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STANDARD OPERATING PROCEDURE

SOP 5.2 Valves

Abstract: This SOP defines the inspection and maintenance of all control and distribution valves.



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Revision Tracking Sheet

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2. Process Flow Diagrams
3. (b) (3) (B) , Maintenance and Installation Manual
4. (b) (3) (B) Irrigation Pressure Relief Valve Fact Sheet
5. (b) (3) (B) Electric Control Valve Fact Sheet
6. (b) (3) (B) Air Release Valve Operation, Maintenance and Installation Manual
7. (b) (3) (B) Automatic Control Valve Installation, Operation, and Maintenance Manual
8. (b) (3) (B) Wedge Gate Valve Operation and Maintenance Manual
9. (b) (3) (B) Roll Seal Valve Installation, Operation, and Maintenance Manual
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13. (b) (3) (B) Butterfly Valve Operation, Maintenance, and Installation Manual
14. (b) (3) (B) Rotary Actuator Instruction Manual

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1. DEFINITIONS/ACRONYMS

1.1. Definitions

- Air release valve: A valve designed to release trapped air from pipelines.
- Backflow: The unwanted reversal of water flow in a water distribution system.
- Ball valve: A shutoff valve that uses a rotating ball with a bore to control the flow of water.
- Butterfly valve: A rotary valve that uses a flat, circular disc to regulate fluid flow.
- Check valve: A valve that prevents backflow, allowing flow in only one direction. Note check valves are utilized for non-regulated backflow applications (refer to Joint Base Pearl Harbor Hickam (JBPHH) Cross-Connection Control Backflow Prevention Program), for details on regulated backflow device definitions, applications, requirements, and additional details.
- Gate valve: A valve that uses a sliding gate to fully open or close the flow of water. Used primarily for isolation purposes in water distribution system.
- 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.
- Water hammer: Sudden pressure surge in a pipeline caused by the rapid stopping or change in direction of the flowing water.

1.2. Acronyms and Abbreviations

- AWWA American Water Works Association
- DSO Water Distribution System Operator
- JBPHH Joint Base Pearl Harbor Hickam
- NAVFAC Naval Facilities Engineering Systems Command
- OSHA Occupational Safety and Health Administration
- OIT Operator(s) in training
- PPE Personal Protective Equipment
- PRP32A Potable Water Branch
- SDS Safety Data Sheet
- SOP Standard Operating Procedure

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2. OVERVIEW

2.1. Scope and Purpose

This Standard Operating Procedure (SOP) covers the inspection and maintenance of different valves within the JBPHH water distribution system. Valves perform essential function in the water systems, including isolating sections of pipe, controlling flow, releasing air, and preventing backflow. This SOP does not cover disinfection procedures required for contact with the interior of valves. Refer to *SOP 5.1 Water Main* for these procedures.

2.2. Operating Summary

Valves located in Pearl Harbor and Hickam undergo yearly maintenance and testing. JBPHH utilizes a network of valves throughout the water distribution system. These valves are integrated at different locations as described below. The operating instructions and manuals for the equipment are located in *Attachments 4-14*.

2.2.1. Pump Station Valves

JBPHH pump stations house various types of control and isolation valves. The location and type of valves can be seen in *Table 2-1*. The exact location of these valves can be observed in the provided process flow diagram of each pump station (*Attachment 2*).

2.2.2. Distribution System

Water distribution systems involve hydrants and gate valves. Hydrant maintenance is described in *SOP 5.3 Hydrants*. Like hydrants, distribution system gate valves must undergo annual preventative maintenance.

2.2.2.1. Hickam

Detailed information, including geographic information system images, and valve numbers, is tabulated in Excel sheets, which are maintained by operations staff. Each month, the valves and their associated hydrant in one zone undergo inspection and maintenance.

2.2.2.2. Pearl Harbor

Valves in Pearl Harbor undergo testing sequentially based on location. Hydrant isolation valves are generally inspected, tested, and maintained during the maintenance on the associated hydrant.

