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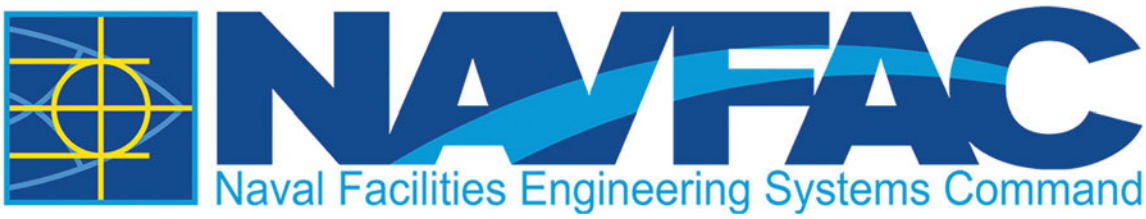

STANDARD OPERATING PROCEDURE

SOP 5.3 Hydrants

Abstract: Hydrants are valving devices installed on water mains to provide for fire suppression, flushing, and miscellaneous uses.

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Revision Tracking Sheet			
Date of Revision	Changed from:	Changed to:	Revised By (Initial)
1/31/2025	N/A	Original "Draft"	[redacted]
05/05/2025	Original	Revision 1	[redacted]
11/03/2025	Revision 1	Revision 2	[redacted]
Jan 2026	Revision 2	Revision 3	[redacted]

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7. (b) (3) (B) : User Guide
8. (b) (3) (B) Pressure Gauge Installation, Operation, and Maintenance

Notes:

1. DEFINITIONS/ACRONYMS

1.1. Definitions

- Fire hydrant: A connection point placed at a defined location for firefighters to tap into a water supply line. Fire hydrants are also used for flushing distribution systems. *Figure 1-1* shows typical hydrant configurations.

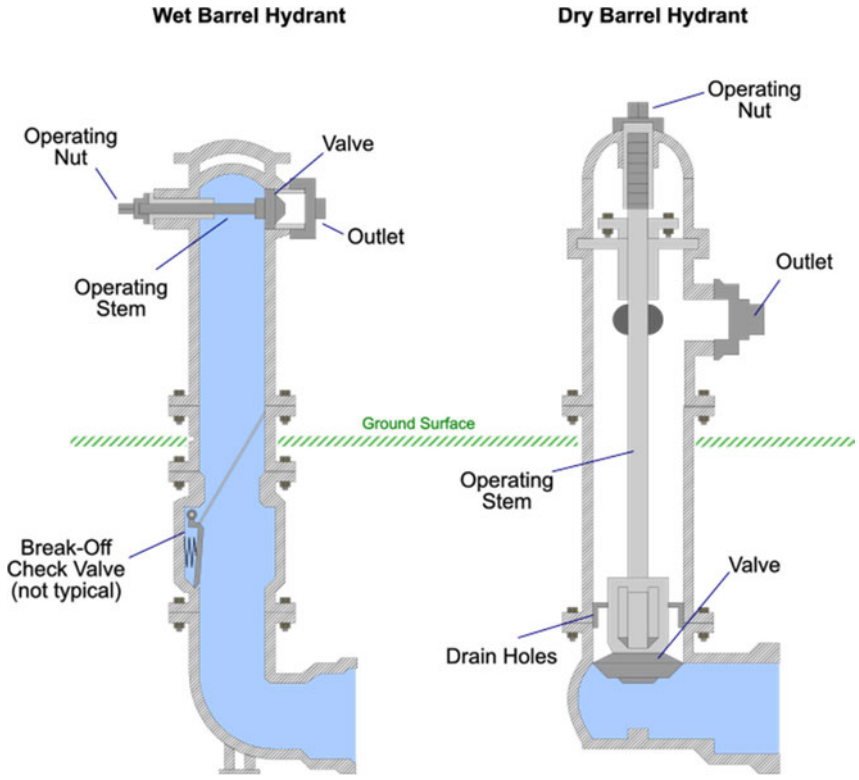

Figure 1-1 Hydrant Types

- Wet-Barrel Hydrant: This type is used at Joint Base Pearl Harbor Hickam (JBPHH) because there is no potential for the water to freeze in the barrel. They are generally equipped with a compression-type valve for each outlet. Wet-barrel hydrants are easier to construct and less expensive than dry-barrel hydrants. The (b) (3) (B) Company Model [redacted] wet-barrel hydrants used at JBPHH are not equipped with a break-off valve, which can result in a large loss of water upon damage from a vehicle impact.
- Dry-Barrel Hydrant: For dry-barrel hydrants, the valve controlling the water is located below ground. At the base of the hydrant there are drain holes that open when the main valve closes, permitting the hydrant barrel to drain after use. Dry-barrel hydrants are used in regions where low temperatures could cause water in the barrel to freeze. In addition, upon damage, the control valve remains closed, and no water is lost. At JBPHH, there is only one dry-barrel hydrant in service, which is utilized for training in preparation of any supply chain issues regarding wet-barrel hydrants.
- Flow hydrant: The hydrant at which flow is measured.

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- Pitot pressure: The pressure reading obtained on the pitot gauge during a flow test, which can be converted to flow rate.
- Residual hydrant: The hydrant where the static and residual pressures are measured.
- Residual pressure: The pressure in the distribution system, measured at the residual hydrant at the time the flow readings are taken at the flow hydrants.
- Safety Data Sheet (SDS): An Occupational Safety and Health Administration (OSHA) standardized hazard communication document detailing a chemical's properties and hazards (physical, health, and environmental); protective measures; and safety precautions for handling, storing, and transporting the chemical.
- Static pressure: The pressure that exists at a given point under normal distribution-system flow conditions.
- Water hammer: A sudden pressure surge in a pipeline caused by the rapid stopping or change in direction of the flowing water. Hydrants must always be opened and closed slowly to avoid water hammer.

1.2. Acronyms and Abbreviations

- AWWA American Water Works Association
- DSO Water Distribution System Operator
- GIS geographic information system
- JBPHH Joint Base Pearl Harbor Hickam
- NAVFAC Naval Facilities Engineering Systems Command
- NFPA National Fire Protection Association
- OIT Operators-in-Training
- OSHA Occupational Safety and Health Administration
- PPE personal protective equipment
- PRP32A Potable Water Branch
- psi pounds per square inch
- SDS Safety Data Sheet
- SOP Standard Operating Procedure
- UFC Unified Facility Criteria
- WHHP6B Pearl Harbor & Outlying Areas Distribution

Notes:_____

2. OVERVIEW

2.1. Scope and Purpose

This Standard Operating Procedure (SOP) covers the maintenance, repair, and testing of wet-barrel and dry-barrel hydrants, including inspecting hydrants for damage, lubricating moving parts, flushing hydrants, and conducting flow tests to verify water pressure and flow rates. This SOP adheres to the guidelines set forth by the American Water Works Association (AWWA) and the National Fire Protection Association (NFPA) standards, including NFPA 1, NFPA 25, and NFPA 291.

