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Fire Main Flow Testing

Regional Case Studies Demonstrating Lessons On The Importance And Things To Consider

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Peter has been working as a Fire Engineer for more than twenty-five years of which 15 years in the Middle East

He handled building fire and life safety projects ranging from schools, hotels, hospitals to large shopping malls to multi occupancy high rise and industrial developments, from initial concept to assistance during construction.

Peter has also been involved in the fire safety system design and engineering fire safety system construction supervision and site management and in assistance and witnessing of testing and commissioning of fire and life safety systems.

He also has extensive experience in fire risk assessments ranging from qualitative fire risk assessments of refinery and chemical processes to quantitative fire risk assessments of installations. In his role, he has conducted numerous risk assessments involving gas installations and involving the storage and handling of hazardous materials.

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- ✓ Code Requirements
- ✓ Why Fire Main Flow Testing
- ✓ How To Do Fire Main Flow Testing
- ✓ Practical Considerations

Code Requirements

SYSTEM TO BE TESTED

- **SPRINKLER SYSTEM**
- **STANDPIPE AND HOSE SYSTEMS**
- **PRIVATE FIRE SERVICE MAINS**
- **FIRE PUMPS**
- **WATER SPRAY SYSTEM**

NFPA 25 AND 295 TESTING COMPLIANCE

Table 7.1.1.2 Summary of Private Fire Service Main Inspection, Testing, and Maintenance

Item	Frequency	Reference
Inspection		
Hose houses	Quarterly	7.2.2.7
Hydrants (dry barrel and wall)	Annually and after each operation	7.2.2.4
Monitor nozzles	Semiannually	7.2.2.6
Hydrants (wet barrel)	Annually and after each operation	7.2.2.5
Mainline strainers	Annually and after each significant flow	7.2.2.3
Piping (exposed)	Annually	7.2.2.1
Piping (underground)	See 7.2.2.2	7.2.2.2
Test		
Monitor nozzles	Flow, annually (range and operation)	7.3.3
Hydrants	Flow, annually	7.3.2
Piping (exposed and underground) (flow test)	5 years	7.3.1
Valve status test		13.3.1.2.1
Maintenance		
Mainline strainers	Annually and after each operation	7.2.2.3
Hose houses	Annually	7.2.2.7
Hydrants	Annually	7.4.2
Monitor nozzles	Annually	7.4.3

Code Requirements
NFPA - 25

7.3.1* Underground and Exposed Piping Flow Tests. Underground and exposed piping shall be flow tested to determine the internal condition of the piping at minimum 5-year intervals.

7.3.1.1 Flow tests shall be made at flows representative of those expected during a fire, for the purpose of comparing the friction loss characteristics of the pipe with those expected for the particular type of pipe involved, with due consideration given to the age of the pipe and to the results of previous flow tests.

7.3.1.2 Any flow test results that indicate deterioration of available waterflow and pressure shall be investigated to the complete satisfaction of the authority having jurisdiction to ensure that the required flow and pressure are available for fire protection.

7.3.1.3 Where underground piping supplies individual fire sprinkler, standpipe, water spray, or foam-water sprinkler systems and there are not means to conduct full flow tests, tests generating the maximum available flows shall be permitted.

7.3.2 Hydrants. Hydrants shall be tested annually to ensure proper functioning.

7.3.2.1 Each hydrant shall be opened fully and water flowed until all foreign material has cleared.

7.3.2.2 Flow shall be maintained for not less than 1 minute.

7.3.2.3 After operation, dry barrel and wall hydrants shall be observed for proper drainage from the barrel.

7.3.2.4 Full drainage shall take no longer than 60 minutes.

7.3.2.5 Where soil conditions or other factors are such that the hydrant barrel does not drain within 60 minutes, or where the groundwater level is above that of the hydrant drain, the hydrant drain shall be plugged and the water in the barrel shall be pumped out.

When and Why is Adequacy Assessment of Firewater Supply, Hydraulic Analysis and Fire Main Flow Testing essential?

