IOM FDV-DC0

ELECTRO-PNEUMATICALLY ACTUATED, LOCAL RESET, DELUGE VALVE

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

Fire Protection

RAPHAEL VALVES INDUSTRIES

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IOM FDV-DC0

Electro-Pneumatically Actuated, Local Reset, Deluge Valve

DESCRIPTION



This deluge system is based on Raphael's FDV valve, equipped with a pneumatically or electrically actuated control trim. The installed FDV valve is available in a range of optional materials and coatings to meet the required operating conditions, while the functional principle of the system remains unchanged.
Two detection systems, pneumatic (a dry pilot line) and electric (smoke or heat detectors), are installed in series and operate a pneumatic actuator.
In a fire situation, either of these detection systems can activate the pneumatic actuator, release the water trapped in the FDV control chamber and open the deluge valve.
Opening the emergency valve overrides all conditions and opens the deluge valve immediately. The system is equipped with a PSA that serves as a local reset and hydraulic device.
This system is suitable for sprinkler piping equipped with open nozzles.

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PARTS LIST

Electro-Pneumatically Actuated, Local Reset, Deluge Valve

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

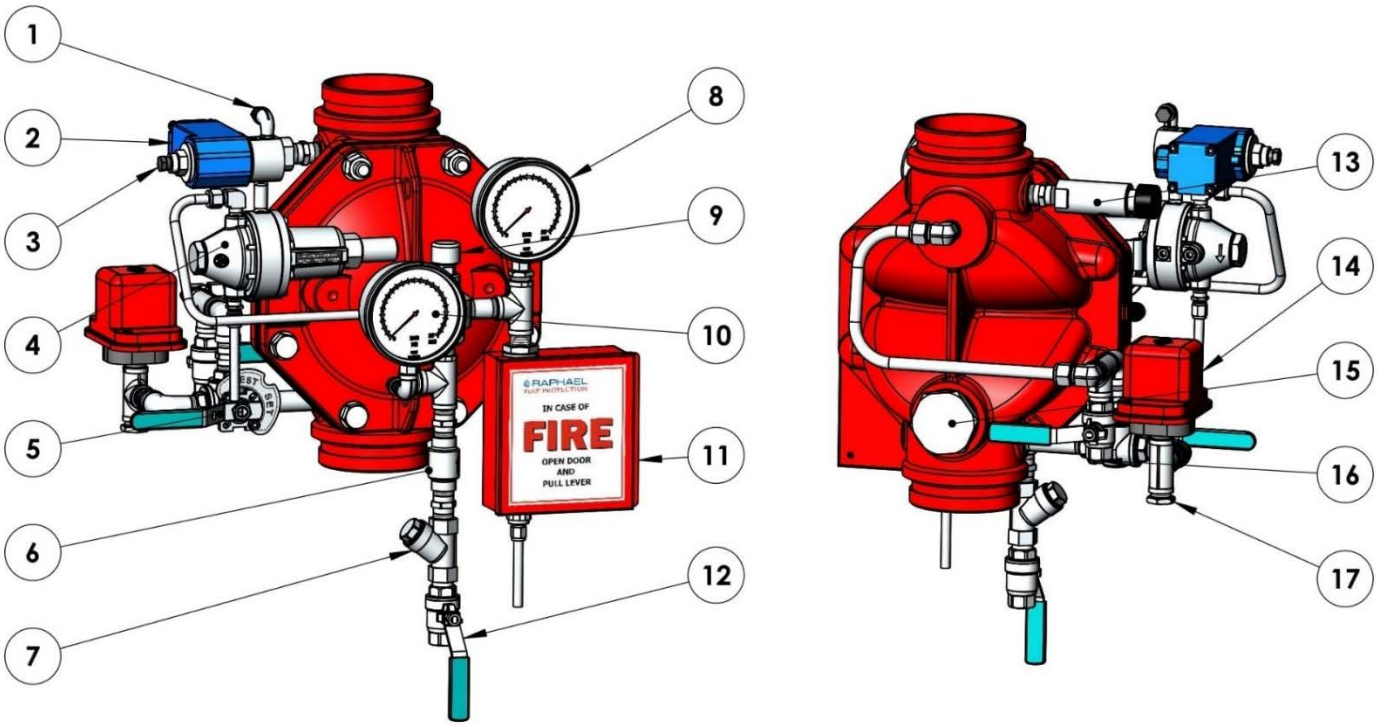


Fig. 1

OPERATION (Reference Figure 1)

SET position:

Water is supplied by the trim pressure supply valve (**12**), passes the "Y" strainer (**7**), the check valve (**6**) flows PSA (**9**) while its push button is pressed, and fills the FDV's control chamber.

