IOM FDV-PA0

FDV-PA0 – Hydraulic actuated, Pressure reducing Local Reset Deluge Valve & Anti-Columning.

Installation **O**peration & **M**aintenance manual

Fire Protection

RAPHAEL VALVES INDUSTRIES

RAPHAEL FP

FDV-PA0 – Hydraulic actuated, Pressure reducing Local Reset Deluge Valve & Anti-Columning.

Description

This deluge system is based on Raphael's FDV valve, equipped with hydraulic actuated control trim. The FDV valve installed, have a range of optional materials and coating to fulfill operation condition needed, but the system function principle stays unchanged:
in fire situation, a hydraulic detection system (wet pilot pipe), trips the valve's control trim and consequently, pressurized water trapped in the FDV's control chamber are drained, and the valve opens. When opened, it admits water to the spray sprinklers pipeline.

The trim is equipped with a PSA, a device that enables a local reset of the system and serves as a latching device.
This system is capable to reduce the upstream pressure to a set downstream pressure and maintain it in a steady level. Its responses to any downstream pressure changes caused by consumption flow rate changes and keeps a stable set pressure.

The anti-Columning sub-system enables the use of a nearly unlimited wet pilot height. The system gets tripped only by the pressure drop caused by the blow-opening of one or more of the wet pilot's automatic sprinklers, while the hydrostatic pressure of the water column is separated and isolated by the anti-Columning sub-system. This system is suitable for water spray pipelines with open nozzles.

RAPHAEL FP

Part list

1. – Orifice
2. – 3-way alarm ball valve
3. – wet pilot connection point
4. – Check valve
5. – “Y” Strainer
6. – Trim pressure supply valve
7. – Downstream Pressure gauge
8. – Control chamber pressure gauge
9. – PSA – Pressure Supply Arrestor
10. – HAV-2 Hydraulic Actuator
11. – EMU Emergency Unit
12. – Anti-columning pilot
13. – MADV – Drain valve
14. – Needle valve
15. – Alarm Pressure Switch
16. – Gong connection port
17. – Downstream drain Valve
18. – Upstream Drain Port

