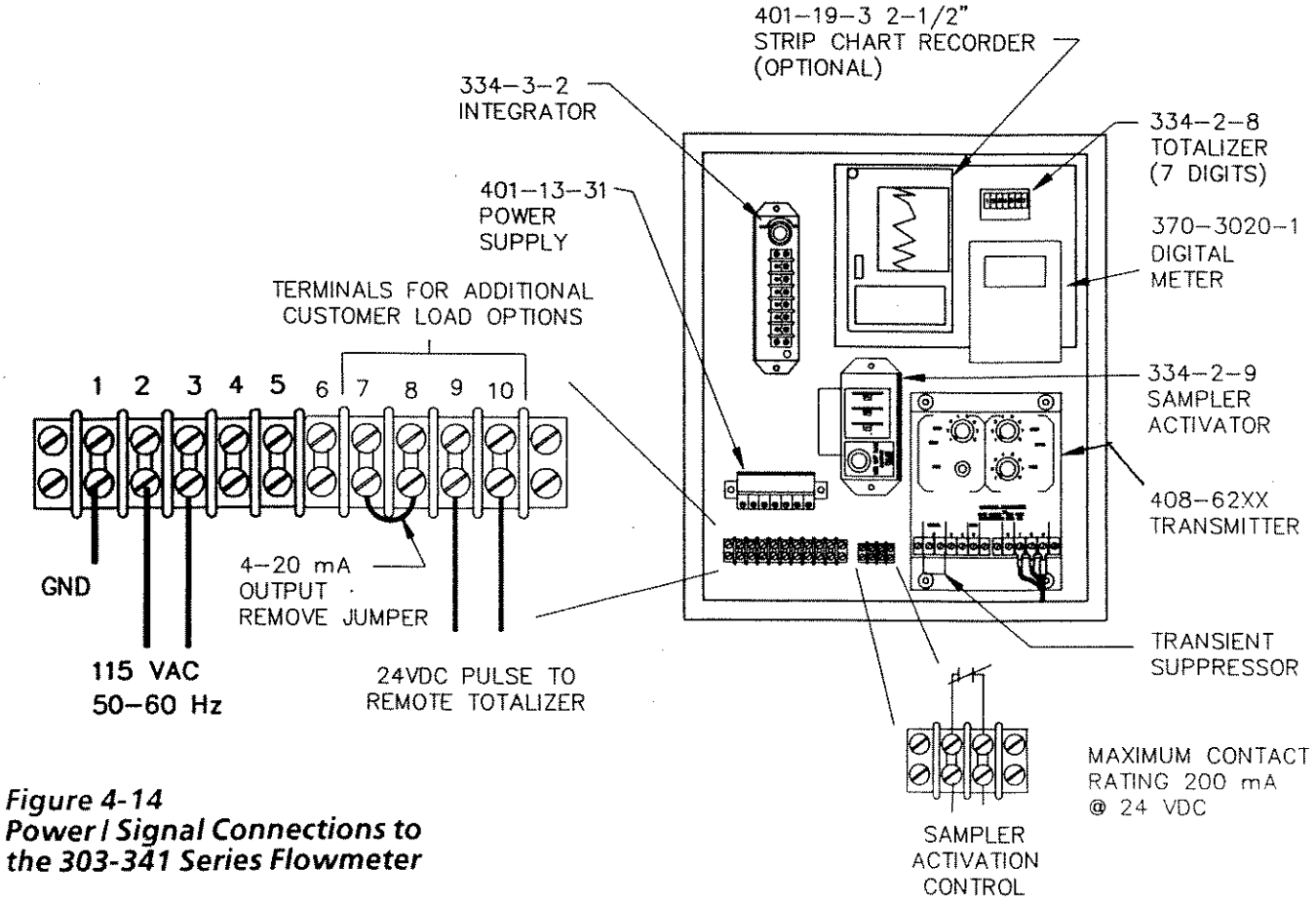


Figure 4-14
Power / Signal Connections to the 303-341 Series Flowmeter

4.5 Wiring the Sensing Element

4.5.1 Integral Cable

Drexelbrook open channel flow flush sensing elements are furnished standard with 25 feet of three-terminal cable integral with the sensing element. See Fig. 4-15 for sensing element cable connections to the electronic unit. The cable should not be run in conduit where substantial moisture could accumulate.

4.5.2 Long Cable Kit

If a cable length of more than 25 feet is needed, that distance can be extended, in the field, to 100 feet by using a long cable kit. See Figure 4-16. (The sensing element can also be purchased with integral cable up to 100 feet.)

Note: When cable connections are verified, condulet should be potted with 2 part silicone or melted paraffin.

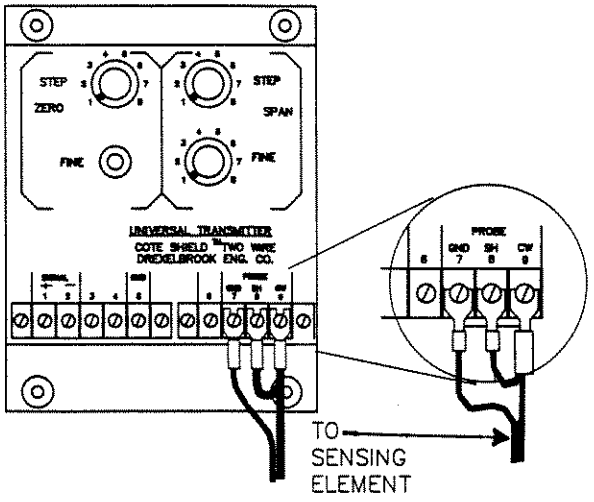


Figure 4-15
Sensing Element Cable Connections to the Electronic Unit

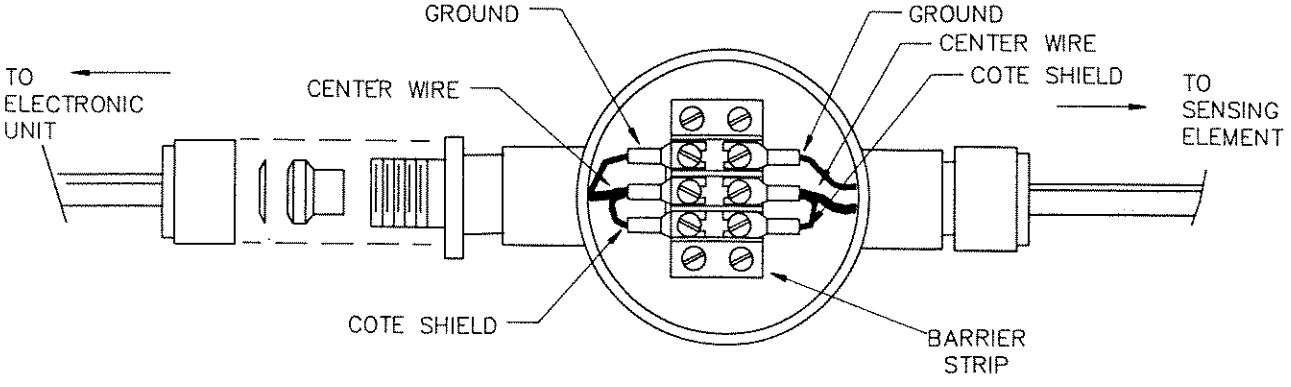


Figure 4-16
Wiring the Long Cable Extension Kit

5.0 Operation/Calibration

5.1 Start-Up

Be sure the input power to the electronic unit chassis is between 24 and 100 Vdc. This can be accomplished by checking the voltage on terminals #1 and #2 of the electronic unit. Check all wiring connections, observing polarity of the output loop.

5.2 Calibration Controls and Adjustments

5.2.1 Zero and Span Controls

There are four main calibration controls on the chassis front panel. They are Step Zero, Fine Zero, Step Span, and Fine Span. See Figure 5-1.

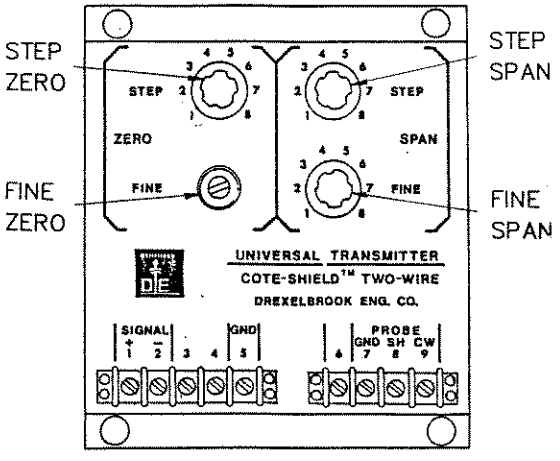


Figure 5-1
Zero and Span Controls on the Electronic Unit

The Step Zero and Fine Zero controls work together to provide continuous adjustment of the minimum current point. Each Step Zero position advances the minimum current point approximately 60 pF, while the Fine Zero provides continuous adjustment between each step.

Note: Under normal circumstances, the interaction between zero and span should be less than 1%. If this interaction becomes greater than 1%, consult factory for assistance.

The Step Span and Fine Span controls also work together to provide continuous adjustment of the change in capacitance required to produce full scale current. Each Step Span position advances the range to approximately three times the previous setting. The Fine Span provides continuous adjustment between the Step Span positions.

5.2.2 Time Delay Control

Time delay or adjustable damping is available on Drexelbrook open channel flow transmitters. It is a RC time constant circuit that is variable over a range of zero to 30 seconds. Calibration of the transmitter is done with the time delay control turned off. See Figure 5-2. After calibration is complete, the time delay can be added, without affecting the calibration, by turning the control knob clockwise. Occasionally, when the time delay is first turned on, there is a temporary upset in the transmitter output until the circuit settles out.

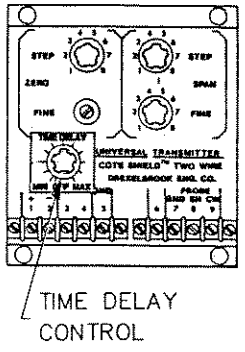


Figure 5-2
Time Delay Control

5.2.3 Fail-Safe Selector

The fail-safe link on the open channel flow electronics unit is set by the factory and normally does not need to be changed. However, if necessary, it can be reset by field personnel.

The fail-safe selector determines whether increasing or decreasing level

(flowrate) will cause the output current to increase. It is a moveable link located on the P.C. board on the right side of the electronic unit chassis. See Figure 5-3.

The instrument is supplied as low-level fail-safe unless otherwise specified. However, it may be changed in the field, after which the instrument must be recalibrated.

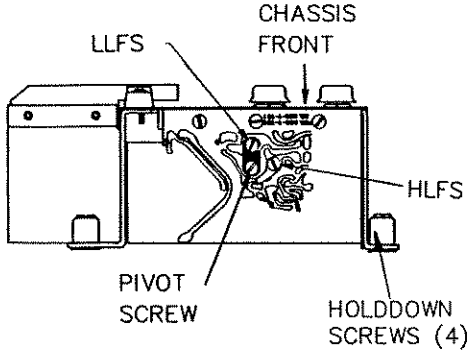


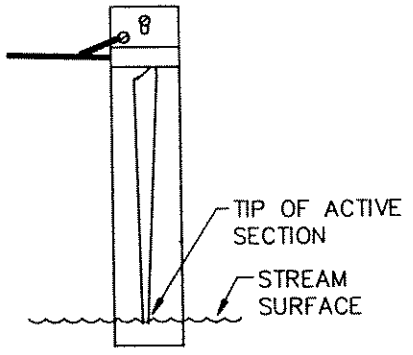
Figure 5-3
Fail-Safe Selector

To change the fail-safe of the instrument, take the chassis out of the housing by removing the four holddown screws and lifting up. See Figure 5-3. To change the fail-safe link, loosen the fail-safe screw that the link is attached to and swing the link to the other fail-safe screw. When the link is in place, tighten down both screws. Do not force.

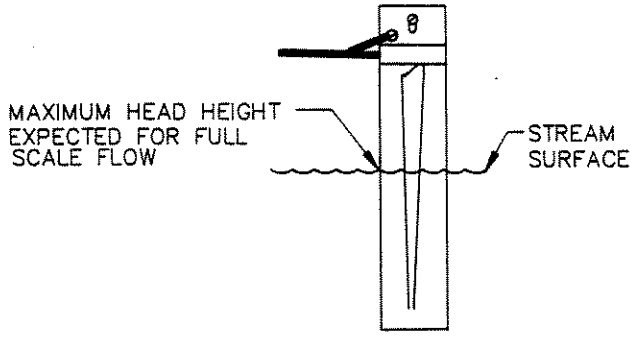
Low-Level Fail-Safe (LLFS) is also called direct acting. This is the most commonly used fail-safe position for continuous instruments. Output current increases as level (flowrate) increases. In the event of most probable failures, the output current will drop and indicate low level (flowrate).

High-Level Fail-Safe (HLFS) is called reverse acting. Output current increases as level (flowrate) decreases. In the event of most probable failures, output current will drop indicating high level (flowrate).

5.3 Transmitter Calibration Procedures



ZEROING THE SENSING ELEMENT
FIG 5-4A



SPANNING THE SENSING ELEMENT
FIG 5-4B

Figure 5-4
Calibrating the Sensing Element in the Flow Stream

5.3.1 Calibration In Stream (Insitu)

It is always best to calibrate the system in the flume or weir. During calibration, be sure you are not touching the face of the sensing element.

A. Set the Fine Span control to the extreme clockwise (CW) position. Do not force. See Figure 5-1.

B. Set the Step Span control to position #1.

C. With the tip of the sensing element active section just touching the stream surface, adjust the Step Zero and Fine Zero controls until the output is minimum (i.e. 4 mA). See Fig. 5-4A.

D. Immerse the sensing element in the stream up to the mark corresponding to the maximum head height expected for full scale. Output current should now exceed full scale current. See Figure 5-4B.

E. Turn the Step Span control clockwise (CW) until the output is just less than full scale. Then turn back the Step Span control one position.

F. Turn the Fine Span control counter-clockwise (CCW) until the output is full scale (i.e. 20 mA).

G. With calibration complete, the output reading will be linear with the flow rate.

Note: The maximum flow rate corresponding to full scale for Parshall Flumes and Rectangular Weirs can be obtained by consulting tables on flow rate vs. head height. For 3/2 power law probes, the maximum head height corresponding to full scale should be greater than 1/3 the maximum calibrated length of the sensing element to insure optimum accuracy. For example, a sensing element with a 20 inch maximum calibrated length should be used with a maximum head height for full scale flow of greater than 6 inches.

5.3.2 Calibration in a Bucket

Although it is always best to calibrate the system in the flume or weir, sometimes this is not possible. In this situation, a calibration can be accomplished in a bucket.

A. Fill a well grounded, bare metal bucket with process water to simulate the stream. Attach a jumper wire between the ground screw on the sensing element and the bucket. See Figure 5-5.

B. Set the Fine Span control on the electronic unit to the extreme clockwise (CW) position. Do not force. See Figure 5-1.

C. Set the Step Span to position #1.

D. With the tip of the sensing element at the surface of the water, adjust the Step Zero and Fine Zero controls for minimum output, or zero flow (i.e. 4 mA), depending on the output range.

E. Immerse the sensing element to the level which corresponds to the maximum expected flow rate. See Figure 5-5.

Note: The scale markings on the sensing element are in 1/2 inch increments and correspond to the vertical level in the flow channel.

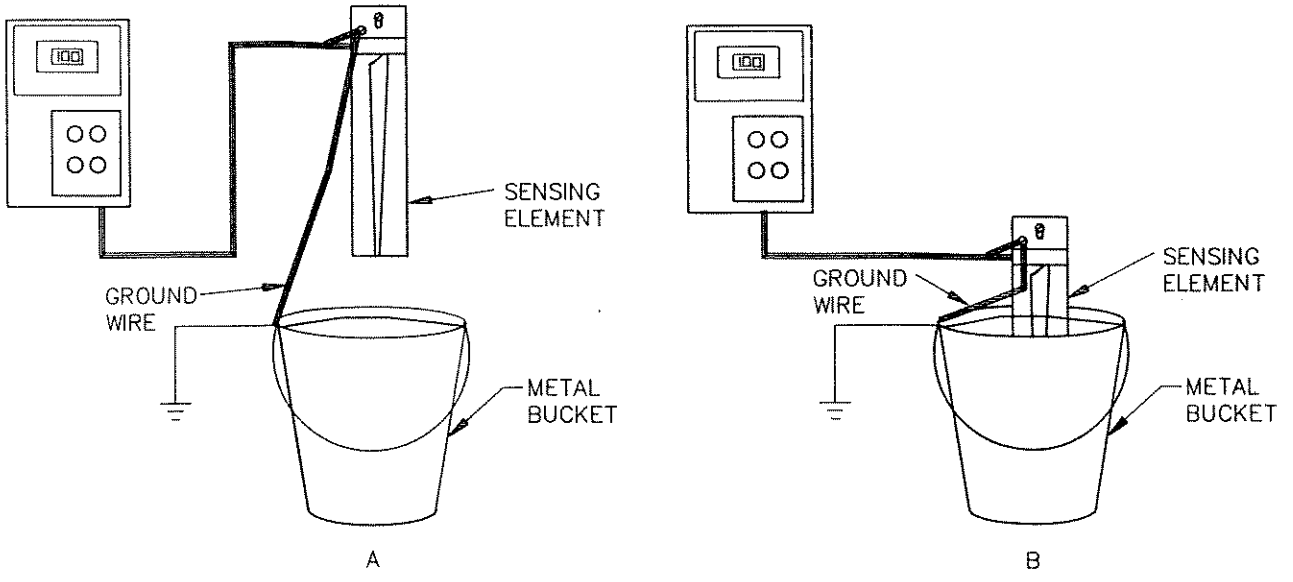


Figure 5-5
Calibrating the Sensing Element in a Bucket

F. Turn the Step Span control clockwise (CW) until the output is just less than full scale, then turn back the Step Span control one position.

G. Turn the Fine Span control counter-clockwise (CCW) until the output is full scale (i.e. 20 mA).

H. Calibration is complete. Slide the sensing element into its mounting track and secure it in place.

5.4 Integrator-Totalizer Calibration

303-331 Series, 303-341 Series, and 303-351 Series flow transmitters are equipped with an integrator- totalizer. See Figure 5-6. The count rate control on the integrator is a 10 turn pot that reads 1.11 in the full counterclockwise position. The 1.11 setting corresponds to 111 counts/hour at the full scale current (20 mA) and the 11.1 setting corresponds to 1111 counts/hour at the full scale current (20 mA). Normally the system is supplied with the count rate control factory-set to the appropriate count rate. If the count rate needs adjustment, it can be reset in the field. (See Figure 4-14 for 24 Vdc pulse wiring for remote use.)