Pressurized water in the FDV valve's control chamber get trapped by PSA (**9**) while its push button is released, the check-valve (**6**), by the closed pneumatic actuator PAV-2 (**4**) and by the closed emergency valve MEU (**11**), 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, keeping the actuator in its CLOSE state and by that, blocking the FDV's drain line.

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 (**4**) moves to its OPEN state and drains the FDV's control chamber through the PAV-2 vented port (**1**) to the atmosphere. Consequently, the FDV deluge valve opens, and admits water into the open spray nozzles pipeline/s. The drop of pressure in the control chamber, causes the PSA (**9**) to prevent the upstream flow to re-pressurize the control chamber (and close the valve). Consequently, the FDV deluge valve remains latched 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. Its coil energizes and it opens. When open, it vents the pneumatic pressure at the sense chamber of the PAV-2 through vent port (**1**), what causes the PAV-2 actuator to open. Consequently, the FDV deluge valve opens, and admits water into the open spray nozzles pipeline/s. The PSA serves as a latching device as described above.

RESET Position

The upstream butterfly valve needs to be closed and all the blown-open sprinklers at the dry pilot line should be replaced. This enables the re-pressurizing of the dry pilot line and the sense chamber of the PAV-2 actuator. Consequently, the PAV-2 actuator moves to its close position and blocks the valve's control chamber drain line. Then, the push button needs to be pressed, pressurizing the deluge control chamber and causing the valve to close. The open sprinklers water spray stops. Then, the upstream butterfly valve needs to be opened. It is recommended to drain the spray pipeline by opening the FDV's downstream drain valve (**16**) or by pressing the MADE (MB) push-button (**13**).

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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 basis, 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 needs to be positioned vertically only. Systems with identical operation but for horizontal installation are marked with a prefix "H", e.g. HFDV-DC0.

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 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.
   (**7**) - Alarm gong - ½" NPT female.
   (**11**) – Dry pilot line & ASK supply line to the PAV-2 actuator – ¼" NPT female (temporary plugged).
   (**21**) – EMU emergency valve drain tube – 3/8" tube.

9. Remove plastic plugs ¼" from the vent elbow on the solenoid valve and from the dry pilot & air supply connection (**11**).

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

11. Before performing the high-pressure leak test, make sure that the butterfly valve or the OS&Y valve upstream of the deluge valve is closed, in order to prevent damage to the diaphragms in the valve and in the trim components.

12. Make sure that the gong connected to its designated outlet is supported so that its weight, along with the weight of the piping attached to it, is not applied to the valve trim.

INSTALLATION PARTS LIST (Reference Figure 2)