The fire hydrant is one of the most important parts of a water distribution system but is often one of the most ignored. The primary uses of hydrants include the following:

- Fire fighting
- Flushing water mains
- Flow testing
- Filing tank trucks for street washing, irrigation, and construction jobs
- Recreational uses

Hydrants stand idle for long periods of time and are vulnerable to damage, but they are expected to work well in emergencies. To ensure that hydrants will operate correctly when they are needed, the proper procedures must be followed when they are inspected, installed, tested, and maintained. *Figure 2-1* shows a typical hydrant installation.

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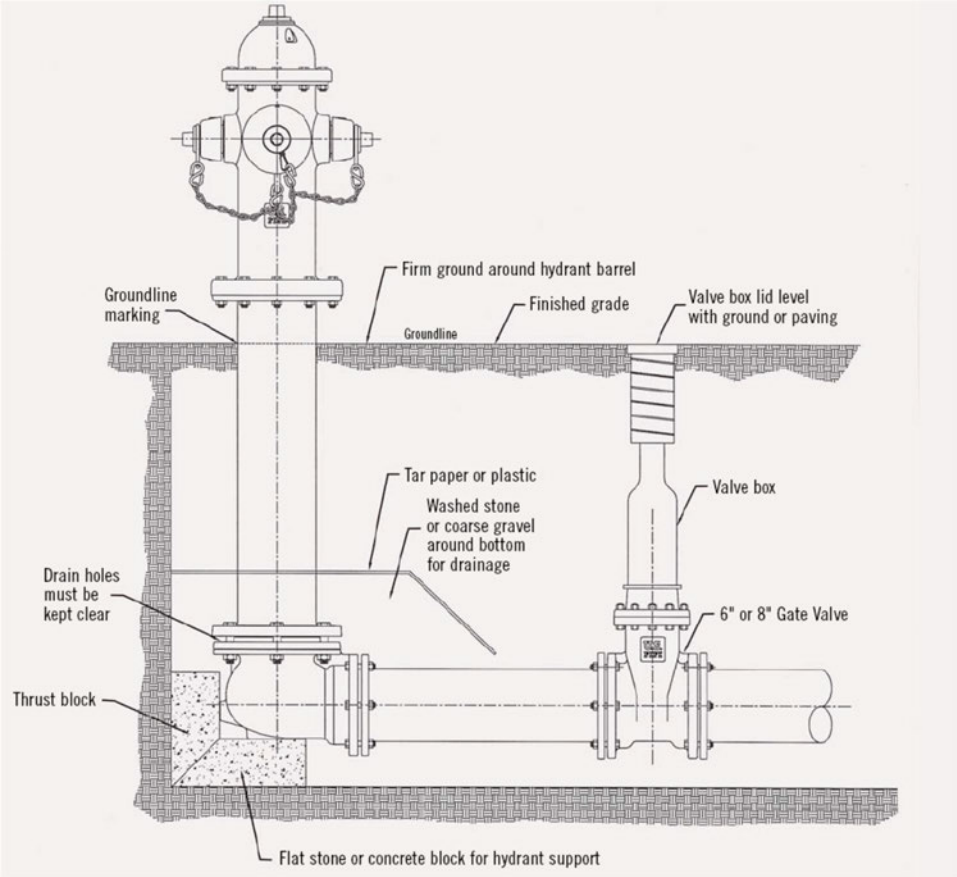

Figure 2-1 Typical Fire Hydrant Installation

2.2. Operating Summary

Hydrants undergo yearly maintenance and testing. Adhere to the following when operating hydrants:

- Hydrants may be operated by utility personnel, fire department, and contractors with special permission. If necessary, unauthorized use of hydrants can be prevented using hydrant locks. This practice helps control unmetered water consumption and improper use that could introduce contaminants into the water supply.
- Observe cross-connection control and backflow prevention practices: The use of hydrants to fill street sweepers, sewer-flushing trucks, and sewer high-velocity cleaners require special attention. The connection of a hose from the hydrant to the truck, even through a check valve, is a cross-connection and therefore hazardous. Each truck should have an acceptable in-line backflow prevention device connection. Another solution is to identify watering points that can be protected by backflow-prevention devices, such as reduced pressure zone backflow preventers and/or air gaps. Refer to the JBPHH cross connection control and backflow prevention program for further details.

2.2.1. Hickam

Hydrants on the Hickam Air Force Base are located in 12 zones. Detailed information, including Geographic Information System (GIS) images, hydrant numbers, manufacturers, and models, is

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tabulated in Excel sheets, which are maintained by operations staff. Each month, the hydrants in one zone undergo maintenance, including flow testing and inspection of main valves.

2.2.2. Pearl Harbor

Hydrants in Pearl Harbor are tested sequentially, based on location and hydrant number. This includes inspection and maintenance of main valves and hydrants in addition to a flow test of each hydrant.

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3. RESPONSIBILITIES AND QUALIFICATIONS

3.1. Responsibilities

The JBPHH Public Works Department owns and operates the JBPHH drinking water system. Operation and maintenance of the system is the responsibility of the Utilities Management Potable Water Branch (PRP32A). Hydrant operation and maintenance within JBPHH is performed by Pearl Harbor & Outlying Areas Work Center (WHHP6B). WHHP6B is responsible for hydrants in the Hickam distribution system.

