IOM FPS-DIE0

DOUBLE INTERLOCK, ELECTRIC-ELECTRICALLY ACTUATED, LOCAL RESET, PREACTION SYSTEM

Installation Operation & Maintenance manual

Fire Protection

RAPHAEL VALVES INDUSTRIES

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IOM FPS-DIE0

Double Interlock, Electric-Electrically Actuated, Local Reset, Preaction System

DESCRIPTION

The preaction system is based on a controlled deluge valve and a clapper-type check valve installed downstream. The riser check valve remains closed due to the pressure maintained in the automatic-sprinkler pipeline. The space between the deluge valve's closed outlet and the closed clapper of the riser check valve serves as the intermediate chamber, where the acoustic alarm and the pressure switch are installed.

In a fire situation, heat opens one or more automatic sprinklers, causing the pipeline to lose pressure. This pressure drop is detected by the upper pressure switch and transmitted to the main control board, constituting the first actuation event. When one or more smoke detectors are activated, they send an electrical signal to the main control board, constituting the second actuation event. Only after both actuation events occur does the control board energize the solenoid-operated valve (SOV), allowing the deluge valve to open and admit water into the sprinkler pipeline.

The system is equipped with a PSA device that functions as a hydraulic latching mechanism and is essential for the local reset procedure.

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1. Air/Water pressure switch
2. Air supply check valve ¼" NPT female
3. Riser check valve drain ball valve – 1/2" NPT female
4. MADV drain valve
5. PSA Pressure supply arrestor
6. Upstream pressure gauge
7. Alarm pressure switch
8. Set/Test 3-way valve
9. "Y" Strainer
10. Trim pressure supply ½" NPT female
11. Air/water pressure gauge
12. Riser check valve
13. SOV solenoid valve
14. Control chamber pressure gauge.
15. Check Valve
16. MEU emergency unit
17. Upstream drain (plugged)