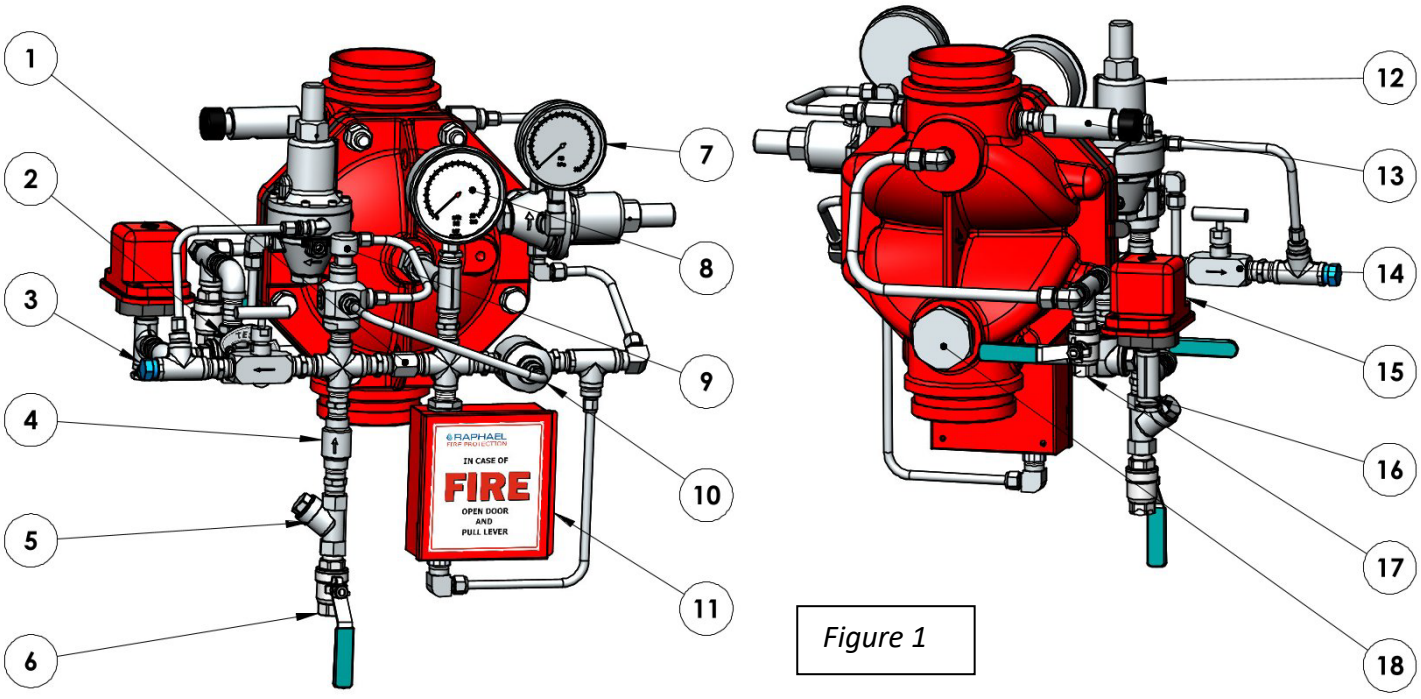


Figure 1

Operation

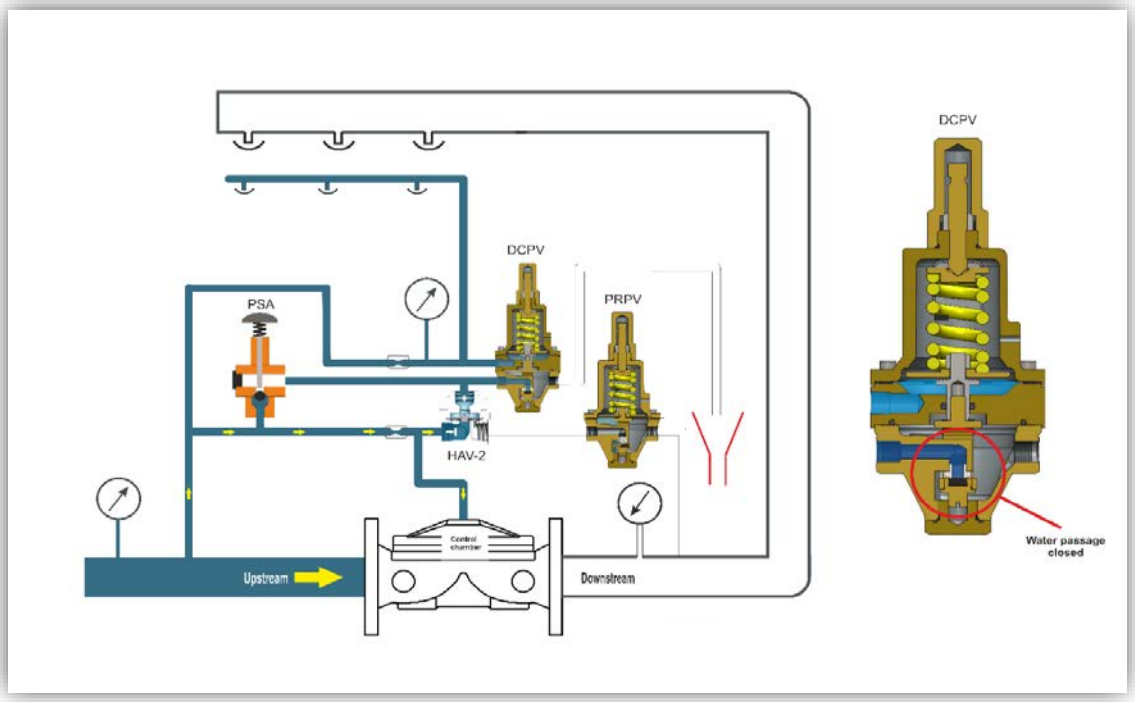
SET position:

Water is supplied via the Trim pressure supply ball valve (**6**), passes through the “Y” strainer (**5**), the Check valve (**4**) flows through the orifice (**1**) and fills the FDV’s control chamber.
Pressurized water in the valve’s control chamber gets trapped by the check-valve (**4**), by the closed emergency valve, the MEU, (**11**) and the closed HAV-2 actuator (**10**), maintaining the deluge valve in closed position.

The pressurized wet pilot line is connected to the DCPV’s sense port. Its pressure overcomes the pilot valve’s spring and holds this N.O. device in a close state. If the wet pilot stays pressurized, the closed HAV-2 maintains the FDV valve close. The system is in SET position.