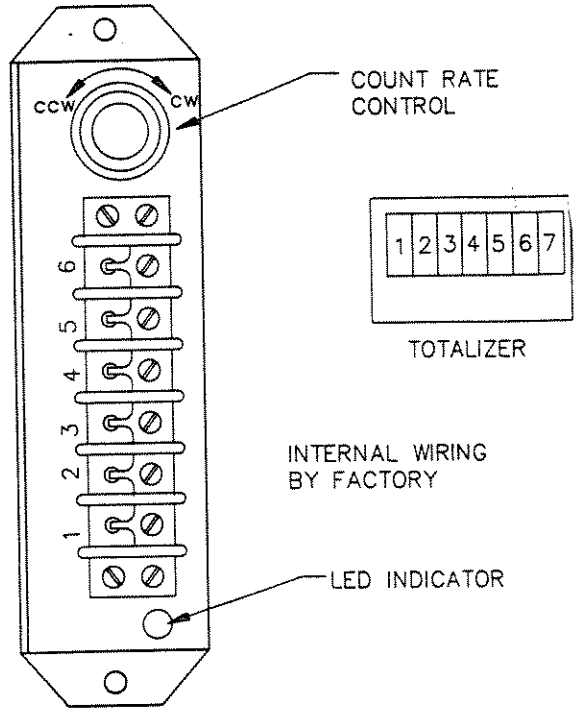


Figure 5-6 Integrator-Totalizer Adjustments

A. Determine the maximum flow rate for full scale indication, and convert the flow to gallons per minute (GPM).

B. The following table shows count rate for maximum flow.

Totalizer Count Ranges

Max Flow in GPM	Gals/Count (Count Rate)
1.8 to 18.5	1
18.6 to 185	10
186 to 1852	100
1853 to 18516	1000
18517 to 185166	10,000
185167 plus . . .	100,000

C. Multiply the flow rate in GPM by 60 to obtain gallons per hour.

D. Divide the gallons per hour by the count rate corresponding to the max flow rate in GPM.

E. Divide the result of Step D by 100 for the count rate control setting.

F. Set this number on the count rate control. With calibration complete, the instrument will now indicate totalized flow.

Example:

A. The maximum flow rate is determined to be 5156 GPM.

B. According to the totalizer count ranges (see table), 5156 GPM corresponds to 1000 gallons/count.

C. 5156 x 60 = 309,360 gallons per hour

D. 309,360 ÷ 1000 = 309.36 counts per hour.

E. 309.36 ÷ 100 = 3.09 = count rate control setting.

5.5 Sampler Activator Calibration

303-341 Series flow transmitters are equipped with a sampler/activator. See Figure 5-7. The sampler/activator provides a momentary contact closure (SPST, n.o. 200 mA max @ 24 Vdc) for operating a sampler at pre-set intervals. (See Figure 4-14 for customer wiring of the SPST contact.) This contact closure duration is adjustable from 60m sec to 2 sec. The sampler/activator consists of a pulse width

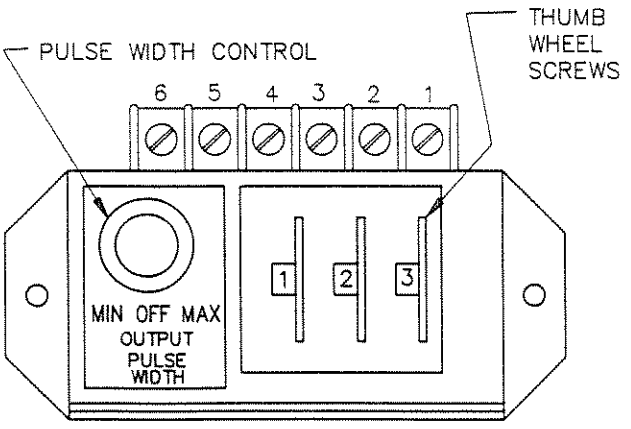


Figure 5-7
Sampler Activator Adjustments

control and a 3-digit thumbwheel switch. The sampler activator counts pulses from the integrator until the number of pulses equals the thumbwheel setting. At this time, the contact closes for the preset interval and the sampler activator resets itself.

Use the following instructions to calibrate the sampler-activator.

A. Determine the flow units per count (gallons/count) from the integrator setting.

B. Decide on the number of units desired per sample.

C. Divide units per sample by units per count to determine the number of counts per sample.

i.e. $\frac{\text{gallons/sample}}{\text{gallons/count}} = \frac{\#\ \text{counts}}{\text{sample}}$

D. Set the resulting number from Step C on the thumbwheel switch. See Figure 5-7. If that number is greater than 999, it will be necessary to make an adjustment on the P.C. board on the back of the sampler/activator unit. See Figure 5-8. For sample counts below 999, the jumper on the P.C. board will be in the X1 (top) position. For counts over 999, move the jumper to the X10 (bottom) position, divide the number obtained in Step C by 10, and set it on the thumbwheel switch. The count range will now be from 10 to 9990.

E. The pulse width control determines the amount of time the relay contact will be closed each time the sampler/activator

Figure 5-8
Sampler Activator P.C. Board

reaches the number of pulses set on the thumbwheel switch. With the pulse width control set at midscale, the relay contact is closed for about 1/2 second per sample. Turning the control clockwise (CW) will increase the time up to a maximum of 2 seconds, and turning it counterclockwise (CCW) will decrease the time to a minimum of 60 milliseconds. By turning the knob one step CCW beyond the minimum relay closure time, you can turn off the sampler/activator without affecting any other part of the system.

F. Once the counts per sample are set on the thumbwheel switch, and the contact closure time is set on the pulse width control, calibration of the sampler-activator is complete.

Example:

A. Gallons per count = 1000

B. One sample is desired every 10,000 gallons.

C. 10,000 ÷ 1000 = 10 counts per sample.

D. With the multiplier jumper in the X1 position, set the thumbwheel switch to 010.

E. Set the pulse width control to the desired contact closure time.

5.6 Strip Chart Recorder Operation

Optional 2 1/2" Strip Chart Recorders can be provided with 303-331 Series and 303-341 Series flow transmitters. See Figure 5-9. Refer to the recorder instruction manual for operation procedures.

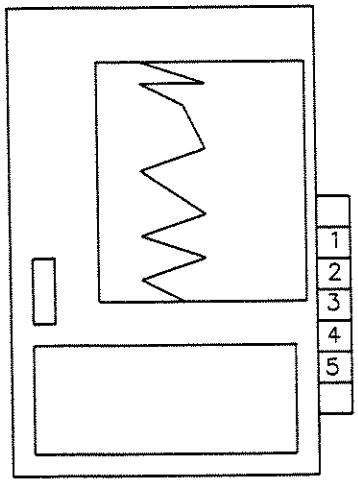


Figure 5-9
Strip Chart Recorder
(Optional)

6.0 Troubleshooting

6.1 Introduction

The 303-300 Series instruments are designed to give years of dependable service.

A spare electronic chassis is recommended for every 10 units so that, in case of a failed unit, a critical application will not be held up while the unit is returned to the factory for repair.

If a difficulty occurs when operating your measurement system, divide the system into its component parts and test each part individually for proper operation.

These troubleshooting procedures should be followed in checking out your system. If attempts to locate the difficulty fail, notify your local factory representative or call the factory direct and ask for the service department.

6.2 Testing the 408-6200 Series Electronics

6.2.1 Operational Check

A. Remove the sensing element and signal wires from the transmitter.

B. Be sure the Fail-Safe link is in the **low-level** fail-safe position. See Figure 6-1.

C. With a pencil, mark the positions of all controls on the faceplate in order to return to them.

D. Put the Step Span control in Position #1 and the Fine Span in the full clockwise (CW) position. Put the Step Zero in Position #1 (most sensitive position). See Figure 6-2.

E. Observing polarities, connect a DC milliammeter and DC power supply (24 to 100 volts) in series, and complete the loop by connecting to Terminals 1 and 2. See Figure 6-3.

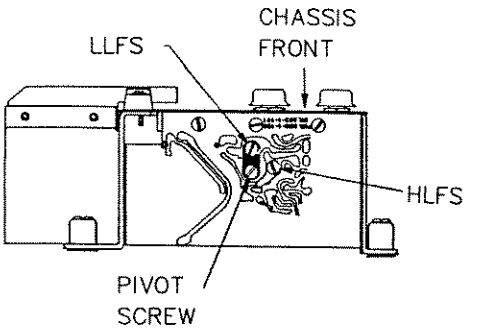


Figure 6-1
Fail-Safe Selector

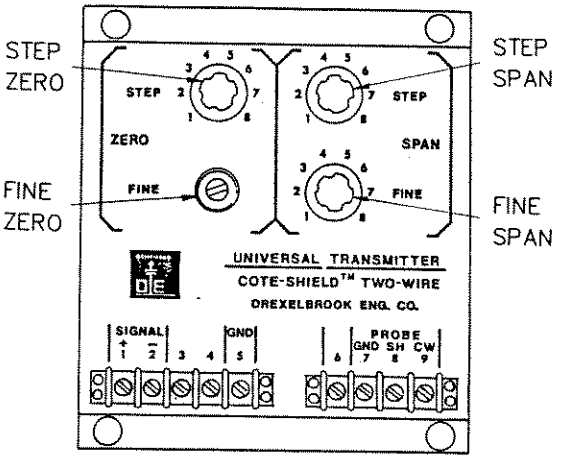


Figure 6-2
Zero and Span Controls

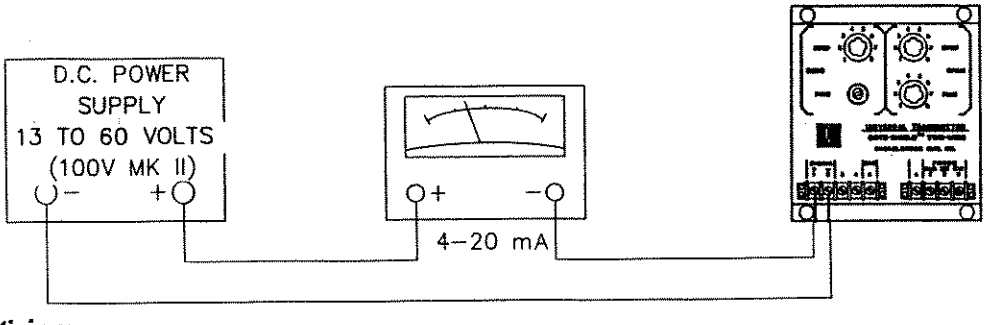


Figure 6-3
Power / Signal Wiring

F. Adjust the Fine Zero until the meter reads 0% (4 mA).

G. Turn the Fine Zero control one turn further clockwise. The output should read greater than 30% if the electronic unit is a 408-6230 and greater than 50% if it is a 408-6200.

   If so, the instrument is probably working correctly. Each turn of the Fine Zero changes the input of a known amount. This checks the operation and gain of the transmitter.

H. If the difficulty has not been located at this point, proceed to the next checkout procedure.

6.2.2 Drift Check

If the output of a transmitter seems to be drifting, it is important to determine whether the drift is in the transmitter or in the sensing element. (A properly connected cable never drifts).

A. Remove the sensing element cable from the transmitter.

B. Without disturbing the dial settings, connect a capacitance standard or an NPO capacitor* across the probe-to-ground input. Adjust the capacitance standard or select a capacitor value that will bring the unit on scale.

*The capacitor should remain stable with changes in temperature.

C. Observe the reading over a 24-hour period to see if it is stable (± 1/2%).

D. If the reading is stable, the sensing element or the application must be the source of the drift. If the reading drifted, return the instrument for repair. Be sure to mark on the tag that the problem is drift. (List the capacitor size and mA deviation).

6.3 Checking the Two-Wire System Loop.

A. See Figure 6-4. With the sensing element disconnected, remove the power wires from Terminals 1 and 2 and measure the open circuit voltage from the power supply. Voltage should be between 13 and 100 Vdc.

B. Connect the signal wires to Terminals 1 and 2. Turn the Step Span and Step Zero controls to Position #1. Turn the Fine Span control completely clockwise (CW) and adjust the Fine Zero until 20 mA flows.

C. Measure the voltage between Terminals 1 and 2. Voltage should be between 13 and 100 Vdc. If there is less than the minimum 13 volts required, the loop has too much resistance or not enough power supply voltage.

D. If, in Step C above, the voltage is less than 13 Vdc, disconnect the power supply and signal wires to the unit. Short the wires that were removed from the power supply (+) and (-) terminals.

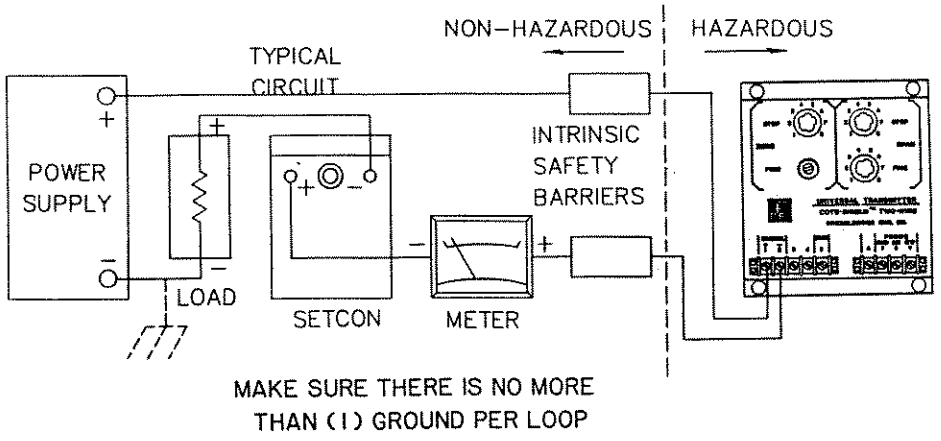


Figure 6-4
Loop Check

E. Measure the resistance between the two wires that were just removed from Terminals 1 and 2 of the electronic unit. The graph below will tell you when the resistance is too large. See Figure 6-5.

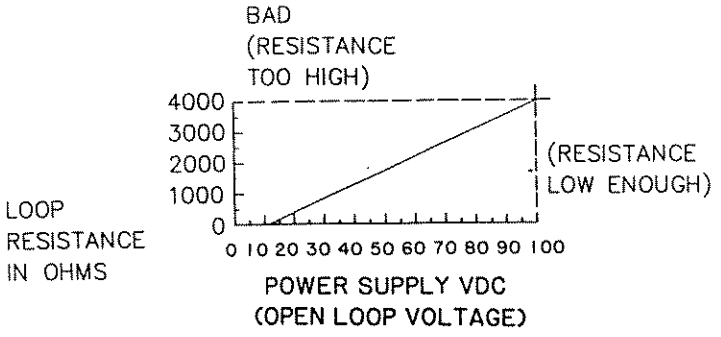


Figure 6-5
Loop Resistance

6.4 Checking the Power Supply

A. With 20 mA (100%) indicated on the flowmeter, measure the line voltage across power supply terminals 1 and 2. See Figure 6-6. The voltage should be between 95 and 135 Vac.

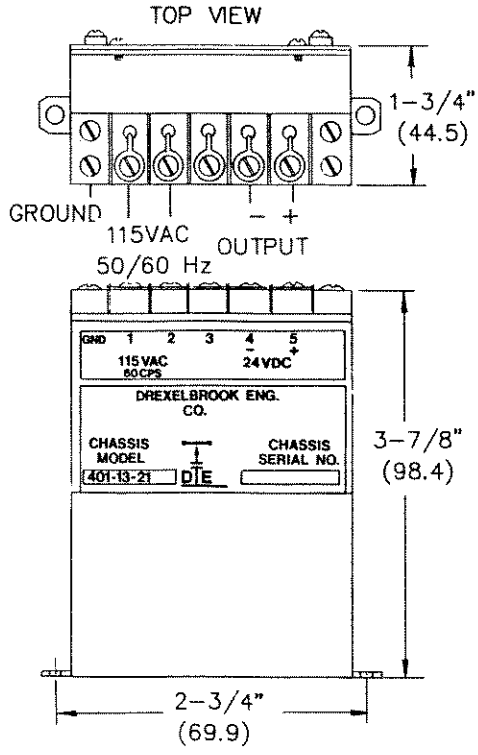


Figure 6-6
Power Supply Connections

B. Measure the voltage at terminals 4 (-) and 5 (+). The voltage should be 24 ± 3 Vdc for power supply model 401-13-21 and 45 ± 5 Vdc for model 401-13-31.

6.5 Checking the Flush Sensing Element

6.5.1 Operational Check

A. Remove the sensing element from the mounting track and lay the sensing element down flat with the back facing down.

B. Disconnect the cable at the electronic unit terminals 7, 8 and 9.

C. With the Step Span control in position #1 and the Fine Span control fully clockwise (CW), adjust the Fine Zero control for an output of 0% (4mA).

D. Reconnect the cable to terminals 7, 8 and 9 of the electronic unit. The flowmeter reading should stay at 0% ± 30%.

E. Pick up the sensor and hold it at the ground terminal with one hand. Grab the sensor with the other hand, placing the thumb in the center of the sensor, at approximately the 50% flow point. The flowmeter output should increase 30% or more. **Note:** placing the hand on the back side of the sensing element should have little effect.

