

PRODUCT MANUAL PM - 58C

FETTEROLF RAM-SEAL

SPRAY-RINSE VALVE

Introduced in 1973 by Fetterolf, Spray-Rinse Valves were first used as a means to wash loosely hanging residue from the walls of PVC (polyvinyl chloride) reactors. Simple spraying systems with open-end nozzles could not be utilized due to the formation of solid polymer within the nozzle thereby clogging it during the reaction.

The Fetterolf design features a seal between the reactor atmosphere and the spray orifices thereby rendering them clog-free. Further, during the entire reaction they are submerged in a protective bath of the spraying fluid.

Benefits to users were immediately evident:

1. Less downtime for manhole cover removal and preparing the reactor for the next batch--higher production, -revenue, -profit.
2. Protection from VCM gas emissions which U.S. governmental agencies, OSHA and its medical wing, NIOSH, later declared to be suspect in the development of liver cancer.

Eventually, standards for reactor gas volume releases were established and Closed Reactor Techniques demanded. In short, internal cleaning became a "must" to enable the facility to continue production.

But it must be warned, the internal cleaning between each batch may not be the total answer. Differing recipes produce different products with different adhesive characteristics. Frequently, supplementary high-pressure cleaning procedures must be employed at intervals ranging from ten to one thousand batches.

As the pollution standards of the U.S. were recognized and adopted in other parts of the world, so did the reputation of the Fetterolf Spray-Rinse Valve spread. Currently it is standardized in plants representing approximately 95% of the PVC production in the U.S.A. Overseas, we reference installations on every continent and with every major process licensor.

Aside from PVC, the Fetterolf Spray-Rinse Valve has been successfully utilized for reactors in the production of SBL (styrene-butadiene latex), EPS (expanded polystyrene), Neoprene rubber, Nylon and classified polymer films.

This manual is prepared to assist our customers and customers-to-be in the best choice of hardware and to serve as an introductory training manual for Fetterolf personnel.

Andy Ritter
President (retired)
FETTEROLF TECHNOLOGIES INT'L

FETTEROLF SPRAY-RINSE VALVES

MODELS

At present there are two distinct models of the FETTEROLF RAM-SEAL SPRAY-RINSE VALVE:

1. The Fig. 9410 models (and the earlier 9412) are single-function designed. Connected to a water supply (150-250 psi), they are utilized to (1) wash the residue from the walls of the reactor and, in some plants, (2) to distribute a water or steam mixture of an anti-stick agent through the same apertures.

2. The Fig. 9420 models are dual-function designed. In addition to the wash-down service, a second inlet and separate channel leads to atomizing spray nozzles through which is distributed the water mixture of an anti-stick fluid prescribed in many process licenses. The secondary channel is of considerably less flow capability to conserve the more concentrated solutions of anti-stick.

OPERATING CYCLE1. WASH MODE

All models have the same cycle in the wash mode. At the start of the opening stroke, water is forcibly directed downward in a solid stream to flush the heavy bottom residue toward the drain. As the spray apertures emerge from the body of the valve, approaching the limit of stroke, separate sprays are directed outward and upward to provide cleaning by both jet and cascading actions. At the end of the vertical opening stroke, the spray elements automatically shift into a continuous 360 degree rotation for whatever time period the process demands. Upon command, the valve will stop rotation and begin the closing stroke with the spray action reverse to that of opening: finishing with the solid stream directly downward just before complete closure with automatic fluid shut-off. Until the next occasion for opening, the spray apertures remain sealed in a bath of fluid protecting them from clogging and preventing any back-flow from the reactor into the fluid supply line.