The pressurized line between the PSA and the HAV-2 (**10**) actuator should be considered as a “command line”: a change in the wet pilot line’s pressure will activate the DCPV, drain this command line, open the HAV-2 actuatoe and as a result, open the FDV valve.

System with Anti-Columning and pressure reduction in SET position

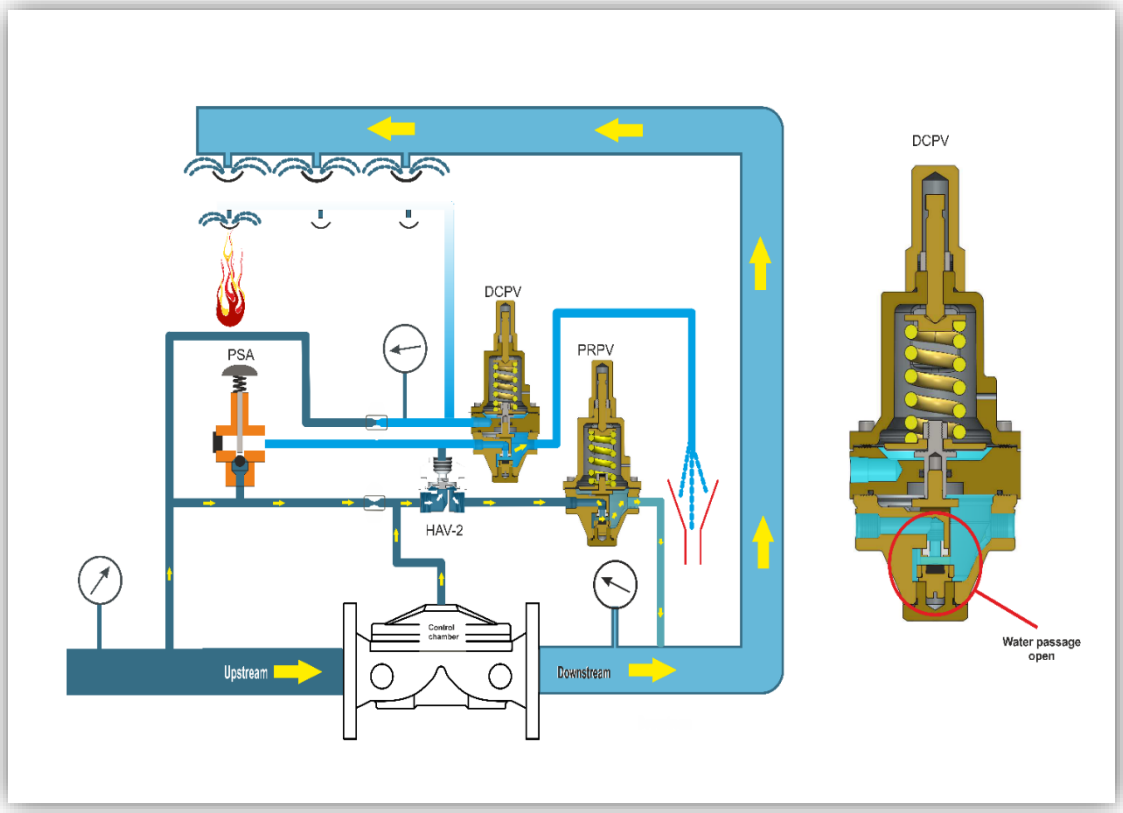


In the SET state of the system, the N.O. reducing pilot PRPV (**12**) is isolated by the closed HAV-2 actuator.

FIRE situation:

When one or more of the automatic sprinklers along the wet pilot line senses fire heat and blows-open, the pressure drops. This pressure drop is transmitted into the DCPV's sense port. The pilot valve spring overcomes the static pressure caused by the water column and "detects" much smaller pressure drops at the height level of the deluge installation. Consequently, the DCPV changes it state and opens. The state change of the DCPV pilot opens its internal drain passage. The pressurized "command line" vents and the HAV-2 move to the OPEN state.

System in Fire situation position



In its open state, the HAV-2 admits the FDV control chamber's trapped water to the PRPV reducing pilot. The PRPV drains the FDV control chamber pressure to its downstream maintaining the set pressure and the deluge valve admits the flow to the sprinklers spray pipeline/s.

