

Irrigation FACTSHEET



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PROPER USAGE OF FLOW CONTROL VALVES IN IRRIGATION SYSTEMS

Flow control valves (FCV) are used in the irrigation industry in the following situations:

1. To maintain constant sprinkler discharge along a lateral line that runs up or down a hillside.
2. To regulate flows in laterals or sprinklers that are subject to excessively high pressure.
3. To maintain constant flow in laterals or sprinklers that are subject to pressure variations during an irrigation set.
4. Required by an irrigation district to control the flow to a specified water allotment.

Irrigation systems may utilize flow control valves (FCV) at the sprinkler head, beginning of each lateral or at the water source. The type and size FCV used is dependent upon the site-specific situation.

Due to operating problems experienced with flow control valves, the Bio-Resource Engineering Department, U.B.C. and Resource Management Branch, Ministry of Agriculture and Food, conducted a flow control valve testing project in the summer of 1982. Master FCV as well as the individual sprinkler FCV were examined.

SPRINKLER FLOW CONTROL VALVES

(1.0 gpm – 10 gpm range)

Although these types of FCV's have been assessed by other agencies in the past, additional testing was conducted. The FCV's used a flexible orifice as the

control device, the principle of operation being that orifice diameter changed with pressure to maintain a constant flow rate. The testing results are as follows:

1. FCV will function as a flow control device only when the upstream pressure is at or above the threshold pressure.

The threshold pressure is the minimum pressure required before the FCV will deliver its rated flow. The threshold pressure for 1.0 gpm – 5.0 gpm FCV's was 20 - 40 psi and 35 - 50 psi for the 6.0 gpm - 10.0 gpm FCV's.

2. Although the majority of FCV's tested did regulate flow to within 5% of the stated flow, numerous FCV's were encountered that did not provide accurate flow control.
3. The minimum pressure loss across the 1.0 gpm – 4.0 gpm FCV was 10 – 15 psi, whereas 15 – 20 psi pressure loss existed in the 5.0 – 10.0 gpm FCV's.
4. The sprinkler nozzle size and FCV must be matched correctly to achieve satisfactory performance. If the nozzle selected is too large, the operating pressure will be too low, affecting sprinkler performance and distribution. (This is due to the FCV restricting the amount of flow required by the nozzle). Also, if a nozzle that is too small is selected, the required flow rate would not be met. Table 1 provides design information on the selection of FCV – nozzle combinations.

TABLE 1

NOZZLE SIZES AND RECOMMENDED PRESSURES FOR FLOW CONTROL VALVES

FLOW CONTROL VALVE (gpm)	NOZZLE SIZE (in)	NOZZLE PRESSURE (psi)	MINIMUM LINE PRESSURE (psi)
1.5	3/32	35	45
2.0	7/64	34	44
2.5	1/8	31	41
3.0	9/64	28	38
	or 1/8	44	54
3.5	9/64	38	50
4.0	9/64	49	61
	or 5/32	34	46
5.0	5/32	50	65
	or 1/8 x 3/32	50	65
6.0	11/64	50	65
	or 5/32 x 3/32	39	54
	or 9/64 x 3/32	53	68
7.0	3/16	48	65
	or 11/64 x 3/32	40	57
8.0	13/64	44	62
	or 11/64 x 3/32	53	71
9.0	3/16 x 3/32	50	68
10.0	7/32	53	73

MASTER FLOW CONTROL VALVES

(15.0 gpm – 130 gpm range)

Two types of FCV's were observed, the spring compensating flow control device and the flexible orifice type.

The results of the tests are as follows:

1. Similar to sprinkler FCV's, master FCV's will not regulate the flow if the line pressure is below the threshold pressure of the FCV.

Threshold pressure for 15.0 gpm – 50.0 gpm was 40 – 60 psi and 50 – 70 psi for FCV's with rated flow larger than 50 gpm.

2. The spring actuated FCV has a lower minimum pressure loss than the flexible orifice type. (10 psi minimum loss for the spring actuated vs. 25 psi for the flexible orifice). Minimum pressure losses of 40 psi were experienced for some FCV's.
3. The rated flow was more accurate for the spring actuated FCV than the orifice type. Although manufacturers stated a flow tolerance of 5%, flow variations or 20% were experienced.

CONCLUSIONS AND RECOMMENDATIONS

Consideration should be given to the following points before selecting flow control valves.

- a) Check with the irrigation district as to the regulations that exist. Some districts require master control valves at each outlet whereas others allow just the sprinkler FCV's.
- b) If a master control valve is used, the minimum pressure loss and flow variation should be determined. The pressure loss is especially important in areas that have a supply pressure of 55 psi or less.

The flow variation must be determined to ensure that the flow requirement of the sprinklers in operation do not exceed the output of the master control valve.

- c) In fields that require the lateral to run up or downhill, sprinkler FCV's must be used, even if a master control valve is installed at the source. If the sprinkler performance is inadequate, the flow rate of the FCV or each sprinkler should be checked to ensure that the total flow rate demanded by the system does not exceed the amount supplied by the master control valve.

Also, the pressure supplied must exceed the irrigation system requirements by a minimum of 25 psi in order to accommodate the pressure loss through a master control valve and the sprinkler FCV.

- d) Unless sprinkler FCV are essential for the irrigation system, it is more economical to install one master control valve than a FCV at each sprinkler head.
- e) Irrigation systems that use a wheelmove or handmove operating on the same mainline as a gun system should use FCV at each sprinkler. This is required due to the high-pressure demand of a gun system.
- f) The FCV threshold pressure should be determined before it is put into operation. This is to ensure that the stated flow rate is achieved.