2.2.3. Backflow Prevention Devices

The JBPHH water distribution system utilizes different backflow prevention devices including double check valve assemblies, pressure vacuum breakers, atmospheric vacuum breakers, and reduced pressure principal devices. Perform inspection and maintenance on backflow prevention devices semi-annually or annually as required based upon hazard classification. For details, refer to the JBPHH Cross-Connection Control Backflow Prevention Program.

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Table 2-1 Valve Type and Count by Location

Location	Valve Type (count)
Waiawa Shaft	(b) (3) (B)
Aiea-Halawa Shaft	
Red Hill Shaft	
Red Hill Booster Pump Station	
Aiea-Halawa Booster	
Manana Booster Pump Station	
Moanalua Terrace Booster Pump Station	
(b) (3) (B)	System valves (approximately 7,800)
(b) (3) (B)	System valves (approximately 1,700)
(b) (3) (B)	(b) (3) (B)

Notes: _____

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 Maintenance Potable Water Branch (PRP32A). Valve operation and maintenance at JBPHH is performed by all three work centers within their areas of responsibility. Refer to *Figure 3-1* for details.

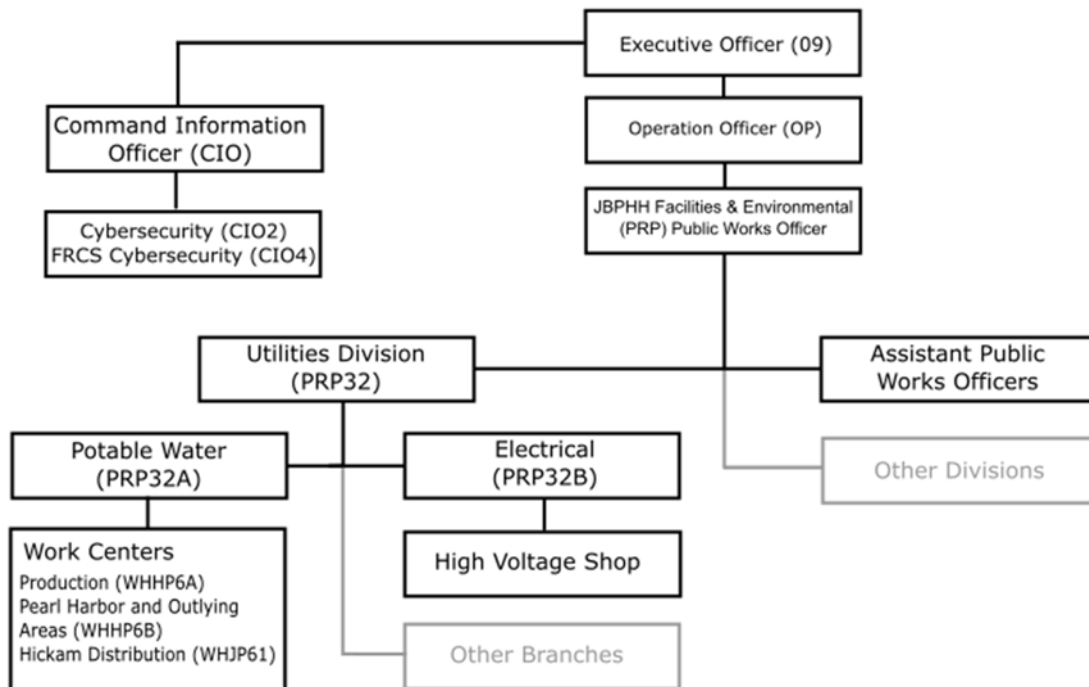


Figure 3-1 Public Works Department Organization

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 or 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*.