COMMON PROBLEM	STUDY	BENEFITS
Updates/Changes in Codes and Standards	Adequacy Assessment of Firewater Supply System	To know further development required for intended use.
Inconsistency in project implementation		Maximize current and future asset value.
Insufficient pressure and flow in the fire main	Hydraulic Analysis	Serves as a tool for "Decision Making"
Insufficient fire water pump capacity and pressure		Gives various options/ solutions for fire main constraints
Pipe Deterioration		Provide simulation on different scenarios
Upgrade/renovation of site facilities		Provides theoretical overview of pressure and flow in the fire water main.
Insufficient pressure and flow in the fire main	Fire Main Flow Testing	Provides realistic overview of pressure and flow of fire water main.
		Challenge the level of detail and validates the results of the hydraulic analysis.
Verification of actual flow and pressure under realistic worst case conditions		Verifies hydraulic analysis

How To Do Fire Main Flow Testing

- Pitot Meter

$$Q = 29.84 c d^2 \sqrt{p}$$ (Empirical)

- Q: in GPM
- c: Discharge coefficient
- d: in inches
- p: in PSI

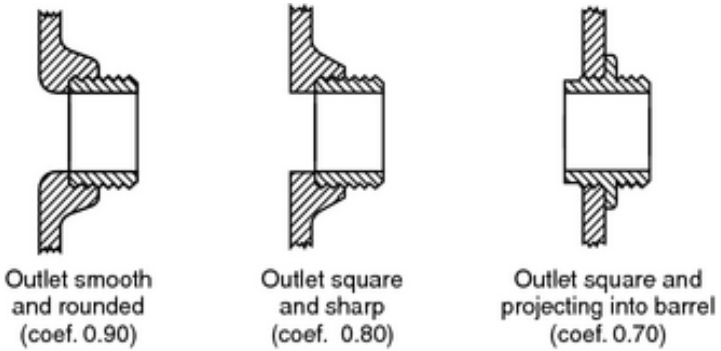
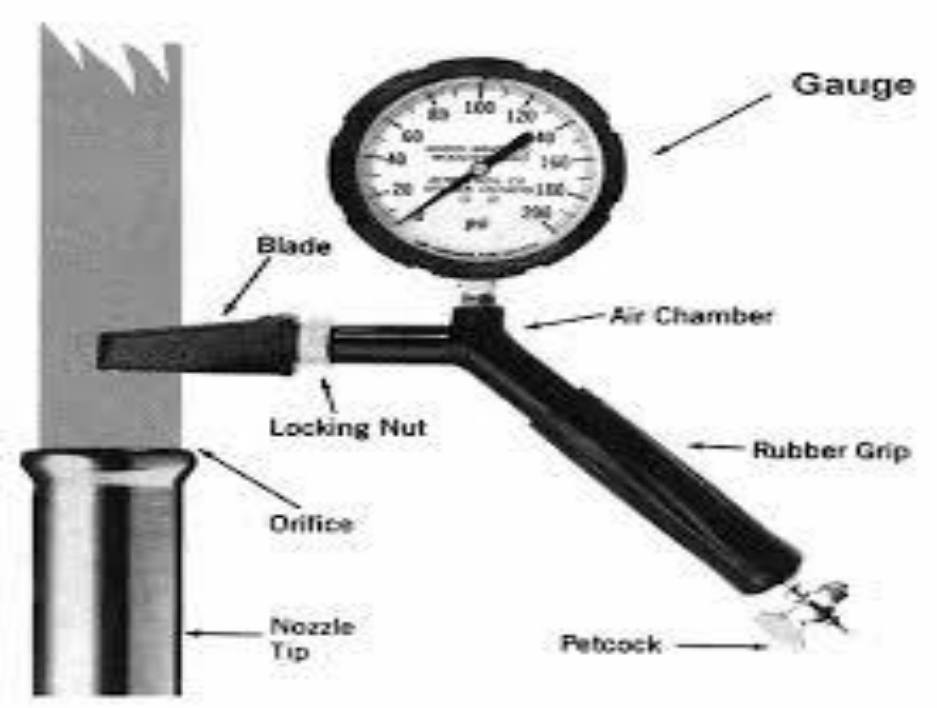
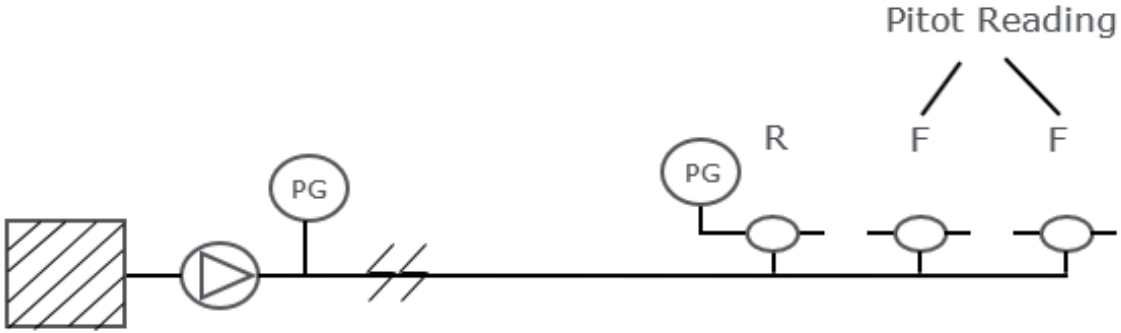