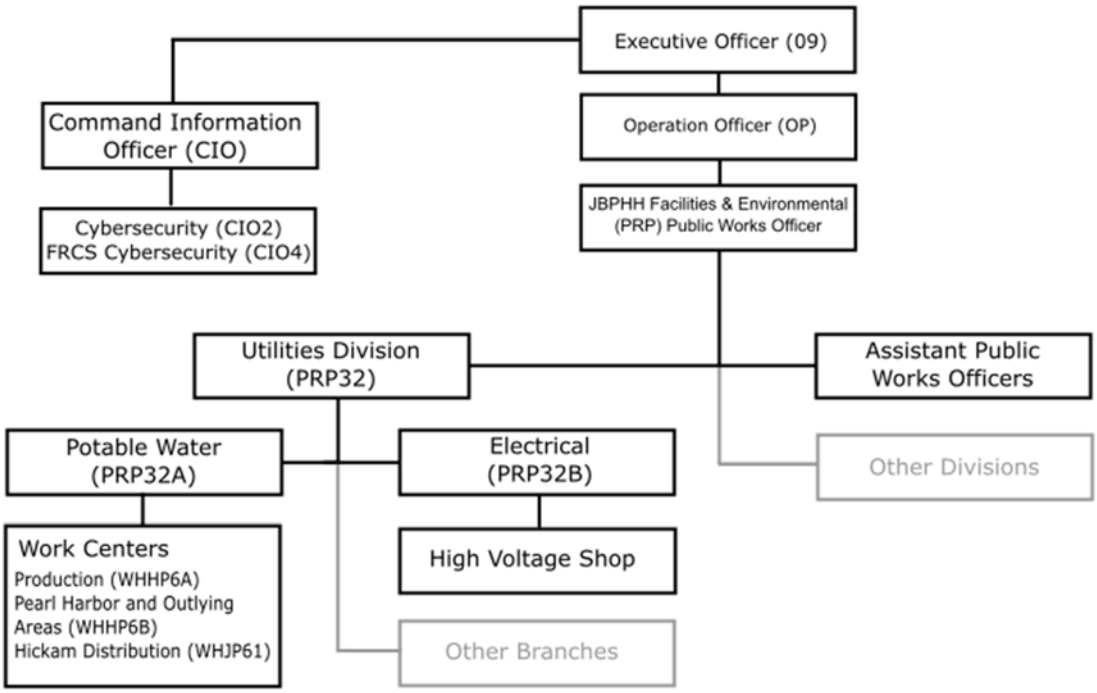

Figure 3-1 Public Works Department Organization

Lead operators and supervisors in PRP32A must ensure that the operators are trained and qualified prior to using this SOP. To support this process, a copy of this SOP should be made readily available to all users. Senior operators are required to update the SOP to reflect any changes in equipment, procedures, or regulations, and train the subordinate operators and maintenance crew(s) accordingly. Senior operators approve, coordinate, and maintain records of any major repairs on the equipment highlighted in this SOP. Training shall consist of in-depth, hands-on training for all new employees and employees new to this SOP and annual refresher meetings facilitated by the lead operator. All training should be documented using *Attachment 1 SOP Acknowledgement and Training Form*.

Notes:_____

3.2. Qualifications

All personnel involved in operations and maintenance activities of hydrants must adhere to the following:

- If required, personnel are responsible for obtaining and maintaining a Water Distribution System Operator's (DSO) certificate, Grade 1 or higher from the State of Hawaii, Department of Health, Safe Drinking Water Branch. Please note unlicensed and uncertified operators and Operators-in-Training (OIT) shall not make process control or system integrity decisions about water quality or quantity that affect public health.
- Follow Navy and base-specific safety regulations and directives and obtain appropriate safety training (see *Section 4*).
- Be familiar with the following:
  - Emergency protocols and communications
  - Operation of tools and equipment
  - Procedures outlined in this SOP

Notes:_____

4. HEALTH AND SAFETY

4.1. General Guidelines

With respect to health and safety, operators shall implement the following:

- Comply with the JBPHH Safety Manual.
- Use engineering, operational, or administrative controls or other means of performing work to eliminate or minimize health and safety hazard risk. Eliminating or minimizing health and safety hazard risk is preferred over the use of personal protective equipment (PPE). Use PPE to reduce hazard exposure when the hazard cannot be eliminated.
- Follow all OSHA requirements for work in confined spaces, trenching, roadways, etc.
- Pay specific attention to the hazards outlined in *Section 4.2*.
- Be familiar with all applicable SDSs. Ensure SDSs are up to date. Ensure the SDSs displayed / available match the chemical being used (i.e., do not use an SDS for the same chemical from another manufacturer).

4.2. Anticipated Hazards

- Moving parts
- Heavy equipment
- Work environment (hot weather, humid environment, wet slippery grounds, elevated platform, uneven/unstable ground, noise, etc.)
- Traffic

4.3. Personal Protective Equipment

Utilize the following PPE based on anticipated activities:

- Safety steel toe shoes with anti-slip soles
- Gloves
- Eye protection
- Ear protection if loud equipment is operating
- Hard hat/helmet
- Class 2 safety vest (class 3 vest is required when visibility conditions are limited)
- Back-brace if required for lifting heavy items

4.4. First Aid

Stocked first aid kits shall be kept in two primary locations: service trucks and water supply pump stations. Promptly remove any expired stock from first aid kits and replace. Operators shall follow detailed instructions in the JBPHH Safety Manual and EM-385-1-1, *Section 3* regarding first aid kit requirements, documentation, and follow up procedures.

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5. EQUIPMENT AND MATERIALS

The section lists the equipment and materials that are relevant to perform this SOP. For detailed information regarding location and quantity of each item, please refer to the JBPHH inventory provided as an attachment to *SOP 1.1 Introduction and Overview*.

Parts:

- Gaskets
- Bolts
- Duct tape
- Hydrant valve
- Strainers
- 2.5-inch Hydrant Caps
- 4.5-inch Hydrant Caps
- Wet-barrel hydrant

Equipment:

- Hydrant wrench
- Discharge nozzle/diffuser
- Fire hose(s) with 2.5-inch adapter
- Hydrant adapter
- Valve key
- Manhole pole
- Pressure gauge(s)
- Pliers
- Measuring tape
- Painting supplies
- Wire brush
- “Out of service” sign
- Fire hydrant spreader
- Traffic cones
- Portable generator(s)
- Shop vacuum cleaner
- Hand-held radios
- Material handling equipment
- Flashlight
- 2-pound hammer
- Screwdrivers
- Landscaping tools (shears, mower, shovel, etc.) if needed

Consumables:

- Food-grade grease (ANSI/NSF-certified, food-grade lubricant)
- Paint

Notes:_____

6. SCHEDULE AND PROCEDURES

6.1. Schedule

Refer to *Table 6-1* for a routine tank operation and maintenance schedule. Detailed procedures are discussed in subsequent sections.

Table 6-1 Hydrant Maintenance Schedule

Frequency	Task	Section
Semi-Annual	Update hydrant asset management	6.2
Annual	Perform hydrant maintenance and inspection.	6.3
	Perform refresher training on this SOP.	6.4
Every 5 years	Perform hydrant flow test.	6.5

6.2. Semi-Annual Hydrant Asset Management

- Update hydrant asset inventory.
- Identify hydrant assets that need to be replaced.
- Update hydrant maintenance records, including inspection dates, repairs, and flow test results.
- Update the hydrant inventory database (MAXIMO®) and/or spreadsheets to reflect on any changes, such as new installations, removals, or damage.