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3.2. Qualifications

All personnel involved in operations and maintenance activities of valves within the distribution system must be trained and qualified to perform their assigned tasks:

- If required, personnel are responsible for obtaining and maintaining a Water Distribution System Operator (DSO) certification, Grade 1 or higher from the State of Hawaii, Department of Health, Safe Drinking Water Branch. Please note unlicensed and uncertified operators or 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

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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.
- Use shoring for any hole deeper than 4 feet.
- 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

- Confined space
- 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)
- Knee pads (as needed)

4.4. First Aid

Stocked first aid kits shall be kept in two primary locations: service trucks and water supply pump stations. Operators should 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:

- 2-inch gaskets
- 6-inch gaskets
- 8-inch gaskets
- 10-inch gaskets
- 2-inch gate valve
- ¾-inch ball valve
- 1 ¼-inch ball valve
- 2-inch ball valve
- 2 ½-inch ball valve
- 8-inch gate valve
- Diaphragm valve
- O-rings

Equipment:

- Flashlight
- Manhole pole
- Metal detector
- Portable generators
- Pry bar
- Screwdrivers
- Tape measure
- Temporary signs/boards (arrow boards, traffic maintenance signs)
- Traffic cones
- Vacuum cleaner
- Valve keys for all sizes
- Backhoe
- Bobcat
- Bulldozer
- Dump truck
- Excavator
- Flatbed truck
- Smooth wheeled roller
- Tanker truck

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Consumables:

- Caution tape
- Food-grade grease
- Paint
- Paint protective coating
- Towels

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6. SCHEDULE AND PROCEDURES

6.1. Schedule

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

Table 6-1 Valves Maintenance Schedule

Frequency	Task	Section
Semi-Annual	Update valve asset management	6.2
Annual	Perform maintenance on pump station valves	6.3
	Perform maintenance on distribution system gate valves	6.4
	Perform refresher training on this SOP	6.5

6.2. Semi-Annual Valve Asset Management

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

6.3. Annual Pump Station Valve Inspection and Maintenance

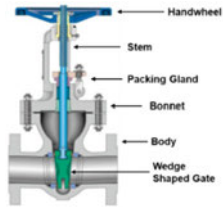
Visit the pump stations annually and perform general valve inspection and maintenance on the different types of valves. For each valve type, consult the subsequent sections for specific maintenance and testing procedures. *Figure 6 1* provides a visual representation of the different valves involved in the pump station. Refer to *Attachments 4-15* for valve-specific operation and maintenance manuals.

6.3.1. General Valve Inspection and Maintenance

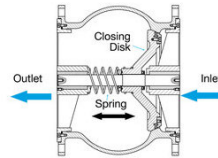
- Safety precautions:
 - Ensure that the area is safe from any hazard.
 - If necessary, secure the surrounding area with cones or traffic control measures.
 - If valve is located within an underground enclosure, pit, or a confined space, consult the JBPHH Safety Manual and EM-385-1-1 for the applicable entry procedures and protocols.
 - Conduct a gas-free test if the valve is in a confined space.
- Valve visual inspection:
 - Check for signs of corrosion, damage, or wear on the valve body, piping, and fittings.
 - If applicable, check the condition of the valve opening/closing device (e.g., handwheel, hand lever, nut key).
 - Check the protective coating for damage.
 - Check for leaks around the valve body, connections and gauges.

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Gate valve



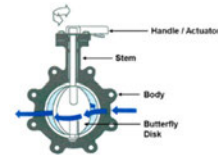
Globe style silent check valve



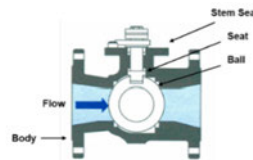
Wafer check valve



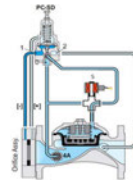
Butterfly valve



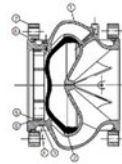
Ball valve



Diaphragm valve



Roll seal valve



Air release valve

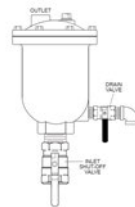


Figure 6-1 Visual Representation of Valves

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- Maintenance:
 - Clean the valve body, pipping, fittings, and gauges.
 - Lubricate moving parts as per manufacturer's recommendations.
 - Where applicable, confirm pressure gauges are operating properly.
 - Where applicable, inspect and clean filter. Replace the filter if necessary, as per manufacturer's recommendations.
 - Paint pipes, valves, and fittings (excluding brass, copper, and stainless steel).
- If a valve is damaged beyond repair, replace it immediately according to the manufacturer's instructions.
- Document and report any maintenance, repairs, or unusual findings, including specific issues and actions taken.