F. If the output in Step E does not increase 30% or more, consult factory.

6.5.2 Checking for Defective Insulation

A. With the sensing element out of the mounting track, disconnect the cable from the electronic unit. Use an analog ohmmeter to measure the resistance between the sensing element terminals. See Figure 6-7.

a. Resistance, center wire to shield _____
b. Resistance, shield to ground _____
c. Resistance, center wire to ground _____

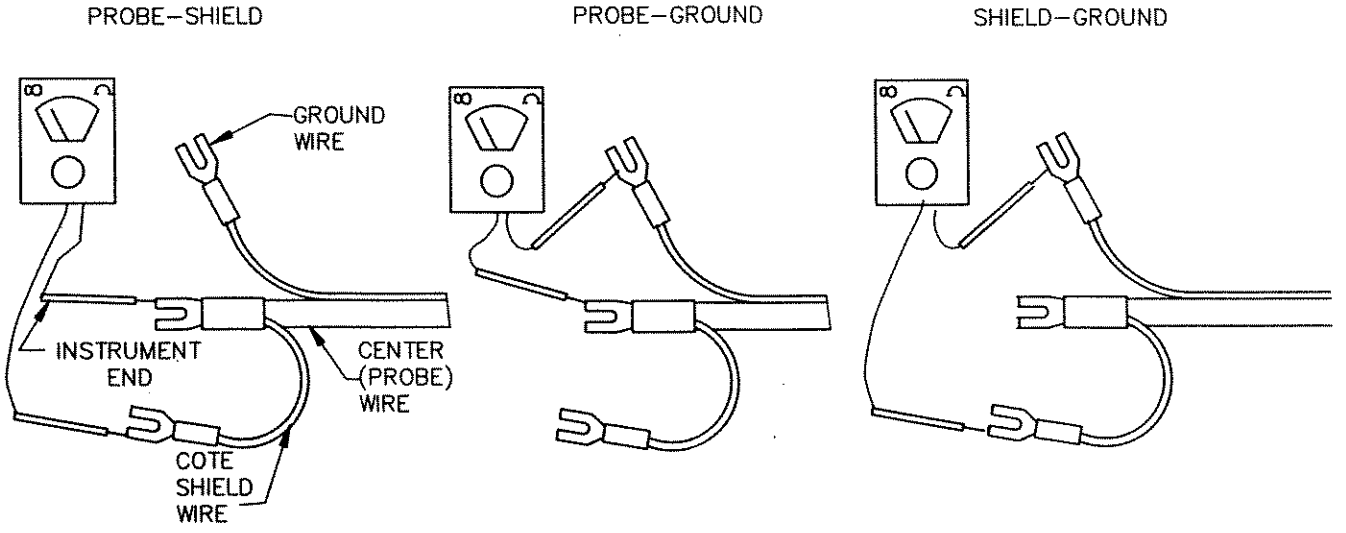


Figure 6-7
Checking the Sensing Element For Defective Insulation

B. With the sensing element in air and no coating, the resistance measured should be infinite in all three cases. Resistances less than one megohm may indicate a defect in the insulation.

C. With the sensing element, including ground connection, completely immersed in a bucket of water containing one tablespoon salt per gallon, minimum resistance readings should still be greater than one megohm. Resistance less than one megohm may indicate defect in insulation. Consult factory.

6.6 Checking the Extension Cable. See Figure 6-8

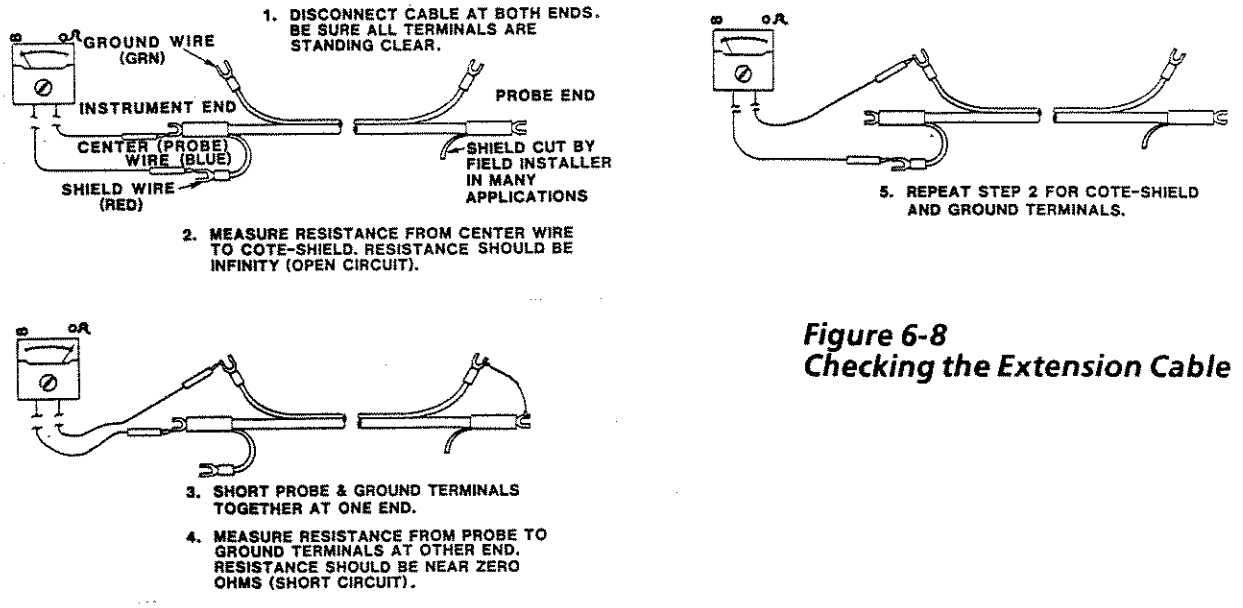


Figure 6-8
Checking the Extension Cable

6.7 Checking the Integrator/Totalizer

A. Adjust the electronic unit controls to produce an output current of 4 mA (0%). See Section 6.2.1.

B. Note and record the setting on the pulse rate adjustment. Now turn the adjustment to the full clockwise position (11-1). With the transmitter output at 0% (4 mA), the totalizer should not index. Wait 60 seconds to make sure it does not index.

C. Adjust the electronic unit to produce a current output of 20 mA (100%). The totalizer should now index one number approximately every three seconds. If so, the integrator and totalizer are working properly and you can proceed to Step F. If not, continue with Step D.

D. Check the LED on the integrator. See Figure 6-9. If the LED is flashing approx. every 3 sec., the totalizer is defective and should be replaced.

E. If the LED on the integrator is not flashing, the integrator may be at fault. Check the voltage across the integrator terminals 4 and 6 with a DC voltmeter. See Figure 6-9. The input voltage should be 45 ± 5 Vdc. If the input voltage is correct, return the integrator to the factory for repair. If the input voltage is not correct, check the power supply. See Section 6.4.

F. Return the pulse rate adjustment to the original number recorded above.

Note: If the meter is reading the correct percentage of flow, but the totalizer seems incorrect in relation to the input water meter, the integrator may be set for the wrong flow rate. Recalibrate integrator per Sec. 5.4.

6.8 Checking the Sampler/Activator

A. Measure the voltage between terminals 1 and 2. See Figure 6-10. The voltage should be between 11.5 and 50 Vdc with terminal 1 positive.

B. Check the voltage pulse from the integrator on terminals 3 and 4. The pulse should measure between 12 and 24 Vdc with a minimum duration of 60 milliseconds.

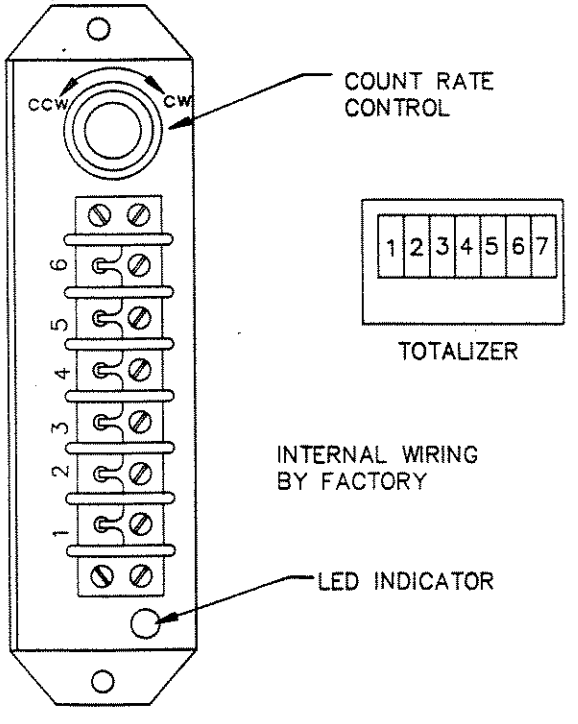


Figure 6-9
Integrator Totalizer

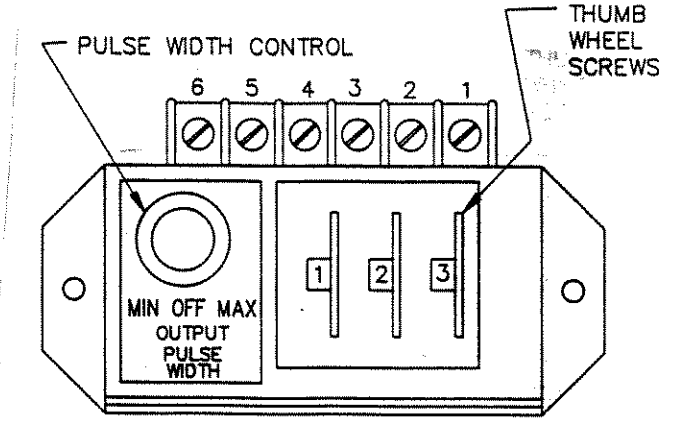


Figure 6-10
Sampler Activator

C. Turn the output pulse width control to the full clockwise (CW) position.

D. Turn the thumbwheel switch to 001. Make sure the multiplier jumper is in the XI position on the sampler/activator P.C. board. See Section 5.5.

E. Each time the integrator sends a pulse to the sampler activator, the relay contact on terminals 5 and 6 of the sampler activator

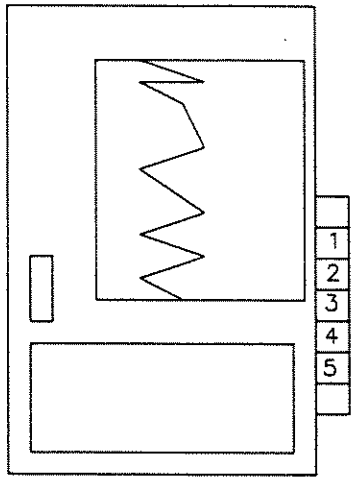
should close for approximately 2 seconds. If not, the unit should be returned to the factory for repair.

Note: The integrator should be set to provide a pulse to the sampler activator once every 45 seconds or longer. This allows the sampler activator to reset between pulses.

6.9 Checking the Optional Strip Chart Recorder

A. Use procedure 6.3 to produce a current of 20 mA. Connect a voltmeter or digital voltmeter across the recorder terminals 4 and 5. See Figure 6-11. The voltmeter should read .2 Vdc, and the recorder should read 100%.

B. If the recorder does not read 100% with .2 Vdc across terminals 4 and 5, it should be returned to the factory for repair.



6-11
Strip Chart Recorder

7.0 Factory and Field Service Assistance

7.1Telephone Assistance

If you are having difficulty with your Drexelbrook equipment, and attempts to locate the problems have failed, notify your local Drexelbrook representative, or call the factory direct and ask for the service department. Drexelbrook Engineering Company is located at 205 Keith Valley Road, Horsham, Pa. 19044. The telephone number is (215) 674-1234. To help us solve your problem quickly, please have as much of the following information as possible when you call:

Instrument Model#_____

_____

Probe Model#_____

_____

P.O. #_____

Date_____

Cable Length_____

Application_____

_____

Material being measured_____

_____

Temperature _____

Pressure _____

Agitation _____

Brief description of the problem _____

_____

_____

Checkout procedures that failed _____

_____

_____

_____

7.2 Equipment Return

Do not return equipment without first contacting the factory for a return authorization number. Any equipment being returned must include the following information:

Reason for return_____

_____

Return Authorization# _____

_____

Original P.O.#_____

Drexelbrook order#_____

Your company contact _____

"Ship To" address _____

To keep the paperwork in order, please include a purchase order with returned equipment even though it may be coming back for warranty repair. You will not be charged if covered under warranty. Please return your equipment with freight charges prepaid. We regret that we cannot accept collect shipments.

Drexelbrook usually has a stock of reconditioned exchange units available for faster turnaround of a repair order. If you prefer your own unit repaired rather than exchanged, please mark clearly on the return unit, "Do Not Exchange".

Spare instruments are generally in factory stock. If the application is critical, a spare chassis should be kept on hand.

7.3 Field Service

Trained field servicemen are available on a time-plus-expense basis to assist in start-ups, diagnosing difficult application problems, or in-plant training of personnel.

Contact the service department for further details.

7.4 Customer Training

Periodically, Drexelbrook instrument training seminars for customers are held at the factory. These sessions are guided by Drexelbrook engineers and specialists, and provide detailed information on all aspects of level measurement including theory and instrument operation. For more information about these valuable workshops, write to Drexelbrook Engineering, Attention: Communi-cations/Training Group; or call direct (215) 674-1234.

Table 1

1 inch to 24 inch PARSHALL Flumes

Flow in GPM vs. Head Height in Inches

Flow	1"	2"	3"	6"	9"	12"	18"	24"
10	2.1	1.4	1.0	.7	.5	.4	.3	.3
20	3.2	2.1	1.6	1.1	.8	.6	.5	.4
30	4.2	2.8	2.1	1.4	1.0	.8	.6	.5
40	5.1	3.3	2.5	1.6	1.2	1.0	.8	.7
50	5.9	3.8	2.9	1.9	1.4	1.1	.9	.8
65	6.9	4.5	3.5	2.2	1.6	1.4	1.1	.9
80	7.9	5.2	4.0	2.6	1.9	1.6	1.2	1.0
95	8.9	5.8	4.4	2.8	2.1	1.7	1.4	1.2
110	9.8	6.4	4.9	3.1	2.3	1.9	1.5	1.3
125	10.6	6.9	5.3	3.4	2.5	2.1	1.6	1.4
140	11.4	7.4	5.7	3.6	2.7	2.2	1.8	1.5
155	12.2	7.9	6.1	3.9	2.9	2.4	1.9	1.6
170	12.9	8.4	6.5	4.1	3.1	2.5	2.0	1.7
185	13.6	8.9	6.8	4.3	3.2	2.7	2.1	1.8
200	14.4	9.4	7.2	4.6	3.4	2.8	2.2	1.9
220	15.3	9.9	7.6	4.8	3.6	3.0	2.4	2.0
240	16.1	10.5	8.1	5.1	3.8	3.2	2.5	2.1
260	17.0	11.1	8.5	5.4	4.0	3.4	2.6	2.2
280	17.8	11.6	8.9	5.6	4.2	3.5	2.8	2.3
300	18.6	12.2	9.3	5.9	4.4	3.7	2.9	2.4
320	19.4	12.7	9.7	6.1	4.6	3.9	3.0	2.5
340	20.2	13.2	10.1	6.4	4.8	4.0	3.1	2.6
360		13.7	10.5	6.6	5.0	4.2	3.2	2.7
380		14.2	10.9	6.8	5.2	4.3	3.4	2.8
400		14.6	11.3	7.1	5.3	4.5	3.5	2.9
420		15.1	11.6	7.3	5.5	4.6	3.6	3.0
440		15.6	12.0	7.5	5.7	4.8	3.7	3.1
460		16.0	12.3	7.7	5.9	4.9	3.8	3.2
480		16.5	12.7	7.9	6.0	5.0	3.9	3.3
500		16.9	13.0	8.1	6.2	5.2	4.0	3.4
525		17.4	13.4	8.4	6.4	5.3	4.1	3.5
550		18.0	13.8	8.6	6.6	5.5	4.3	3.6
575		18.5	14.2	8.9	6.8	5.7	4.4	3.7
600		19.0	14.6	9.1	7.0	5.8	4.5	3.8
625		19.5	15.0	9.4	7.2	6.0	4.6	3.9
650		20.0	15.4	9.6	7.3	6.2	4.8	4.0
675		20.5	15.8	9.8	7.5	6.3	4.9	4.1
700		21.0	16.2	10.1	7.7	6.5	5.0	4.2
725		21.5	16.5	10.3	7.9	6.6	5.1	4.3
750		21.9	16.9	10.5	8.1	6.8	5.2	4.4
800		22.9	17.6	11.0	8.4	7.1	5.5	4.6
850		23.8	18.3	11.4	8.7	7.3	5.7	4.7
900		24.7	19.0	11.8	9.1	7.6	5.9	4.9
950			19.7	12.2	9.4	7.9	6.1	5.1
1000			20.3	12.6	9.7	8.2	6.3	5.3
1050			21.0	13.0	10.0	8.4	6.5	5.4
1100			21.6	13.4	10.3	8.7	6.7	5.6
1150			22.3	13.8	10.7	9.0	6.9	5.8
1200			22.9	14.2	11.0	9.2	7.1	5.9
1250			23.5	14.5	11.3	9.5	7.3	6.1
1300			24.1	14.9	11.5	9.7	7.5	6.2
1350			24.7	15.3	11.8	9.9	7.7	6.4
1400			25.3	15.6	12.1	10.2	7.8	6.5
1450			25.9	16.0	12.4	10.4	8.0	6.7
1500			26.4	16.3	12.7	10.7	8.2	6.8
1550			27.0	16.7	13.0	10.9	8.4	7.0
1600			27.6	17.0	13.2	11.1	8.6	7.1
1650			28.1	17.3	13.5	11.4	8.7	7.3
1700			28.7	17.7	13.8	11.6	8.9	7.4
1750			29.2	18.0	14.0	11.8	9.1	7.5

