FDV-PC0

Electric - Pneumatic Actuation, Local Reset Deluge Valve with Pressure Reducing

INSTALLATION OPERATION & MAINTENANCE MANUAL

FIRE PROTECTION

RAPHAEL VALVES INDUSTRIES

Raphael Valves Industries Ltd. / info@raphael-valves.com / www.raphael-valves.com

Description

This deluge system is based on the Raphael's FDV valve, equipped with pneumatic 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 pneumatic and/or an electric detection system, trips the valve's control trim and consequently, pressurized water trapped in the FDV' control chamber are drained, and the valve opens.

This system is capable to reduce the upstream pressure to a set downstream pressure and maintain it in a steady level. The system responses to any downstream pressure changes caused by consumption flow rate changes and keeps a stable set pressure. The system is suitable for water spray pipelines with open sprinklers.

Part List (reference figure 1)

1. – Solenoid valve (3 way)
2. – PSA, Pressure Supply Arrestor
3. – Dry pilot connection (1/2” NPT female)
4. – Air supply from compressor – ½” NPT female)
5. – Alarm pressure Switch (optional)
6. – Check Valve
7. – Alarms Test Valve (3 way)
8. – “Y” Strainer
9. – Trim Pressure Supply Valve
10. – MEU Manual Emergence Unit
11. – PRPV Pressure Reducing Pilot Valve
12. – Downstream pressure gauge
13. – Needle Valve
14. – Control chamber pressure gauge
15. – PAV-2 Pneumatic actuator
16. – PAV-2 vent port to atmosphere (1/4” NPT female temporary plugged)
17. – MADV manual automatic drain valve
18. – Downstream drain valve (1/2” NPT female)
19. – Alarms Test Valve (3 way)
20. – Water motor alarm conn. (1/2” NPT female)
21. – Upstream drain port (plugged)