6.3.2. Annual Air Release Valve Inspection and Maintenance

In addition to the general inspection and maintenance tasks in *Section 6.3.1*, perform the following tasks for an air release valve. A visual representation of an air release valve can be seen in *Figure 6-1*. Exercise the valve as follows:

- With the inlet shutoff valve open, partially open the drain valve until flow can be heard. If the air valve is working properly, water should be exhausted from the drain valve. If the air is exhausted, continue with the next steps:
- Close the inlet shutoff valve.
- Slowly open the drain valve to allow fluid in the valve to drain.
- Close the drain valve.
- Slowly open the inlet shutoff valve to fill the valve with water. Observe the seating action and verify that the valve closes without leakage.
- If leakage occurs, the valve should be removed and inspected for wear or possible damage from any foreign matter. To disassemble, refer to *Attachment 7*.

6.3.3. Annual Diaphragm/Roll Seal Valve Inspection and Maintenance

A visual representation of diaphragm/roll seal valves is presented in *Figure 6-2*. Diaphragm valves and roll seal valves can have identical functions but have slightly different designs. Refer to attachments for manufacturer manuals and drawings. Perform the following tasks (in addition to the general maintenance):

- Valve exercise:
 - Close upstream and downstream isolating valves (and external operating pressure, if applicable).
 - Verify the operation of the valve.
 - Manually operate the valve to ensure smooth and free movement.
 - Verify that the valve opens and closes fully.
 - Simulate high pressures or other operating conditions that trigger a specific response to test the valve's operation.
 - Monitor the downstream pressure to ensure it remains stable.
- Pilot system maintenance
 - Loosen tube fittings to relieve pressure from pilot tubing.
 - Inspect pilot tubing and gauges, replace if necessary.
 - Bleed air from pilot tubing.
- Inspect, clean, and replace diaphragm seals.

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- Pump control valves
 - Lock out pump associated with control valve during inspecting and maintenance.
 - Observe pump startup and pump control pump operation ensuring pump startup is smooth.