1 inch to 24 inch PARSHALL Flumes

Flow in GPM vs. Head Height in Inches

Flow	1"	2"	3"	6"	9"	12"	18"	24"
1800			29.7	18.3	14.3	12.0	9.2	7.7
1850			30.3	18.6	14.5	12.2	9.4	7.8
1900			30.8	19.0	14.8	12.5	9.6	8.0
1950			31.3	19.3	15.0	12.7	9.7	8.1
2000			31.8	19.6	15.3	12.9	9.9	8.2
2050			32.4	19.9	15.5	13.1	10.1	8.4
2100			32.9	20.2	15.8	13.3	10.2	8.5
2150			33.4	20.5	16.0	13.5	10.4	8.6
2200			33.9	20.8	16.3	13.7	10.5	8.7
2250			34.4	21.1	16.5	13.9	10.7	8.9
2300			34.9	21.4	16.8	14.1	10.8	9.0
2350			35.3	21.7	17.0	14.3	11.0	9.1
2400			35.8	22.0	17.2	14.5	11.1	9.3
2450			36.3	22.3	17.5	14.7	11.3	9.4
2500			36.8	22.5	17.7	14.9	11.4	9.5
2600				23.1	18.2	15.3	11.7	9.7
2700				23.7	18.6	15.7	12.0	10.0
2800				24.2	19.1	16.1	12.3	10.2
2900				24.8	19.5	16.4	12.6	10.5
3000				25.3	19.9	16.8	12.9	10.7
3100				25.8	20.4	17.2	13.2	10.9
3200				26.4	20.8	17.5	13.4	11.1
3300				26.9	21.2	17.9	13.7	11.4
3400				27.4	21.6	18.3	14.0	11.6
3500				27.9	22.1	18.6	14.2	11.8
3600				28.4	22.5	19.0	14.5	12.0
3700				28.9	22.9	19.3	14.8	12.2
3800				29.4	23.3	19.6	15.0	12.4
3900				29.9	23.7	20.0	15.3	12.7
4000				30.4	24.1	20.3	15.5	12.9
4100				30.8	24.5	20.6	15.8	13.1
4200				31.3	24.8	21.0	16.0	13.3
4300				31.8	25.2	21.3	16.3	13.5
4400				32.2	25.6	21.6	16.5	13.7
4500				32.7	26.0	21.9	16.8	13.9
4600				33.2	26.4	22.3	17.0	14.1
4700				33.6	26.7	22.6	17.2	14.3
4800				34.1	27.1	22.9	17.5	14.5
4900				34.5	27.5	23.2	17.7	14.7
5000				35.0	27.8	23.5	18.0	14.9
5100				35.4	28.2	23.8	18.2	15.0
5200				35.8	28.6	24.1	18.4	15.2
5300				36.3	28.9	24.4	18.6	15.4
5400				36.7	29.3	24.7	18.9	15.6
5500					29.6	25.0	19.1	15.8
5600					30.0	25.3	19.3	16.0
5700					30.3	25.6	19.5	16.2
5800					30.7	25.9	19.8	16.3
5900					31.0	26.2	20.0	16.5
6000					31.4	26.5	20.2	16.7
6100					31.7	26.8	20.4	16.9
6200					32.0	27.1	20.6	17.1
6300					32.4	27.4	20.9	17.2
6400					32.7	27.7	21.1	17.4
6500					33.1	27.9	21.3	17.6
6600					33.4	28.2	21.5	17.8
6700					33.7	28.5	21.7	17.9
6800					34.0	28.8	21.9	18.1
6900					34.4	29.1	22.1	18.3
7000					34.7	29.3	22.3	18.5

1 inch to 24 inch PARSHALL Flumes

Flow in GPM vs. Head Height in Inches

Flow	1"	2"	3"	6"	9"	12"	18"	24"
7200					35.3	29.9	22.8	18.8
7400					36.0	30.4	23.2	19.1
7600					36.6	31.0	23.6	19.5
7800						31.5	24.0	19.8
8000						32.0	24.4	20.1
8200						32.5	24.8	20.4
8400						33.1	25.2	20.8
8600						33.6	25.5	21.1
8800						34.1	25.9	21.4
9000						34.6	26.3	21.7
9200						35.1	26.7	22.0
9400						35.6	27.1	22.3
9600						36.1	27.4	22.6
9800						36.6	27.8	22.9
10000							28.2	23.2
10200							28.5	23.5
10400							28.9	23.8
10600							29.3	24.1
10800							29.6	24.4
11000							30.0	24.7
11200							30.3	25.0
11400							30.7	25.3
11600							31.0	25.6
11800							31.4	25.9
12000							31.7	26.1
12200							32.1	26.4
12400							32.4	26.7
12600							32.7	27.0
12800							33.1	27.2
13000							33.4	27.5
13200							33.7	27.8
13400							34.1	28.1
13600							34.4	28.3
13800							34.7	28.6
14000							35.1	28.9
14200							35.4	29.1
14400							35.7	29.4
14600							36.0	29.7
14800							36.4	29.9
15000							36.7	30.2
15500								30.8
16000								31.5
16500								32.1
17000								32.7
17500								33.3
18000								33.9
18500								34.6
19000								35.2
19500								35.7
20000								36.3
20500								

Table 2

3 ft to 12 ft PARSHALL Flumes

Flow in GPM vs. Head Height in Inches

Flow	3'	4'	5'	6'	7'	8'	10'	12'
100	.9	.8	.7	.6	.6	.5	.5	.4
200	1.5	1.2	1.1	1.0	.9	.8	.7	.7
300	1.9	1.6	1.4	1.3	1.2	1.1	.9	.8
400	2.3	1.9	1.7	1.5	1.4	1.3	1.1	1.0
500	2.6	2.2	1.9	1.8	1.6	1.5	1.3	1.2
600	3.0	2.5	2.2	2.0	1.8	1.7	1.4	1.3
700	3.3	2.7	2.4	2.2	2.0	1.8	1.6	1.4
800	3.6	3.0	2.6	2.4	2.1	2.0	1.7	1.6
900	3.8	3.2	2.8	2.5	2.3	2.1	1.9	1.7
1000	4.1	3.4	3.0	2.7	2.5	2.3	2.0	1.8
1100	4.4	3.7	3.2	2.9	2.6	2.4	2.1	1.9
1200	4.6	3.9	3.4	3.0	2.8	2.6	2.2	2.0
1300	4.8	4.1	3.6	3.2	2.9	2.7	2.3	2.1
1400	5.1	4.3	3.7	3.3	3.0	2.8	2.5	2.2
1500	5.3	4.4	3.9	3.5	3.2	2.9	2.6	2.3
1600	5.5	4.6	4.0	3.6	3.3	3.1	2.7	2.4
1700	5.7	4.8	4.2	3.8	3.4	3.2	2.8	2.5
1800	6.0	5.0	4.4	3.9	3.6	3.3	2.9	2.6
1900	6.2	5.2	4.5	4.0	3.7	3.4	3.0	2.7
2000	6.4	5.3	4.7	4.2	3.8	3.5	3.1	2.8
2200	6.8	5.7	4.9	4.4	4.0	3.7	3.3	2.9
2400	7.2	6.0	5.2	4.7	4.3	3.9	3.4	3.1
2600	7.5	6.3	5.5	4.9	4.5	4.1	3.6	3.3
2800	7.9	6.6	5.8	5.2	4.7	4.3	3.8	3.4
3000	8.3	6.9	6.0	5.4	4.9	4.5	4.0	3.6
3200	8.6	7.2	6.3	5.6	5.1	4.7	4.1	3.7
3400	8.9	7.5	6.5	5.8	5.3	4.9	4.3	3.8
3600	9.3	7.7	6.7	6.0	5.5	5.1	4.4	4.0
3800	9.6	8.0	7.0	6.2	5.7	5.2	4.6	4.1
4000	9.9	8.3	7.2	6.4	5.9	5.4	4.7	4.3
4200	10.2	8.5	7.4	6.6	6.1	5.6	4.9	4.4
4400	10.5	8.8	7.7	6.8	6.2	5.7	5.0	4.5
4600	10.8	9.0	7.9	7.0	6.4	5.9	5.2	4.6
4800	11.1	9.3	8.1	7.2	6.6	6.1	5.3	4.8
5000	11.4	9.5	8.3	7.4	6.7	6.2	5.4	4.9
5500	12.2	10.1	8.8	7.9	7.2	6.6	5.8	5.2
6000	12.9	10.7	9.3	8.3	7.6	7.0	6.1	5.5
6500	13.5	11.3	9.8	8.7	7.9	7.3	6.4	5.8
7000	14.2	11.8	10.3	9.2	8.3	7.7	6.7	6.0
7500	14.8	12.3	10.7	9.6	8.7	8.0	7.0	6.3
8000	15.4	12.9	11.2	10.0	9.1	8.3	7.3	6.6
8500	16.1	13.4	11.6	10.3	9.4	8.7	7.6	6.8
9000	16.7	13.8	12.0	10.7	9.7	9.0	7.9	7.1
9500	17.2	14.3	12.4	11.1	10.1	9.3	8.1	7.3
10000	17.8	14.8	12.8	11.5	10.4	9.6	8.4	7.5
10500	18.4	15.3	13.2	11.8	10.7	9.9	8.7	7.8
11000	18.9	15.7	13.6	12.2	11.0	10.2	8.9	8.0
11500	19.5	16.2	14.0	12.5	11.4	10.4	9.2	8.2
12000	20.0	16.6	14.4	12.8	11.7	10.7	9.4	8.5
12500	20.5	17.1	14.8	13.2	12.0	11.0	9.7	8.7
13000	21.1	17.5	15.2	13.5	12.3	11.3	9.9	8.9
13500	21.6	17.9	15.5	13.8	12.5	11.5	10.1	9.1
14000	22.1	18.3	15.9	14.1	12.8	11.8	10.4	9.3
14500	22.6	18.7	16.2	14.5	13.1	12.1	10.6	9.5
15000	23.1	19.1	16.6	14.8	13.4	12.3	10.8	9.7
15500	23.6	19.5	16.9	15.1	13.7	12.6	11.0	9.9
16000	24.0	19.9	17.3	15.4	14.0	12.8	11.3	10.1
16500	24.5	20.3	17.6	15.7.	14.2	13.1	11.5	10.3
17000	25.0	20.7	17.9	16.0	14.5	13.3	11.7	10.5
17500	25.5	21.1	18.3	16.3	14.8	13.6	11.9	10.7

3 ft to 12 ft PARSHALL Flumes

Flow in GPM vs. Head Height in Inches

Flow	3'	4'	5'	6'	7'	8'	10'	12'
18000	25.9	21.5	18.6	16.6	15.0	13.8	12.1	10.9
18500	26.4	21.9	18.9	16.8	15.3	14.0	12.3	11.1
19000	26.8	22.2	19.3	17.1	15.5	14.3	12.5	11.3
19500	27.3	22.6	19.6	17.4	15.8	14.5	12.8	11.5
20000	27.7	23.0	19.9	17.7	16.0	14.7	13.0	11.6
20500	28.2	23.3	20.2	18.0	16.3	15.0	13.2	11.8
21000	28.6	23.7	20.5	18.2	16.5	15.2	13.4	12.0
21500	29.0	24.0	20.8	18.5	16.8	15.4	13.6	12.2
22000	29.5	24.4	21.1	18.8	17.0	15.6	13.8	12.4
22500	29.9	24.7	21.4	19.0	17.3	15.9	13.9	12.5
23000	30.3	25.1	21.7	19.3	17.5	16.1	14.1	12.7
23500	30.7	25.4	22.0	19.6	17.7	16.3	14.3	12.9
24000	31.2	25.8	22.3	19.8	18.0	16.5	14.5	13.0
24500	31.6	26.1	22.6	20.1	18.2	16.7	14.7	13.2
25000	32.0	26.5	22.9	20.3	18.4	16.9	14.9	13.4
25500	32.4	26.8	23.2	20.6	18.7	17.2	15.1	13.5
26000	32.8	27.1	23.5	20.8	18.9	17.4	15.3	13.7
26500	33.2	27.5	23.7	21.1	19.1	17.6	15.4	13.9
27000	33.6	27.8	24.0	21.3	19.3	17.8	15.6	14.0
27500	34.0	28.1	24.3	21.6	19.6	18.0	15.8	14.2
28000	34.4	28.4	24.6	21.8	19.8	18.2	16.0	14.4
28500	34.8	28.7	24.9	22.1	20.0	18.4	16.2	14.5
29000	35.2	29.1	25.1	22.3	20.2	18.6	16.3	14.7
29500	35.5	29.4	25.4	22.6	20.4	18.8	16.5	14.8
30000	35.9	29.7	25.7	22.8	20.7	19.0	16.7	15.0
31000	36.7	30.3	26.2	23.3	21.1	19.4	17.0	15.3
32000		30.9	26.7	23.7	21.5	19.8	17.4	15.6
33000		31.5	27.3	24.2	21.9	20.1	17.7	15.9
34000		32.1	27.8	24.7	22.3	20.5	18.0	16.2
35000		32.7	28.3	25.1	22.8	20.9	18.4	16.5
36000		33.3	28.8	25.6	23.2	21.3	18.7	16.8
37000		33.9	29.3	26.0	23.6	21.6	19.0	17.1
38000		34.5	29.8	26.4	24.0	22.0	19.3	17.4
39000		35.1	30.3	26.9	24.3	22.3	19.7	17.7
40000		35.6	30.8	27.3	24.7	22.7	20.0	18.0
41000		36.2	31.3	27.7	25.1	23.1	20.3	18.2
42000		36.8	31.7	28.2	25.5	23.4	20.6	18.5
43000			32.2	28.6	25.9	23.7	20.9	18.8
44000			32.7	29.0	26.2	24.1	21.2	19.1
45000			33.1	29.4	26.6	24.4	21.5	19.3
46000			33.6	29.8	27.0	24.8	21.8	19.6
47000			34.1	30.2	27.4	25.1	22.1	19.9
48000			34.5	30.6	27.7	25.4	22.4	20.1
49000			35.0	31.0	28.1	25.8	22.7	20.4
50000			35.4	31.4	28.4	26.1	23.0	20.6
51000			35.9	31.8	28.8	26.4	23.3	20.9
52000			36.3	32.2	29.1	26.7	23.5	21.2
53000			36.7	32.6	29.5	27.0	23.8	21.4
54000				33.0	29.8	27.4	24.1	21.7
55000				33.3	30.2	27.7	24.4	21.9
56000				33.7	30.5	28.0	24.7	22.2
57000				34.1	30.9	28.3	24.9	22.4
58000				34.5	31.2	28.6	25.2	22.6
59000				34.8	31.5	28.9	25.5	22.9
60000				35.2	31.9	29.2	25.7	23.1
61000				35.6	32.2	29.5	26.0	23.4
62000				35.9	32.5	29.8	26.3	23.6
63000				36.3	32.8	30.1	26.5	23.8
64000				36.7	33.2	30.4	26.8	24.1
65000					33.5	30.7	27.1	24.3

Table 2

3 ft to 12 ft PARSHALL Flumes

Flow in GPM vs. Head Height in Inches

Flow	3'	4'	5'	6'	7'	8'	10'	12'
66000					33.8	31.0	27.3	24.5
67000					34.1	31.3	27.6	24.8
68000					34.5	31.6	27.8	25.0
69000					34.8	31.9	28.1	25.2
70000					35.1	32.2	28.3	25.5
72000					35.7	32.7	28.8	25.9
74000					36.3	33.3	29.3	26.4
76000						33.9	29.8	26.8
78000						34.4	30.3	27.3
80000						35.0	30.8	27.7
82000						35.5	31.3	28.1
84000						36.0	31.8	28.5
86000							32.2	29.0
88000							32.7	29.4
90000							33.2	29.8
92000							33.6	30.2
94000							34.1	30.6
96000							34.5	31.0
98000							35.0	31.4
100000							35.4	31.8
105000							36.5	32.8
110000							37.6	33.8
115000							38.7	34.7
120000							39.7	35.7
125000							40.7	36.6
130000							41.7	37.5
135000							42.7	38.4
140000							43.7	39.3
145000							44.7	40.1
150000							45.6	41.0
155000							46.6	41.9
160000							47.5	42.7
165000							48.4	43.5
170000								44.3
175000								45.2
180000								46.0
185000								46.8
190000								47.5
195000								48.3
200000								49.1
205000								49.8
210000								50.6
215000								51.4
220000								52.1
225000								52.8
230000								53.6
235000								54.3
240000								55.0
245000								55.7
250000								56.4
255000								57.1
260000								57.8
265000								58.5
270000								59.2
275000								59.9

Table 3

4 inch to 21 inch PALMER-BOWLUS Flumes

Flow in GPM vs. Head Height in Inches

Flow	4"	6"	8"	10"	12"	15"	18"	21"
5	.8	.7	.7	.6	.6	.6	.5	.5
10	1.2	1.1	1.0	.9	.9	.8	.7	.7
15	1.5	1.3	1.2	1.1	1.1	1.0	.9	.9
20	1.8	1.6	1.4	1.3	1.3	1.1	1.1	1.0
25	2.0	1.7	1.6	1.5	1.4	1.3	1.2	1.2
30	2.2	1.9	1.8	1.6	1.5	1.4	1.3	1.3
35	2.4	2.1	1.9	1.7	1.7	1.5	1.4	1.4
40	2.6	2.2	2.0	1.9	1.8	1.7	1.5	1.5
45	2.8	2.4	2.2	2.0	1.9	1.8	1.6	1.6
50	3.0	2.5	2.3	2.1	2.0	1.9	1.7	1.7
60	3.3	2.8	2.5	2.3	2.2	2.0	1.9	1.8
70	3.6	3.0	2.8	2.5	2.4	2.2	2.1	2.0
80	3.8	3.2	3.0	2.7	2.6	2.4	2.2	2.1
90		3.4	3.1	2.9	2.8	2.5	2.4	2.3
100		3.6	3.3	3.1	2.9	2.7	2.5	2.4
115		3.9	3.6	3.3	3.1	2.9	2.7	2.6
130		4.2	3.8	3.5	3.4	3.1	2.9	2.8
145		4.4	4.1	3.7	3.6	3.3	3.0	2.9
160		4.7	4.3	3.9	3.7	3.4	3.2	3.1
175		4.9	4.5	4.1	3.9	3.6	3.4	3.2
190		5.1	4.7	4.3	4.1	3.8	3.5	3.4
205		5.3	4.9	4.5	4.3	3.9	3.7	3.5
220		5.5	5.1	4.7	4.4	4.1	3.8	3.6
235		5.7	5.2	4.9	4.6	4.2	3.9	3.8
250		5.9	5.4	5.0	4.7	4.4	4.1	3.9
275			5.7	5.3	5.0	4.6	4.3	4.1
300			6.0	5.5	5.2	4.8	4.5	4.3
325			6.2	5.8	5.4	5.0	4.7	4.5
350			6.5	6.0	5.7	5.2	4.9	4.7
375			6.7	6.2	5.9	5.4	5.1	4.8
400			7.0	6.5	6.1	5.6	5.2	5.0
425			7.2	6.7	6.3	5.8	5.4	5.2
450			7.4	6.9	6.5	5.9	5.6	5.3
475			7.6	7.1	6.6	6.1	5.7	5.5
500				7.3	6.8	6.3	5.9	5.6
525				7.5	7.0	6.5	6.1	5.8
550				7.7	7.2	6.6	6.2	5.9
575				7.9	7.3	6.8	6.4	6.1
600				8.0	7.5	6.9	6.5	6.2
625				8.2	7.7	7.1	6.7	6.3
650				8.4	7.8	7.2	6.8	6.5
675				8.6	8.0	7.4	6.9	6.6
700				8.7	8.1	7.5	7.1	6.7
725				8.9	8.3	7.7	7.2	6.9
750				9.1	8.4	7.8	7.3	7.0
775				9.2	8.6	7.9	7.5	7.1
800				9.4	8.7	8.1	7.6	7.2
825				9.5	8.9	8.2	7.7	7.4
850					9.0	8.3	7.8	7.5
875					9.2	8.5	8.0	7.6
900					9.3	8.6	8.1	7.7
925					9.4	8.7	8.2	7.8
950					9.6	8.8	8.3	7.9
975					9.7	9.0	8.4	8.0
1000					9.8	9.1	8.6	8.1
1050					10.1	9.3	8.8	8.4
1100					10.3	9.5	9.0	8.6
1150					10.6	9.8	9.2	8.8
1200					10.8	10.0	9.4	9.0
1250					11.1	10.2	9.6	9.2