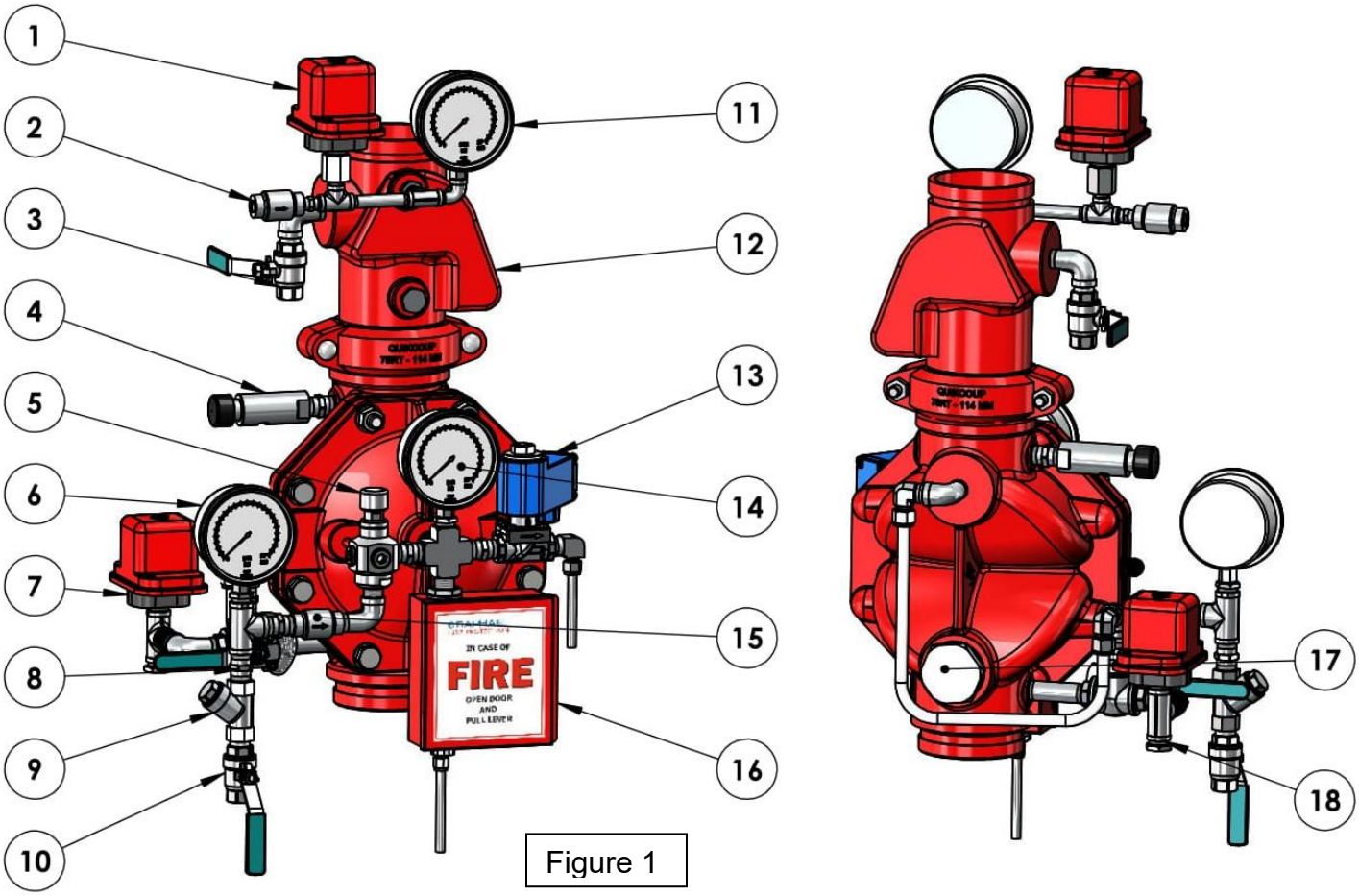

Figure 1

OPERATION (Reference Figure 1)

SET position:

The trim pressure is supplied through ball valve (**10**) and the "Y"-strainer (**9**), filling the FDV control chamber. Pressurized water in the control chamber is retained by the check valve (**15**), the closed SOV (**13**) and the closed emergency valve unit (**16**), keeping the deluge valve in the closed position.
The sprinkler pipeline is pressurized by the Air Supply Kit through check valve (**2**) and is monitored by the air/water pressure gauge (**11**) and the pressure switch (**1**).
The pneumatic pressure is held by the clapper of the riser check valve, by the closed check valve (**2**), by the drain ball valve (**3**) and by the automatic sprinklers.
A series of smoke and heat detectors are installed over the protected area and electrically connected to the main fire-protection control board (**13** in figure **2**).

Fire Situation

When one or more smoke detectors are activated by fire, a signal is sent to the main fire-protection control board.
When heat causes one or more automatic sprinklers to open, the trapped pneumatic pressure drops and the pressure switch (**1**) sends a signal to the control board as well. Consequently, the control board energizes the solenoid valve (**13**), which opens and drains the FDV control chamber, causing the deluge valve to open.
The hydraulic pressure drop in the FDV control chamber pushes the PSA's internal elastomeric ball (**5**) against the upper internal orifice, blocking it. Once blocked, upstream pressure can no longer flow into the control chamber and the FDV becomes latched open.
Opening the emergency ball valve bypasses all interlocks, drains the FDV control chamber and opens the valve immediately.

Reset Position

The reset procedure is described in detail on page 10, Commissioning the System – Phase 3: Resetting and Placing in Service.

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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 adjustments or order, pipe and tubes length or ports for axillary connection sizes, will affect the system operation and therefore prohibited.
2. The system (the FDV valve and the riser check valve), cannot be installed at a location where it might be subject 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 basis, during periodical tests procedures and when operating in fire situations. Therefore, a drainage plan should be considered.
5. The system described is to be mounted vertically only. Systems with identical operation but for horizontal installation are marked with a prefix "H", e.g. HFPS-DIE0.
6. It is essential that the PSA's installation orientation will be vertical only, regardless of the deluge valve orientation.
7. The downstream pipe connected to the riser check valve needs to be supported firmly to prevent the pipeline's weight from loading on the system.
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, FPS valve's drains, solenoid drainpipe, etc.), is prohibited.
9. All connections to water supply, alarms etc. should be done in accordance with figure 2:
   (**1**) – Trim pressure supply connection (1/2" NPT female)
   (**6**) – Water motor alarm connection (connect ½" to ¾" NPT nipple) - optional
   (**7**) – Pressure switch connection – optional (1/2" NPT female)
   (**4**&**5**) – ASK In and Out air connections (1/4" NPT female)
   (**11**) – riser check valve drain ball valve (1/2" NPT female)
   (**12**) – air supply check valve (1/4" NPT female)
   (**20**) – MEU emergence valve drain tube (3/8" tube).
10. Pressure switch wiring:
    Alaram pressure switch (7) need to be wired using the N.O. contacts so its function will be: closing contacts at pressure increase.
    Air pressure alarm switch (14) needs to be wired using the N.C. contacts so its function will be: closing contacts at pressure decrease.
    Installation parts list (Reference Figure 2)

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, 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.

