OLYMPIC VALLEY
PUBLIC SERVICE DISTRICT
BOARD REPORT

SUBJECT:	Full-Time Chlorination Feasibility Study	**EXHIBIT:**	F-2, 176 Pages
AUTHOR:	Dave Hunt, District Engineer	**MEETING DATE:**	September 29, 2026

RECOMMENDED ACTION: This report is for information only; no action is requested from the Board

DISCUSSION: The State Water Resources Control Board Division of Drinking Water (DDW) performed a compliance inspection of the District's water system on August 27, 2025. DDW typically performs these inspections on a bi-annual basis. The 2025 inspection concluded that the District's water system is in good condition and well-operated. However, in Appendix A. Compliance Inspection Findings, of the inspection report (2025 COMPLIANCE INSPECTION OF THE OLYMPIC VALLEY PSD PUBLIC WATER SYSTEM, PWS NO. 3110020, dated September 16, 2025) DDW is requiring the District to "investigate the use of a disinfectant on a permanent basis and provide their findings to the Division." Currently, the District chlorinates our water only on a seasonal basis to coincide with our springtime water system flushing activities (April/May).

In response, the District contracted with Hydros Engineering to prepare the Full-Time Chlorination Feasibility Study to provide the District, regulators and the public with an objective evaluation of the feasibility, water quality implications, operational requirements, regulatory considerations, and estimated costs associated with implementing full-time chlorination systemwide.

Below is a summary of findings presented in the study:

- Regulatory compliance - chlorinated systems generally showed overall strong bacteriological performance.
- Water quality – the regional survey found that disinfection byproduct (DBP) formation is not a significant concern. Benchtop water quality testing conducted on District water confirmed that DBP formation potential is unlikely to be a limiting factor for implanting full-time chlorination.
- Primary benefits – Provide an additional layer of public health protection and a measurable indicator of distribution system integrity.
- Chlorination capital improvements – focus on expanding chlorination capabilities at Well Site 2R, 5R, and Zone 3 Booster Pump Station. The estimated total capital cost to implement full-time chlorination is $260,000. Additional annual operation and maintenance costs are $10,600 for testing and chemical costs.

- Regional survey of Tahoe-Truckee area water systems – chlorination is common in the region but not universal; more than 90% of the service connections in the region are in chlorinated water systems.

Following the presentation, staff will invite Board and public discussion of the study's findings, including the potential public health benefits, changes customers may notice, operational requirements, and costs of full-time chlorination. DDW has directed the District to investigate permanent disinfection and provide its findings; it has not directed the District to implement full-time chlorination at this time. Staff will consider the discussion and public comments before returning to the Board with any proposed next steps. No decision on full-time chlorination is requested at this meeting.

FISCAL/RESOURCE IMPACTS: There are no direct fiscal impacts to the District at this time.

STRATEGIC PLAN ALIGNMENT:

Focus Area: Service **| Goal:** Maintain and invest in infrastructure, facilities, and equipment to align with future growth, environmental resilience, and meet regulatory requirements

ATTACHMENTS:

- PowerPoint Presentation
- *OVPSD Full-Time Chlorination Feasibility Study, Hydros Engineering, September 2026*

DATE PREPARED: September 21, 2026

FULL-TIME CHLORINATION FEASIBILITY STUDY

Olympic Valley Public Service District

Presentation to the OVPSD Board of Directors

Final Report | September 2026

Prepared by Hydros Engineering • Gerry LaBudde, P.E.

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Purpose of This Study

Prepared in response to direction from the California Division of Drinking Water (DDW)

GL1

The DDW requirement followed four historical total coliform detections in the OVPSD distribution system between 2008 and 2024. The study is intended to provide the District, regulators, and the public with an objective evaluation of feasibility, water quality implications, operational requirements and estimated costs of full-time chlorination.