Electro-Pneumatically Actuated, Local Reset, Deluge Valve

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

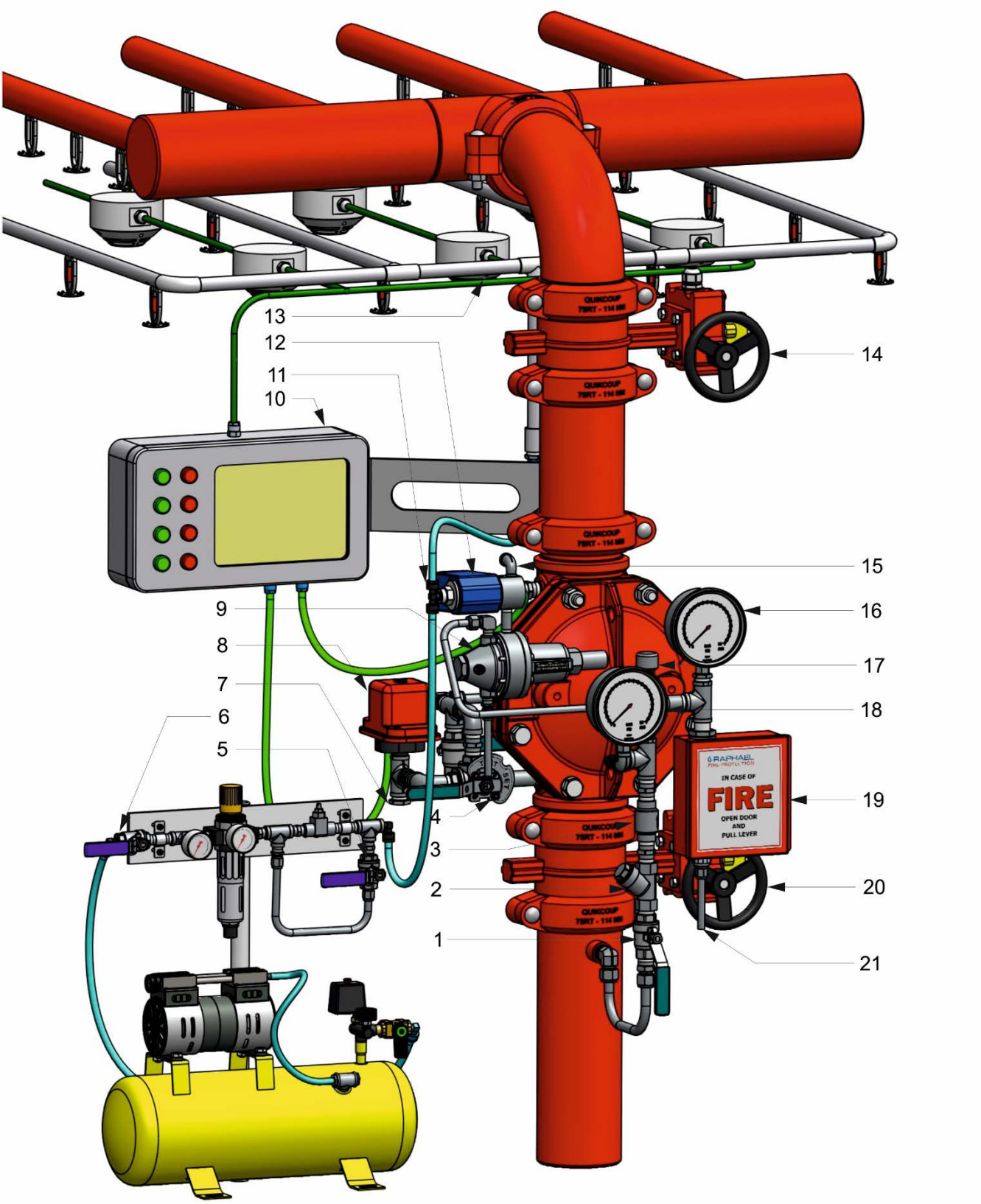
*** Optional**

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Electro-Pneumatically Actuated, Local Reset, Deluge Valve

Fig. 2



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OPERATING INSTRUCTIONS (Reference Drawing - 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 is performed only after flushing the pipeline. The flushing needs to be done when both butterfly valves (**14** & **20**) are open, and the trim supply valve (**1**) is close.

2. After flushing, close the upstream butterfly valve (**20**).

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

4. Make sure that the Emergency valve in the EMU (**19**) is fully closed.

5. Pressurize the pilot line to the rated pressure. No adjustments to the PAV-2 (**9**) actuator are needed as the device is factory set.

6. Close downstream separation butterfly valve (**13**) 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**). Press the PSA (**17**) push button and fill the trim and FDV's control chamber. The reading in pressure gauge (**16**) needs to be like in pressure gauge (**18**)

8. Open gradually the upstream butterfly valve (**20**).

9. Observe the downstream drain valve (**16 figure 1**): there should be no leakage or dripping.

10. If ok, close the Downstream drain valve.

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

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Commissioning the system - phase 2.

Fire Situation Simulation

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 (**14**) is close

2. Make sure that the downstream drain valve (**16 figure 1**) 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 drain the FDV's control chamber. Consequently, the FDV deluge valve will open.

4. Observe the downstream drain valve. A significant stream of water should flow out of this valve. If ok, close the inspector's valve at the end of dry pilot line and wait until the line gets pressurized to air set pressure. The process can be expedited by temporarily opening the needle valve bypass ball valve (**5**) at the ASK (Air Supply Kit).

5. **Actuated by the Heat/Smoke detection sensors**: initiate a fault alarm for the Heat/Smoke detection sensors at the control board. The solenoid valve (**12**) needs to be energized and the pressurized air in the pilot pipeline needs to be vented through the PAV-2 vent port (**1** figure 1)

6. Consequently, the FDV valve will open, and a significant stream of water should flow out of the downstream drain valve.

The system is ready for re-setting and placing in service.

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Commissioning the system - phase 3.