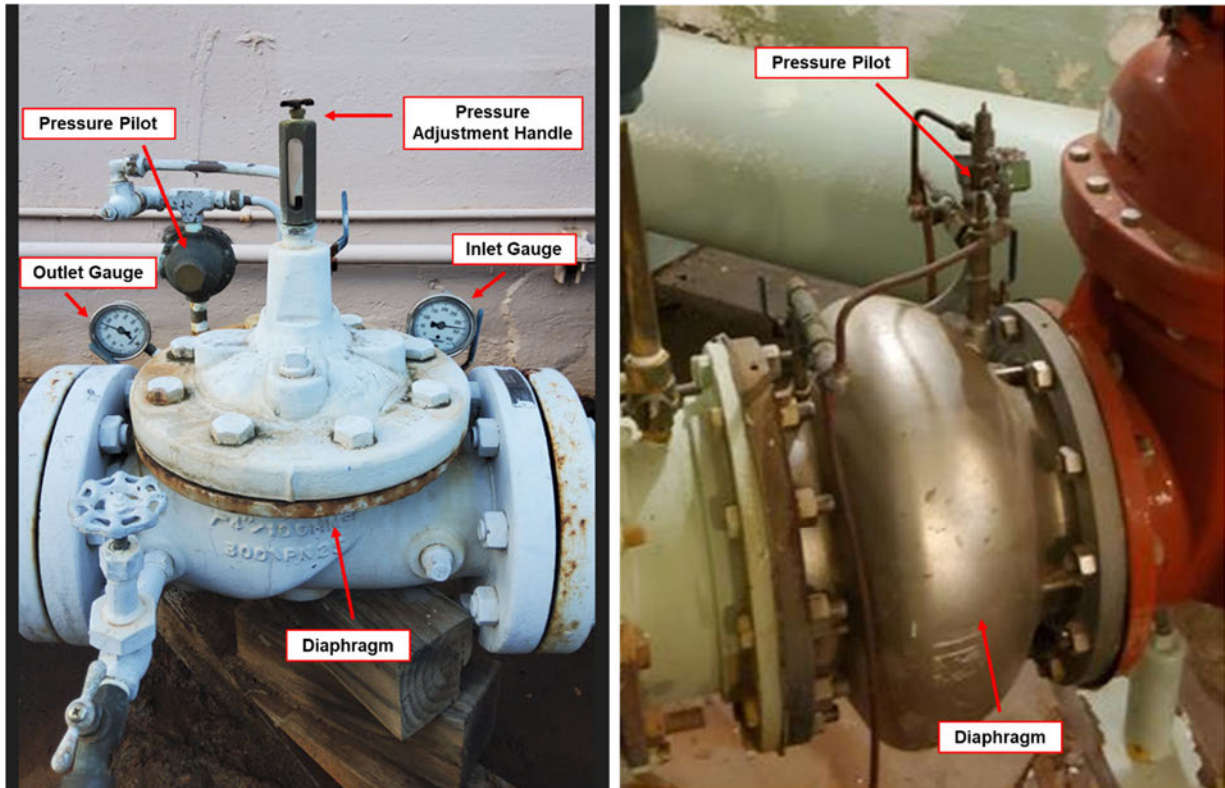


Figure 6-2 Diaphragm/Roll Seal Valves

6.4. Annual Distribution System Gate Valve Inspection and Maintenance

Perform distribution gate valve maintenance in conjunction with the annual hydrant maintenance schedule. Control valve maintenance procedure involves the following tasks:

- Notifications
 - Notify any pertinent personnel about the planned valve maintenance.
 - Whenever water flow may be restricted or shut off, notify all customers in the affected area prior to water shut off and water turn on. If possible, provide the customers with the estimated time water in the affected area will remain off. Coordinate all notifications with housing and facilities operating specialties, as required, who will contact the end users.
- Secure the surrounding area. Use cones or traffic control measures, if necessary.
- If valve has a valve box, perform the following:
 - Identify the location of the valve box/vault (*Figure 6-3A*).
 - Remove obstructions around the valve box/vault to ensure it is clear and visible.

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- Check the valve box cover for signs of damage, such as cracks, leaks, or corrosion. Replace, if necessary.
- Ensure lid properly locks into place.
- If valve box cover is non-locking, determine if the lid is at risk of coming loose (i.e., vehicular traffic or other condition) use manhole sealant to ensure lid does not shift, come loose, or rattle as required.
- Valve visual inspection
 - Using a manhole pole, remove the valve box cover (*Figure 6-3B*).
 - Inspect the valve nut for any damage (*Figure 6-3C*). Replace, if necessary.
 - If a valve nut is not visible/under water, use a vacuum connected to a portable generator to remove the water and clean the area.
 - Clean the valve nut of any debris if necessary.
 - Lubricate valve stem with food grade grease according to the manufacturer's guidelines.