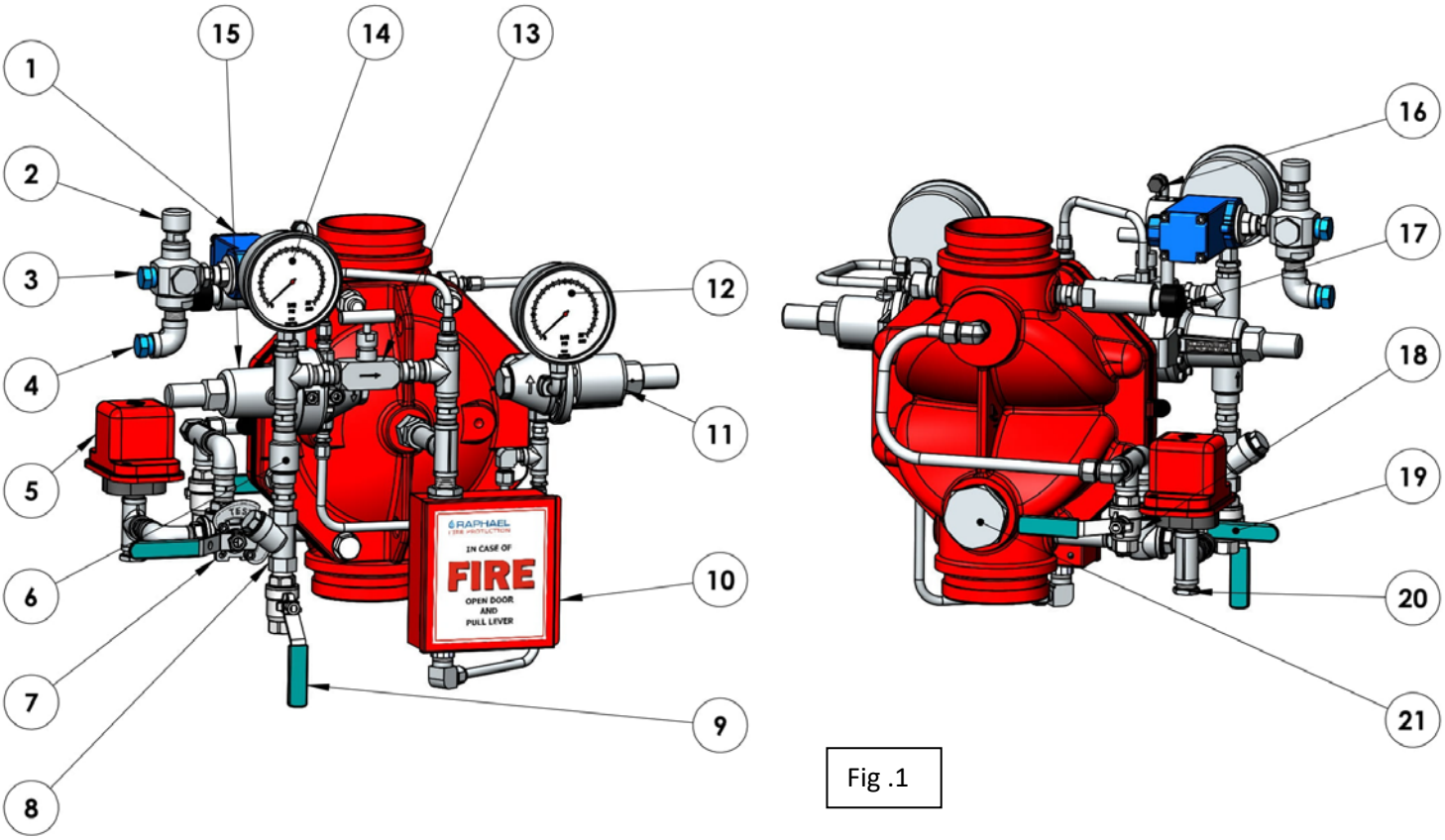


Fig .1

Operation (Reference Figure 1)

SET position:

Water is supplied by the trim pressure supply valve (**9**), passes the "Y" strainer (**8**), the check valve (**6**) flows through the needle valve (**13**) and fills the FDV's control chamber.

Pressurized water in the FDV valve's control chamber get trapped by closed PAV-2 actuator (**15**) the check-valve (**6**), and by the closed emergency valve MEU (**10**), maintaining the deluge valve in closed position. The PAV-2 actuator's sense-chamber is subjected to constant pneumatic pressure in the dry pilot line, that passes through the PSA (**2**) connection port (**3**) and through the N.O. solenoid valve, keeping the actuator in its CLOSE state and by that, blocks the FDV's drainage.

Fire Situation

When one or more of the dry pilot line automatic sprinklers is subjected to fire, it blows open and the pneumatic pressure vents to the atmosphere.

When its sense-chamber gets de-pressurized, the PAV-2 (**15**) moves to its OPEN state and drains the FDV's control chamber through the PRPV pilot (**11**) to the FDV valve's downstream. Consequently, the FDV deluge valve opens and admits water at set reduced pressure into the open spray nozzles pipeline/s. The drop of the pneumatic pressure in the dry pilot pipeline, causes the PSA (**2**) to prevent the supply pressure connected to supply port (**3**) filling and re-pressurizing the dry pilot (and close the PAV-2 actuator and cconsequently, the deluge valve). By that, the PSA latched the deluge valve open.

Alternately, if a heat / smoke detector senses flames heat, it transmits an electric signal to the main control board that in turn, transmits a signal to the solenoid valve (**1**). Its coil energizes and it change its state. Consequently, it vents the PAV-2 actuators sense chamber pneumatic pressure and simultaneously, isolate it from the dry pilot's pressure. PAV-2 (**15**) moves to its OPEN state and drains the FDV's control chamber through the PRPV pilot (**11**) to the FDV valves' downstream. Consequently, the FDV deluge valve opens, and admits water at set reduced pressure into the open spray nozzles pipeline/s.
Note: If the pneumatic pressure in the pilot line decreases due to a leakage, the internal elastomeric ball in the PSA raises and enables the the supply pressure to flow into the pilot line and compensate for its pressure loss.

Reset Position

Flow the procedure described at chapter **Commissioning the system - phase 3** page 7

Installation (Reference Figure 2)

1. This system is supplied pre-assembled and factory pre-adjusted. Any change carried out at the system's trim components order, pipes 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. maintaining sufficient room around the system location ensures operational safety, and ease of maintenance.

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, as the PSA need to be positioned vertically only. Systems with identical operation but for horizontal installation are marked with a prefix "H", e.g. HFDV-PC0.

6. The downstream pipe connected to the FDV valve at a vertical and horizontal mount system, must be supported firmly to prevent the pipeline's weight to be loaded on the system's valve.