Simultaneously, the wet pilot's drop of pressure, causes the PSA's (**9**) ball to move to its upper seal seat, preventing water entrance from the valve's trim, into the wet pilot's line. By that, the PSA latches the DCPV pilot drain state, the HAV-2 open state and FDV valve's open position.

Opening the MEU door and pulling down the ball valve's handle bypasses all terms, drains the FDV control chamber and opens the valve immediately.

RESET position.

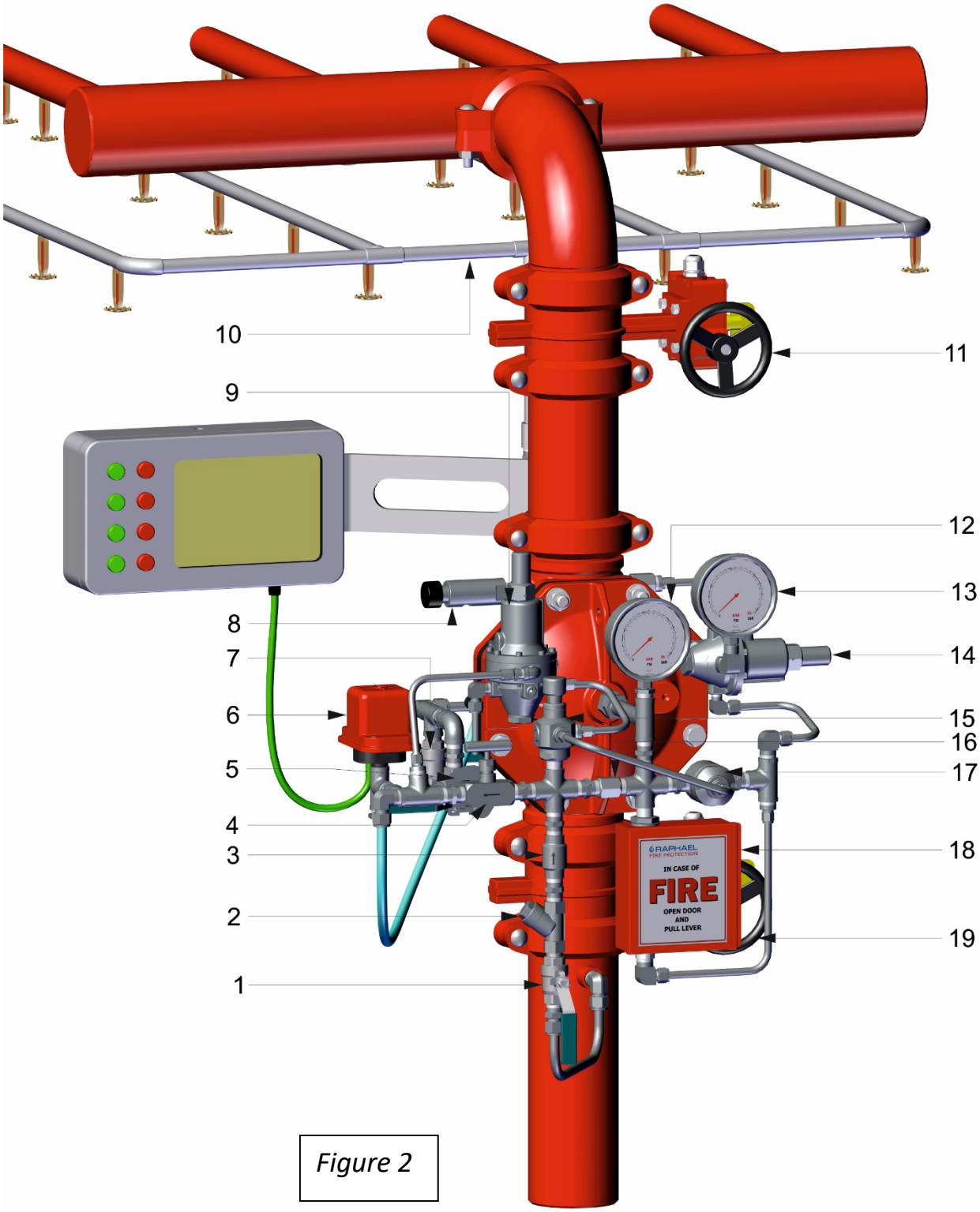
The first step in the RESET process: replace the blown-open automatic sprinklers. Doing so will enable the increase of pressure in the wet pilot's line and a state change of the DCPV from open to close.