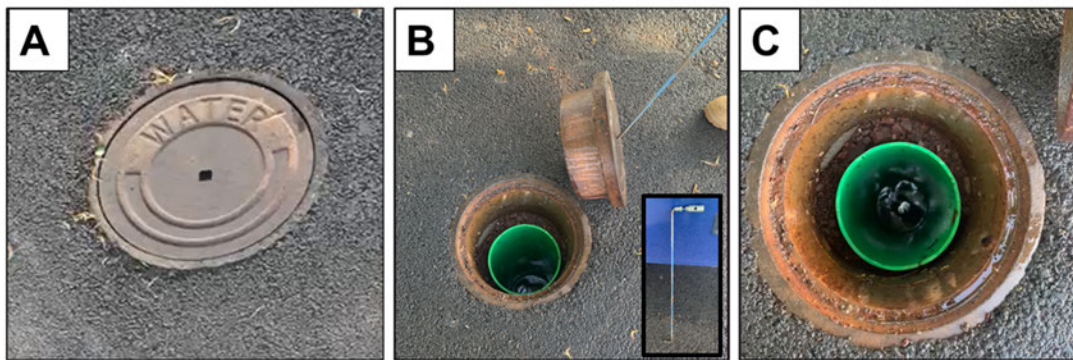


Figure 6-3 Distribution System Gate Valve (A) Cover; (B) Manhole Pole to Remove Cover; (C) Valve Nut

- Valve exercise
 - Slowly close the valve fully by turning it clockwise using a valve key with a steady force for 5-10 rotations (*Figure 6-4*). Note the number of turns/rotations it took to fully close the valve. Document any right turn (clockwise opening) valves, to prevent over torquing by turning the wrong direction.
 - If the valve is stiff, difficult to turn, or leaks, notify the Distribution Shop Supervisor for repair or replacement.
 - If the distribution gate valve isolates a fire hydrant, check for leakage.
 - While the valve is closed, uncup a single outlet of a hydrant.
 - Use a hydrant wrench to open the hydrant slightly to check for any leaks around the hydrant barrel (*Figure 6-5*). If the valve is fully closed, there should be no water flow/leak.

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Figure 6-4 Valve Exercise with Valve Key



Figure 6-5 Leak Check

- Using the valve key, open the valve by turning it counterclockwise for 2-3 rotations. Then close the valve by reversing the rotation. Repeat opening and closing cycle 2-3 times to ensure the valve is fully exercised.
- Fully open the valve slowly by turning it counterclockwise while counting the number of turns. Compare the number of rotations to fully open and fully close.
- Divide the number of turns by 3 to estimate the main pipe size (in inches). The required turns are a function of valve size and can vary slightly depending on the manufacturer. *Table 6-2* provides an estimate for the required turns. Refer to valve manufacturer instruction for exact values.

Table 6-2 Valve Size by Turns

Valve Size (Inch)	Number of Turns
2	8
3	11
4	14
6	20
8	26
10	32
12	38
16	50
18	56
20	62
24	74

- Securely install the valve box cover.
- Documentation
 - Report any maintenance, repairs, or unusual findings, including specific issues and actions taken.
 - Note the number of turns required to fully open and fully close the valve.
 - Note the size of the main pipe.
 - Note the valve location.

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6.5. 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:
 - Cover maintenance procedures for each valve type.
 - Review normal operating ranges for each valve type when applicable.
 - Review emergency shutdown procedures.
 - Incorporate hands-on practice where possible.
 - Address operators' questions or concerns.
 - Identify areas to improve the SOP.
- Documentation
 - Record the date, time, and attendees of the training sessions in *Attachment 1*.
 - Note any updates or revisions made to the SOP.

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7. TROUBLESHOOTING

In general, first identify the problem(s) and course of action (i.e., stop leaks, restore flow, reduce noise, etc.) For detailed troubleshooting of a specific valve types, consult the corresponding table: diaphragm valve - *Table 7-1*; air release valve - *Table 7-2*; distribution system gate valve - *Table 7-3*.