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

8. All connections to water supply, should be done in accordance with figure 2
   (**1**) – Trim pressure supply connection - ½" NPT female.
   (**6**) - Alarm gong - ½" NPT female.
   (**10**) – Dry pilot line & ASK supply line to the PSA – 1/2" NPT female (temporary plugged).

9. Remove plastic plug ¼" from the vent elbow on the solenoid valve.

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

Installation parts list.

(reference - figure 2)

1. Trim supply valve (1/2” NPT female)
2. Y Strainer
3. Alarms test valve (3 way)
4. Needle valve bypass ball valve at the ASK
5. Air supply ball valve at the ASK
6. Water Motor Alarm connection (1/2” NPT female, plugged)
7. Alarm Pressure switch*****. (½” NPT female connection) *
8. Downstream drain valve
9. PAV-2 Pneumatic Actuator Valve 2 way.
10. PSA – Pressure Supply Arrestor
11. Main Control hub
12. Solenoid valve, 3-way, ¼” NPT.
13. Heat / Smoke detection sensors.
14. Dry pilot line
15. Downstream separation valve (butterfly or OS&Y valves).
16. Upstream pressure gauge
17. Needle valve
18. Downstream pressure gauge
19. PRPV Pressure Reducing Pilot Valve
20. Check Valve
21. MEU Manual Emergency Unit
22. Upstream separation valve (butterfly or OS&Y valves).