6.3. Annual Hydrant Maintenance and Inspection

- Secure the surrounding area with cones. Use traffic control measures, if necessary.
- Locate the hydrant control valve. Ensure it is visible and accessible. For valve operation and maintenance, refer to *SOP 5.2 Valves*.
- Landscape inspection
  - Ensure there is a clear 3-foot radius around the hydrant. Clear the area from any vegetation and debris using appropriate tools.
  - Verify that the drainage around the hydrant is clear of any obstruction to prevent flooding.
  - Verify the presence and visibility of a blue reflector, which should have a minimum dimension of three inches, and is located in the center of the street or road on the side where the hydrant is located (*Figure 6-1*).

Figure 6-1 Blue Road Reflector

Notes:_____

- Hydrant visual inspection
  - Record the hydrant's manufacturer, model number, and hydrant number.
  - Confirm the presence of two 2 ½" and one 4 ½" hose outlet featuring national standard hose threads in accordance with NFPA.
  - Check the hydrant for signs of damage (cracks, corrosion, or missing parts).
  - Replace any damaged or missing component following the manufacturer's recommended procedure. If the hydrant is beyond repair, tag it with a clear visible mark and notify the fire department. Refer to *Section 6.6.2* for hydrant replacement procedures.
  - Use a measuring tape to ensure the centerline of the 4 ½" nozzle is 20-24 inches above the finished grade to comply with the State of Hawaii Water System Standards (*Figure 6-2*). If adjustment is needed, schedule the work.
  - Inspect all bolts at the base of the hydrant for tightness and corrosion. Replace any damaged or missing bolts following the manufacturer's recommended procedure.

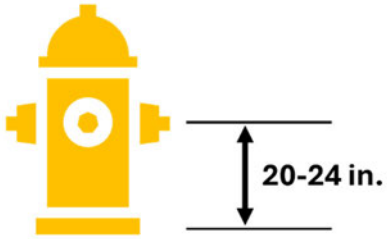

Figure 6-2 Hydrant Height Requirement

- Hydrant exercise
  - Exercise each stem nut (*Figure 6-3*) and test for ease of operation. If stem action is tight, open and close several times until opening and closing actions are smooth and free.
  - Remove outlet-nozzle caps and inspect for any damage. Replace any damaged caps if necessary.
  - Inspect the gaskets inside the caps for any damage. Replace any damaged or worn-out gaskets. Follow the manufacturer's recommended procedure.

Figure 6-3 Hydrant Stem Nuts

Notes:_____

- Leak check
  - Remove the top outlet nozzle cap.
  - Briefly open the hydrant valve allowing water to pour out from the nozzle.
  - Place the nozzle cap loosely to allow air to escape.
  - Once all the air is purged (no hissing sound), tighten the nozzle cap securely.
  - Slowly open the hydrant valve fully.
  - Inspect the hydrant for any water leakage at the hydrant. If a leak is detected, refer to *Section 7* for troubleshooting instructions.
- Hydrant flushing (*Figure 6-4*)
  - Remove an outlet-nozzle cap from one of the hydrant outlets (choose an outlet that will cause the least disruption to the surrounding area).
  - Use a hydrant wrench to slowly open the hydrant fully.
  - Allow water to flow for at least one minute, or until the water runs clear. This helps remove any sediment and debris.
  - Slowly close the valve making sure it is fully closed.

Figure 6-4 Hydrant Flushing

- Maintenance
  - Clean the outlet threads and cap threads with a wire brush to remove any debris or corrosion.
  - Apply ANSI/NSF-certified, food-grade grease to the threads of the nozzle and cap threads.
  - Reinstall the caps. Tighten them and then back off slightly so they will not be excessively tight. Leave them tight enough to prevent their removal by hand.
  - Inspect the cap chains or cables for free action on each cap. If the chains or cables bind, open the loop around the cap until they move freely. This will keep the chains or cables from kinking when the cap is removed during an emergency.
- Repainting
  - Inspect all parts of the hydrants for any signs of peeling or fading.
  - If necessary, apply weather-resistant paint to any hydrant part showing signs of corrosion.

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- Painting needs to adhere to the color-coding requirements of Unified Facility Criteria (UFC) 3-600-01 and the NFPA.

- If hydrant is deemed beyond repair:
  - Inform the fire department to provide details about the hydrant number, location, and reason for deactivation.
  - If necessary, initiate hydrant deactivation process (Refer to *Section 6.6.1*).
  - Schedule a hydrant replacement (Refer to *Section 6.6.2*).
- Documentation
  - Report any maintenance, repairs, or unusual findings, including specific issues and actions taken.
  - Note the hydrant's manufacturer, model number, and hydrant number.
  - Note the hydrant location.

6.4. Annual SOP Refresher Training

- Schedule Training
  - Review operator schedules to identify a convenient time and date for most or all operators to attend the training session.
  - Provide Refresher Training.
- Review key aspects of this SOP.
  - Address operators' questions or concerns.
  - Identify areas to improve the SOP.
- Documentation
  - Record the date, time, and attendees of the training sessions on *Attachment 1*.
  - Note any updates or revisions made to the SOP.

6.5. Hydrant Flow Test (Every 5 years)

Hydrant flow tests can be conducted on a single hydrant, but a two-hydrant procedure is preferred. For both approaches, secure the surrounding area of each hydrant. Use cones or traffic control measures when necessary.

6.5.1. One-Hydrant Flow Test

A one-hydrant flow test uses only a single hydrant (*Figure 6-5*).