Then, close the FDV valve by pressing the PSA push-button down. By that, the device ball is pushed from its seat, enabling the upstream water to flow through and fill the HAV-2 control chamber. Consequently, the drain flow through the PRPV pilot will stop and the FDV valve will close. It is essential to keep pushing the PSA button until the actuator's control chamber becomes fully pressurized.

It is recommended to drain the sprinklers spray pipeline by opening the ball valve connected to the FDV's downstream drain port (**17**).

Installation Parts List

1. Trim pressure supply valve
2. “Y” Strainer
3. Check valve
4. Needle valve
5. Alarms Test Valve
6. Pressure switch
7. Downstream drain ball valve
8. MADV-MB – Manual Automatic Drain Valve – Metal Ball
9. DCPV – Drain Control Pilot Valve
10. Wet pilot line
11. Downstream butterfly valve
12. Control Chamber pressure gauge
13. Downstream pressure gauge
14. PRPV – Pressure reducing Pilot Valve
15. PSA – Pressure Supply Arrestor
16. Orifice
17. HAV-2 – Hydraulic Actuator Valve – 2 Way
18. MEU – Manual Emergency Unit
19. Upstream butterfly valve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IN CASE OF
FIRE
OPEN DOOR
AND
PULL LEVER

Figure 2

Installation (reference drawing – figure 2)

1. This system is supplied pre-assembled and factory pre-adjusted except of the DCPV pilot valve. Any change carried out at the system's trim components order, pipe and tubes length or ports for axillary connection sizes, will affect the system operation and therefore, prohibited.

2. The system cannot be installed at a location where it might be subjected to freezing temperatures.

3. Sufficient room around the system location should be kept, to enable assembly/disassembly and maintenance work.

4. It should be considered that water will be drained during regular maintenance on a routine base, during periodical tests procedures and when operating in fire situation. Therefore, a drainage plan should be considered.

5. The system described is to be mounted vertically only. Systems with identical operation for horizontal installation are marked with a prefix "H", e.g. HFDV-PA0.

6. It is essential that the PSA's installation orientation will be vertical only, regardless of the deluge valve orientation.

7. The downstream and upstream pipes connected to the FDV valve at a horizontal & vertical mount, need to be supported firmly to prevent the pipeline's weight to be loaded on the system's valve.

8. Any use of pipe/thread reduction-fittings installed at open ports designated for axillary components, (like water motor alarm, pressure switch, trim pressure supply, FDV valve's drains, DCPC, MADV's and MEU drain ports), is prohibited.

9. All connections to water supply, alarms etc. should be done in accordance with figure 2:
   (Blue plastic plug) – Wet pilot pipeline connection – ½" NPT female
   (SST plug) – Water motor alarm connection – ½" NPT female
   (1) – Trim pressure supply connection – ½" NPT female.

10. The FDV valve should be installed with the flow arrow marked on the valve's body, in the proper direction.

Commissioning the system - phase 1.

Filling and pressurizing the system

(Reference Drawing - figure 2)

The procedure described should be carried out after system installation completion and a comprehensive inspection.

1. Make sure the upstream butterfly valve (**18**) is fully closed.
2. Make sure the trim pressure supply valve (**1**) is Closed.
3. Make sure that MEU door (**18**) is fully closed. If open – turn valve's lever upwards and close the door.
4. Make sure the FDV's downstream drain valve (**11**) is open and upstream drain valve (if equipped), is closed.
5. Loosen completely the DCPV (**9**) pilot's spring by turning the adjustment screw anticlockwise. Open the inspector's test valve located at the wet pilot line end.
6. Open the trim pressure supply valve (**1**). Drain the wet pilot valve until a continuous and free of air bubbles flow is observed.
7. Close the inspector's test valve.
8. Press the PSA's push-button and fill the trim and the HAV-2 control chamber. When done release the PSA push buttom.
9. Gradually open the upstream butterfly valve (**19**) and make sure the downstream drain valve (**7**) is not dripping.
10. leave the Downstream drain valve (**10**) open.

The system is ready for a leakage inspection.

DCPV Pilot's adjustment procedure:

This procedure should be carried out after the system was pressurized and a comprehensive leakage inspection was commissioned.

The DCPV pilot's adjustment procedure completion is essential for the "fire situation simulation test" performance.

Note: As the pilot line's elevation increases, the residual hydrostatic pressure increases. Therefore, enabling the drainage of FDV's control chamber requires an additional tension applied on the DCPV's spring.