WHAT THE STUDY COVERS

1. **System description & disinfection practice** — Sources of supply, pressure zones, storage, existing chemical addition
2. **Bacteriological history review** — The four coliform events that preceded this study
3. **Regional systems survey** — Bacteriological & DBP experience of 20 Tahoe-Truckee area systems
4. **Benefits & drawbacks assessment** — Full-time chlorination considered on its technical merits
5. **Bench-top water quality testing** — Chlorine decay and DBP formation potential in OVPSD source water
6. **Conceptual design & cost estimates** — Well Site 2R, Well Site 5R, Zone 3 Booster, Horizontal Wells

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System Overview

Groundwater community water system serving Olympic Valley

OVPSD distribution system — wells, storage, and pressure zones

908	metered connections
4	Active groundwater wells
2	Horizontal Wells
3	pressure zones

SOURCES OF SUPPLY

Well 1R	420 gpm	Well Site 2R manifold
Well 2R	340 gpm	Well Site 2R manifold
Well 3	115 gpm	Well Site 2R manifold
Well 5R	425 gpm	standalone well house
Horizontal Wells 1 & 2	60 gpm	approved — standby supply

Combined active capacity ~1,200–1,300 gpm. Caustic soda (NaOH) is fed at Well Sites 2R and 5R for corrosion control; no continuous disinfection is currently practiced.

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Bacteriological Water Quality History

Four total coliform events recorded between 2008 and 2024

NOV 2008

Total Coliform Positive

Everline Resort (formerly Resort at Squaw Creek)

Routine	400 Squaw Creek Rd – TC+
Repeat	410 Squaw Creek Rd – TC+
Other	Remaining repeat results not in project file

Inadequate tap flushing identified, stagnant water in service line to sample point. MCL violation recorded; resolved and closed. No citation issued.

MCL Violation

NOV 2018

Total Coliform Positive

Forest Glen Road

Routine	410 Forest Glen – TC+
Repeat 1	2 TC+, 1 TC+ (300 Forest Glen)
Repeat 2	3 TC–
Source	Four wells tested all TC–

Leaking tap stem identified. Citation No. 01-02-19C-003 issued; compliance achieved 4/1/2019.

MCL Violation

OCT 2023

Total Coliform Positive

Zone 3 Booster & Everline Resort

Routine	Zone 3 Booster – TC+
Repeat 1	2 TC–, TC+ (3103 Sierra Ridge)
Repeat 2	3 TC–
Routine	Everline Resort – TC+
Repeat 1	TC–
Source	Three wells tested all TC–

Level 1 Assessment: stagnant water, contractor hot-tap, tank diver activity. System flushed.

No Violation

JAN 2024

Total Coliform Positive

Zone 3 Booster Station

Routine	Zone 3 Booster – TC+
Repeat 1	3 TC–
Source	3 wells TC–

Same location as October 2023 event. Project files did not document cause of positive sample.

No Violation

E. coli was absent in all samples across all four events, indicating no evidence of fecal contamination.
Wells never tested TC positive – indication problem was within distribution/storage

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GL1

Regional Survey of Tahoe-Truckee Area Systems

20 systems serving about 27,100 connections — 92 percent receive chlorinated water

Service Connections by Chlorination Practice

- Chlorinated — 24,872 (92%)
- Not chlorinated — 2,245 (8%)

Median system size of chlorinated system: **672 connections**
Median system size without disinfection: **138 connections**
Connection counts from SABL, 2021–2026

CONTINUOUSLY OR ROUTINELY CHLORINATED (11 systems — 24,872 connections)

Truckee-Donner PUD	Truckee Main, Hirschdale
Northstar CSD	Northstar, Martis Valley
Tahoe City PUD	Tahoe City Main, McKinney/Quail
North Tahoe PUD	North Tahoe Main, Dollar Cove, Carnelian Woods
Alpine Springs CWD	
Olympic Valley MWC	

WITHOUT CONTINUOUS DISINFECTION (9 systems — 2,245 connections)

Olympic Valley PSD	
Tahoe City PUD	Tahoe Swiss Village, Alpine Peaks, Timberland, Glenridge, Kilner Park
Smaller systems	Talmont RID, Ward Well Water Company and Tahoe Park Water Company

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Regional Systems — Service Connections & Water Source

Tahoe-Truckee area systems, grouped by chlorination practice

CHLORINATED SYSTEMS

District Name	Connections	Water Source
Truckee-Donner PUD (TDPUD) – Main	13,764	Ground Water
North Tahoe PUD (NTPUD) – Main	3,763	Surface Water
TCPUD Tahoe City – Main	2,921	Ground Water
Northstar CSD – Martis Valley	1,343	Ground Water
Northstar Community Services District	959	Surface Water/Ground Water
Alpine Springs County Water District	672	Springs/Ground Water
TCPUD McKinney/Quail	571	Ground Water
North Tahoe PUD – Carnelian Woods	298	Ground Water
North Tahoe PUD (NTPUD) – Dollar Cove	286	Ground Water
Olympic Valley Mutual Water Co. (OVMWC)	270	Ground Water
Truckee-Donner PUD (TDPUD) – Hirschdale	25	Ground Water
Total — 91.7% of connections surveyed	**24,872**	