* **Optional**

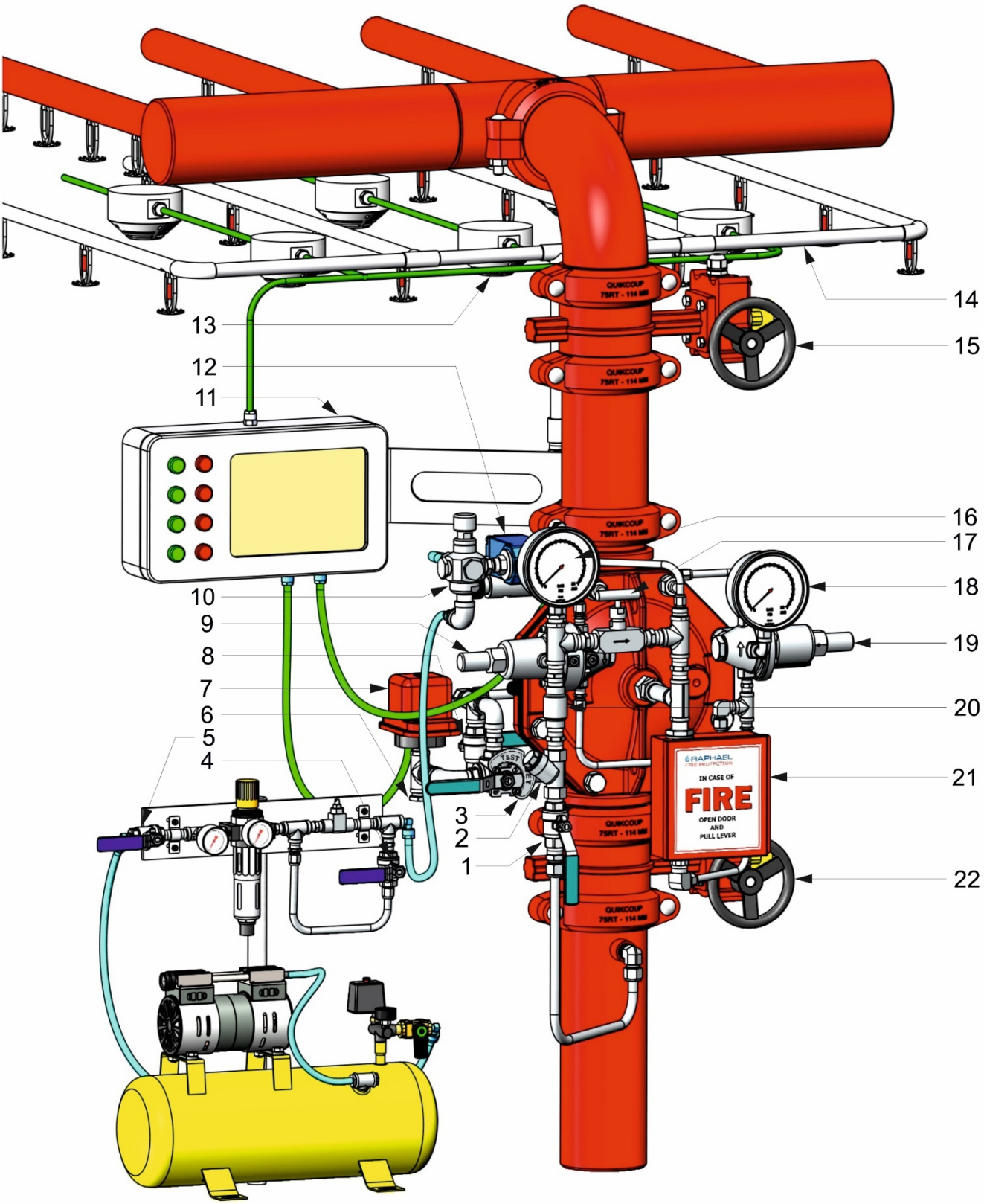

14
15
13
12
11
16
17
18
10
9
8
19
7
6
20
5
4
21
3
2
1
22
IN CASE OF
FIRE
OPEN DOOR
AND
PULL LEVER
TEST

Figure 2.

Commissioning the system - Phase 1

Filling and pressurizing the system.

The procedure described should be carried out after system installation completion and a comprehensive inspection. (Reference Drawing - figure 2)

1. The filling process needs to be performed only after flushing the pipeline. The flushing needs to be done when both butterfly valves (**15** & **22**) are open, and the trim supply valve (**1**) is close.

2. After flushing, close the upstream butterfly valve (**22**).

3. Make sure the trim pressure supply ball valve (**1**) is closed.

4. Make sure that the Emergency valve in the MEU (**21**) is fully closed.

5. Open ASK air supply ball valve (**5**) and the needle valve bypass ball valve (**4**). Press down the PSA (**10**) push button and pressurize the pilot line to the rated set pressure. No adjustments at the PAV-2 (**9**) actuator are needed as the device is factory set. When reached to set pressure, close the needle bypass ball valve (**4**).

6. Close downstream separation butterfly valve (**15**) and open the FDV's downstream drain valve (**8**). The Upstream drain remains plugged, or its valve (if equipped) is close.

7. Open the trim pressure supply valve (**1**) and fill the trim and FDV's control chamber.

8. Open gradually the upstream butterfly valve (**22**).

9. Observe the downstream drain valve (**8**): there should be no leakage or dripping. Leave this ball valve open

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

Commissioning the system - Phase 2

Fire Situation Simulation (Reference Drawing - figure 2)

The procedure described, should be carried out after the system was pressurized and a comprehensive leakage inspection was commissioned.
Energizing the solenoid can simulate a fire situation and cause the system to response by opening the FDV deluge valve.

NOTICE:

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 personnel and the close central fire station must be reported.

(Reference drawing - figure 2)

1. Make sure the downstream separation valve (**15**) is close

2. Make sure that the downstream drain valve (**8**) is open.

3. **Actuated by the dry pilot line**: Open the inspector's valve (at the end of the dry pilot line – not illustrated) and vent the pilot line. The pilot's pressure drop will cause the PAV-2 (**9**) actuator to open and consequently, the FDV deluge valve will open.

4. **Downstream set pressure adjustment**: Observe the pressure gauge installed on the PRPV pilot valve (**18**). Downstream set pressure correction if needed, need to be performed following this method -
   ***** Release the small hexagon M4 socket screw located at the adjusting screw cover about two turns using 2mm Allen key and fully unscrew the cover.
   ***** Unscrew the locking nut on the pilot's adjusting screw about two turns using a 17mm (11/16") wrench.
   ***** Use a 10mm wrench for the adjusting screw following the procedure below:
   - to increase the pressure – turn the pilot's adjusting screw clockwise
   - to decrease the pressure – turn the pilot's adjusting screw anticlockwise
   after adjustment completion, tighten the locking nut (while holding the adjusting screw in place). Re-install the cover and tighten the M4 screw lock screw.

5. If downstream pressure is ok, close partly and gradually the downstream drain valve (**8**). Observe the downstream pressure gauge and make sure that the PRPV pilot keeps set pressure steady.