1. Close the upstream & downstream butterfly valve (**19 & 11**).

2. Press the PSAs push-button (**15**).

   Notice: the PSA's push-button should be pressed consecutively up to the completion of chapter 8.

3. Verify that the DCPV (**9)** pilot's spring is completely loosen (step 5 page 6). The DCPV pilot should remain in its close state and no dripping through its vented port should be observed.

4. Open the inspector's test valve located at the wet pilot line end.

5. Increase the spring tension of the DCPV pilot by turning the adjusting screw clockwise until a trickle of water is released out of the Pilot's drain port.

6. Turn the adjusting screw an additional ¼ of a turn clockwise.

7. Close the inspector's test valve. The pressure in the wet pilot line should increase and the flow out of the DCPV's vented port should stop.

8. Assure the proper function of the Anti-Columning sub system by re-opening the pilot line inspector's valve. The DCPV should drain the FDV control valve through its vented port.

9. Close the inspector's test valve. Release the PSAs push-button.

10. Open the upstream butterfly valve.

The system is ready for the 'fire situation simulation'.

Commissioning the system - phase 2.

Fire Situation Simulation

The procedure described below, should be carried out after the needle valve was adjusted (after installation) and, after the system was pressurized and a comprehensive leakage inspection was commissioned (as a part of the annual maintenance procedure)

Prior to any stoppage of the fire protection system, a fire patrol should be placed in the area covered by the interrupted system.

Prior to generating any test procedures, turning on false alarms or turning off the alarm system, the local safety personal and the close central fire station must be notified.

1. Open the inspector's valve (located on the wet pilot's pipeline). Trapped water will drain out from the FDV's control chamber through the DCPV pilot's vented port and the FDV valve will open.

2. Observe this drain flow: It should be short timed flow. A constant and significant drain flow can indicate an internal leakage at the PSA.

3. Observe the pressure gauge installed on the PRPV pilot valve. Downstream pressure correction if needed, is performed by this method:
   - to increase the pressure – turn the pilot's adjusting screw clockwise
   - to decrease the pressure – turn the pilot's adjusting screw anticlockwise.

4. Assure the functionality of the PRPV pilot valve and the downstream pressure steadiness: While the FDV valve is open, turn the downstream drain valve handle gradually to partly close the valve. Wait until the pressure reaches to SET. Then, open this ball valve. Observe the downstream gauge reading - it should reach again to SET pressure.

Commissioning the system - phase 3.

Resetting & placing in service (Reference Drawing - figure 2).

The procedure described, should be carried out after any periodic operational test simulated, or real fire situation.

1. Close the trim pressure supply valve (**7).**
2. Replace any wet pilot pipeline's blown-open automatic sprinklers.
3. Make sure the trim pressure supply valve is open.
4. Open the inspector's valve, drain air bubbles, and close the inspector's valve.
5. Press the PSA's push-button (**15**) until the FDV valve closes.
6. Close the upstream butterfly valve (**19**).
7. Close the trim pressure supply valve (**1**).
8. Clean the "Y" strainer's (**2**) screen. Reassemble the strainer.
9. Open the trim pressure supply valve.
10. Press the PSAs push-button. Release the push-button a few seconds after internal flow sound stops, to assure a complete filling of the HAV-2's control chamber.
11. Open downstream drain valve (**7**) and drain the spray pipeline.
12. At drainage end, close the downstream drain valve (**7**) and open both butterfly valves (**19 & 11**)

System is in SET state and placed in service.

Maintenance

Prior to any stoppage of the fire protection system, a fire patrol should be placed in the area covered by the interrupted system.
Prior to generating any test procedures, turning on false alarms or turning off the alarm system, the local safety personal and the close central fire station must be notified.

The Maintenance and inspection procedures are based on the relevant chapters at the NFPA 25.

Daily Inspection

Make sure that the deluge valve's heating system (If equipped), functions correctly and that the Fire protection valve surrounding temperature is 4°C min.

Monthly maintenance procedure

1. Verify that the upstream and downstream butterfly valves (**19 & 11**) and the Trim pressure supply valve (**1**) are in fully open position. The downstream drain valve (**7**) is in fully close position.
2. Make sure that the required supply water pressures are applied to the Deluge Valve inlet and trim: Observe the control pressure gauge (**12**) for the correct upstream pressure.
3. Press the MADV push-button (**8**) to drain accumulated water. Significant amount of water may indicate an ADV's valve sealing issue (see Troubleshooting chapter in FDV's basic valves datasheet & IOM bulletin)
4. Turn the Water Motor Alarm Test valve's handle (**4**) to "Test" position to perform an alarm test. The alarm should sound. Turn the valve's handle back to its initial position.