4 inch to 21 inch PALMER-BOWLUS Flumes

Flow in GPM vs. Head Height in Inches

Flow	4"	6"	8"	10"	12"	15"	18"	21"
1300					11.3	10.4	9.8	9.4
1350					11.5	10.6	10.1	9.5
1400						10.8	10.2	9.7
1450						11.0	10.4	9.9
1500						11.2	10.6	10.1
1550						11.4	10.8	10.3
1600						11.6	11.0	10.4
1650						11.8	11.2	10.6
1700						12.0	11.4	10.8
1750						12.2	11.5	11.0
1800						12.4	11.7	11.1
1850						12.6	11.9	11.3
1900						12.7	12.1	11.4
1950						12.9	12.2	11.6
2000						13.1	12.4	11.8
2100						13.4	12.7	12.1
2200						13.8	13.1	12.4
2300						14.1	13.4	12.7
2400						14.4	13.7	12.9
2500							14.0	13.2
2600							14.3	13.5
2700							14.6	13.8
2800							14.9	14.0
2900							15.1	14.3
3000							15.4	14.6
3100							15.7	14.8
3200							16.0	15.1
3300							16.2	15.3
3400							16.5	15.6
3500							16.7	15.8
3600							17.0	16.0
3700							17.2	16.3
3800								16.5
3900								16.7
4000								17.0
4100								17.2
4200								17.4
4300								17.6
4400								17.8
4500								18.1
4600								18.3
4700								18.5
4800								18.7
4900								18.9
5000								19.1
5100								19.3
5200								19.5
5300								19.7
5400								19.9

Table 4

24 inch to 72 inch PALMER-BOWLUS Flumes

Flow in GPM vs. Head Height in Inches

Flow	24"	27"	30"	36"	42"	48"	60"	72"
50	1.6	1.6	1.5	1.6	1.4	1.2	1.2	1.1
100	2.3	2.2	2.1	2.2	2.0	1.7	1.7	1.6
150	2.9	2.8	2.7	2.7	2.4	2.2	2.1	2.0
200	3.3	3.2	3.1	3.2	2.8	2.5	2.5	2.3
250	3.8	3.6	3.5	3.6	3.2	2.8	2.8	2.6
300	4.1	4.0	3.8	3.9	3.5	3.1	3.1	2.9
350	4.5	4.3	4.2	4.2	3.8	3.4	3.3	3.1
400	4.8	4.7	4.5	4.5	4.1	3.7	3.6	3.4
450	5.1	5.0	4.8	4.8	4.3	3.9	3.8	3.6
500	5.4	5.2	5.0	5.0	4.6	4.1	4.0	3.8
550	5.7	5.5	5.3	5.3	4.8	4.3	4.2	4.0
600	6.0	5.8	5.5	5.5	5.0	4.6	4.4	4.2
650	6.2	6.0	5.8	5.8	5.3	4.8	4.6	4.4
700	6.5	6.3	6.0	6.0	5.5	4.9	4.8	4.5
750	6.7	6.5	6.2	6.2	5.7	5.1	5.0	4.7
800	6.9	6.7	6.4	6.4	5.9	5.3	5.2	4.9
850	7.2	6.9	6.7	6.6	6.1	5.5	5.3	5.0
900	7.4	7.1	6.9	6.8	6.2	5.7	5.5	5.2
950	7.6	7.3	7.1	7.0	6.4	5.8	5.7	5.3
1000	7.8	7.6	7.3	7.2	6.6	6.0	5.8	5.5
1100	8.2	7.9	7.6	7.5	6.9	6.3	6.1	5.8
1200	8.6	8.3	8.0	7.9	7.3	6.6	6.4	6.0
1300	9.0	8.7	8.3	8.2	7.6	6.9	6.7	6.3
1400	9.3	9.0	8.7	8.5	7.9	7.2	6.9	6.5
1500	9.7	9.3	9.0	8.8	8.2	7.5	7.2	6.8
1600	10.0	9.7	9.3	9.1	8.4	7.7	7.5	7.0
1700	10.3	10.0	9.6	9.4	8.7	8.0	7.7	7.3
1800	10.7	10.3	9.9	9.7	9.0	8.2	7.9	7.5
1900	11.0	10.6	10.2	9.9	9.2	8.5	8.2	7.7
2000	11.3	10.9	10.5	10.2	9.5	8.7	8.4	7.9
2100	11.6	11.2	10.8	10.5	9.8	9.0	8.6	8.1
2200	11.9	11.4	11.0	10.7	10.0	9.2	8.8	8.3
2300	12.1	11.7	11.3	11.0	10.2	9.4	9.0	8.5
2400	12.4	12.0	11.5	11.2	10.5	9.6	9.2	8.7
2500	12.7	12.2	11.8	11.4	10.7	9.9	9.4	8.9
2600	12.9	12.5	12.0	11.7	10.9	10.1	9.6	9.1
2700	13.2	12.7	12.3	11.9	11.1	10.3	9.8	9.3
2800	13.5	13.0	12.5	12.1	11.3	10.5	10.0	9.4
2900	13.7	13.2	12.8	12.3	11.6	10.7	10.2	9.6
3000	14.0	13.5	13.0	12.5	11.8	10.9	10.4	9.8
3100	14.2	13.7	13.2	12.7	12.0	11.1	10.6	10.0
3200	14.4	13.9	13.4	13.0	12.2	11.3	10.8	10.1
3300	14.7	14.2	13.7	13.2	12.4	11.5	10.9	10.3
3400	14.9	14.4	13.9	13.4	12.6	11.6	11.1	10.5
3500	15.1	14.6	14.1	13.6	12.8	11.8	11.3	10.6
3600	15.4	14.8	14.3	13.7	12.9	12.0	11.4	10.8
3700	15.6	15.0	14.5	13.9	13.1	12.2	11.6	10.9
3800	15.8	15.3	14.7	14.1	13.3	12.4	11.8	11.1
3900	16.0	15.5	14.9	14.3	13.5	12.5	11.9	11.3
4000	16.3	15.7	15.1	14.5	13.7	12.7	12.1	11.4
4100	16.5	15.9	15.3	14.7	13.9	12.9	12.3	11.6
4200	16.7	16.1	15.5	14.9	14.0	13.0	12.4	11.7
4300	16.9	16.3	15.7	15.0	14.2	13.2	12.6	11.8
4400	17.1	16.5	15.9	15.2	14.4	13.4	12.7	12.0
4500	17.3	16.7	16.1	15.4	14.6	13.5	12.9	12.1
4600	17.5	16.9	16.3	15.6	14.7	13.7	13.0	12.3
4700	17.7	17.1	16.5	15.7	14.9	13.9	13.2	12.4
4800	17.9	17.3	16.7	15.9	15.1	14.0	13.3	12.6
4900	18.1	17.5	16.8	16.1	15.2	14.2	13.5	12.7
5000	18.3	17.6	17.0	16.2	15.4	14.3	13.6	12.8

24 inch to 72 inch PALMER-BOWLUS Flumes

Flow in GPM vs. Head Height in Inches

Flow	24"	27"	30"	36"	42"	48"	60"	72"
5200	18.7	18.0	17.4	16.6	15.7	14.6	13.9	13.1
5400	19.1	18.4	17.7	16.9	16.0	14.9	14.2	13.4
5600	19.4	18.7	18.1	17.2	16.3	15.2	14.5	13.6
5800	19.8	19.1	18.4	17.5	16.6	15.5	14.7	13.9
6000	20.1	19.4	18.7	17.8	16.9	15.8	15.0	14.1
6200	20.5	19.8	19.1	18.1	17.2	16.1	15.3	14.4
6400	20.8	20.1	19.4	18.4	17.5	16.4	15.5	14.6
6600	21.2	20.4	19.7	18.7	17.8	16.7	15.8	14.9
6800	21.5	20.7	20.0	19.0	18.1	16.9	16.0	15.1
7000	21.9	21.1	20.3	19.3	18.4	17.2	16.3	15.3
7200	22.2	21.4	20.6	19.5	18.6	17.5	16.5	15.6
7400	22.5	21.7	20.9	19.8	18.9	17.7	16.8	15.8
7600		22.0	21.2	20.1	19.2	18.0	17.0	16.0
7800		22.3	21.5	20.4	19.5	18.2	17.2	16.2
8000		22.6	21.8	20.6	19.7	18.5	17.5	16.5
8200		22.9	22.1	20.9	20.0	18.7	17.7	16.7
8400		23.2	22.4	21.1	20.2	19.0	17.9	16.9
8600		23.5	22.7	21.4	20.5	19.2	18.1	17.1
8800		23.8	23.0	21.6	20.7	19.5	18.4	17.3
9000		24.0	23.2	21.9	21.0	19.7	18.6	17.5
9200		24.3	23.5	22.1	21.2	19.9	18.8	17.7
9400		24.6	23.8	22.4	21.5	20.2	19.0	17.9
9600		24.9	24.0	22.6	21.7	20.4	19.2	18.1
9800		25.1	24.3	22.9	21.9	20.6	19.4	18.3
10000		25.4	24.6	23.1	22.2	20.9	19.7	18.5
10500			25.2	23.7	22.7	21.4	20.2	19.0
11000			25.8	24.2	23.3	22.0	20.7	19.5
11500			26.4	24.8	23.9	22.5	21.2	19.9
12000			27.0	25.3	24.4	23.0	21.6	20.4
12500			27.6	25.9	24.9	23.5	22.1	20.8
13000			28.2	26.4	25.5	24.0	22.6	21.3
13500				26.9	26.0	24.5	23.0	21.7
14000				27.4	26.5	25.0	23.5	22.1
14500				27.9	27.0	25.5	23.9	22.5
15000				28.4	27.4	26.0	24.4	22.9
15500				28.8	27.9	26.4	24.8	23.4
16000				29.3	28.4	26.9	25.2	23.7
16500				29.8	28.9	27.4	25.6	24.1
17000				30.2	29.3	27.8	26.0	24.5
17500				30.7	29.8	28.2	26.4	24.9
18000				31.1	30.2	28.7	26.8	25.3
18500				31.6	30.6	29.1	27.2	25.6
19000				32.0	31.1	29.5	27.6	26.0
19500				32.4	31.5	29.9	28.0	26.4
20000				32.8	31.9	30.4	28.4	26.7
21000				33.7	32.8	31.2	29.1	27.4
22000					33.6	32.0	29.8	28.1
23000					34.4	32.7	30.5	28.8
24000					35.1	33.5	31.2	29.4
25000					35.9	34.3	31.9	30.1
26000					36.7	35.0	32.6	30.7
27000					37.4	35.7	33.2	31.3
28000					38.1	36.4	33.9	31.9
29000					38.8	37.1	34.5	32.5
30000					39.5	37.8	35.1	33.1
31000						38.5	35.7	33.7
32000						39.2	36.4	34.3
33000						39.8	36.9	34.8
34000						40.5	37.5	35.4
35000						41.1	38.1	35.9

Table 4

24 inch to 72 inch PALMER-BOWLUS Flumes

Flow in GPM vs. Head Height in Inches

Flow	24"	27"	30"	36"	42"	48"	60"	72"
36000						41.7	38.7	36.5
37000						42.4	39.3	37.0
38000						43.0	39.8	37.5
39000						43.6	40.4	38.0
40000						44.2	40.9	38.6
41000						44.8	41.4	39.1
42000							42.0	39.6
43000							42.5	40.1
44000							43.0	40.6
45000							43.5	41.0
46000							44.0	41.5
47000							44.5	42.0
48000							45.0	42.5
49000							45.5	42.9
50000							46.0	43.4
52000							47.0	44.3
54000							47.9	45.2
56000							48.9	46.1
58000							49.8	46.9
60000							50.7	47.8
62000							51.6	48.6
64000							52.4	49.4
66000							53.3	50.3
68000							54.2	51.1
70000							55.0	51.8
72000							55.8	52.6
74000								53.4
76000								54.2
78000								54.9
80000								55.6
82000								56.4
84000								57.1
86000								57.8
88000								58.5
90000								59.2
92000								59.9
94000								60.6
96000								61.3
98000								61.9
100000								62.6
102000								63.3
104000								63.9
106000								64.6
108000								65.2
110000								65.9
112000								66.5
114000								67.1
116000								67.7

Table 5

6 inch to 24 inch LEOPOLD-LAGCO^{tm} Flumes

Flow in GPM vs. Head Height in Inches

Flow	6"	8"	10"	12"	15"	18"	21"	24"
10	.9	.7	.7	.6	.5	.5	.4	.4
20	1.4	1.2	1.0	.9	.8	.7	.6	.6
30	1.8	1.5	1.3	1.2	1.0	.9	.8	.8
40	2.2	1.8	1.6	1.4	1.2	1.1	1.0	.9
50	2.5	2.1	1.8	1.6	1.4	1.3	1.2	1.1
60	2.8	2.4	2.1	1.9	1.6	1.4	1.3	1.2
70	3.1	2.6	2.3	2.0	1.8	1.6	1.4	1.3
80	3.4	2.9	2.5	2.2	1.9	1.7	1.6	1.5
90	3.7	3.1	2.7	2.4	2.1	1.9	1.7	1.6
100	3.9	3.3	2.9	2.6	2.2	2.0	1.8	1.7
115	4.3	3.6	3.2	2.8	2.5	2.2	2.0	1.8
130	4.7	3.9	3.4	3.1	2.7	2.4	2.2	2.0
145	5.0	4.2	3.7	3.3	2.9	2.6	2.3	2.1
160	5.4	4.5	3.9	3.5	3.0	2.7	2.5	2.3
175	5.7	4.7	4.1	3.7	3.2	2.9	2.6	2.4
190	6.0	5.0	4.4	3.9	3.4	3.0	2.8	2.5
205		5.3	4.6	4.1	3.6	3.2	2.9	2.7
220		5.5	4.8	4.3	3.7	3.3	3.0	2.8
235		5.7	5.0	4.5	3.9	3.5	3.2	2.9
250		6.0	5.2	4.7	4.1	3.6	3.3	3.0
275		6.4	5.5	5.0	4.3	3.9	3.5	3.2
300		6.7	5.9	5.2	4.6	4.1	3.7	3.4
325			6.2	5.5	4.8	4.3	3.9	3.6
350			6.5	5.8	5.0	4.5	4.1	3.8
375			6.8	6.1	5.3	4.7	4.3	4.0
400			7.1	6.3	5.5	4.9	4.5	4.1
425			7.3	6.6	5.7	5.1	4.7	4.3
450			7.6	6.8	5.9	5.3	4.8	4.4
475			7.9	7.1	6.1	5.5	5.0	4.6
500			8.2	7.3	6.4	5.7	5.2	4.8
525			8.4	7.5	6.6	5.9	5.3	4.9
550				7.8	6.8	6.0	5.5	5.1
575				8.0	7.0	6.2	5.7	5.2
600				8.2	7.2	6.4	5.8	5.4
625				8.4	7.3	6.6	6.0	5.5
650				8.6	7.5	6.7	6.1	5.6
675				8.9	7.7	6.9	6.3	5.8
700				9.1	7.9	7.1	6.4	5.9
725				9.3	8.1	7.2	6.6	6.1
750				9.5	8.3	7.4	6.7	6.2
800				9.9	8.6	7.7	7.0	6.4
850				10.3	9.0	8.0	7.3	6.7
900					9.3	8.3	7.6	7.0
950					9.6	8.6	7.8	7.2
1000					9.9	8.9	8.1	7.4
1050					10.3	9.2	8.3	7.7
1100					10.6	9.5	8.6	7.9
1150					10.9	9.7	8.9	8.2
1200					11.2	10.0	9.1	8.4
1250					11.5	10.3	9.3	8.6
1300					11.8	10.5	9.6	8.8
1350					12.1	10.8	9.8	9.0
1400					12.4	11.1	10.1	9.3
1450						11.3	10.3	9.5
1500						11.6	10.5	9.7
1550						11.8	10.7	9.9
1600						12.0	11.0	10.1
1650						12.3	11.2	10.3
1700						12.5	11.4	10.5
1750						12.8	11.6	10.7

6 inch to 24 inch LEOPOLD-LAGCO^{tm} Flumes

Flow in GPM vs. Head Height in Inches

Flow	6"	8"	10"	12"	15"	18"	21"	24"
1800						13.0	11.8	10.9
1850						13.2	12.0	11.1
1900						13.5	12.2	11.3
1950						13.7	12.5	11.5
2000						13.9	12.7	11.7
2050						14.1	12.9	11.8
2100						14.4	13.1	12.0
2150							13.3	12.2
2200							13.5	12.4
2250							13.7	12.6
2300							13.9	12.8
2350							14.0	12.9
2400							14.2	13.1
2450							14.4	13.3
2500							14.6	13.5
2600							15.0	13.8
2700							15.4	14.2
2800							15.7	14.5
2900							16.1	14.8
3000							16.5	15.2
3100							16.8	15.5
3200							17.2	15.8
3300							17.5	16.1
3400							17.8	16.4
3500							18.2	16.7
3600							18.5	17.0
3700							18.8	17.4
3800							19.2	17.7
3900							19.5	18.0
4000							19.8	18.2
4100							20.1	18.5
4200							20.4	18.8
4300							20.8	19.1