6. Close the inspector's valve at the end of dry pilot line (**14**) and press down the PSA (10) push button until the line gets pressurized to air set pressure. The process can be expedited by temporarily opening the needle valve bypass ball valve (**4**) at the ASK (Air Supply Kit). When reached to set pressure, release the push button. The FDV deluge valve need to close.

7. **Actuated by the Heat/Smoke detection sensors**: initiate a false alarm for the Heat/Smoke detection sensors at the control board (**11**). The solenoid valve (**12**) needs to be energized and the pressurized air in the PAV-2 control chamber need to be vented through the PAV-2 vent port (**16** figure **1**) to the atmosphere.

8. Consequently, the FDV valve will open, and a significant stream of water should flow out of the downstream drain valve (**8**).

System is ready for re-setting and placing in service.

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. After a real fire situation, replace all blown-open sprinklers before pressurizing the pilot line.

Resetting after a Fire Situation Simulation:

1. Close the Upstream Butterfly valve (**22**)
2. Close the trim pressure supply (**1**).
3. Close the inspector's valve (at the end of dry pilot line **14**) and / or turn off the false alarm for the Heat/Smoke detection sensors at the main control board.
   Press the PSA (**10**) and make sure the dry pilot line becomes pressurized to set pressure. The process can be expedited by temporarily opening the needle valve bypass ball valve (**4**) at the ASK. When reached to air set pressure, release the PSA push-button and close ball valve (**4**).
4. Disassemble the "Y" strainer (**2**) and clean its screen. Re-assemble the strainer.
5. Open the pressure supply valve (**1**).
6. Open the Upstream Butterfly valve (**22**) and observe the downstream drain valve - make sure there is no leakage or dripping. If ok, close this valve.
7. Close the downstream butterfly valve (**15**)

Resetting after a Real Fire Situation:

1. Close the Upstream Butterfly valve (**20**)
2. Close the trim pressure supply (**1**).
3. Close the air supply ball valve at the ASK (**6**)
4. All the Dry pilot line's blown-open sprinklers must be replaced. When done. Open the air supply ball valve (5) and needle ball valve bypass valve (4). Press the PSA (**10**) and make sure the dry pilot line becomes pressurized to set pressure. The process can be expedited by temporarily opening the needle valve bypass ball valve (**4**) at the ASK. When reached to air set pressure, release the PSA push-button and close ball valve (**4**).
5. Follow steps 5 to 7 listed above under ***Resetting after a Fire Situation Simulation instruction.***

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 Inspection

1. Observe the FDV deluge valve and its trim for external damage: observe the trim piping and hose connections for leakage or damage.

2. Verify that the upstream and downstream separation butterfly valves (**22** & **14**) and the Trim pressure supply valve (**1**) are in fully open position.
   Downstream drain valve (**8**) and upstream drain valve (if equipped) are fully close.

3. Press the PSA push button about 5-10 seconds and release. Observe the dry pilot pipeline pressure gauge for set pressure.

4. Make sure that the required supply water pressure is applied to the deluge Valve inlet and trim.

5. Push the MADV (MB) (**20 figure 1**) and make sure that after emptying condensing water, the drain flow/dripping stops. If a constant leakage is observed, it might indicate a deluge valve sealing problem.

6. Move the 3-way SET/TEST valve handle (**3**) to TEST. The acoustic alarm should sound, and the alarm pressure switch (**7**) should transmit a signal to the main control board. If ok, move the valve's handle to the SET state.

Annual test procedure

1. Conduct the monthly test & inspection procedure.

2. Perform the procedure described in chapter - **Commissioning the system - phase 2. -** Fire Situation Simulation. Check the system's proper operation.

3. Follow the procedure described in chapter - **Commissioning the system - phase 3.** - Resetting & placing in service, chapter ***Resetting after a Fire Situation Simulation.***

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.

1. Close the upstream butterfly valve (**22**) and the trim pressure supply valve (**1**).
2. Open the drain valve (**8**) and the upstream drain valve if equipped. Drain the FDV's control chamber using the MEU Emergency valve (**21**).
3. Turn off or disconnect all relevant electrical circuits.
4. Release all relevant tubes, fitting nuts and the central union pipe connection (if equipped) at valves cover center.
5. Remove and disassembled front trim.
6. Remove all the FDV's cover bolts. The cover will hang on its studs (4" DN100 valve size and up). 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).
8. Worn or damaged parts should be replaced. Consult Raphael's local representative or the service department for any maintenance issue or part replacement issue.

