FREE FLOW® INC.

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KLUG

INSTALLATION

Location

The conditions required for the successful use of Parshall flumes can be divided into three areas of concern:

Upstream conditions should promote laminar flow conditions at the inlet of the flume. Channel turns, tees, elevation drops or other obstructions should be avoided. Upstream channel slope should not allow excessive velocity at the flume. Provide a slope of almost flat, to 3% maximum, for very small flumes, and 2% maximum for larger flumes. A 1:4 sloping ramp upstream should be provided for flumes installed above channel floor.
The crest of the flume (the floor of the converging section where depth measurements are made) must be level both longitudinally & transversely.
The downstream channel should not permit submerged flow conditions to occur. A large fall immediately downstream of the metering station can eliminate the possibility of submerged flow conditions. Long, narrow, flat or undersized channels can result in a backwater effect at the flume and should be avoided.

Sizing of flumes is be based on anticipated normal and maximum flows. In general, the smallest flume of adequate capacity is selected. Flumes are restrictions in the channel and consideration should be given to the effect of the resulting backwater on upstream drains and channel walls or banks.

Observe elevations during design & installation such that modular flow, also known as "Free Flow" conditions are always present. Submerged flow conditions are usually avoided to allow use of the standard discharge tables and depth measurements at Ha only.

Submerged Flow

Submerged flow conditions occur when the resistance to flow in the downstream channel becomes sufficient to reduce the velocity, increase the flow depth, and cause a backwater effect at the Parshall flume. The standard flow tables must be corrected when

the Submergence Ratio, Hb/Ha, expressed as a per cent, exceeds the following values:

50% for 1", 2" & 3" flumes
60% for 6" & 9" flumes
70% for 1 Ft. through 8 Ft. flumes

Montana Flume Installation

When a Parshall flume is installed with a large fall downstream, which assures that submerged flow conditions will not occur, there is no need to construct the portion downstream of the throat. The truncated Parshall flume (without diverging section) has the same modular characteristics as the standard flume. The truncated flume is sometimes referred to as the "Montana Flume"

Installation to Insure a Free Discharge

In most cases it is preferable to have a Parshall flume operate under free flow conditions. The principal advantage is that only the upstream flow depth, Ha, need be measured to determine discharge. Another advantage, if a continuous recorder is to be used, is the expense involved in purchasing a recorder that only measures one flow depth (Ha) rather than two (Ha and Hb) that would be required if the flume were submerged. The procedure for installing a Parshall flume in a canal to insure free flow, is listed below.

1. Establish the maximum flow rate to be measured.

2. Locate the high water line on the canal bank where the flume is to be installed and determine the maximum depth flow.

3. Select from the Parshall flume discharge tables (in sec-ft), the proper depth of water, Ha, corresponding with the maximum discharge capacity of the canal. For example, assuming that a 2-foot flume is to be used and the maximum discharge is 27.0 second-feet, the depth of water, Ha, on the crest is 2.19 feet.

4. Place the floor of the flume at a depth which does not exceed the transition submergence multiplied by Ha (St x Ha) below the high water line (Fig. 1). In general, the floor of the flume should be placed as high in the canal as grade and other conditions permit.

As an example, a 2-foot Parshall flume is shown in Fig.1. The

3 foot flume (W)
St = .68
rights = 16.05 cfs
(1.2 ft)(.68)
.82 feet
no more than below maximum water surface
d/s ditch capacity reported to be 500" 10 cfs

transition submergence for the 2-foot flume is 66 percent. The maximum discharge in the canal is 27.0 cfs, which for free flow conditions has an Ha value equal to 2.19 feet. Multiplying Ha (2.19) by the transition submergence (0.66), gives a depth to flume floor of 1.45 feet (2.19 x 0.66 = 1.45).

Therefore, the flume crest should be set no lower than 1.45 feet below the original maximum water surface.

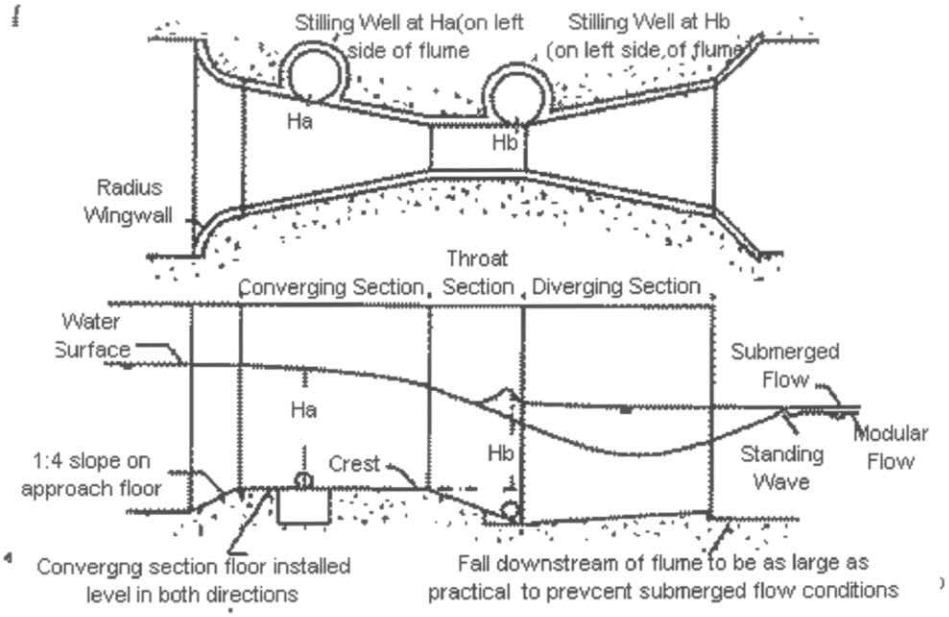
The loss of head through the structure will be the difference between 2.19 feet and 1.45 feet, which is 0.74 feet, as shown in Fig. 1.

If the amount of head loss is too great, then a larger flume could be used with a resulting decrease in the head loss.

When installing a flume in a pipeline, assume a section the pipe has been removed and replaced by a channel section. The water level in the channel will be the same as the depth in the pipe.

Reference: DESIGN AND CALIBRATION OF SUBMERGED OPEN CHANNEL FLOW MEASUREMENT STRUCTURES. Part 2. Parshall Flumes, Utah Water Research Laboratory, Logan, UT.

Flume Throat Width "W"	St		Flume Throat Width "W"	St
1"	0.56		3.0'	0.68
2"	0.61		4.0'	0.70
3"	0.64		5.0'	0.72
6"	0.55		6.0'	0.74
9"	0.63		7.0'	0.76
1.0	0.62		8.0'	0.76
1.5	0.64		10.0'	0.80
2.0	0.66		12.0'	0.80



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