Table 6

30 inch to 72 inch LEOPOLD-LAGCO^{tm} Flumes

Flow in GPM vs. Head Height in Inches

Flow	30"	36"	42"	48"	54"	60"	66"	72"
50	.9	.8	.8	.7	.7	.6	.6	.5
100	1.5	1.3	1.2	1.1	1.0	1.0	.9	.9
150	1.9	1.7	1.5	1.4	1.3	1.2	1.2	1.1
200	2.3	2.0	1.9	1.7	1.6	1.5	1.4	1.3
250	2.6	2.4	2.2	2.0	1.8	1.7	1.6	1.5
300	3.0	2.7	2.4	2.2	2.1	1.9	1.8	1.7
350	3.3	2.9	2.7	2.5	2.3	2.1	2.0	1.9
400	3.6	3.2	2.9	2.7	2.5	2.3	2.2	2.1
450	3.9	3.5	3.1	2.9	2.7	2.5	2.4	2.3
500	4.1	3.7	3.4	3.1	2.9	2.7	2.6	2.4
550	4.4	3.9	3.6	3.3	3.1	2.9	2.7	2.6
600	4.7	4.2	3.8	3.5	3.2	3.0	2.9	2.7
650	4.9	4.4	4.0	3.7	3.4	3.2	3.0	2.9
700	5.2	4.6	4.2	3.9	3.6	3.4	3.2	3.0
750	5.4	4.8	4.4	4.0	3.8	3.5	3.3	3.1
800	5.6	5.0	4.6	4.2	3.9	3.7	3.5	3.3
850	5.8	5.2	4.8	4.4	4.1	3.8	3.6	3.4
900	6.1	5.4	4.9	4.5	4.2	4.0	3.7	3.5
950	6.3	5.6	5.1	4.7	4.4	4.1	3.9	3.7
1000	6.5	5.8	5.3	4.9	4.5	4.2	4.0	3.8
1100	6.9	6.2	5.6	5.2	4.8	4.5	4.2	4.0
1200	7.3	6.5	5.9	5.5	5.1	4.8	4.5	4.3
1300	7.7	6.9	6.3	5.8	5.4	5.0	4.7	4.5
1400	8.1	7.2	6.6	6.0	5.6	5.3	5.0	4.7
1500	8.4	7.5	6.9	6.3	5.9	5.5	5.2	4.9
1600	8.8	7.9	7.1	6.6	6.1	5.7	5.4	5.1
1700	9.1	8.2	7.4	6.8	6.4	6.0	5.6	5.3
1800	9.5	8.5	7.7	7.1	6.6	6.2	5.8	5.5
1900	9.8	8.8	8.0	7.4	6.8	6.4	6.0	5.7
2000	10.2	9.1	8.3	7.6	7.1	6.6	6.3	5.9
2100	10.5	9.4	8.5	7.9	7.3	6.8	6.5	6.1
2200	10.8	9.7	8.8	8.1	7.5	7.1	6.6	6.3
2300	11.1	9.9	9.0	8.3	7.7	7.3	6.8	6.5
2400	11.4	10.2	9.3	8.6	8.0	7.5	7.0	6.7
2500	11.7	10.5	9.5	8.8	8.2	7.7	7.2	6.8
2600	12.0	10.8	9.8	9.0	8.4	7.9	7.4	7.0
2700	12.3	11.0	10.0	9.2	8.6	8.0	7.6	7.2
2800	12.6	11.3	10.3	9.5	8.8	8.2	7.8	7.4
2900	12.9	11.5	10.5	9.7	9.0	8.4	7.9	7.5
3000	13.2	11.8	10.7	9.9	9.2	8.6	8.1	7.7
3100	13.5	12.1	11.0	10.1	9.4	8.8	8.3	7.9
3200	13.8	12.3	11.2	10.3	9.6	9.0	8.5	8.0
3300	14.0	12.6	11.4	10.5	9.8	9.2	8.6	8.2
3400	14.3	12.8	11.6	10.7	10.0	9.3	8.8	8.3
3500	14.6	13.0	11.9	10.9	10.2	9.5	9.0	8.5
3600	14.9	13.3	12.1	11.1	10.3	9.7	9.1	8.7
3700	15.1	13.5	12.3	11.3	10.5	9.9	9.3	8.8
3800	15.4	13.8	12.5	11.5	10.7	10.0	9.5	9.0
3900	15.6	14.0	12.7	11.7	10.9	10.2	9.6	9.1
4000	15.9	14.2	12.9	11.9	11.1	10.4	9.8	9.3
4100	16.2	14.4	13.1	12.1	11.3	10.5	9.9	9.4
4200	16.4	14.7	13.3	12.3	11.4	10.7	10.1	9.6
4300	16.7	14.9	13.5	12.5	11.6	10.9	10.3	9.7
4400	16.9	15.1	13.7	12.7	11.8	11.0	10.4	9.9
4500	17.2	15.3	14.0	12.8	11.9	11.2	10.6	10.0
4600	17.4	15.6	14.1	13.0	12.1	11.4	10.7	10.2
4700	17.7	15.8	14.3	13.2	12.3	11.5	10.9	10.3
4800	17.9	16.0	14.5	13.4	12.5	11.7	11.0	10.4
4900	18.1	16.2	14.7	13.6	12.6	11.8	11.2	10.6
5000	18.4	16.4	14.9	13.8	12.8	12.0	11.3	10.7

30 inch to 72 inch LEOPOLD-LAGCO^{tm} Flumes

Flow in GPM vs. Head Height in Inches

Flow	30"	36"	42"	48"	54"	60"	66"	72"
5200	18.8	16.8	15.3	14.1	13.1	12.3	11.6	11.0
5400	19.3	17.3	15.7	14.5	13.4	12.6	11.9	11.3
5600	19.8	17.7	16.1	14.8	13.8	12.9	12.2	11.5
5800	20.2	18.1	16.4	15.1	14.1	13.2	12.4	11.8
6000	20.7	18.5	16.8	15.5	14.4	13.5	12.7	12.1
6200	21.1	18.9	17.2	15.8	14.7	13.8	13.0	12.3
6400	21.6	19.3	17.5	16.1	15.0	14.1	13.3	12.6
6600	22.0	19.6	17.9	16.5	15.3	14.3	13.5	12.8
6800	22.4	20.0	18.2	16.8	15.6	14.6	13.8	13.1
7000	22.8	20.4	18.6	17.1	15.9	14.9	14.1	13.3
7200	23.3	20.8	18.9	17.4	16.2	15.2	14.3	13.6
7400	23.7	21.2	19.2	17.7	16.5	15.4	14.6	13.8
7600		21.5	19.6	18.0	16.8	15.7	14.8	14.0
7800		21.9	19.9	18.3	17.1	16.0	15.1	14.3
8000		22.3	20.2	18.6	17.3	16.2	15.3	14.5
8200		22.6	20.6	18.9	17.6	16.5	15.6	14.8
8400		23.0	20.9	19.2	17.9	16.8	15.8	15.0
8600		23.3	21.2	19.5	18.2	17.0	16.1	15.2
8800		23.7	21.5	19.8	18.4	17.3	16.3	15.4
9000		24.0	21.8	20.1	18.7	17.5	16.5	15.7
9200		24.4	22.1	20.4	19.0	17.8	16.8	15.9
9400		24.7	22.5	20.7	19.2	18.0	17.0	16.1
9600		25.0	22.8	21.0	19.5	18.3	17.2	16.3
9800		25.4	23.1	21.2	19.8	18.5	17.5	16.6
10000		25.7	23.4	21.5	20.0	18.8	17.7	16.8
10500		26.5	24.1	22.2	20.7	19.4	18.3	17.3
11000		27.3	24.9	22.9	21.3	20.0	18.8	17.8
11500			25.6	23.6	21.9	20.5	19.4	18.4
12000			26.3	24.2	22.5	21.1	19.9	18.9
12500			27.0	24.9	23.1	21.7	20.4	19.4
13000			27.7	25.5	23.7	22.2	21.0	19.9
13500			28.4	26.1	24.3	22.8	21.5	20.4
14000			29.1	26.8	24.9	23.3	22.0	20.8
14500			29.7	27.4	25.5	23.9	22.5	21.3
15000			30.4	28.0	26.0	24.4	23.0	21.8
15500			31.0	28.6	26.6	24.9	23.5	22.3
16000				29.2	27.1	25.4	24.0	22.7
16500				29.8	27.7	25.9	24.5	23.2
17000				30.3	28.2	26.4	24.9	23.6
17500				30.9	28.7	26.9	25.4	24.1
18000				31.5	29.3	27.4	25.9	24.5
18500				32.0	29.8	27.9	26.3	25.0
19000				32.6	30.3	28.4	26.8	25.4
19500				33.2	30.8	28.9	27.2	25.8
20000				33.7	31.3	29.4	27.7	26.3
20500				34.2	31.8	29.8	28.1	26.7
21000				34.8	32.3	30.3	28.6	27.1
21500				35.3	32.8	30.8	29.0	27.5
22000				35.8	33.3	31.2	29.5	27.9
22500					33.8	31.7	29.9	28.3
23000					34.3	32.1	30.3	28.7
23500					34.8	32.6	30.7	29.1
24000					35.3	33.0	31.2	29.5
24500					35.7	33.5	31.6	29.9
25000					36.2	33.9	32.0	30.3
25500					36.7	34.4	32.4	30.7
26000					37.1	34.8	32.8	31.1
26500					37.6	35.2	33.2	31.5
27000					38.0	35.7	33.6	31.9
27500					38.5	36.1	34.0	32.3

30 inch to 72 inch LEOPOLD-LAGCO^{tm} Flumes

Flow in GPM vs. Head Height in Inches

Flow	30"	36"	42"	48"	54"	60"	66"	72"
28000					39.0	36.5	34.4	32.6
28500					39.4	36.9	34.8	33.0
29000						37.3	35.2	33.4
29500						37.8	35.6	33.7
30000						38.2	36.0	34.1
30500						38.6	36.4	34.5
31000						39.0	36.8	34.8
31500						39.4	37.1	35.2
32000						39.8	37.5	35.6
32500						40.2	37.9	35.9
33000						40.6	38.3	36.3
33500						41.0	38.7	36.6
34000						41.4	39.0	37.0
34500						41.8	39.4	37.3
35000						42.2	39.8	37.7
35500						42.6	40.1	38.0
36000						42.9	40.5	38.4
36500						43.3	40.9	38.7
37000						43.7	41.2	39.1
37500						44.1	41.6	39.4
38000						44.5	41.9	39.7
38500						44.9	42.3	40.1
39000						45.2	42.6	40.4
39500						45.6	43.0	40.8
40000							43.4	41.1
41000							44.0	41.7
42000							44.7	42.4
43000							45.4	43.1
44000							46.1	43.7
45000							46.8	44.3
46000							47.4	45.0
47000							48.1	45.6
48000							48.8	46.2
49000							49.4	46.8
50000							50.1	47.5
51000							50.7	48.1
52000							51.4	48.7
53000								49.3
54000								49.9
55000								50.5
56000								51.1
57000								51.7
58000								52.2
59000								52.8
60000								53.4
61000								54.0

Table 7

1 ft to 5 ft RECTANGULAR Weirs with End Contractions

Flow in GPM vs. Head Height in Inches

Flow	1'	1.5'	2'	3'	4'	5'
100	2.0	1.5	1.3	1.0	.8	.7
200	3.3	2.4	2.0	1.5	1.2	1.1
300	4.3	3.2	2.6	2.0	1.6	1.4
400	5.3	3.9	3.2	2.4	2.0	1.7
500	6.2	4.6	3.7	2.8	2.3	2.0
600	7.1	5.2	4.2	3.2	2.6	2.2
700	7.9	5.8	4.7	3.5	2.9	2.5
800	8.8	6.3	5.1	3.9	3.2	2.7
900	9.6	6.9	5.6	4.2	3.4	2.9
1000	10.4	7.4	6.0	4.5	3.7	3.2
1100	11.2	7.9	6.4	4.8	3.9	3.4
1200	12.0	8.4	6.8	5.1	4.2	3.6
1300	12.8	8.9	7.2	5.4	4.4	3.8
1400	13.6	9.4	7.6	5.6	4.6	4.0
1500	14.4	9.9	7.9	5.9	4.8	4.1
1600	15.3	10.4	8.3	6.2	5.1	4.3
1700	16.1	10.9	8.7	6.4	5.3	4.5
1800	16.9	11.3	9.0	6.7	5.5	4.7
1900	17.8	11.8	9.4	6.9	5.7	4.9
2000	18.7	12.2	9.7	7.2	5.9	5.0
2100	19.6	12.7	10.0	7.4	6.1	5.2
2200	20.5	13.2	10.4	7.7	6.3	5.4
2300	21.5	13.6	10.7	7.9	6.5	5.5
2400	22.5	14.1	11.0	8.2	6.6	5.7
2500	23.6	14.5	11.4	8.4	6.8	5.9
2600	24.7	14.9	11.7	8.6	7.0	6.0
2700	25.9	15.4	12.0	8.8	7.2	6.2
2800	27.3	15.8	12.3	9.1	7.4	6.3
2900	28.9	16.3	12.7	9.3	7.6	6.5
3000	30.9	16.7	13.0	9.5	7.7	6.6
3200		17.6	13.6	9.9	8.1	6.9
3400		18.4	14.2	10.4	8.4	7.2
3600		19.3	14.8	10.8	8.8	7.5
3800		20.2	15.4	11.2	9.1	7.8
4000		21.1	16.0	11.6	9.4	8.0
4200		22.0	16.6	12.0	9.7	8.3
4400		22.8	17.2	12.4	10.1	8.6
4600		23.7	17.8	12.8	10.4	8.9
4800		24.7	18.4	13.2	10.7	9.1
5000		25.6	18.9	13.6	11.0	9.4
5200		26.5	19.5	14.0	11.3	9.6
5400		27.5	20.1	14.3	11.6	9.9
5600		28.4	20.7	14.7	11.9	10.1
5800		29.4	21.2	15.1	12.2	10.4
6000		30.4	21.8	15.5	12.5	10.6
6200		31.5	22.4	15.8	12.7	10.8
6400		32.5	22.9	16.2	13.0	11.1
6600		33.7	23.5	16.5	13.3	11.3
6800		34.8	24.1	16.9	13.6	11.6
7000		36.0	24.6	17.3	13.9	11.8
7200		37.3	25.2	17.6	14.1	12.0
7400		38.6	25.8	18.0	14.4	12.2
7600		40.1	26.3	18.3	14.7	12.5
7800		41.7	26.9	18.7	14.9	12.7
8000		43.5	27.5	19.0	15.2	12.9
8200		45.6	28.1	19.3	15.5	13.1
8400		48.3	28.6	19.7	15.7	13.4
8600			29.2	20.0	16.0	13.6
8800			29.8	20.4	16.3	13.8
9000			30.4	20.7	16.5	14.0

1 ft to 5 ft RECTANGULAR Weirs with End Contractions

Flow in GPM vs. Head Height in Inches

Flow	1'	1.5'	2'	3'	4'	5'
9200			31.0	21.0	16.8	14.2
9400			31.5	21.4	17.0	14.4
9600			32.1	21.7	17.3	14.6
9800			32.7	22.0	17.5	14.9
10000			33.3	22.4	17.8	15.1
10200			33.9	22.7	18.0	15.3
10400			34.5	23.0	18.3	15.5
10600			35.1	23.3	18.5	15.7
10800			35.7	23.7	18.8	15.9
11000			36.4	24.0	19.0	16.1
11200			37.0	24.3	19.3	16.3
11400			37.6	24.6	19.5	16.5
11600			38.2	25.0	19.8	16.7
11800			38.9	25.3	20.0	16.9
12000			39.5	25.6	20.2	17.1
12200			40.2	25.9	20.5	17.3
12400			40.9	26.2	20.7	17.5
12600			41.5	26.6	20.9	17.7
12800			42.2	26.9	21.2	17.9
13000			42.9	27.2	21.4	18.1
13200			43.6	27.5	21.7	18.3
13400			44.3	27.8	21.9	18.5
13600			45.1	28.1	22.1	18.7
13800			45.8	28.5	22.4	18.8
14000			46.6	28.8	22.6	19.0
14200			47.3	29.1	22.8	19.2
14400			48.1	29.4	23.0	19.4
14600			49.0	29.7	23.3	19.6
14800			49.8	30.0	23.5	19.8
15000			50.7	30.3	23.7	20.0
15500			52.9	31.1	24.3	20.4
16000			55.5	31.9	24.9	20.9
16500			58.4	32.7	25.4	21.4
17000				33.4	26.0	21.8
17500				34.2	26.5	22.3
18000				35.0	27.1	22.7
18500				35.7	27.6	23.1
19000				36.5	28.2	23.6
19500				37.3	28.7	24.0
20000				38.1	29.2	24.5
20500				38.8	29.8	24.9
21000				39.6	30.3	25.3
21500				40.4	30.8	25.7
22000				41.2	31.4	26.2
22500				41.9	31.9	26.6
23000				42.7	32.4	27.0
23500				43.5	33.0	27.4
24000				44.3	33.5	27.9
24500				45.1	34.0	28.3
25000				45.9	34.5	28.7
25500				46.7	35.0	29.1
26000				47.5	35.5	29.5
26500				48.3	36.1	29.9
27000				49.1	36.6	30.3
27500				49.9	37.1	30.7
28000				50.7	37.6	31.1
28500				51.5	38.1	31.5
29000				52.3	38.6	31.9
29500				53.2	39.1	32.3
30000				54.0	39.6	32.7

Table 7

1 ft to 5 ft RECTANGULAR Weirs with End Contractions

Flow in GPM vs. Head Height in Inches

Flow	1'	1.5'	2'	3'	4'	5'
30500				54.8	40.1	33.1
31000				55.7	40.7	33.5
31500				56.6	41.2	33.9
32000				57.4	41.7	34.3
32500				58.3	42.2	34.7
33000				59.2	42.7	35.1
33500				60.1	43.2	35.4
34000				61.0	43.7	35.8
34500					44.2	36.2
35000					44.7	36.6
35500					45.2	37.0
36000					45.7	37.4
36500					46.2	37.8
37000					46.7	38.1
37500					47.2	38.5
38000					47.7	38.9
38500					48.2	39.3
39000					48.7	39.6
39500					49.2	40.0
40000					49.7	40.4
41000					50.7	41.2
42000					51.7	41.9
43000					52.7	42.6
44000					53.7	43.4
45000					54.7	44.1
46000					55.7	44.9
47000					56.7	45.6
48000					57.8	46.3
49000					58.8	47.1
50000					59.8	47.8
51000					60.8	48.5
52000						49.3
53000						50.0
54000						50.7
55000						51.4
56000						52.1
57000						52.9
58000						53.6
59000						54.3
60000						55.0
61000						55.7
62000						56.5
63000						57.2
64000						57.9
65000						58.6
66000						59.3
67000						60.1
68000						60.8