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INSTALLATION PARTS LIST (Reference Figure 2)

Double Interlock, Electric-Electrically Actuated, Local Reset, Preaction System

1. Trip supply valve (1/2” NPT female)
2. “Y” Strainer
3. 3-way Test/Set ball valve
4. ASK air supply unit fast filling valve (1/4” NPT female)
5. ASK air supply unit fast supply valve (1/4” NPT female)
6. Water motor alarm connection * (1/2” NPT female)
7. Alarm pressure switch * (1/2” NPT female connection)
8. Upstream presser gauge
9. MADV manual automatic drain valve
10. PSA Pressure Supply Arrestor
11. Air / water drain valve on riser check valve Main control board
12. Air supply check valve
13. Main control board
14. Air pressure switch (in the scope of supply)
15. Heat/Smoky detection sensors
16. Downstream separation butterfly valve.
17. Air pressure gauge
18. Solenoid valve (2 way)
19. Control chamber pressure gauge
20. MEU manual Emergency Unit
21. Upstream separation butterfly valve.

*** Optional**

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PARTS LIST

Double Interlock, Electric-Electrically Actuated, Local Reset, Preaction System

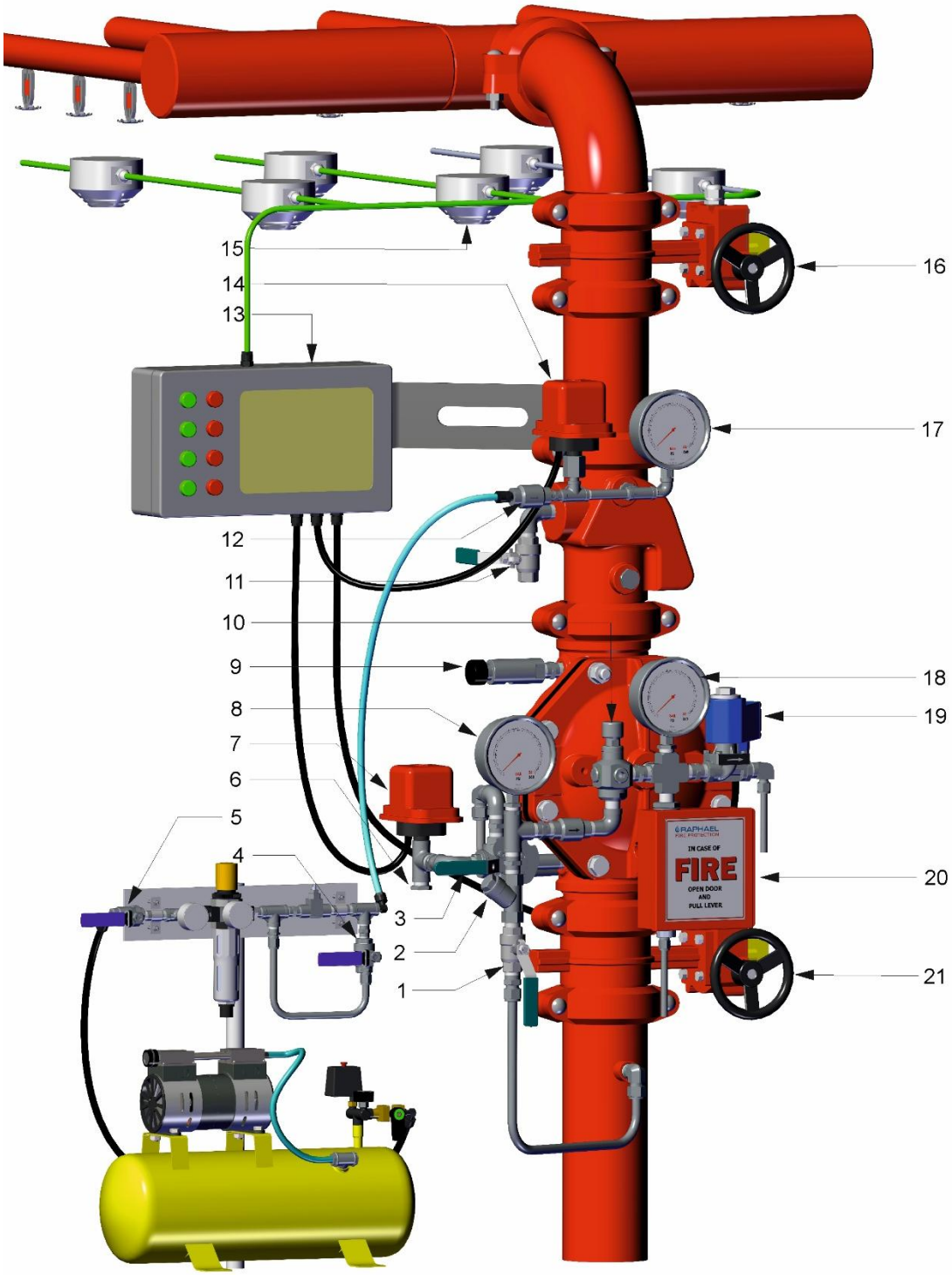

Figure 2

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. Close the Upstream & Downstream butterfly valves (**16 & 21**).
2. Make sure the solenoid (**18**) is de-energized.
3. Close the trim pressure supply ball valve (**1**).
4. Make sure that the Emergency valve at the MEU (**21**) is fully closed.
5. Open the Air supply flow rate selection ball valve, mounted vertically at the ASK (**4**), move its handle to the horizontal position and open the supply ball valve of the ASK (**5**).
6. Pressurize the sprinkler's pipeline to set pressure – observe air pressure gauge (**17**). When the pipeline has been fully pressurized, move the Air supply flow rate selection ball-valve handle to the vertical position (**4**).
7. It is recommended to verify the system's sealing by closing the ASK air supply valve (**5**) and monitoring air pressure for over 1 hour. If no air pressure decrease was observed, re-open the ASK air supply valve (**5**).