9. Replace the Diaphragm. The identification tongue should point to the valve's stamped size side (from top view – at the left side).

10. Reinstall the valve's cover: use the Anti-seize paste supplied in the maintenance kit for bolts and nuts pre-installation lubrication. Tight it in accordance with **"Bolt's torque moments table".**

11. Reinstall the front trim carefully: avoid causing twists or dents on bent tubes and do not overtight the compression fitting's nuts.

12. When the system is fully re-assembled, perform the "**Commissioning the system - phase 1** - Filling and pressurizing the system" procedure.

13. Perform the **Annual test 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

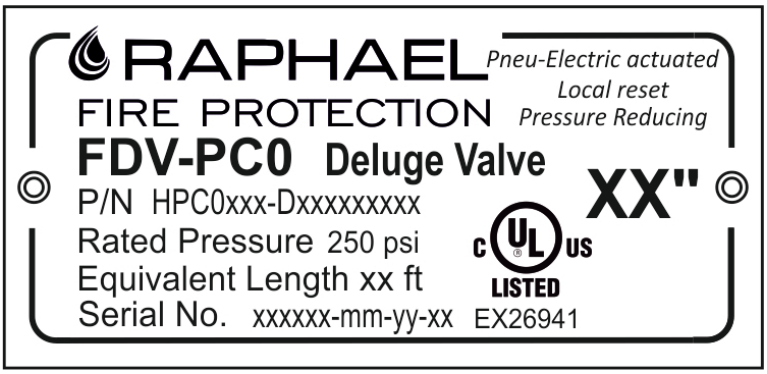
Equivalent pipe length for FDV deluge valves

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)