Depending on the valve size and aperture areas in the spray tube, capacities may be calculated from the standard formulae:

$$G = C_v \sqrt{dP} \quad \text{or} \quad L = 14.4 C_v \sqrt{dB}$$

where:

G = gallons/minute (US)	L = liters/minute
dP = pressure differential (in psi)	dB = pressure differential (in bars)

For comparison:

C_v = 5.0 (or less) to 7.5	for 1" valve size
C_v = 10 (or less) to 15.0	for 1-1/2" valve size

In all cases, the aperture areas may be characterized within the above limits to achieve the desired capacity within a given time span.

OPERATING CYCLE (cont'd)2. FOG MODE

For application of the anti-stick fluid or vapor (Fig. 9420 models), the fluid supply line to the Spray/Fog elements is opened; the wash water supply line is closed. The cycle of the valve is identical to that of the wash mode except the valve is now distributing the mist to the walls of the reactor for whatever time period is required. Due to wide variations in required capacities of different processes, it is necessary that the valve specifications include:

- a. Reactor pressure during anti stick application
- b. Anti-stick supply line pressure
- c. Fluid or vapor media
- d. Distribution rate:gallons(or liters) per minute

Normally, the spray head is fabricated to accommodate three fog-spray nozzles:Two in use and the third is plugged. Thus, it is an easy revision should the process require up to a 50% increase in capacity. To decrease the capacity, orifice bushings of lesser size may be inserted.

ACTUATION

Automatic actuators guarantee the complete closure of the FETTEROLF Spray-Rinse Valve thereby effecting the necessary forces for seal-ring compression/expansion prior to the shut-down of the actuator. Further, these actuators provide the full and continuing 360 degree rotation of the spray-head. Listed below are driver options:

1. The Type EM is an electric actuator professionally made by Rotork for this specific application. It is an integral motor/gear reducer unit which provides the desired stem/spray-tube speed of rotation. A torque sensing mechanism automatically cuts off power to the motor on valve closure. A de-clutching feature permits emergency manual operation by disengaging the motor and engaging a handwheel to give direct 1:1 ratio to the stem/spraytube. The actuator is waterproof and explosion-proof and is best specified to include complete electric controls: reversing controller, reset overload relay for each phase of power supply, space heater, low voltage control transformer, integral pushbutton station and a selector switch to connect the actuator to either the local or a remote pushbutton station or computer which sequences the wash program.

2. The Type AM actuator consists of a Gast Air-motor with speed reducing gearbox to provide approximately 30 RPM to the stem/spray element. Since stalling is not damaging to an air-motor, the motor should be pressurized for several seconds after the closing stall to assure tight setting of the Ram-Seal ring. This can be accomplished with the use of an electrical time-delay mechanism to control the 4-way solenoid valve in the air supply line. Airsets consisting of a filter-regulator and lubricator are a must for trouble-free performance hence are included.

INSTALLATION

FETTEROLF Spray-Rinse Valves are installed on the dome of the reactor. The use of two per reactor affords multiple advantages:

1. The optimum prevention of "shadows" cast by the agitator shaft and internal baffles on the opposite reactor wall.
2. The creation of a third (vector) spray caused by the interfering two direct sprays results in cleansing of areas where neither of the two direct sprays may not reach.
3. The cleaning of each valve body by the spray from the other.
4. Three distinctly different spray patterns applied in sequence gives greater efficiency to the cascading effect.

Since the valves are generally mounted on flanged nozzles or pads, such must be identified as to size, pressure rating and code standard in the specification.

A dimension important to the cleaning efficiency is that shown as "P", the body penetration. Extensive testing and monitoring of close to 1,500 valve installations have determined that a body length of 24" or more beyond the reactor wall produces optimum results.

In some instances where there may be no "idle" nozzles on existing reactors, a tee fitting may be installed atop a charging nozzle. This permits the Spray-Rinse Valve to occupy the "run" of the tee and the charge to be brought in through the branch.

CAPACITY CRITERIA

The following general rules of size choice apply:

REACTOR VOLUME	SIZE (two valves)
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To 14,000 gallons (53 m ³)	1"
14,000-40,000 (53-150 m ³)	1-1/2"