   Note: the ASK needle valve opening is factory set and should not be changed.
8. If ok, open the trim supply ball valve (**1**) and press the PSA (**10**) push-button until both pressure gauges **8 & 19** show the same reading. By that, the Deluge control chamber becomes pressurized, and the valve is closed.
9. Open the upstream butterfly valve (**21**).
10. Push the MADV (**9**) push-button and drain the space between the riser check valve and the deluge valve downstream – the "intermediate chamber". Note that air leakage indicates a clapper sealing malfunction and water leakage indicates FDV sealing issue.
11. If ok, open the downstream butterfly valve (**16**).

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 that the downstream butterfly valve (**16**) is close
2. De-pressurize the space between the check valve's clapper and the downstream butterfly valve by opening Clapper Check valve drain-valve (**11**).
3. Make sure that the Air pressure switch transfers a signal to the main control board (**13**).
4. Initiate false alarm activation, for fume or heat detection sensors system at the control board (**13**), to energize and open the SOV, and drain the FDV control chamber.
   The FDV deluge valve should open, force the check valve's clapper to open as well and admit water into the blocked spray sprinklers pipeline part.
5. Water should run out of the open Clapper-Check-valve drain-valve (**11**). Both alarms (water motor alarm & pressure switch, should be activated.
6. Stop the false alarms at the main control board to de-activate the SOV (**18**).
   Make sure that the Preaction system continues admitting water through the riser check valve's drain valve. By that, the PSA's operation as a latching device was verified.

End of Fire Situation Simulation

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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, make sure that the SOV is closed by de-energizing its coil (through the FP main control board). (Reference drawing - figure 2)