NOT CONTINUOUSLY CHLORINATED

District Name	Connections	Water Source
Olympic Valley PSD (OVPSD)	**908**	**Ground Water**
TCPUD Tahoe Swiss Village	385	Ground Water
Talmont Resort Improvement District	347	Ground Water
Ward Well Water Company	226	Ground Water
TCPUD – Timberland	138	Ground Water
TCPUD - Alpine Peaks	98	Ground Water
Tahoe Park Water Company	96	Ground Water
TCPUD – Glenridge	46	Ground Water
TCPUD – Kilner Park	1	Ground Water
Total — 8.3% of connections surveyed	**2,245**	

20 systems surveyed • 27,117 total connections • **91.7% receive chlorinated water** | 8.3% receive non-chlorinated water

Source: California Drinking Water System Area Boundaries (SABL), Division of Drinking Water, State Water Resources Control Board (date range 2021–2026).

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Regional Survey — Key Findings

What the surveyed systems show about chlorination practice and outcomes in the region

1. **Majority of customers receive chlorinated water**
   92% of chlorinated vs 8% in unchlorinated in the systems surveyed
2. **Lower violation rate among chlorinated systems**
   Non-chlorinated systems, as a group, experienced coliform events more frequently
3. **DBP formation is not a regional concern**
   No chlorinated Tahoe-Truckee system had a TTHM or HAA5 MCL violation in the period reviewed.
4. **Sodium hypochlorite is used in the region for disinfection**
   NaOCl is the disinfectant of choice across the continuously chlorinated systems surveyed in the region.
5. **Larger Systems Are More Likely to Chlorinate**
   Seven of eight surveyed systems with more than 500 service connections use routine or continuous chlorination; OVPSD is the exception in this group. This pattern is specific to the systems surveyed and is not a regulatory requirement.

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Potential Benefits of Full-Time Chlorination

1. **Pathogen Inactivation**
   Continuous barrier against contamination entering the system after the wellhead.
2. **Biofilm Control**
   Suppresses biofilm on pipe and tank surfaces that can harbor pathogens, including Legionella.
3. **System Integrity Indicator**
   A measurable residual gives real-time feedback on distribution system condition.
4. **Multi-Barrier Protection**
   Adds an additional barrier that travels with the water, beyond source protection at the wells.
5. **Seasonal Demand Swings**
   Shoulder-season lows increase water age and stagnation – potential for bacteriological growth
6. **Vulnerable Populations**
   Infants, older adults and immunocompromised residents and guests face higher risk.
7. **Emergency Conditions**
   Main breaks, wildfire fire-flow demands and low-pressure events raise contamination risk.
8. **Reduced Reliance on Annual Flushing**
   A year-round residual lessens dependence on the annual flush-and-chlorinate program.

Without a residual, protection ends at the wellhead — there is no persistent barrier against regrowth or recontamination in the distribution system.

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Other Considerations

- **Operations & Maintenance**
  Daily or weekly residual checks, chemical inventory, equipment inspection, and periodic calibration of feed pumps and analyzers. Sodium hypochlorite requires secondary containment, PPE, and an updated Hazardous Materials Business Plan.
  Operators already handle hypochlorite during the annual flushing program; eyewash and shower stations are in place.
- **Regulatory Requirements**
  Water supply permit amendment, DBP Monitoring Plan, updated O&M Plan, SCADA alarming, MRDL compliance at 4.0 mg/L, and quarterly TTHM and HAA5 monitoring.
  Monitoring may be reduced to annual if LRAA results stay below 50 percent of the MCLs and DDW approves.
- **Taste, Odor & Perception**
  Sensitivity varies among individuals. Some customers may notice chlorine taste or odor, particularly at points of low water age near Wells 1R and 5R.
  Minimal or no perceptible change is anticipated at target residuals of 0.5 to 1.0 mg/L.
- **Customer Communication**
  A change in a system that has never chlorinated full-time will prompt customer questions about why the change is being made and what it means for their water.
  Outreach explaining the water quality basis for the change would support implementation.