Annual maintenance procedure

1. Conduct the weekly inspection, the monthly maintenance procedure and the quarterly test & inspection.
2. Follow the procedure described in chapter - **Commissioning the system - phase 2. -** Fire Situation Simulation.
   Check and confirm the system's proper operation.
3. Follow the procedure described in chapter - **Commissioning the system - phase 3. -** Resetting & placing in service.
   Check and confirm the system's proper operation.

Every 5 years inspection procedure

This major inspection and maintenance procedure includes the removal of the trim, the dismantling of the FDV's valve cover and a performance of a comprehensive internal part examination. Then, the relevant trim accessories should be replaced, After the completion, the Annual maintenance procedure is to be conducted.

Reference figure 2

1. Close the Upstream butterfly valve and the trim pressure supply valve (**1**).
2. Open the drain valves (**7**). Drain the FDV's control chamber using the MEU (**18**) valve.
3. Turn off or disconnect all relevant electrical circuits.
4. Release all relevant tubes fitting nuts, central union pipe connection.
5. Remove the disassembled trim.
6. Remove all the FDV's cover bolts. The cover will hang on its studs. Release both nuts and remove the cover carefully.
7. Observer the internals of the valve and cover for excessive scale residuals, foreign particles, damaged coating (rust, cracks, or pealing), diaphragm inflexibility or deformation. Worn or damaged parts should be replaced. Consult Raphael's local representative or the service department for any maintenance or part replacement issue.
8. Replace the Diaphragm with the one supplied with the system's maintenance kit. The identification tongue should point to the valve's stamped flow direction arrow side.
9. Reinstall the valve's cover: use Anti-seize paste to lubricate bolts and nuts and tight them in accordance with "Bolt's torque moments table".
10. The PSA, DCPV pilot, the PRPV pilot and the MADV must be maintained in accordance with the relevant maintenance instructions as mentioned in the "Accessories Booklet" and NFPA-25, in "Standard for the inspection testing and maintenance of water-based fire protection systems".
11. Reinstall the trim carefully: avoid causing twists, dents on bent tubes and do not overtight the compression fitting's nuts.
12. When the system is fully reassembled, perform the "**Commissioning the system - phase 1** - Filling and pressurizing the system" procedure.
13. Perform the "***Annual maintenance procedure***".

Bolt's Torque Moments Table

Valve size	1.5"	2"	2.5"	3"	4"	6"	8"	10"
Torque lb/ft	22	29	36	54	65	72	87	118

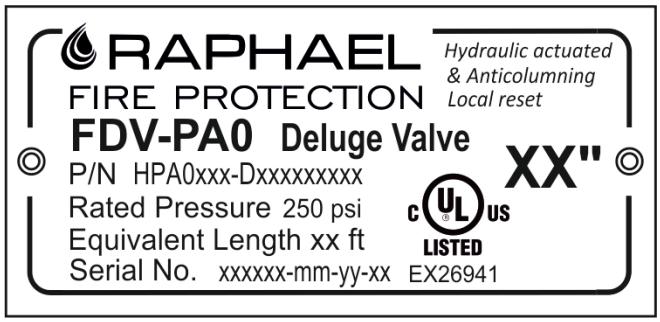
Equivalent pipe length for FDV deluge valves

Valve size	Equivalent length value ft (m)
1.5"	11 (3.6)
2"	24 (7.3)
2.5"	25 (7.6)
3"	28 (8.5)
4"	31 (9.4)
6"	46 (14)
8"	72 (21.9)
10"	117 (35.6)