1. Close the upstream butterfly valve (**21**).
2. Close the air supply ball valve at the ASK (**5**).
3. Drain the downstream pipeline part through the riser drain valve (**11**) and open the air supply ball valve at the ASK. In addition, open the needle valve bypass ball valve and let the air stream “push” the leftover water out of the pipe part.
4. When the air stream looks dry and no water drops can be seen drifting through the open drain valve outside, close the drain valve (**11**) and pressurize it to set pressure. Observe the air pressure gauge (**17**) for the set reading.
5. Press the push button of the PSA to fill and pressurize the deluge valve control chamber. Push the button until the pressure gauges **8&19** becomes the same. This will close the deluge valve.
6. Gradually open the upstream butterfly valve (**21**).
7. Press the push button of the MADV drain valve and drain the space between the closed FDV deluge valve diaphragm, and the riser check valve clapper – the “Intermediate chamber”.
   If a dripping or leakage is observed, there is a sealing issue at the FDV deluge valve.
   If you hear or feel an air leak noise, there is a sealing issue at the riser check valve clapper.
8. Open downstream butterfly valve (**16**) the ASK will compensate any air pressure loss to set pressure.
9. Move the needle valve bypass ball valve at the ASK back to its close state.
10. Close the supply ball valve at the ASK and check for any air pressure decrease at list for 1 hour. If ok, fully open this ball valve.

The system is in SET state and placed in service.

MAINTENANCE (Reference Figure 2)

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.

Maintenance and inspection procedures follow the NFPA 25 instructions for deluge valves.

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 Preaction system for external damage: observe the piping and hose connections for leakage or damage.
2. Verify that the upstream butterfly valve (**21**) and the Trim pressure supply valve (**1**) are in fully open position. Upstream drain valve (if equipped) is fully close.
3. Press the PSA push-button (**10**) for about 5-10 sec. to assure that FDV valve control chamber is pressurized and then, release.
4. Push the MADV (**9**) 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 to TEST (**3**). The acoustic alarm should sound, and alarm pressure switch (**7**) should transmit a signal to the main control board.

Annual test procedure

1. Conduct the monthly inspection procedure.
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.

Periodic testing of systems for pressure leakage

Once every 3 years for air leakage, using one of the following test methods:

With the system at normal system pressure, shut off the air source (compressor or shop air) for 4 hours. If the low air pressure alarm goes off within this period, the air leaks shall be addressed.

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 (**21**) and the trim pressure supply valve (**1**).
2. Open the upstream drain valve (if equipped). Drain the FDV's control chamber using the EMU Emergency valve (**20**).
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 the disassembled trim.
6. Remove all the FDV's cover bolts. The cover will hang on its studs (4" 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 (diameter in inch) side.
10. Reinstall the valve's cover: use the Anti-seize paste tube supplied in the maintenance kit for bolts and nuts lubrication. Tight them in accordance with "Bolt's torque moments table".
11. Reinstall the 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 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		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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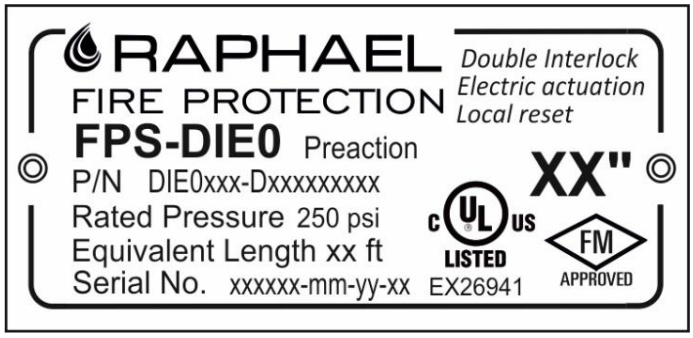
MARKING

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

The marking plate contains the data about (top to bottom):

- *Company name and trademark.*
- *Short description (Italic letters)*
- *Application’s type*: FPS-DIE0 – Double Interlock, Electric /Electric actuation with Local Reset Preaction system
- (P/N) *The Application’s part number*: System properties–Valve properties
- *Rated pressure*: 250 psi
- *Equivalent Length: reference table - page 14.*
- *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”