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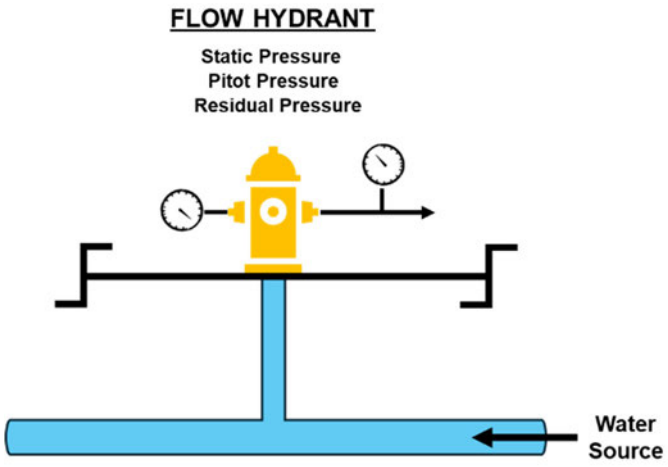

Figure 6-5 One-Hydrant Flow Test Schematic

Step 1: To take a static pressure reading, do the following:

- Connect a pressure gauge to one of the 2.5-inch hydrant outlets using a hydrant adapter. Ensure that the adapter valve lever is parallel to the flow of water (*Figure 6-6A*).
- Use a hydrant wrench to gradually open the hydrant—allowing air to escape and water to flow through the adapter.
- Once water starts flowing, close the adapter by placing the lever in perpendicular position (*Figure 6-6B*).
- Record the initial static pressure (in psi) reading on the gauge (*Figure 6-6B*).

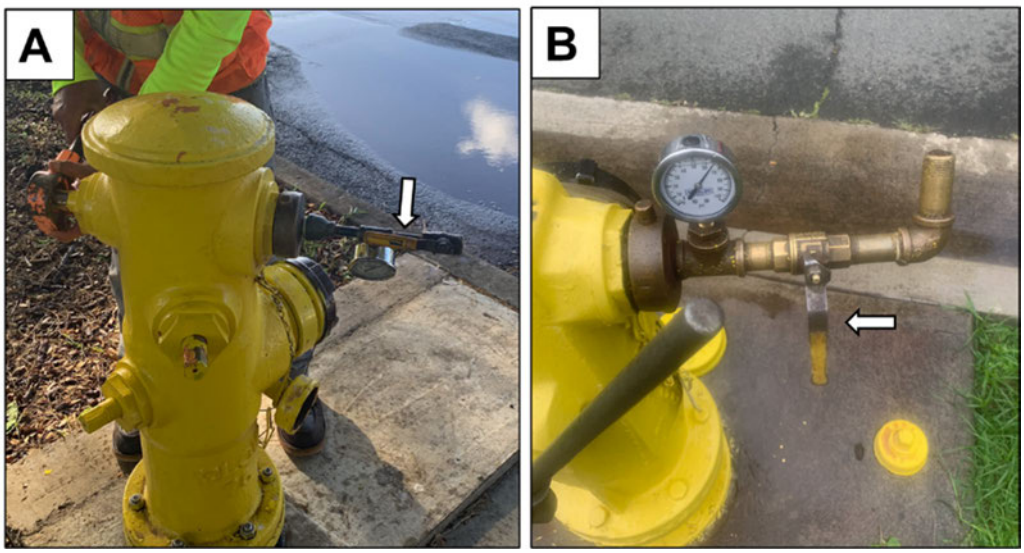

Figure 6-6 One-Hydrant Static Pressure Reading

Step 2: To measure the flow rate of the hydrant, do the following:

- Once the static pressure has been recorded, close the hydrant valve.

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- Slowly turn the adapter valve lever ON (parallel to the direction of flow) to release the pressure.
- While keeping the pressure gauge adapter connected to the hydrant, connect a 2.5-inch hose to another hydrant outlet. Attach a pitot gauge connected with a diffuser nozzle to the free end of the hose (*Figure 6-7*). Refer to *Attachments 7* and *Attachment 8* for user guides.
- Slowly open the hydrant valve fully to prevent water hammer. Once water flows out of the adapter, close the adapter valve.
- Allow the water to flow from the diffuser for 5 minutes.
- Record the residual pressure (in pounds per square inch [psi]) and the pitot pressure (in psi).
- Slowly close the hydrant valve to prevent water hammer.

Step 3: Restore the hydrant to original conditions as follows:

- Disconnect the hose from the hydrant and place back the cap on the hydrant outlet.
- Remove the static/residual pressure gauge and adapter and replace cap.

Figure 6-7 Hose with a Pitot Gauge and Diffuser

6.5.2. Two-Hydrant Flow Test

A two-hydrant flow test utilizes one hydrant to measure flow using a pitot gauge and a second hydrant (“residual hydrant”) to monitor the static and residual pressure (*Figure 6-8*). The residual hydrant should be less than 400 feet upstream from the flow (test) hydrant. The flow test can be performed with one or two hydrant outlets.

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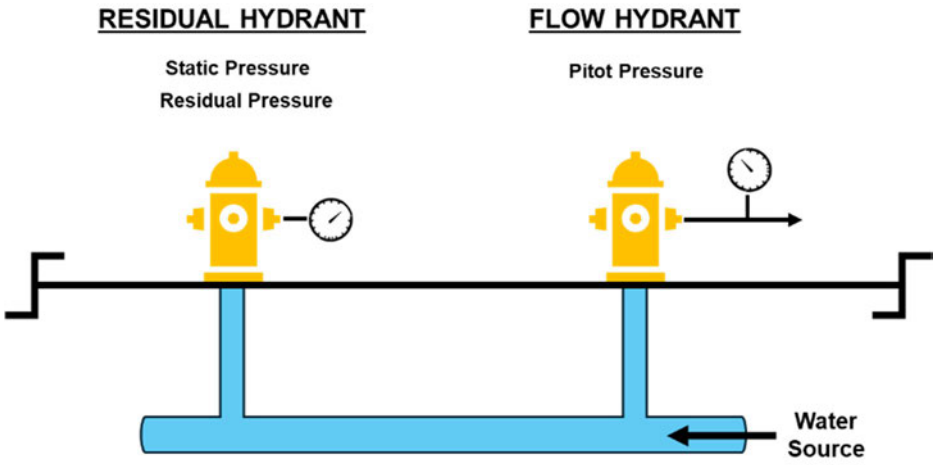

Figure 6-8 Two-Hydrant Flow Test Schematic

Step 1: Attach a static pressure gauge on the residual hydrant and take a static pressure reading as described in *Section 6.5.1* Step 1 (*Figure 6-9*).