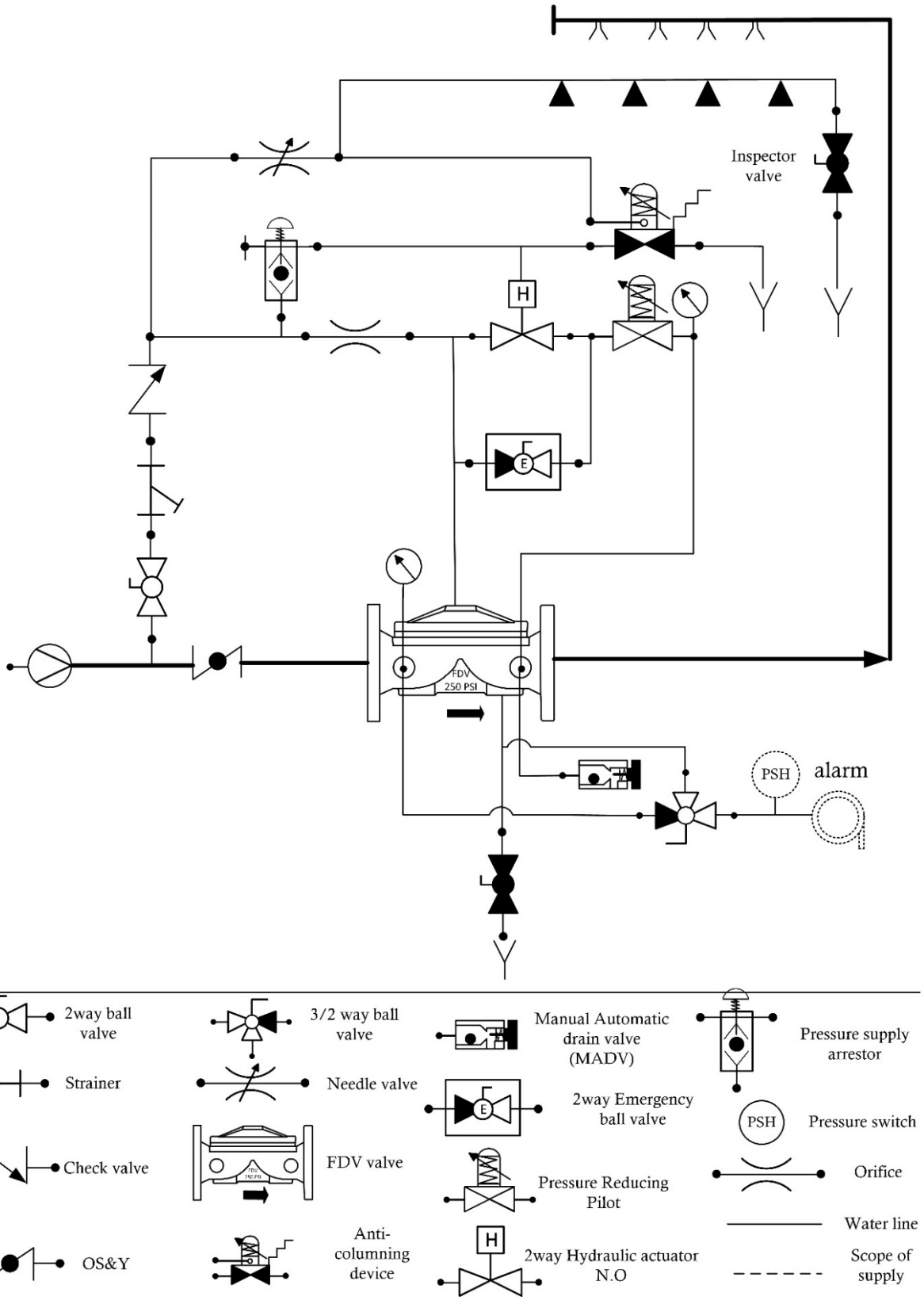
Marking

The FDV valves are marked by a laser engraved, black anodized, 0.8mm (0.031") thick metal plate, riveted to the valve's cover.

- *Company name and trademark.*
- *Application's type* - Hydraulic actuated, Local Reset, Pressure reducing & Anti-Columning
- *The Application's part number* - actuation type–valve properties
- *Rated pressure* - 250 psi.
- *Equivalent Length: reference table - page 13.*
- *Serial Number* – MM-20YY-xxx (01-99)
- *The UL listing mark & QR code.* – Exxxxxx
- *The FM approved mark*
- *The Application's* DN - x"



Hydraulic actuated, local manual reset, pressure reducing FDV deluge valve with anti-columning device FDV-PA0



RAPHAEL, founded in 1949, is the first Israeli manufacturer of water control valves. RAPHAEL´s research department constantly strives to introduce new and innovative products and solutions for water control systems including water works, fire-protection and irrigation systems.

RAPHAEL

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