Table 7-1 Diaphragm Valve Troubleshooting Guide

Issue	Potential Cause	Remedy
Not closing	Weak or worn spring	Replace spring
	Debris buildup	Clean valve body and disk
	Improper orientation/alignment	Reinstall valve per manufacturer's instructions
Valve is stuck	Debris buildup	Clean valve body
	Corrosion	Clean valve and apply corrosion-resistant coating. Replace corroded parts.
	Mechanical failure	Repair/replace damaged components.
	Improper installation	Re-install valve correctly.
External leak	Cracked/damaged valve body	Repair/replace valve body.
	Loose fittings/connections	Tighten loose fittings/connections.
	Corrosion	Clean valve and apply corrosion resistant coating. Replace corroded parts.
Excessive pressure reduction	Over-adjusted spring tension	Adjust spring tension.
	Malfunctioning diaphragm/piston	Replace diaphragm/piston.
Fluctuating pressure output	Malfunctioning pilot valve	Repair/replace pilot valve.
	Clogged filter	Clean/replace filter.

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Table 7-2 Air Release Valve Troubleshooting Guide

Issue	Potential Cause	Remedy
Not venting air	Clogged vent hole	Clean vent hole and pipe.
Leaking	Worn seals or gaskets	Replace seal or gaskets according to manufacturer's instructions.
	Excessive pressure	Adjust system pressure.
	Improper installation	Reinstall valve per manufacturer's instructions.
Noisy	Loose components	Tighten loose components.
	Incorrect valve orientation	Reorient valve per manufacturer's instructions.

Table 7-3 Distribution System Gate Valve Troubleshooting Guide

Issue	Potential Cause	Remedy
Unexpected turn count	Tabulation/debris in seat area	Create flow through the valve by opening downstream hydrant. Then exercise valve to loosen/remove debris.
Operating nut continues to rotate	Damaged stem or stem nut due to excessive torque	Expose valve and inspect stem and stem nut. Replace valve according to manufacturer's instructions.
Operating nut will not turn	Valve box interference with operating key	Re-position valve box.
	Unevenly tightened stuffing box bolts/nuts	Loosen and re-tighten stuffing box bolts/nuts evenly.
	Debris/corrosion between stem and stuffing box	Remove and clean/replace stem and stuffing box.
	Debris wedged under disc	Expose the valve, remove the bonnet, and clean debris.
Valve body/bonnet leak	Loose bolts and nuts	Tighten bonnet bolts and nuts.
	Damaged or pinched bonnet gasket	Remove the bonnet and replace gasket.
	Cracked or broken body/bonnet flange	Inspect and replace damaged body/bonnet flanges.

Notes: _____

8. REFERENCES

- AWWA M44 Distribution Valves: Selection, Installation, Field Testing, and Maintenance, Third Edition, 2016.
- AWWA M14 Backflow Prevention and Cross-Connection Control: Recommended Practices, Fifth Edition
- UFC 3-230-02 Operation and Maintenance: Water Supply Systems. 1 November 2023.
- AWWA C500-19 Metal-Seated Gate Valves for Water Supply Services
- AWWA C500-09 Metal-Seated Gate Valves for Water Supply Service
- AWWA C504-10 Rubber-Seated Butterfly Valves, 3 In. (75 mm) Through 72 In. (1,800 mm)
- AWWA C507-15 Ball Valves, 6 In. Through 60 In. (150 mm Through 1,500 mm)
- AWWA C508-09 Swing-Check Valves for Waterworks Service, 2-In. Through 24-In. (50-mm Through 600-mm) NPS
- AWWA C509-09 Resilient-Seated Gate Valves for Water Supply Service
- AWWA C512-07 Air-Release, Air/Vacuum, and Combination Air Valves for Waterworks Service
- AWWA C515-09 Reduced-Wall Resilient-Seated Gate Valves for Water Supply Service
- AWWA C516-14 Large-Diameter Rubber-Seated Butterfly Valves, Sizes 78 In. (2,000 mm) and Larger.
- AWWA C518-13 Dual-Disc Swing-Check Valves for Waterworks Service
- AWWA C530-12 Pilot-Operated Control Valves
- AWWA C542-09 Electric Motor Actuators for Valves and Slide Gates
- **International Plumbing Code (IPC) 2018, Table 604.3, "Water Distribution System Design Criteria,"**
- JBPHH Safety Manual
- EM-385-1-1 Safety and Occupational Health (SOH) Requirements Manual. 15 March 2024.
- OPNAV M-5100.23: Navy Safety and Occupational Health Manual. 5 June 2020.