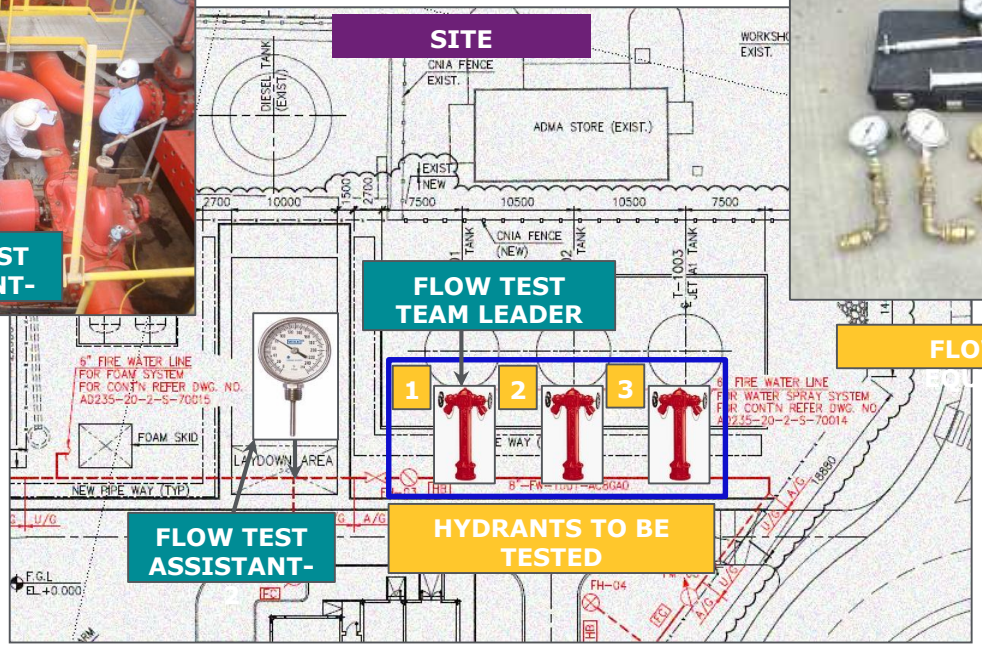
Figure 1. Three General Types of Hydrant Outlets and Their Coefficients of Discharge