For the sprinkler FCV's if the minimum line pressure (sprinkler operating pressure plus FCV pressure loss) does not exceed the threshold pressure of the FCV, the sprinkler will not work properly. This can be avoided by selecting the FCV-nozzle combinations shown in this note.

PROPER INSTALLATION OF FLOW CONTROL VALVES

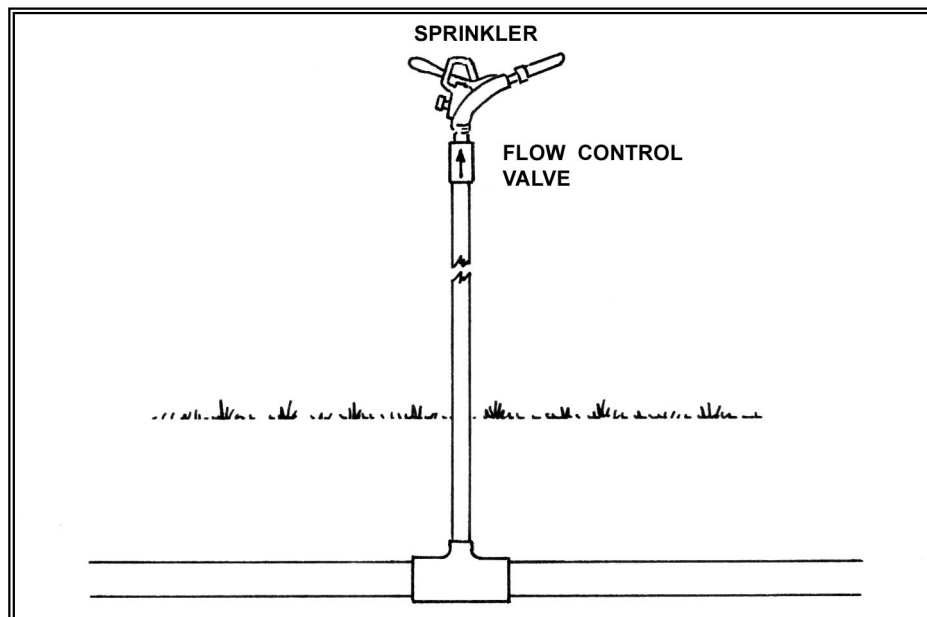


Figure 1 Sprinkler Flow Control Valves

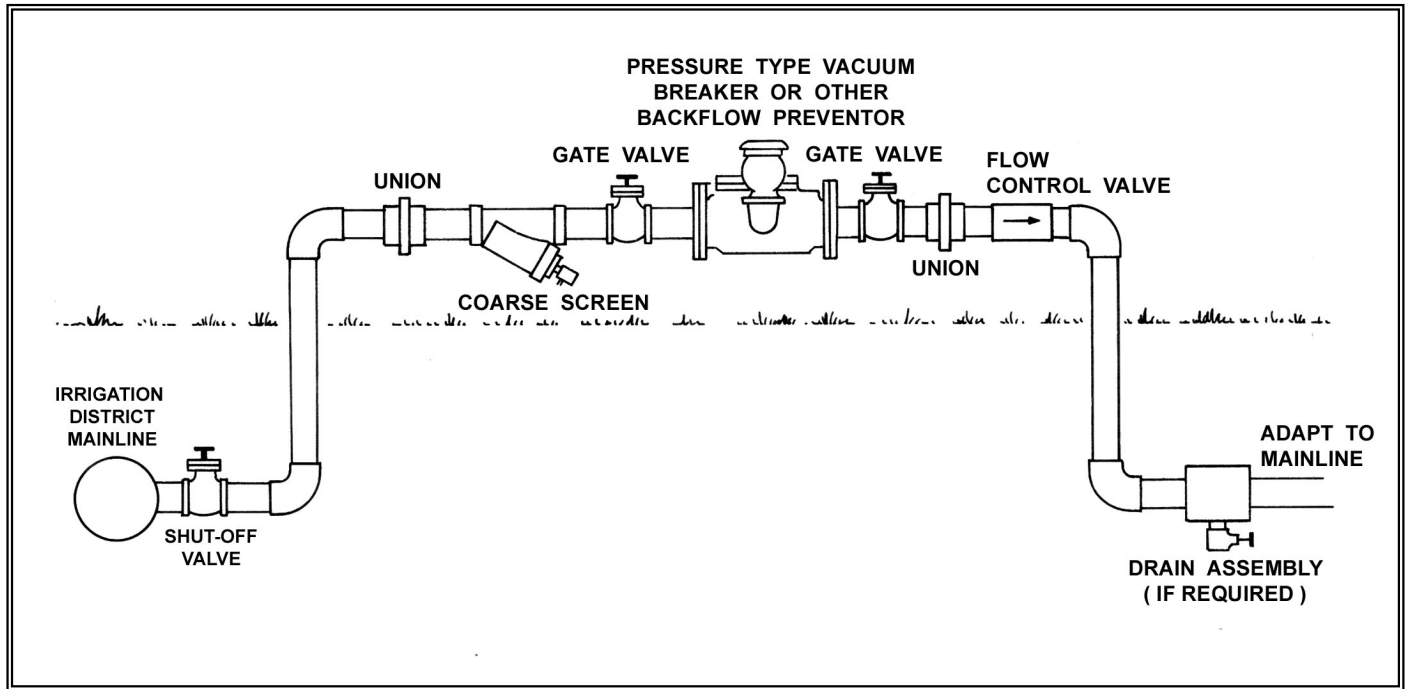


Figure 2 Master Flow Control Valve (Installed at Irrigation District Connection)

FOR FURTHER INFORMATION CONTACT:

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