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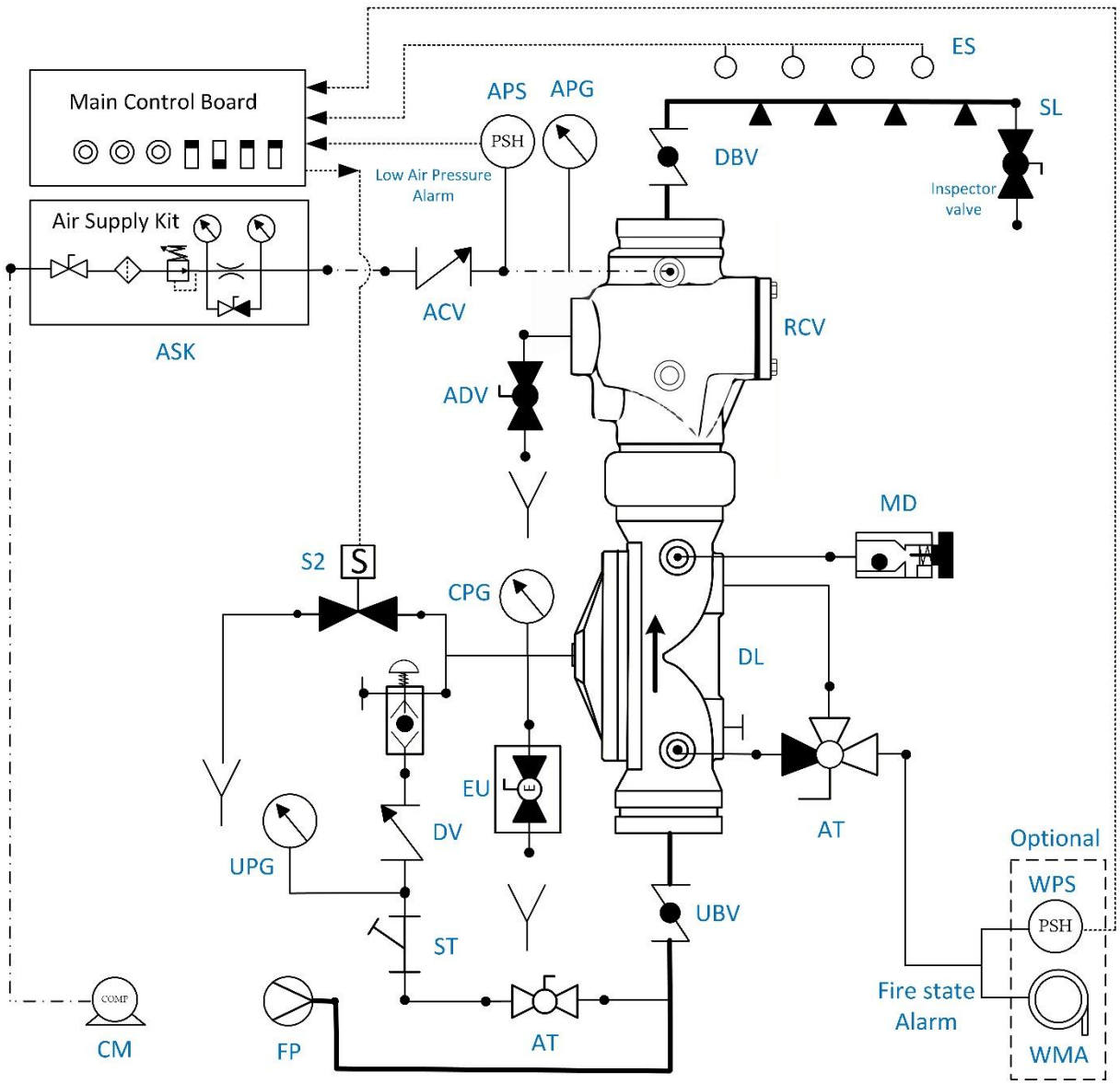

TS -	Trim supply	UBV -	Upstream Butterfly Valve		Water lines
ST -	Strainer	DBV -	Downstream Butterfly Valve		Air line
AT -	Alarm Test valve	CPG -	Control Chamber P. gauge		Electrical line
GC -	Gong connection	UPG -	Upstream Pressure gauge		
CV -	Check Valve	APG -	Air Pressure gauge	ACV -	Air Check Valve
PSA -	Pressure Supply Arrestor	EU -	Manual Emergency Valve	CM -	Air Compressor
WPS -	Water Pressure Switch (optional)	SL -	Sprinkles Line	S2 -	2-way Solenoid valve
DL -	Deluge Valve	ADV -	Air Drain Valve	APS -	Air Pressure Switch
MD -	MADV – Man./ Auto. Drain Valve	FP -	Fire Pump	RCV -	Riser Check Valve
ES -	Electric Sensors System	SL -	Sprinklers Line	ASK -	Air Supply 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.

Waterworks | Fire Protection | Irrigation | Smart Solutions

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