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Bench-Top Water Quality Testing

Well 2R water, May 18–25, 2026 — chlorine decay and DBP formation potential

EPA Free Chlorine Hold Study Protocol

Sample collection and chlorine dose — Composited water from the Well 2R manifold
Hold sample — Sealed amber bottles, 7 days at system temperature
Laboratory analysis — Chlorine, TTHM, HAA5, TOC at six intervals
Projected water quality — EPA model extends results to 30-day water age

Chlorine residual — target dose vs. maximum allowed

MRDL 4.0 mg/L

0.5 mg/L target dose — about one-eighth of the maximum allowed

TTHM formation — measured and projected vs. the standard

MCL 80 µg/L

2.7 µg/L after 7 days • **6.9 µg/L** projected at 30 days — under 10 percent of the standard

No HAA5 compounds were detected above the laboratory reporting limit at any interval. Total organic carbon measured 1.3 mg/L, consistent with low DBP formation potential.

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Bench-Top Testing — Summary & Implications

What the hold study results mean for OVPSD

- ✓ OVPSD source water has low total organic carbon (1.3 mg/L), consistent with low DBP formation potential.
- ✓ Projected 30-day TTHM concentration (~6.9 µg/L) is far below the 80 µg/L regulatory MCL.
- ✓ Results are consistent with regional experience: no chlorinated Tahoe-Truckee groundwater system has recorded a TTHM or HAA5 MCL violation.
- ✓ A temporary rise in DBPs is possible at initial startup as chlorine mobilizes organic material from biofilm; annual flushing is expected to moderate this effect.

Bench-scale testing indicates that DBP formation is unlikely to be a limiting factor for OVPSD if full-time chlorination is implemented.

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Proposed Chlorination Improvements

Four feed locations under one design basis

CHEMICAL/STORAGE — Sodium hypochlorite, double-contained storage
DOSE CONTROL — Flow-paced feed at the primary sources
MONITORING — Residuals recorded and alarmed through SCADA

Site	Role	Dose control	Storage	Monitoring
Well Site 2R Wells 1R, 2R and 3	**Primary source** Continuous	Flow-paced from the manifold meter, adjustable via SCADA	120-gallon double-contained HDPE tank	Hach CL17 / SC200 continuous analyzer
Well Site 5R	**Primary source** Continuous	Flow-paced from the VFD pump meter, adjustable via SCADA	60-gallon double-contained HDPE tank	Hach CL17 / SC200 continuous analyzer
Zone 3 Booster Station	**End-of-system boost** Proposed regardless of a system-wide decision	Set by the operator based on observed residual trends	5-gallon cube, contingency use	Halogen Systems inline probe, zero discharge
Horizontal Wells 1 & 2	**Standby source** When placed in service	Manual on/off with the well pump	5-gallon cube	Operator grab samples at a new sample station

Continuous residual monitoring at both primary sources, with recording and alarming through SCADA; feed equipment sized for the 0.5 mg/L target dose at each site.

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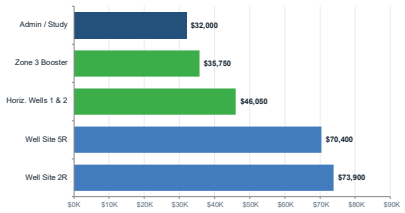
Estimated Capital Costs

Budget-level estimate



TOTAL ESTIMATED CAPITAL COST

$260,000

All four sites plus administrative, permitting, and engineering costs with a 20% contingency.

WHAT'S INCLUDED

Chemical feed pumps and skids, storage tanks and containment, chlorine analyzers, SCADA integration, admin, engineering and construction.

Estimates are budget-level and should be refined during detailed design.

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Estimated Annual Operation & Maintenance Costs

Based on a 0.5 mg/L target dose and 2023–2025 production of 98–104 Mgal/yr

Chemical Costs $6,000

Sodium hypochlorite at ~$10.50/gal (53-gallon drum) at the 0.5 mg/L target dose

Reagents $3,400

Hach analyzer reagents at Well Sites 2R and 5R ($90/mo each), plus Zone 3 analyzer replacement

Laboratory $1,200

Quarterly TTHM / HAA5 monitoring at $300 per test

Operator Labor no added cost

~2 hrs/week of additional operator time is expected to be absorbed by existing staff

TOTAL ANNUAL O&M **$10,600 / yr**

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Questions

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Olympic Valley Public Service District

