

OPENCHANNELFLOW FLUMES

Operation & Maintenance



Operation & Calibration

Flumes are fixed geometry, primary devices which generate known level to flow relationships through the restriction and subsequent acceleration of open channel flows. There are no moving parts to wear out or replace as the level to flow relationships are developed solely through the use of converging the sidewalls, raising the floor elevation, or a combination of both.

As such, once a flume has been properly selected, sized, and installed, and assuming that neither the channel nor the flow conditions have altered, there is generally no need for additional calibration of a flume.

Periodic calibration of the secondary device (flow meter) will still be necessary, and should be conducted as often as the device manufacturer or site conditions require.

To properly operate, a flume relies on:

- The correct selection of the style and size of flume to use, based upon the site conditions and the anticipated flow rates.
- Proper installation.
- Strict adherence to published flume dimensions.
- Proper upstream flow conditions.
- A downstream channel of sufficient size and geometry to ensure that flow does not back-up into the flume (creating submergence issues).
- Proper application and location of staff (head) gauges and secondary device / flow metering instrumentation.

Site Inspection

1. In earthen channels, localized scouring may occasionally be present near the entrance and will probably be present at the exit of the flume. Ensure that sufficient channel reinforcement is present. Upstream scouring can lead to flow bypassing the flume, while downstream scouring can lead to flume settling. As a rule of thumb, downstream riprap protection should extend not less than 4 times the maximum normal depth of the downstream channel, nor less than 5 feet [1.50 m]. Design details of downstream protection can be found in Water Measurement with Flumes and Weirs, ISBN 90-70754-55-X.
2. Inspect the upstream and downstream channels and remove any growths of vegetation or accumulations of trash or silt.
3. There should be no obstructions, bends, dips, or elbows, immediately downstream of the flume, which would otherwise restrict flow from exiting the flume, resulting in submergence.
4. If baffles are used to correct and smooth the approach flow, they should be located at least 10 times the maximum anticipated level (head) at the point of measurement in the flume ($10 H_{max}$) upstream of the flume.



Flow Inspection

1. The approaching flow should be laminar, tranquil, uniformly distributed across the channel and possessing a non-critical velocity. Additionally, the flow should not be turbulent, surging, unbalanced, or possessing a poorly distributed velocity pattern.
2. To achieve the first criteria, the approach velocity should not exceed a Froude number of 0.5 at the flume or for a recommended upstream distance of 30 times the maximum anticipated level (head) at the point of measurement in the flume (30 H_{max}). If feasible, the Froude number should be limited to no more than 0.2.

$$0.2 \sqrt{gH_{\max}} \leq v_{\max} \leq 0.5 \sqrt{gH_{\max}}, \text{ where } g = 32.2 \text{ fps}^2 \text{ or } 9.8 \text{ mps}^2$$

Remembering that to control aquatic pest the approach velocity should exceed 1 fps [0.305 mps]. To minimize sedimentation, the approach velocity should be above 1.8 fps [0.549 mps].

Flume Positioning

1. Verify that the flume is positioned correctly. Regardless of type, flumes should be level from front to back and from side to side. Consult the pertinent dimensional prints, installation instructions, or Openchannelflow.com discharge tables (each of which contains an orientation diagram).

Flume Inspection

1. As flumes in natural channels are subjected to numerous wetting and drying cycles, as well as freezing and thawing cycles in some locales, they can become susceptible to settlement. Verify that the flume has not settled from front to back or from side to side, leveling as necessary and correcting any site conditions that have lead to the settling.
2. Verify that the flume sidewalls and floor are structurally sound and not distorted in any way.
3. Verify that the flow meter (if used) is mounted at the correct point of measurement.
4. Inspect the surfaces of the flume for corrosion, algal growth, or surface residue. A mild detergent solution can be used to removal algal growths and surface residue. If there is doubt as to the chemical compatibility of the detergent with the flume or its accessories, consult with the detergent manufacturer before proceeding.

In surface water applications, make sure to use only environmentally suitable detergents.

5. If a staff-level gauge is present, verify that the gauge is legible; cleaning or replacing it as necessary.
6. Verify the flume dimensions, correcting any discrepancies as necessary.