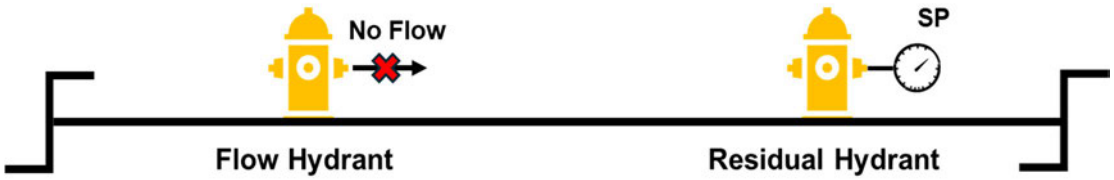

Figure 6-9 Static Pressure Reading Schematic

Step 2A: First perform the flow test with one outlet (*Figure 6-10*):

- Connect a 2.5-inch hose to the flow hydrant outlet. Attach a pitot gauge connected with a diffuser nozzle to the free end of the hose (***Error! Reference source not found.***).
- Slowly open the hydrant valve fully to prevent water hammer.
- Allow the water to flow for 5 minutes.
- Take pitot pressure reading at the flow hydrant.
- Take residual pressure reading at the residual hydrant.
- Slowly turn off the flow on the flow hydrant. If a test with two open nozzles is desired perform Step 2B below. Otherwise skip to Step 3.

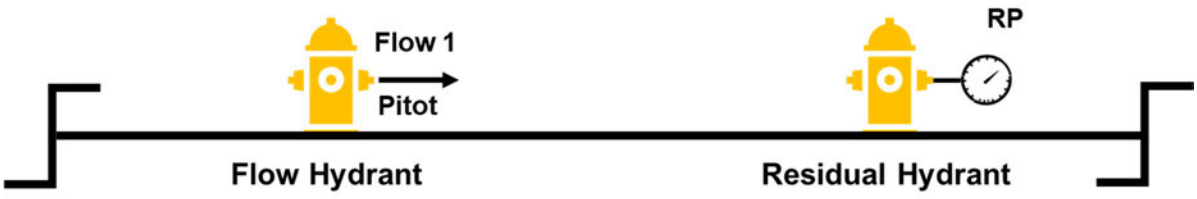

Figure 6-10 One-Flow Pitot Pressure and Residual Pressure Readings Schematic

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Step 2B: If desired, perform a flow test with two open nozzles (*Figure 6-11*).

- Attach a second 2.5-inch hose with a pitot gauge and diffuser to the flow hydrant (*Figure 6-12*).
- Flow water through both hoses by turning on their respective hydrant valves using a wrench.
- Allow the water to flow for 5 minutes.
- Take pitot pressure readings at both flowing nozzles (*Figure 6-13*).
- Take a residual pressure reading at the residual hydrant.
- Slowly turn off the flow on both nozzles at the flow hydrant.

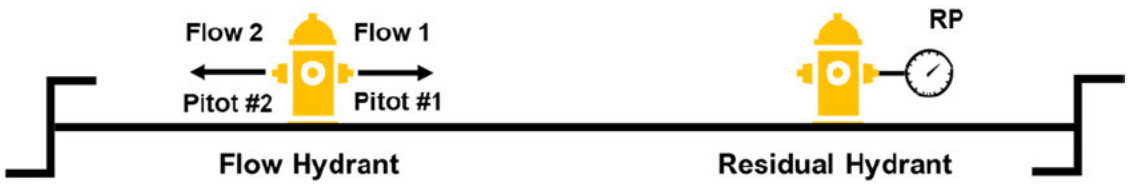

Figure 6-11 Two-Flow Pitot Pressure and Residual Pressure Readings Schematic

Figure 6-12 Two-Flow Hose Attachments

Figure 6-13 Pitot Pressure Reading

Step 3: Restore hydrants to original conditions as follows:

- Disconnect the hose(s) from the flow hydrant and place back the caps on the hydrant outlets.
- Remove the static/residual pressure gauge and adapter from the residual hydrant and replace the cap.

6.5.3. Flow Test Documentation

Document the following using *Attachment 2* Fire Hydrant Flow Test:

- Hydrant number, location, pressure readings, and any observations
- Insert the pressure readings into the Hydrant Flow Calculations Sheet (*Attachment 3*).

Notes:_____

- Ensure that the hydrant is color-coded correctly to indicate its flow capacity (*Attachment 4*).

6.6. Unscheduled Maintenance

6.6.1. Deactivating a Hydrant

Reasons for hydrant deactivation include, but are not limited to, physical damage, malfunction, construction requirements, or emergency situations.

- Inform the fire department and provide them with details about the hydrant number, location, and reason for deactivation. This must be done as soon as the damage is discovered.
- If necessary, secure the surrounding area. Use cones or traffic control measures.
- If hydrant control valve is accessible, close the valve fully by rotating the valve nut clockwise using a valve key.
- Mark the hydrant using one of the following methods
  - Place an "Out of Service" sign (*Figure 6-14*). Make sure it is visible.
  - Cover the hydrant with a black trash bag. Ensure the trash bag remains on the hydrant using yellow caution tape (*Figure 6-15*).
- Remove any hazards, such as broken components or debris, before leaving the site.
- Document the deactivation process including date and reason for deactivation.

Note: If a hydrant is frequently damaged by vehicles, consider relocating it or installing a protective barrier (e.g., bollards) 3 feet away from the hydrant.

Figure 6-14 "Out of Service" Signage

Figure 6-15 Hydrant Covered in Trash Bag

6.6.2. Hydrant Replacement

When a hydrant is past its service life and can no longer be repaired to restore functionality, the hydrant must be replaced. In preparation for the replacement:

- Inspect the hydrant to determine the size and type of base (concrete or soil).
- Have the area around the hydrant scoped for underground utilities.
- Locate the hydrant control valve and ensure it is working.
- Notify pertinent personnel about the planned hydrant replacement.

Notes:_____

- Obtain Dig Permit, see *SOP 1.2 Miscellaneous Maintenance* for details.

On or before the scheduled day of work, secure the surrounding area. Use cones or traffic control measures if necessary.

- Using the valve key, close the main valve to isolate the hydrant from the water supply.
- Open the hydrant valve to drain any residual water from the old hydrant.

If there is a soil base around the hydrant, use a shovel to remove the soil around the hydrant until you can access the bolts at the base of the hydrant. If hydrant has concrete collar base, the bolts should be accessible (see earlier *Figure 6-3*). If not, to avoid damaging the flange or the hydrant barrel, carefully chip away the concrete 2-3 inches from the hydrant barrel.

- Disconnect the hydrant from the supply pipe by carefully removing any bolts, fittings, and gaskets.
- Lift the old hydrant out of the ground.

To assemble the new hydrant, follow the manufacturer's instructions and disinfect the hydrant and the connected piping that was exposed as outlined in *SOP 5.1 Water Mains*. See *Attachment 4 of SOP 5.1* for AWWA recommended disinfection methods. Disinfect the replacement hydrant and fittings by swabbing the interior of all pipe and fittings with a 1% hypochlorite solution. Ensure that the 4.5-inch hydrant outlet is facing the street. Use a shovel to gradually add appropriate backfill material, ensuring it fills the space around the hydrant.