FULL-TIME CHLORINATION FEASIBILITY STUDY

September 2026

Prepared for: **Olympic Valley Public Service District**

Prepared By: Hydros Engineering

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9/17/2026

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List of Abbreviations

BSSP	Bacteriological Sample Siting Plan
CBC	California Building Code
CCR	California Code of Regulations
CCR	Consumer Confidence Report
CDC	Centers for Disease Control and Prevention
CDPH	California Department of Public Health
CEQA	California Environmental Quality Act
Cl_2	Chlorine (residual)
CWS	Community water system
DBP	Disinfection byproduct
DDW	Division of Drinking Water (within the SWRCB)
EAR	Electronic Annual Report
EPA	U.S. Environmental Protection Agency
EWG	Environmental Working Group
GPD	Gallons per day
GPH	Gallons per hour
gpm	Gallons per minute
GWR	Ground Water Rule
GWUDI	Groundwater under the direct influence of surface water
HAA5	Haloacetic acids (five regulated)
HDPE	High-density polyethylene
HMBP	Hazardous Material Business Plan
LRAA	Locational running average annual
mA	Milliamperes
MCL	Maximum contaminant level
MG	Million gallons
mg/L	Milligrams per liter
MMWR	Morbidity and Mortality Weekly Report
MPN	Most probable number
MRDL	Maximum Residual Disinfectant Level

NaOCl	Sodium hypochlorite
NaOH	Sodium hydroxide (caustic soda)
ND	Not detected / non-detect
NOM	Natural organic matter
NRC	National Research Council
NSF/ANSI	NSF International / American National Standards Institute
NTPUD	North Tahoe Public Utility District
O&M	Operations and maintenance
OVMWC	Olympic Valley Mutual Water Company
OVPSD	Olympic Valley Public Service District
ppb	Parts per billion
PRV	Pressure reducing valve
psi	Pounds per square inch
PUD	Public Utility District
PWS	Public Water System
RP	Reduced pressure (backflow preventer)
RTCR	Revised Total Coliform Rule
SCADA	Supervisory Control and Data Acquisition
SDWIS	State Drinking Water Information System
SWRCB	State Water Resources Control Board
TC	Total coliform
TOC	Total organic carbon
TCPUD	Tahoe City Public Utility District
TDPUD	Truckee-Donner Public Utility District
TTHM	Total trihalomethanes
VFD	Variable frequency drive

Executive Summary

This Chlorination Feasibility Study was prepared for the Olympic Valley Public Service District (OVPSD or District). This study was conducted in response to a requirement by the California State Water Resources Control Board, Division of Drinking Water (DDW), included in the September 2025 compliance inspection report for the Olympic Valley Public Service District (OVPSD or District), PWS No. CA3110020. The requirement followed a history of four total coliform detections in the OVPSD distribution system. DDW directed the District to evaluate the feasibility of implementing full-time chlorination of its potable water distribution system.

The purpose of this study is to provide the District, regulators and the public with an objective evaluation of the feasibility, water quality implications, operational requirements, regulatory considerations, and estimated costs associated with implementing full-time chlorination.

OVPSD operates a community groundwater system serving approximately 908 metered connections. The District's potable water supply is derived entirely from groundwater wells in Olympic Valley. Four wells are currently active: Wells 1R, 2R, 3, and 5R. Wells 1R, 2R, and 3 discharge through a common manifold at Well Site 2R, while Well 5R operates from a separate well house. The Horizontal Wells are approved sources that are currently maintained as needed to supplument the system capacity, and Well 4 has been abandoned. The active wells provide an estimated combined production capacity of approximately 1,200 to 1,300 gallons per minute.

The District's groundwater is high quality and has low natural organic matter, which is important because organic matter is the primary precursor for regulated disinfection byproducts. The wells are not classified as groundwater under the direct influence of surface water, and no surface water sources are used. The District currently adjusts pH using sodium hydroxide for corrosion control, but under normal operations it does not continuously disinfect the water or maintain a chlorine residual in the distribution system.

OVPSD does periodically chlorinate the system during annual flushing and as needed for corrective or emergency response, such as after a main repair or bacteriological detection. Temporary chlorination equipment is available at Well Sites 2R and 5R, but the existing equipment is not intended for continuous operation. No permanent chlorination system is currently installed at the Zone 3 Booster Station.