Gauge
Blade
Air Chamber
Locking Nut
Rubber Grip
Orifice
Nozzle Tip
Petcock

Flow Test Setup

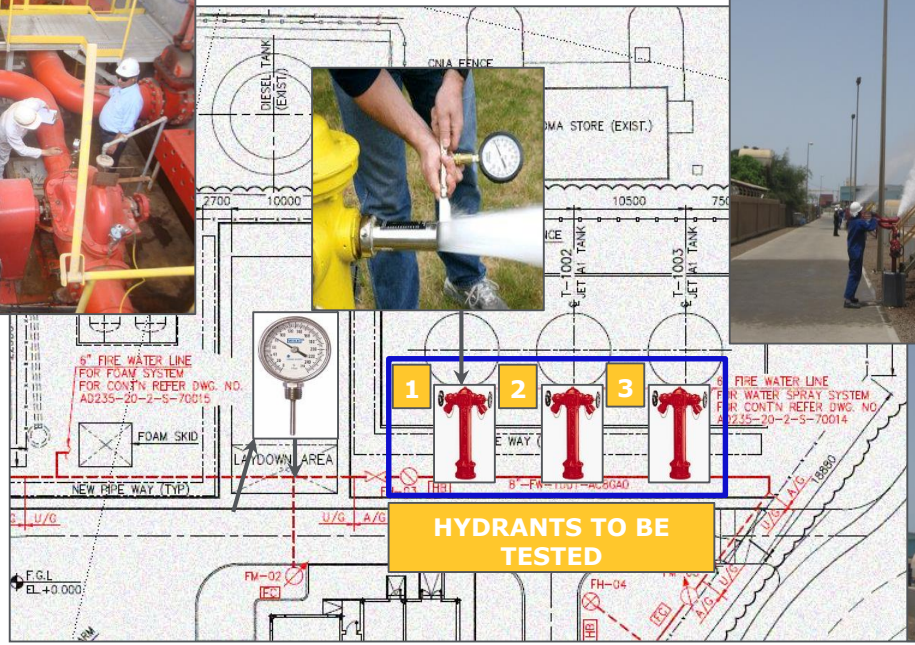


Preparation and Site Testing



- Operators are required for operating the relevant equipment at the fire pump location and at the location where the flow test is going to take place.
- Operator must also shall ensure that site safety precaution/procedure such as barricade, safety tape etc. is installed and followed before the flow test.
- Operators required are minimum of 4 personnel. Flow Test Team Leader will instruct the position of the operators.

Preparation and Site Testing



- Hydrant pressure to be tested shall be open one by one
- Pressure reading shall be taken at the Fire Pump, Fire Main near the hydrants and at the Hydrant.


TK-130

Practical Guidelines
Risk Assessment / Job Safety Analysis

- Check the site and prepare where the flow test is going to take place, ideally where the largest flows are expected.
- You should be able to estimate the anticipated flows and required number of hydrant / monitor outlets to be opened before the actual test.
- A lot of Water / Flow, check if site drainage is adequate
- Flow test in itself takes a few minutes, the whole test including preparation up to 1 day
- There is always something that goes not as planned; you may need to improvise

WORK SHEET	RISK ASSESSMENT REPORT FOR FLOW TESTING								
Issues									
Step Type	Overall Testing Process								
Hazards /Issues	**Cause**	**Consequence Analysis Consequence**	**Severity**	**Safeguard**	**Probability**	**Risk Ranking**	**Action / Recommendations**	**Risk**	**Responsibility**
Sand Erosion	High Flow of water hits the pipe rack area	Sand Erosion may lead to damage of pillar/pipe rack	Minor	○ Metal Sheet can be used to cover below pipe rack in order to avoid sand erosion. ○ Storm water drain channel is available to drain the water	Improbable	LOW			
Asset damage	High Flow of water hit the motion sensor	○ Possibility of Motion sensor/ Detector activation and damage	Minor	○ Storm water drain channel is available to drain the water	Remote	MEDIUM	○ Scaffolding/Barricade covered with tarpaulin sheet shall be provided to protect the motion sensor from water		
Loss of Pressure due to unforeseen major leak from broken pipe.	Major leakage during testing	○ Reduction in pressure at downstream section ○ Delay in testing	Minor	○ Pressure gauge is available to check the pressure ○ Sectional Isolation valves are available to isolate broken portion of pipe.	Remote	MEDIUM	○ SOP should contain the procedure regarding leakage during testing and same to be followed.	LOW	
Flooding of water	Flooding of water due to major block in storm water drain channel	○ Possibility of Environment (Land) issue	Minor	○ Operations to ensure that there is no major block in the Storm water drain channel	Improbable	LOW	○ Operations shall check the Storm water drain channel before the test		
Flow testing with part of network blocked due to closed isolation valves.	Operator Error	○ Inaccurate Results ○ Delay in testing	Minor	○ SOP is available that isolation valves in Fire water main shall be kept open	Remote	MEDIUM	○ Operators shall ensure that Isolation valves remain open during flow testing	LOW	Flow testing with part of network blocked due to closed isolation valves.
Working in Summer Weather	Excessive Exposure to heat	○ Heat stress	Minor	○ First Aid ○ Replacement of worker	Occasional	MEDIUM	○ Worker should have frequent break during summer ○ Provision of Shade		Working in Summer Weather

Thank You

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