Once the hydrant has been installed, required disinfection has been performed, and bacterial tests results return negative, the hydrant can be placed back into service. Additionally, the following tasks should be performed:

- Perform a Hydrant Flow Test (Refer to *Section 6.5*).
- Color-code the hydrant.
- Clean up the site.
- Notify the fire department to inform them that the hydrant is back in service.
- Document the manufacturer, model number, and flow test results of the new hydrant.
- Coordinate GIS updates as required with PRP32A Engineers, see *SOP 1.2 Miscellaneous Maintenance* for details.

Note: If the hydrant and the riser pipe need to be replaced, refer to *SOP 5.1 Water Mains*.

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7. TROUBLESHOOTING

General troubleshooting guidelines include the following:

- Identify problem(s) and course of action (i.e., replace revolving nuts, replace leather, replace broken shaft, or replace hydrant).
  - If the problem involves no water to the hydrant, make sure the hydrant valve is open. If there is still no water, and the hydrant valve is not the problem (broken):
    - If the stem is not moving, then the revolving nut is broken or not attached to the shaft.
    - If the stem is moving, replace the shaft ([redacted] type hydrant) or the safety coupling ([redacted]-type hydrant).
- If the problem is water leaking from inside the barrel, and the stem is moving, replace the leathers. If the stem is not moving, then the revolving nut is broken or not attached to the shaft.
- If the hydrant is leaking from below ground, or the hydrant is chattering, replace the hydrant.

For specific troubleshooting guidelines, refer to *Table 7-1*. Refer to the manufacturer's instructions for further details (*Attachment 5-8*).

Table 7-1 Troubleshooting Guide

Issue	Potential Cause	Remedy
Water Leak	Loose connections	Tighten connections with a wrench. Be cautious not to overtighten, as this can damage the threads.
	Worn-out gaskets and O-rings	Replace worn-out gaskets and O-rings according to manufacturer's instructions.
	Damaged parts	Repair or replace damaged hydrant parts, if cracked. Severe damage may require full replacement.
Hydrant will not open	Corrosion or paint has caused the operating nut, hold-down nut, or upper stem to become stuck to the bonnet	Disassemble the affected components, clean, lubricate, and reassemble.
	Debris accumulation in shoe of hydrant	Remove the main valve assembly and flush hydrant utilizing the isolation/main valve.
Hydrant opens but will not close	Safety coupling is broken or loose.	Remove the bonnet and upper barrel and replace safety coupling according to manufacturer's instructions.
Low flow	Hydrant not fully open or isolation/main valve is not fully open	Confirm that both the hydrant and the main valve are fully open.
	Obstructed Inlet	Inspect the hydrant's inlet for any obstructions like dirt, leaves, or small rocks. Clear any blockage.
	Low system pressure	If multiple hydrants in the area are experiencing low pressure, it may indicate a broader issue with the water main system. Contact the Production Supervisor for assistance.

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8. REFERENCES

- AWWA M17 Fire Hydrants: Installation, Field Testing, and Maintenance, Fifth Edition, 2016.
- EM-385-1-1 Safety and Occupational Health Requirements Manual. 15 March 2024.
- JBPHH Safety Manual
- NFPA 291: Recommended Practice for Water Flow Testing and Marking of Hydrants. 2025.
- OPNAV M-5100.23: Navy Safety and Occupational Health Manual. 5 June 2020.
- UFC 3-600-01: Fire Protection Engineering For Facilities. 28 November 2016
- UFC 3-230-02 Operation and Maintenance: Water Supply Systems. 1 November 2023.
- Water System Standards – Department of Water Supply County of Hawaii.

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9. ATTACHMENTS

- Attachment 1: SOP Acknowledgement and Training Form
- Attachment 2: Fire Hydrant Flow Test
- Attachment 3: Hydrant Flow Calculations
- Attachment 4: Hydrant Color Coding Sheet
- Attachment 5: (b) (3) (B) Barrel Fire Hydrants Operation & Maintenance
- Attachment 6: (b) (3) (B) Barrel Fire Hydrant Assembly & Materials
- Attachment 7: (b) (3) (B) : User Guide
- Attachment 8: (b) (3) (B) Pressure Gauge Installation, Operation, and Maintenance

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Attachment 1:
SOP Acknowledgement and Training Form

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SOP ACKNOWLEDGEMENT AND TRAINING FORM

This SOP must be read and signed each time training is provided, or modifications are made to the SOP. This form should accompany the current SOP version.

Document Title:	Hydrants
Document Revision Number:	
Document Revision Date:	

Please sign below in accordance with the following statement: "I have read and understood the above referenced document. I agree to perform the procedures described in this SOP in accordance with the document until such time that it is superseded by a more recent, approved revision."

Print Name	Signature	Date

Notes:_____

SOP Acknowledgement and Training Form (continued)

Trainee:
Sign below to acknowledge that training on this SOP was received, understood, and all questions/concerns were addressed by the trainer.

Trainer:
Sign below to acknowledge that training on this SOP was completed for the individual listed and that the trainee is competent to perform the procedures described within.

Date of Training [mm/dd/yyyy]	Trainee Print Name	Trainee Signature	Trainer Print Name	Trainer Signature

Notes:_____

Attachment 2:
Fire Hydrant Flow Test

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FIRE HYDRANT FLOW TEST

Date:	**Time:**
Location:	
Operator Name(s):	

Flow Test Results		
	Flow Hydrant	**Residual Hydrant**
Hydrant #		
No Flow	—	SP:
Test #1 (1 discharge flow @ Flow Hydrant)	Pitot:	RP:
Test #2 (2 discharge flows @ Flow Hydrant)	Pitot #1: Pitot #2:	RP:
Calculated GPM @ 20 psi:		