Resetting & placing in service

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 <u>Simulation</u>:

1. Close the Upstream Butterfly valve (**20**)
2. Close the trim pressure supply (**1**).
3. Close the inspector's valve (at the end of dry pilot line) and / or turn off the fault alarm for the Heat/Smoke detection sensors at the main control board. Make sure the dry pilot line became pressurized to set pressure.
4. Disassemble the "Y" strainer (**2**) and clean its screen. Re-assemble the strainer.
5. Open the pressure supply valve (**1**) and press the PSA (17) push button until pressure gauges **16** & **18** need to show the same reading. Open temporarily the downstream drain valve and make sure there is no leakage or dripping. If ok, close this valve.
6. The Upstream Butterfly valve (**20**) and the downstream butterfly valve (**14**) should be opened gradually.

Resetting after a <u>Real</u> 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.
5. When done, open the air supply ball valve at the ASK (**6**). The dry pilot line needs to be pressurized to set pressure. The process can be expedited by temporarily opening the needle valve bypass ball valve (**4**) at the ASK.
6. Disassemble the "Y" strainer (**2**) and clean its screen. Re-assemble the strainer.
7. Open the pressure supply valve (**1**). and press the PSA (17) push button until pressure gauges **16** & **18** show the same reading
8. Open the Upstream Butterfly valve (**20**) gradually, then open the downstream butterfly valve (**14**) and close the downstream drain valve.

The system is ready for re-setting and placing in service.

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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 personnel and the close central fire station must be notified.

The Maintenance and inspection procedures are based on the relevant chapters at 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 (**20** & **14**) and the Trim pressure supply valve (**1**) are in fully open position.
   Downstream drain valve and upstream drain valve (if equipped) are fully close.

3. Press the PSA push button about 5-10 seconds and release. Observe the FDV control chamber pressure gauge (**16**), the upstream pressure gauge (**18**) and make sure that its readings are the same. In addition, make sure that the required supply water pressures are applied to the deluge Valve inlet and trim.

4. Push the MADV (MB) (**13 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.
5. Move the 3-way SET/TEST valve handle (**4**) to TEST. The acoustic alarm should sound, and the alarm pressure switch (**8**) should transmit a signal to the main control board. If ok, move the valve's handle to the SET state.

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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 the performance of a comprehensive internal part examination. Then, the relevant trim accessories should be replaced, after completion, the Annual maintenance procedure is to be conducted.

1. Close the upstream butterfly valve (**20**) and the trim pressure supply valve (**1**).
2. Open the drain valve and the upstream drain valve if equipped. Drain the FDV's control chamber using the EMU Emergency valve (**19**).
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 disassemble 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, or the service department for any maintenance or part replacement issue.

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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

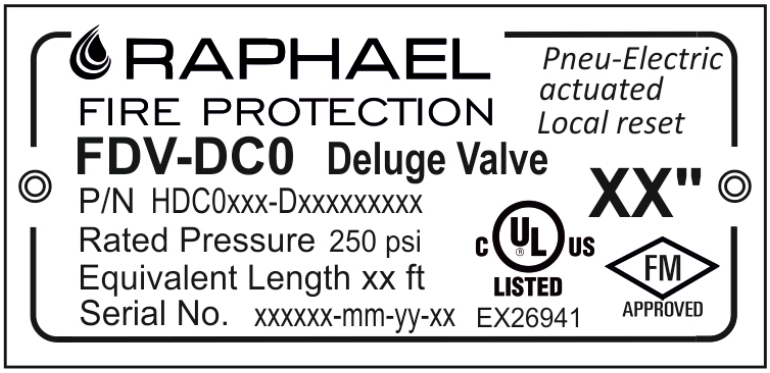
Valve size		1.5"	2"	2.5"	3"	4"	6"	8"	10"
Equivalent length value	ft	11	24	25	28	31	46	72	117
	m	3.6	7.3	7.6	8.5	9.4	14	21.9	35.6