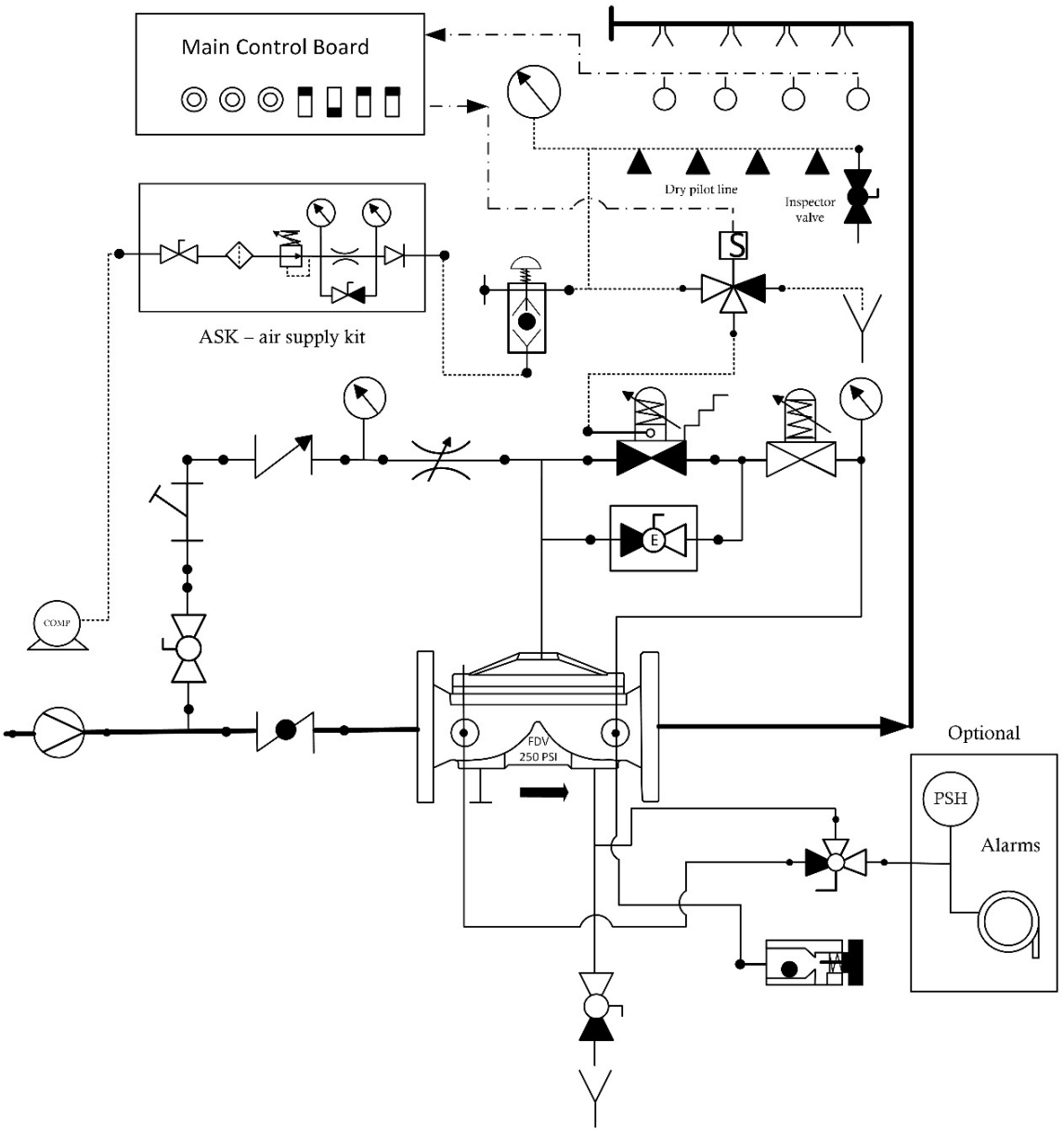
Marking

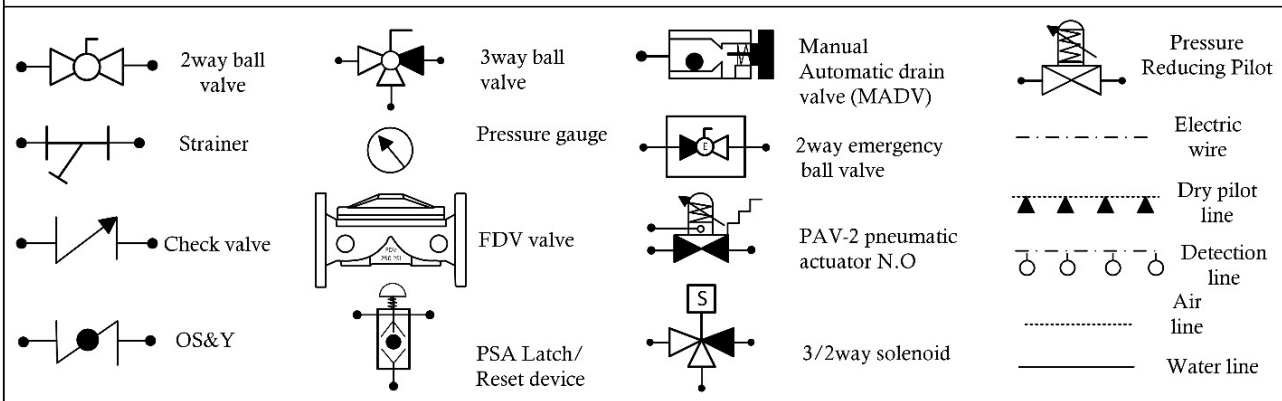
The FDV valves are marked by a laser engraved, black anodized, 0.8mm (0.031”) thick metal plate, riveted to the valve’s cover.

- *Company name and trademark.*
- *Short description (Italic letters)*
- *Application’s type*: FDV-PC0 – Electric / Pneumatic actuated, Local Reset with Pressure Reducing.
- (P/N) *The Application’s part number*: System properties–Valve properties
- *Rated pressure*: 250 psi
- *Equivalent Length: reference table - page 11.*
- *Serial Number*: Work order number-MM-YY-Number in batch 01-99
- *The UL listing mark & QR code:* EXxxxxx
- *The FM approved mark*
- *The Application’s* diameter in inch: XX”



Pneu/Electric actuated, Local Reset FDV deluge valve, With Pressure Reducing, Type: **FDV-PC0**





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

RAPHAEL Valves Industries (1975) Ltd.

North Industrial Zone Or Akiva, 3063927 P.O.Box 555, Israel

Tel. +972 4 6263555 | info@raphael-valves.com | raphael-valves.com