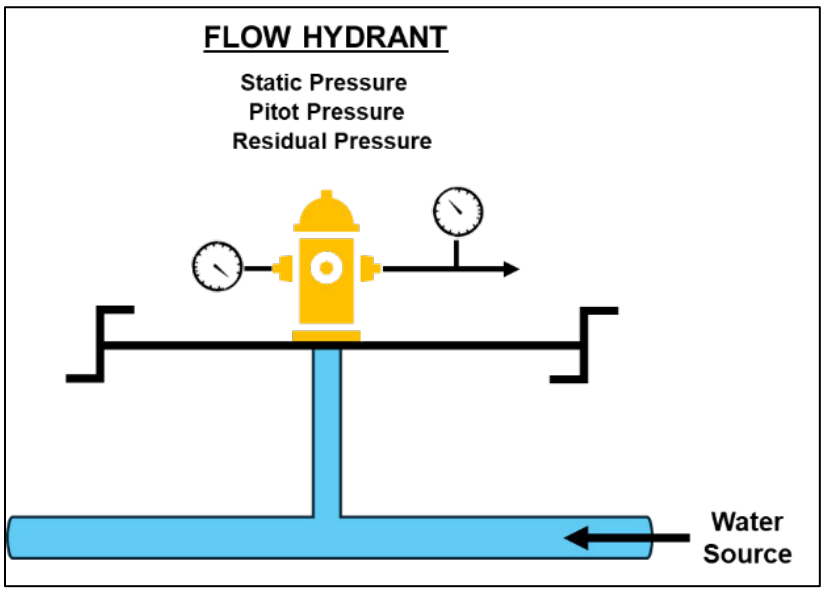
SP: Static Pressure; RP: Residual Pressure; Pitot: Pressure reading at discharge

Observations:

TWO HYDRANT FLOW TEST
(Adapted from NFPA 291)

Hydrant Class	GPM Range	Color Code
AA	1500+	Light Blue
A	1000-1499	Green
B	500-999	Orange
C	< 500	Red

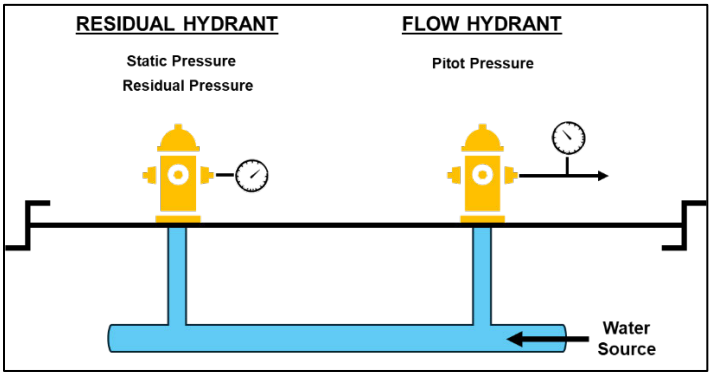
One-Hydrant Flow Test



1. **Record static pressure (SP) at Flow Hydrant**

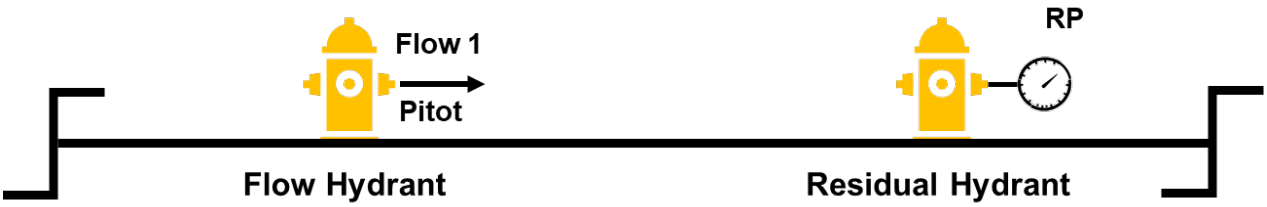
2. **Open one 2.5-inch nozzle at Flow Hydrant. Record pitot pressure and residual pressure (RP) at Flow Hydrant**

Two-Hydrant Flow Test



1. **Record static pressure (SP) at Residual Hydrant**

2. **Open one 2.5-inch nozzle at Flow Hydrant. Record pitot pressure at Flow Hydrant and residual pressure (RP) at Residual Hydrant**



3. **Open a second 2.5-inch nozzle at Flow Hydrant. Record pitot pressure at both flowing nozzles and residual pressure at Residual Hydrant**

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Attachment 3:
Hydrant Flow Calculations

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Flow Hydrant Flow Calculations

Notes:
Input only yellow boxes :

Calculations with Single Flow

Calculated Pitot Flow Q:

$Q_F = 29.83 * c * d^2 * p^{0.5}$, where:

c = Outlet Coefficient =
d = Outlet Diameter = in
p = Measured Pitot Pressure = psi
Q_F = Pitot Flow = gpm

Calculated Flowrate at Specified Residual Pressure:

$Q_R = Q_F * (h_r^{0.54} / h_f^{0.54})$, where:

Measured Static Pressure = psi
Measured Residual Pressure = psi
Target Residual Pressure = psi
Q_f = Calculated Pitot Flow = gpm
h_r = Drop in Pressure from Static to Desired Residual =
h_f = Drop in Pressure from Static to Actual Residual =
Q_R = Calculated flow at residual pressure = gpm

Calculations with Dual Flow

Calculated Pitot Flow Q1:

$Q_F = 29.83 * c * d^2 * p^{0.5}$, where:

c = Outlet Coefficient =
d = Outlet Diameter = in
p = Pitot Pressure = psi
Q_F = Pitot Flow = gpm

Calculated Pitot Flow Q2:

$Q_F = 29.83 * c * d^2 * p^{0.5}$, where:

c = Outlet Coefficient =
d = Outlet Diameter = in
p = Pitot Pressure = psi
Q_F = Pitot Flow = gpm

Calculated Flowrate at Specified Residual Pressure:

$Q_R = Q_F * (h_r^{0.54} / h_f^{0.54})$, where:

Measured Static Pressure = psi
Measured Residual Pressure = psi
Target Residual Pressure = psi
Q_f = Calculated Pitot Flow = gpm
h_r = Drop in Pressure from Static to Desired Residual =
h_f = Drop in Pressure from Static to Actual Residual =
Q_R = Calculated flow at residual pressure = gpm at: psi

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Attachment 4:
Hydrant Color Coding Sheet

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HYDRANT COLOR CODING

UFC 3-600-01 / NFPA 291

Hydrant Class	GPM Range	Color Code	Paint Location
AA	1500+	Light Blue	Bonnet & Caps
A	1000-1499	Green	
B	500-999	Orange	
C	< 500	Red	

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Attachment 5:
(b) (3) (B) Barrel Fire Hydrants Operation and Maintenance

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Attachment 6:
(b) (3) (B) Barrel Fire Hydrant Assembly and Materials

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Attachment 7:

(b) (3) (B) [redacted]: User Guide

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Attachment 8:
(b) (3) (B) Pressure Gauge Installation, Operation, and Maintenance

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