Table 8

6 ft to 10 ft RECTANGULAR Weirs with End Contractions

Flow	Flow in GPM vs. Head Height in Inches 6'	7'	8'	9'	10'
100	.6	.5	.5	.5	.4
200	1.0	.9	.8	.7	.7
300	1.2	1.1	1.0	1.0	.9
400	1.5	1.4	1.2	1.2	1.1
500	1.8	1.6	1.4	1.3	1.2
600	2.0	1.8	1.6	1.5	1.4
700	2.2	2.0	1.8	1.7	1.6
800	2.4	2.2	2.0	1.8	1.7
900	2.6	2.3	2.1	2.0	1.8
1000	2.8	2.5	2.3	2.1	2.0
1100	3.0	2.7	2.5	2.3	2.1
1200	3.2	2.8	2.6	2.4	2.2
1300	3.3	3.0	2.7	2.5	2.4
1400	3.5	3.2	2.9	2.7	2.5
1500	3.7	3.3	3.0	2.8	2.6
1600	3.8	3.4	3.2	2.9	2.7
1700	4.0	3.6	3.3	3.0	2.8
1800	4.1	3.7	3.4	3.1	2.9
1900	4.3	3.9	3.5	3.3	3.0
2000	4.4	4.0	3.7	3.4	3.1
2100	4.6	4.1	3.8	3.5	3.3
2200	4.7	4.3	3.9	3.6	3.4
2300	4.9	4.4	4.0	3.7	3.5
2400	5.0	4.5	4.1	3.8	3.6
2500	5.2	4.7	4.2	3.9	3.7
2600	5.3	4.8	4.4	4.0	3.8
2700	5.4	4.9	4.5	4.1	3.8
2800	5.6	5.0	4.6	4.2	3.9
2900	5.7	5.1	4.7	4.3	4.0
3000	5.8	5.3	4.8	4.4	4.1
3200	6.1	5.5	5.0	4.6	4.3
3400	6.4	5.7	5.2	4.8	4.5
3600	6.6	5.9	5.4	5.0	4.7
3800	6.9	6.2	5.6	5.2	4.8
4000	7.1	6.4	5.8	5.4	5.0
4200	7.3	6.6	6.0	5.6	5.2
4400	7.6	6.8	6.2	5.7	5.3
4600	7.8	7.0	6.4	5.9	5.5
4800	8.0	7.2	6.6	6.1	5.7
5000	8.2	7.4	6.8	6.2	5.8
5200	8.5	7.6	6.9	6.4	6.0
5400	8.7	7.8	7.1	6.6	6.1
5600	8.9	8.0	7.3	6.7	6.3
5800	9.1	8.2	7.5	6.9	6.4
6000	9.3	8.4	7.7	7.1	6.6
6200	9.5	8.6	7.8	7.2	6.7
6400	9.8	8.8	8.0	7.4	6.9
6600	10.0	8.9	8.2	7.5	7.0
6800	10.2	9.1	8.3	7.7	7.1
7000	10.4	9.3	8.5	7.8	7.3
7200	10.6	9.5	8.7	8.0	7.4
7400	10.8	9.7	8.8	8.1	7.6
7600	11.0	9.8	9.0	8.3	7.7
7800	11.2	10.0	9.1	8.4	7.8
8000	11.4	10.2	9.3	8.6	8.0
8200	11.5	10.4	9.4	8.7	8.1
8400	11.7	10.5	9.6	8.9	8.2
8600	11.9	10.7	9.8	9.0	8.4
8800	12.1	10.9	9.9	9.1	8.5
9000	12.3	11.0	10.1	9.3	8.6

6 ft to 10 ft RECTANGULAR Weirs with End Contractions

Flow	Flow in GPM vs. Head Height in Inches 6'	7'	8'	9'	10'
9200	12.5	11.2	10.2	9.4	8.8
9400	12.7	11.4	10.4	9.6	8.9
9600	12.9	11.5	10.5	9.7	9.0
9800	13.0	11.7	10.7	9.8	9.1
10000	13.2	11.9	10.8	10.0	9.3
10200	13.4	12.0	11.0	10.1	9.4
10400	13.6	12.2	11.1	10.2	9.5
10600	13.8	12.3	11.2	10.4	9.6
10800	13.9	12.5	11.4	10.5	9.8
11000	14.1	12.7	11.5	10.6	9.9
11200	14.3	12.8	11.7	10.8	10.0
11400	14.5	13.0	11.8	10.9	10.1
11600	14.6	13.1	11.9	11.0	10.2
11800	14.8	13.3	12.1	11.1	10.4
12000	15.0	13.4	12.2	11.3	10.5
12200	15.1	13.6	12.4	11.4	10.6
12400	15.3	13.7	12.5	11.5	10.7
12600	15.5	13.9	12.6	11.6	10.8
12800	15.7	14.0	12.8	11.8	10.9
13000	15.8	14.2	12.9	11.9	11.1
13200	16.0	14.3	13.0	12.0	11.2
13400	16.2	14.5	13.2	12.1	11.3
13600	16.3	14.6	13.3	12.3	11.4
13800	16.5	14.8	13.4	12.4	11.5
14000	16.7	14.9	13.6	12.5	11.6
14200	16.8	15.1	13.7	12.6	11.7
14400	17.0	15.2	13.8	12.7	11.9
14600	17.1	15.3	14.0	12.9	12.0
14800	17.3	15.5	14.1	13.0	12.1
15000	17.5	15.6	14.2	13.1	12.2
15500	17.9	16.0	14.6	13.4	12.5
16000	18.3	16.3	14.9	13.7	12.7
16500	18.7	16.7	15.2	14.0	13.0
17000	19.0	17.0	15.5	14.3	13.3
17500	19.4	17.4	15.8	14.6	13.5
18000	19.8	17.7	16.1	14.8	13.8
18500	20.2	18.1	16.4	15.1	14.0
19000	20.6	18.4	16.7	15.4	14.3
19500	20.9	18.7	17.0	15.7	14.6
20000	21.3	19.0	17.3	15.9	14.8
20500	21.7	19.4	17.6	16.2	15.1
21000	22.1	19.7	17.9	16.5	15.3
21500	22.4	20.0	18.2	16.7	15.5
22000	22.8	20.3	18.5	17.0	15.8
22500	23.1	20.7	18.8	17.3	16.0
23000	23.5	21.0	19.1	17.5	16.3
23500	23.9	21.3	19.3	17.8	16.5
24000	24.2	21.6	19.6	18.0	16.8
24500	24.6	21.9	19.9	18.3	17.0
25000	24.9	22.2	20.2	18.6	17.2
25500	25.3	22.5	20.5	18.8	17.5
26000	25.6	22.8	20.7	19.1	17.7
26500	26.0	23.1	21.0	19.3	17.9
27000	26.3	23.4	21.3	19.6	18.2
27500	26.6	23.7	21.5	19.8	18.4
28000	27.0	24.0	21.8	20.0	18.6
28500	27.3	24.3	22.1	20.3	18.8
29000	27.7	24.6	22.3	20.5	19.1
29500	28.0	24.9	22.6	20.8	19.3
30000	28.3	25.2	22.9	21.0	19.5

Table 8

6 ft to 10 ft RECTANGULAR Weirs with End Contractions

Flow	Flow in GPM vs. Head Height in Inches 6'	7'	8'	9'	10'
30500	28.7	25.5	23.1	21.3	19.7
31000	29.0	25.8	23.4	21.5	19.9
31500	29.3	26.1	23.7	21.7	20.2
32000	29.6	26.4	23.9	22.0	20.4
32500	30.0	26.7	24.2	22.2	20.6
33000	30.3	27.0	24.4	22.4	20.8
33500	30.6	27.2	24.7	22.7	21.0
34000	31.0	27.5	24.9	22.9	21.2
34500	31.3	27.8	25.2	23.1	21.5
35000	31.6	28.1	25.4	23.4	21.7
35500	31.9	28.4	25.7	23.6	21.9
36000	32.2	28.6	25.9	23.8	22.1
36500	32.6	28.9	26.2	24.0	22.3
37000	32.9	29.2	26.4	24.3	22.5
37500	33.2	29.5	26.7	24.5	22.7
38000	33.5	29.8	26.9	24.7	22.9
38500	33.8	30.0	27.2	24.9	23.1
39000	34.1	30.3	27.4	25.2	23.3
39500	34.5	30.6	27.7	25.4	23.5
40000	34.8	30.8	27.9	25.6	23.7
41000	35.4	31.4	28.4	26.1	24.1
42000	36.0	31.9	28.9	26.5	24.6
43000	36.6	32.5	29.4	26.9	25.0
44000	37.2	33.0	29.8	27.4	25.3
45000	37.8	33.5	30.3	27.8	25.7
46000	38.5	34.0	30.8	28.2	26.1
47000	39.1	34.6	31.2	28.6	26.5
48000	39.7	35.1	31.7	29.0	26.9
49000	40.3	35.6	32.2	29.5	27.3
50000	40.9	36.1	32.6	29.9	27.7
51000	41.4	36.6	33.1	30.3	28.1
52000	42.0	37.1	33.5	30.7	28.4
53000	42.6	37.7	34.0	31.1	28.8
54000	43.2	38.2	34.4	31.5	29.2
55000	43.8	38.7	34.9	31.9	29.6
56000	44.4	39.2	35.3	32.3	29.9
57000	45.0	39.7	35.8	32.7	30.3
58000	45.5	40.2	36.2	33.1	30.7
59000	46.1	40.7	36.6	33.5	31.0
60000	46.7	41.1	37.1	33.9	31.4
61000	47.3	41.6	37.5	34.3	31.8
62000	47.9	42.1	37.9	34.7	32.1
63000	48.4	42.6	38.4	35.1	32.5
64000	49.0	43.1	38.8	35.5	32.8
65000	49.6	43.6	39.2	35.9	33.2
66000	50.1	44.1	39.7	36.3	33.5
67000	50.7	44.6	40.1	36.6	33.9
68000	51.3	45.0	40.5	37.0	34.2
69000	51.8	45.5	40.9	37.4	34.6
70000	52.4	46.0	41.4	37.8	34.9
71000	53.0	46.5	41.8	38.2	35.3
72000	53.5	46.9	42.2	38.5	35.6
73000	54.1	47.4	42.6	38.9	36.0
74000	54.6	47.9	43.0	39.3	36.3
75000	55.2	48.4	43.4	39.7	36.7
76000	55.8	48.8	43.9	40.0	37.0
77000	56.3	49.3	44.3	40.4	37.3
78000	56.9	49.8	44.7	40.8	37.7
79000	57.4	50.2	45.1	41.1	38.0
80000	58.0	50.7	45.5	41.5	38.3

6 ft to 10 ft RECTANGULAR Weirs with End Contractions

Flow	Flow in GPM vs. Head Height in Inches 6'	7'	8'	9'	10'
81000	58.5	51.2	45.9	41.9	38.7
82000	59.1	51.6	46.3	42.2	39.0
83000	59.6	52.1	46.7	42.6	39.3
84000	60.2	52.6	47.1	43.0	39.7
85000	60.7	53.0	47.5	43.3	40.0
86000		53.5	47.9	43.7	40.3
87000		53.9	48.3	44.1	40.7
88000		54.4	48.7	44.4	41.0
89000		54.9	49.1	44.8	41.3
90000		55.3	49.5	45.1	41.6
91000		55.8	49.9	45.5	42.0
92000		56.2	50.3	45.8	42.3
93000		56.7	50.7	46.2	42.6
94000		57.1	51.1	46.5	42.9
95000		57.6	51.5	46.9	43.2
96000		58.0	51.9	47.2	43.6
97000		58.5	52.3	47.6	43.9
98000		58.9	52.7	47.9	44.2
99000		59.4	53.1	48.3	44.5
00000		59.8	53.4	48.6	44.8
02000		60.7	54.2	49.3	45.5
04000			55.0	50.0	46.1
06000			55.8	50.7	46.7
08000			56.5	51.4	47.3
10000			57.3	52.1	48.0
12000			58.1	52.7	48.6
14000			58.8	53.4	49.2
16000			59.6	54.1	49.8
18000			60.3	54.8	50.4
20000				55.4	51.0
22000				56.1	51.6
24000				56.8	52.2
26000				57.4	52.8
28000				58.1	53.4
30000				58.7	54.0
35000				60.4	55.5
40000					56.9
45000					58.4
50000					59.8

Table 9

22.5° to 120° TRIANGULAR or V-NOTCH Wiers with End Contractions

Flow	Flow in GPM vs. Head Height in Inches					
	22.5°	30°	45°	60°	90°	120°
5	2.6	2.3	1.9	1.7	1.3	1.1
10	3.4	3.0	2.5	2.2	1.8	1.4
15	4.0	3.6	3.0	2.6	2.1	1.7
20	4.5	4.0	3.3	2.9	2.3	1.9
25	4.9	4.4	3.7	3.2	2.6	2.1
30	5.3	4.7	3.9	3.5	2.8	2.2
35	5.6	5.0	4.2	3.7	2.9	2.4
40	6.0	5.3	4.4	3.9	3.1	2.5
45	6.3	5.5	4.7	4.1	3.3	2.6
50	6.5	5.8	4.9	4.2	3.4	2.7
60	7.0	6.2	5.2	4.6	3.7	2.9
70	7.5	6.6	5.6	4.9	3.9	3.1
80	7.9	7.0	5.9	5.1	4.1	3.3
90	8.3	7.3	6.2	5.4	4.3	3.5
100	8.6	7.7	6.4	5.6	4.5	3.6
115	9.1	8.1	6.8	5.9	4.8	3.8
130	9.6	8.5	7.1	6.3	5.0	4.0
145	10.0	8.9	7.5	6.5	5.2	4.2
160	10.5	9.3	7.8	6.8	5.4	4.4
175	10.8	9.6	8.1	7.1	5.7	4.5
190	11.2	9.9	8.3	7.3	5.8	4.7
205	11.6	10.2	8.6	7.5	6.0	4.8
220	11.9	10.5	8.8	7.7	6.2	5.0
235	12.2	10.8	9.1	7.9	6.4	5.1
250	12.5	11.1	9.3	8.1	6.5	5.2
275	13.0	11.5	9.7	8.5	6.8	5.4
300	13.5	12.0	10.0	8.8	7.0	5.6
325	13.9	12.3	10.4	9.1	7.3	5.8
350	14.3	12.7	10.7	9.3	7.5	6.0
375	14.8	13.1	11.0	9.6	7.7	6.2
400	15.1	13.4	11.3	9.9	7.9	6.3
425	15.5	13.8	11.5	10.1	8.1	6.5
450	15.9	14.1	11.8	10.3	8.3	6.6
475	16.2	14.4	12.1	10.6	8.5	6.8
500	16.6	14.7	12.3	10.8	8.6	6.9
550	17.2	15.3	12.8	11.2	9.0	7.2
600	17.8	15.8	13.3	11.6	9.3	7.5
650	18.4	16.3	13.7	12.0	9.6	7.7
700	19.0	16.8	14.1	12.4	9.9	7.9
750	19.5	17.3	14.5	12.7	10.2	8.2
800	20.0	17.8	14.9	13.0	10.5	8.4
850	20.5	18.2	15.3	13.4	10.7	8.6
900	21.0	18.6	15.6	13.7	11.0	8.8
950	21.5	19.1	16.0	14.0	11.2	9.0
1000	21.9	19.5	16.3	14.3	11.4	9.2
1050	22.4	19.8	16.7	14.6	11.7	9.4
1100	22.8	20.2	17.0	14.8	11.9	9.5
1150	23.2	20.6	17.3	15.1	12.1	9.7
1200	23.6	21.0	17.6	15.4	12.3	9.9
1250	24.0	21.3	17.9	15.6	12.5	10.0
1300	24.4	21.6	18.2	15.9	12.7	10.2
1350	24.8	22.0	18.4	16.1	12.9	10.4
1400	25.1	22.3	18.7	16.4	13.1	10.5
1450	25.5	22.6	19.0	16.6	13.3	10.7
1500	25.9	22.9	19.2	16.8	13.5	10.8
1550	26.2	23.2	19.5	17.1	13.7	10.9
1600	26.5	23.5	19.7	17.3	13.8	11.1
1650	26.9	23.8	20.0	17.5	14.0	11.2
1700	27.2	24.1	20.2	17.7	14.2	11.4
1750	27.5	24.4	20.5	17.9	14.4	11.5

22.5° to 120° TRIANGULAR or V-NOTCH Wiers with End Contractions

Flow	Flow in GPM vs. Head Height in Inches					
	22.5°	30°	45°	60°	90°	120°
1800	27.8	24.7	20.7	18.1	14.5	11.6
1850	28.2	25.0	20.9	18.3	14.7	11.8
1900	28.5	25.2	21.2	18.5	14.8	11.9
1950	28.8	25.5	21.4	18.7	15.0	12.0
2000	29.1	25.8	21.6	18.9	15.1	12.1
2100	29.6	26.3	22.0	19.3	15.5	12.4
2200	30.2	26.8	22.5	19.6	15.7	12.6
2300	30.7	27.3	22.9	20.0	16.0	12.8
2400	31.3	27.7	23.3	20.4	16.3	13.1
2500	31.8	28.2	23.7	20.7	16.6	13.3
2600	32.3	28.7	24.0	21.0	16.8	13.5
2700	32.8	29.1	24.4	21.3	17.1	13.7
2800	33.3	29.5	24.8	21.7	17.4	13.9
2900	33.8	29.9	25.1	22.0	17.6	14.1
3000	34.2	30.4	25.5	22.3	17.9	14.3
3100	34.7	30.8	25.8	22.6	18.1	14.5
3200	35.1	31.2	26.1	22.9	18.3	14.7
3300	35.6	31.6	26.5	23.2	18.6	14.9
3400	36.0	31.9	26.8	23.4	18.8	15.0
3500	36.4	32.3	27.1	23.7	19.0	15.2
3600		32.7	27.4	24.0	19.2	15.4
3700		33.1	27.7	24.3	19.4	15.6
3800		33.4	28.0	24.5	19.6	15.7
3900		33.8	28.3	24.8	19.9	15.9
4000		34.1	28.6	25.0	20.1	16.1
4100		34.5	28.9	25.3	20.3	16.2
4200		34.8	29.2	25.5	20.5	16.4
4300		35.1	29.5	25.8	20.7	16.6
4400		35.5	29.7	26.0	20.8	16.7
4500		35.8	30.0	26.3	21.0	16.9
4600		36.1	30.3	26.5	21.2	17.0
4700		36.4	30.5	26.7	21.4	17.2
4800			30.8	26.9	21.6	17.3
4900			31.1	27.2	21.8	17.4
5000			31.3	27.4	22.0	17.6
5200			31.8	27.8	22.3	17.9
5400			32.3	28.3	22.6	18.1
5600			32.8	28.7	23.0	18.4
5800			33.3	29.1	23.3	18.7
6000			33.7	29.5	23.6	18.9
6200			34.2	29.9	24.0	19.2
6400			34.6	30.3	24.3	19.4
6600			35.0	30.7	24.6	19.7
6800			35.5	31.0	24.9	19.9
7000			35.9	31.4	25.2	20.2
7200			36.3	31.8	25.4	20.4
7400				32.1	25.7	20.6
7600				32.5	26.0	20.8
7800				32.8	26.3	21.1
8000				33.1	26.6	21.3
8200				33.5	26.8	21.5
8400				33.8	27.1	21.7
8600				34.1	27.3	21.9
8800				34.4	27.6	22.1
9000				34.8	27.9	22.3
9200				35.1	28.1	22.5
9400				35.4	28.3	22.7
9600				35.7	28.6	22.9
9800				36.0	28.8	23.1
10000				36.3	29.1	23.3