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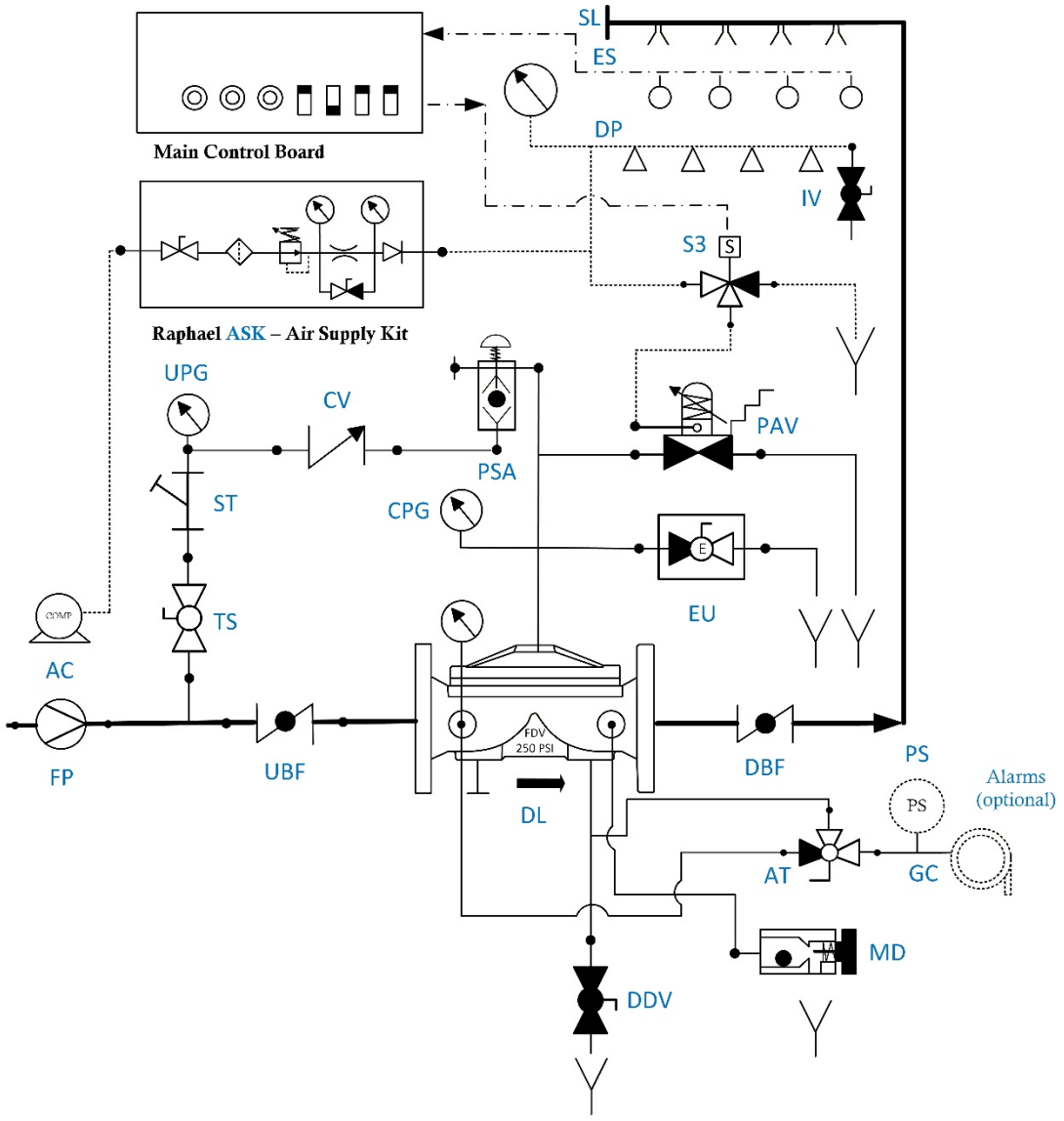
MARKING

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-DC0** – Electric / Pneumatic actuated, Local Reset.
- (P/N) *The Application’s part number*: System properties–Valve properties
- *Rated pressure*: 250 psi
- *Equivalent Length: reference table - page 12.*
- *Serial Number*: Work order number-MM-YY-Number in batch 01-99
- *The UL listing mark & QR code:* EXxxxxx
- *The Application’s* diameter in inch: XX”



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TS -	Trim supply	UBV -	Upstream Butterfly Valve		Water lines
ST -	Strainer	DBV -	Downstream Butterfly Valve		
AT -	Alarm Test valve	PS -	Pressure Switch		Air line
GC -	Gong connection	S3 -	3-Way Solenoid valve		Electric wire
CV -	Check Valve	AC -	Air Compressor		
UPG -	Upstream Pressure Gauge	EU -	Manual Emergency Valve		
CPG -	Control Chamber P. gauge	SL -	Sprinkles Line	ES -	Electric Sensors system
PSA -	Pressure Supply Arrestor	DDV -	Downstream Drain Valve	ASK -	Air Supply Kit
MD -	MADV – Manual / Automtic Drain Valve	FP -	Fire Pump	IV -	Inspector's Valve
PAV -	Pneumatic Actuator valve	DP -	Dry Pilot line	DL -	Deluge Valve

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.



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