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9. ATTACHMENTS

- Attachment 1: SOP Acknowledgement and Training Form
- Attachment 2: Process Flow Diagrams
- Attachment 3: (b) (3) (B) Check Valve Operation, Maintenance and Installation Manual
- Attachment 4: (b) (3) (B) Irrigation Pressure Relief Valve Fact Sheet
- Attachment 5: (b) (3) (B) Deep-Well Pump Electric Control Valve Fact Sheet
- Attachment 6: (b) (3) (B) Air Release Valve Operation, Maintenance and Installation Manual
- Attachment 7: (b) (3) (B) Automatic Control Valve Installation, Operation, and Maintenance Manual
- Attachment 8: (b) (3) (B) Wedge Gate Valve Operation and Maintenance Manual
- Attachment 9: (b) (3) (B) Roll Seal Valve Installation, Operation, and Maintenance Manual
- Attachment 10: (b) (3) (B) Automatic Control Valves Installation, Operation, and Maintenance Manual
- Attachment 11: (b) (3) (B) Pump Surge Control Valve Operation, Maintenance, and Installation Manual
- Attachment 12: (b) (3) (B) Surge Anticipator Valve Installation, Operation, and Maintenance Manual
- Attachment 13: (b) (3) (B) Butterfly Valve Operation, Maintenance, and Installation Manual
- Attachment 14: (b) (3) (B) Rotary Actuator Instruction Manual

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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:	Valves
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."

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Attachment 2: Process Flow Diagrams

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LEGEND	
	BALL VALVE
	GATE VALVE
	GATE VALVE (NORMALLY CLOSED)
	CHECK VALVE
	MOTORIZED BUTTERFLY VALVE
	AIR RELEASE VALVE
	DIAPHRAGM VALVE
	BOOSTER PUMP
	VERTICAL TURBINE PUMP
	METER
	POTABLE WATER LINE

(b) (3) (B)

PROCESS FLOW DIAGRAM RED HILL SHAFT

AH Engineering Consultants
11837 Rock Landing Drive, Suite 300
Newport News, Virginia 23606
(757) 873-4959
www.ahenv.com



CHECKED BY:	JH
DRAWN BY:	DLD
SCALE:	NTS
DATE:	05/2025
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Attachment 3:
(b) (3) (B) Check Valve Operation,
Maintenance and Installation Manual

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Attachment 4:
(b) (3) (B) Irrigation Pressure Relief Valve
Fact Sheet

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Attachment 5:

(b) (3) (B)

Deep-Well Pump Electric Control Valve
Fact Sheet

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Attachment 6:
(b) (3) (B) Air Release Valve Operation,
Maintenance and Installation Manual

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Attachment 7:
(b) (3) (B) Automatic Control Valve
Installation, Operation, and Maintenance
Manual

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Attachment 8:
(b) (3) (B) Wedge Gate Valve
Operation and Maintenance Manual

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Attachment 9:
(b) (3) (B) Roll Seal Valve
Installation, Operation, and Maintenance
Manual

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Attachment 10:

(b) (3) (B) Automatic Control
Valves Installation, Operation, and
Maintenance Manual

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Attachment 11:
(b) (3) (B) Pump Surge Control Valve
Operation, Maintenance, and Installation
Manual

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Attachment 12:
(b) (3) (B) Surge Anticipator Valve
Installation, Operation, and Maintenance
Manual

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Attachment 13:
(b) (3) (B) Butterfly Valve Operation,
Maintenance, and Installation Manual

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Attachment 14:

(b) (3) (B) Rotary Actuator Instruction Manual

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