Table 9

22.5° to 120° TRIANGULAR or V-NOTCH Wiers with End Contractions

Flow	Flow in GPM vs. Head Height in Inches 22.5°	30°	45°	60°	90°	120°
10500					29.6	23.8
11000					30.2	24.2
11500					30.8	24.6
12000					31.3	25.1
12500					31.8	25.5
13000					32.3	25.9
13500					32.8	26.3
14000					33.3	26.7
14500					33.8	27.1
15000					34.3	27.4
15500					34.7	27.8
16000					35.2	28.2
16500					35.6	28.5
17000					36.0	28.9
17500						29.2
18000						29.5
18500						29.9
19000						30.2
19500						30.5
20000						30.8
20500						31.1
21000						31.5
21500						31.8
22000						32.0
22500						32.3
23000						32.6
23500						32.9
24000						33.2
24500						33.5
25000						33.8
25500						34.0
26000						34.3
26500						34.6
27000						34.8
27500						35.1
28000						35.3
28500						35.6
29000						35.8
29500						36.1
30000						36.3

Table 10

1 ft to 5 ft CIPOLLETTI Weirs with End Contractions

Flow in GPM vs. Head Height in Inches

Flow	1'	1.5'	2'	3'	4'	5'
50	1.2	.9	.8	.6	.5	.4
100	2.0	1.5	1.2	.9	.8	.7
150	2.6	2.0	1.6	1.2	1.0	.9
200	3.1	2.4	2.0	1.5	1.2	1.1
250	3.6	2.8	2.3	1.7	1.4	1.2
300	4.1	3.1	2.6	2.0	1.6	1.4
350	4.5	3.5	2.9	2.2	1.8	1.5
400	4.9	3.8	3.1	2.4	2.0	1.7
450	5.4	4.1	3.4	2.6	2.1	1.8
500	5.7	4.4	3.6	2.8	2.3	2.0
550	6.1	4.7	3.9	2.9	2.4	2.1
600	6.5	4.9	4.1	3.1	2.6	2.2
650	6.8	5.2	4.3	3.3	2.7	2.3
700	7.2	5.5	4.5	3.5	2.9	2.5
750	7.5	5.7	4.7	3.6	3.0	2.6
800	7.9	6.0	4.9	3.8	3.1	2.7
850	8.2	6.2	5.2	3.9	3.2	2.8
900	8.5	6.5	5.4	4.1	3.4	2.9
950	8.8	6.7	5.5	4.2	3.5	3.0
1000	9.1	7.0	5.7	4.4	3.6	3.1
1100	9.7	7.4	6.1	4.7	3.9	3.3
1200	10.3	7.9	6.5	4.9	4.1	3.5
1300	10.9	8.3	6.8	5.2	4.3	3.7
1400	11.4	8.7	7.2	5.5	4.5	3.9
1500	11.9	9.1	7.5	5.7	4.7	4.1
1600	12.5	9.5	7.9	6.0	4.9	4.3
1700	13.0	9.9	8.2	6.2	5.2	4.4
1800	13.5	10.3	8.5	6.5	5.4	4.6
1900	14.0	10.7	8.8	6.7	5.5	4.8
2000	14.5	11.0	9.1	7.0	5.7	4.9
2100	14.9	11.4	9.4	7.2	5.9	5.1
2200	15.4	11.8	9.7	7.4	6.1	5.3
2300	15.9	12.1	10.0	7.6	6.3	5.4
2400	16.3	12.5	10.3	7.9	6.5	5.6
2500	16.8	12.8	10.6	8.1	6.7	5.7
2600	17.2	13.1	10.9	8.3	6.8	5.9
2700	17.7	13.5	11.1	8.5	7.0	6.0
2800	18.1	13.8	11.4	8.7	7.2	6.2
2900	18.5	14.1	11.7	8.9	7.4	6.3
3000	19.0	14.5	11.9	9.1	7.5	6.5
3100	19.4	14.8	12.2	9.3	7.7	6.6
3200	19.8	15.1	12.5	9.5	7.9	6.8
3300	20.2	15.4	12.7	9.7	8.0	6.9
3400	20.6	15.7	13.0	9.9	8.2	7.0
3500	21.0	16.0	13.2	10.1	8.3	7.2
3600	21.4	16.3	13.5	10.3	8.5	7.3
3700	21.8	16.6	13.7	10.5	8.7	7.5
3800	22.2	16.9	14.0	10.7	8.8	7.6
3900	22.6	17.2	14.2	10.9	9.0	7.7
4000	23.0	17.5	14.5	11.0	9.1	7.9
4100	23.3	17.8	14.7	11.2	9.3	8.0
4200	23.7	18.1	14.9	11.4	9.4	8.1
4300	24.1	18.4	15.2	11.6	9.6	8.2
4400	24.5	18.7	15.4	11.8	9.7	8.4
4500	24.8	19.0	15.6	11.9	9.9	8.5
4600	25.2	19.2	15.9	12.1	10.0	8.6
4700	25.6	19.5	16.1	12.3	10.1	8.7
4800	25.9	19.8	16.3	12.5	10.3	8.9
4900	26.3	20.1	16.6	12.6	10.4	9.0
5000	26.6	20.3	16.8	12.8	10.6	9.1

1 ft to 5 ft CIPOLLETTI Weirs with End Contractions

Flow in GPM vs. Head Height in Inches

Flow	1'	1.5'	2'	3'	4'	5'
5200	27.3	20.9	17.2	13.1	10.9	9.4
5400	28.0	21.4	17.7	13.5	11.1	9.6
5600	28.7	21.9	18.1	13.8	11.4	9.8
5800	29.4	22.4	18.5	14.1	11.7	10.1
6000	30.1	23.0	19.0	14.5	11.9	10.3
6200	30.8	23.5	19.4	14.8	12.2	10.5
6400	31.4	24.0	19.8	15.1	12.5	10.7
6600	32.1	24.5	20.2	15.4	12.7	11.0
6800	32.7	25.0	20.6	15.7	13.0	11.2
7000	33.3	25.4	21.0	16.0	13.2	11.4
7200	34.0	25.9	21.4	16.3	13.5	11.6
7400	34.6	26.4	21.8	16.6	13.7	11.8
7600	35.2	26.9	22.2	16.9	14.0	12.0
7800	35.8	27.3	22.6	17.2	14.2	12.3
8000	36.4	27.8	23.0	17.5	14.5	12.5
8200		28.3	23.3	17.8	14.7	12.7
8400		28.7	23.7	18.1	14.9	12.9
8600		29.2	24.1	18.4	15.2	13.1
8800		29.6	24.5	18.7	15.4	13.3
9000		30.1	24.8	19.0	15.6	13.5
9200		30.5	25.2	19.2	15.9	13.7
9400		31.0	25.6	19.5	16.1	13.9
9600		31.4	25.9	19.8	16.3	14.1
9800		31.8	26.3	20.1	16.6	14.3
10000		32.3	26.6	20.3	16.8	14.5
10200		32.7	27.0	20.6	17.0	14.7
10400		33.1	27.3	20.9	17.2	14.8
10600		33.6	27.7	21.1	17.4	15.0
10800		34.0	28.0	21.4	17.7	15.2
11000		34.4	28.4	21.7	17.9	15.4
11200		34.8	28.7	21.9	18.1	15.6
11400		35.2	29.1	22.2	18.3	15.8
11600		35.6	29.4	22.4	18.5	16.0
11800		36.0	29.8	22.7	18.7	16.2
12000		36.4	30.1	23.0	19.0	16.3
12200			30.4	23.2	19.2	16.5
12400			30.8	23.5	19.4	16.7
12600			31.1	23.7	19.6	16.9
12800			31.4	24.0	19.8	17.1
13000			31.7	24.2	20.0	17.2
13200			32.1	24.5	20.2	17.4
13400			32.4	24.7	20.4	17.6
13600			32.7	25.0	20.6	17.8
13800			33.0	25.2	20.8	17.9
14000			33.3	25.4	21.0	18.1
14200			33.7	25.7	21.2	18.3
14400			34.0	25.9	21.4	18.4
14600			34.3	26.2	21.6	18.6
14800			34.6	26.4	21.8	18.8
15000			34.9	26.6	22.0	19.0
15500			35.7	27.2	22.5	19.4
16000			36.4	27.8	23.0	19.8
16500				28.4	23.4	20.2
17000				29.0	23.9	20.6
17500				29.5	24.4	21.0
18000				30.1	24.8	21.4
18500				30.6	25.3	21.8
19000				31.2	25.7	22.2
19500				31.7	26.2	22.6
20000				32.3	26.6	23.0

Table 10

1 ft to 5 ft CIPOLLETTI Weirs with End Contractions

Flow in GPM vs. Head Height in Inches

Flow	1'	1.5'	2'	3'	4'	5'
20500				32.8	27.1	23.3
21000				33.3	27.5	23.7
21500				33.9	28.0	24.1
22000				34.4	28.4	24.5
22500				34.9	28.8	24.8
23000				35.4	29.2	25.2
23500				35.9	29.7	25.6
24000				36.4	30.1	25.9
24500					30.5	26.3
25000					30.9	26.6
25500					31.3	27.0
26000					31.7	27.3
26500					32.1	27.7
27000					32.5	28.0
27500					32.9	28.4
28000					33.3	28.7
28500					33.7	29.1
29000					34.1	29.4
29500					34.5	29.8
30000					34.9	30.1
30500					35.3	30.4
31000					35.7	30.8
31500					36.1	31.1
32000					36.4	31.4
32500						31.7
33000						32.1
33500						32.4
34000						32.7
34500						33.0
35000						33.3
35500						33.7
36000						34.0
36500						34.3
37000						34.6
37500						34.9
38000						35.2
38500						35.5
39000						35.8
39500						36.1
40000						36.4

Table 11

6 ft to 10 ft CIPOLLETTI Weirs with End Contractions

Flow	Flow in GPM vs. Head Height in Inches 6'	7'	8'	9'	10'
100	.6	.5	.5	.5	.4
200	.9	.9	.8	.7	.7
300	1.2	1.1	1.0	.9	.9
400	1.5	1.4	1.2	1.1	1.1
500	1.7	1.6	1.4	1.3	1.2
600	2.0	1.8	1.6	1.5	1.4
700	2.2	2.0	1.8	1.7	1.5
800	2.4	2.1	2.0	1.8	1.7
900	2.6	2.3	2.1	2.0	1.8
1000	2.8	2.5	2.3	2.1	2.0
1200	3.1	2.8	2.6	2.4	2.2
1400	3.5	3.1	2.9	2.6	2.5
1600	3.8	3.4	3.1	2.9	2.7
1800	4.1	3.7	3.4	3.1	2.9
2000	4.4	4.0	3.6	3.3	3.1
2200	4.7	4.2	3.9	3.6	3.3
2400	4.9	4.5	4.1	3.8	3.5
2600	5.2	4.7	4.3	4.0	3.7
2800	5.5	4.9	4.5	4.2	3.9
3000	5.7	5.2	4.7	4.4	4.1
3200	6.0	5.4	4.9	4.6	4.3
3400	6.2	5.6	5.2	4.8	4.4
3600	6.5	5.8	5.4	4.9	4.6
3800	6.7	6.1	5.5	5.1	4.8
4000	7.0	6.3	5.7	5.3	4.9
4200	7.2	6.5	5.9	5.5	5.1
4400	7.4	6.7	6.1	5.7	5.3
4600	7.6	6.9	6.3	5.8	5.4
4800	7.9	7.1	6.5	6.0	5.6
5000	8.1	7.3	6.7	6.2	5.7
5500	8.6	7.8	7.1	6.6	6.1
6000	9.1	8.2	7.5	7.0	6.5
6500	9.6	8.7	7.9	7.3	6.8
7000	10.1	9.1	8.3	7.7	7.2
7500	10.6	9.5	8.7	8.1	7.5
8000	11.0	10.0	9.1	8.4	7.9
8500	11.5	10.4	9.5	8.8	8.2
9000	11.9	10.8	9.9	9.1	8.5
9500	12.4	11.2	10.2	9.4	8.8
10000	12.8	11.6	10.6	9.8	9.1
10500	13.2	11.9	10.9	10.1	9.4
11000	13.6	12.3	11.3	10.4	9.7
11500	14.1	12.7	11.6	10.7	10.0
12000	14.5	13.1	11.9	11.0	10.3
12500	14.9	13.4	12.3	11.3	10.6
13000	15.3	13.8	12.6	11.6	10.9
13500	15.6	14.1	12.9	11.9	11.1
14000	16.0	14.5	13.2	12.2	11.4
14500	16.4	14.8	13.5	12.5	11.7
15000	16.8	15.1	13.9	12.8	11.9
15500	17.2	15.5	14.2	13.1	12.2
16000	17.5	15.8	14.5	13.4	12.5
16500	17.9	16.1	14.8	13.6	12.7
17000	18.2	16.5	15.1	13.9	13.0
17500	18.6	16.8	15.4	14.2	13.2
18000	19.0	17.1	15.6	14.5	13.5
18500	19.3	17.4	15.9	14.7	13.7
19000	19.6	17.7	16.2	15.0	14.0
19500	20.0	18.0	16.5	15.3	14.2
20000	20.3	18.3	16.8	15.5	14.5

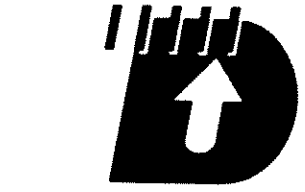
6 ft to 10 ft CIPOLLETTI Weirs with End Contractions

Flow	Flow in GPM vs. Head Height in Inches 6'	7'	8'	9'	10'
20500	20.7	18.7	17.1	15.8	14.7
21000	21.0	19.0	17.3	16.0	14.9
21500	21.3	19.3	17.6	16.3	15.2
22000	21.7	19.6	17.9	16.5	15.4
22500	22.0	19.8	18.2	16.8	15.6
23000	22.3	20.1	18.4	17.0	15.9
23500	22.6	20.4	18.7	17.3	16.1
24000	23.0	20.7	19.0	17.5	16.3
24500	23.3	21.0	19.2	17.8	16.6
25000	23.6	21.3	19.5	18.0	16.8
25500	23.9	21.6	19.7	18.2	17.0
26000	24.2	21.9	20.0	18.5	17.2
26500	24.5	22.1	20.2	18.7	17.4
27000	24.8	22.4	20.5	19.0	17.7
27500	25.1	22.7	20.8	19.2	17.9
28000	25.4	23.0	21.0	19.4	18.1
28500	25.7	23.2	21.3	19.6	18.3
29000	26.0	23.5	21.5	19.9	18.5
29500	26.3	23.8	21.7	20.1	18.7
30000	26.6	24.0	22.0	20.3	19.0
30500	26.9	24.3	22.2	20.6	19.2
31000	27.2	24.6	22.5	20.8	19.4
31500	27.5	24.8	22.7	21.0	19.6
32000	27.8	25.1	23.0	21.2	19.8
32500	28.1	25.4	23.2	21.4	20.0
33000	28.4	25.6	23.4	21.7	20.2
33500	28.7	25.9	23.7	21.9	20.4
34000	29.0	26.1	23.9	22.1	20.6
34500	29.2	26.4	24.1	22.3	20.8
35000	29.5	26.6	24.4	22.5	21.0
35500	29.8	26.9	24.6	22.7	21.2
36000	30.1	27.1	24.8	23.0	21.4
36500	30.4	27.4	25.1	23.2	21.6
37000	30.6	27.6	25.3	23.4	21.8
37500	30.9	27.9	25.5	23.6	22.0
38000	31.2	28.1	25.7	23.8	22.2
38500	31.5	28.4	26.0	24.0	22.4
39000	31.7	28.6	26.2	24.2	22.6
39500	32.0	28.9	26.4	24.4	22.8
40000	32.3	29.1	26.6	24.6	23.0
40500	32.5	29.4	26.9	24.8	23.2
41000	32.8	29.6	27.1	25.0	23.3
41500	33.1	29.8	27.3	25.2	23.5
42000	33.3	30.1	27.5	25.4	23.7
42500	33.6	30.3	27.7	25.6	23.9
43000	33.9	30.6	28.0	25.8	24.1
43500	34.1	30.8	28.2	26.0	24.3
44000	34.4	31.0	28.4	26.2	24.5
44500	34.7	31.3	28.6	26.4	24.7
45000	34.9	31.5	28.8	26.6	24.8
45500	35.2	31.7	29.0	26.8	25.0
46000	35.4	32.0	29.2	27.0	25.2
46500	35.7	32.2	29.5	27.2	25.4
47000	35.9	32.4	29.7	27.4	25.6
47500	36.2	32.7	29.9	27.6	25.7
48000		32.9	30.1	27.8	25.9
48500		33.1	30.3	28.0	26.1
49000		33.3	30.5	28.2	26.3
49500		33.6	30.7	28.4	26.5
50000		33.8	30.9	28.6	26.6

Table 11

6 ft to 10 ft CIPOLLETTI Weirs with End Contractions

Flow	Flow in GPM vs. Head Height in Inches 6'	7'	8'	9'	10'
51000		34.2	31.3	29.0	27.0
52000		34.7	31.7	29.3	27.3
53000		35.1	32.1	29.7	27.7
54000		35.6	32.5	30.1	28.0
55000		36.0	32.9	30.5	28.4
56000		36.4	33.3	30.8	28.7
57000			33.7	31.2	29.1
58000			34.1	31.6	29.4
59000			34.5	31.9	29.8
60000			34.9	32.3	30.1
61000			35.3	32.6	30.4
62000			35.7	33.0	30.8
63000			36.1	33.3	31.1
64000			36.4	33.7	31.4
65000				34.0	31.7
66000				34.4	32.1
67000				34.7	32.4
68000				35.1	32.7
69000				35.4	33.0
70000				35.8	33.3
71000				36.1	33.7
72000				36.4	34.0
73000					34.3
74000					34.6
75000					34.9
76000					35.2
77000					35.5
78000					35.8
79000					36.1
80000					36.4



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