Historical bacteriological results reviewed for this study identified four total coliform events between 2008 and 2024. E. coli was absent in all samples associated with these events. The absence of E. coli indicates that the historical detections do not show evidence of fecal contamination; rather, the available information suggests that the detections were likely associated with sampling conditions, localized distribution system conditions, stagnant water, or other environmental sources. The 2008 and 2018 events resulted in total coliform MCL violations. The 2023 and 2024 events did not result in documented MCL violations, but they were significant enough to prompt DDW direction to evaluate full-time chlorination.

A regional survey was completed to compare OVPSD's experience with other public water systems in the Tahoe-Truckee area. Twenty systems were identified: eleven that operate with continuous or routine chlorination and nine that operate without continuous disinfection. Chlorination is common in the region but not universal, and it is concentrated among the larger systems.

The chlorinated systems surveyed serve 24,872 connections, more than 90 percent of the connections in the survey area, and include the region's major utilities; their median size is about 670 connections. The non-chlorinated systems are generally small, with a median of about 140 connections. OVPSD is the clear exception. At 908 connections, it is the largest non-chlorinated system of those surveyd, more than twice the size of the next largest, and it accounts for about 40 percent of all non-chlorinated connections in the survye group.

Chlorinated systems generally showed strong bacteriological performance, although chlorination does not eliminate the possibility of coliform detections, particularly when distribution system disturbances occur. The unchlorinated systems reviewed were not generally in persistent non-compliance; however, as a group they experienced coliform events more frequently than chlorinated systems.

The regional survey also indicates that disinfection byproduct formation is not a significant concern for chlorinated Tahoe-Truckee area systems based on the available data. Total trihalomethane concentrations in the surveyed chlorinated systems were generally low, with most reported values well below the 80 microgram per liter MCL. Haloacetic acid concentrations were also low, with most systems reporting values below 5 micrograms per liter. No chlorinated Tahoe-Truckee area system reviewed for this study had a documented TTHM or HAA5 MCL violation during the period evaluated. These results are consistent with the low organic matter typically present in Tahoe-Truckee area groundwater.

The primary benefit of full-time chlorination would be the addition of a continuous disinfectant residual throughout the distribution system. This residual would provide an added barrier against microbial contamination after the water leaves the wells, including potential contamination associated with main breaks, seasonal fluctions in water demand associated with a high number of vacation homes, pressure fluctuations, cross-connections, storage facilities, or localized distribution system conditions. Chlorination would also help control biofilm growth inside pipes and storage facilities. While the District has historically operated successfully without continuous chlorination, maintaining a disinfectant residual would provide an additional layer of public health protection and a measurable indicator of distribution system integrity.

The primary drawbacks of full-time chlorination are additional capital cost, ongoing operation and maintenance requirements, regulatory reporting, chemical handling, and potential customer perception issues related to chlorine taste and odor. If implemented, OVPSD would need to obtain a water supply permit amendment from DDW, prepare supporting engineering documentation, update its Operations and Maintenance Plan, prepare a disinfection byproduct monitoring plan, incorporate residual monitoring and alarms into SCADA, and update its Hazardous Materials Business Plan.

Quarterly DBP monitoring would likely be required initially, with the potential to request reduced monitoring if results remain below regulatory thresholds.

Bench-top water quality testing was conducted using an EPA-based free chlorine hold study protocol to evaluate chlorine decay and DBP formation potential in OVPSD source water. The test was conducted using water collected from the Well Site 2R manifold, representing a blend of Wells 1R and 2R. The initial chlorine dose was 0.56 mg/L. After seven days, the free chlorine residual remained at 0.43 mg/L, the measured TTHM concentration was 2.7 micrograms per liter, and HAA5 compounds were not detected. Total organic carbon was measured at 1.3 mg/L, which is consistent with low DBP formation potential.

The EPA hold study model projected that a detectable chlorine residual would persist for approximately 29 days and that TTHM concentrations at that simulated water age would be approximately 6.9 micrograms per liter. This projected TTHM concentration is far below the 80 microgram per liter MCL. Actual distribution system conditions may differ from the sealed bottle test because chlorine will also react with pipe walls, storage tank surfaces, and biofilm in the system. Therefore, actual chlorine residuals may be lower, and actual TTHM concentrations may be somewhat higher than the model predicts. Even with that limitation, the testing strongly indicates that DBP formation is unlikely to be a limiting factor for OVPSD if full-time chlorination is implemented.

The conceptual chlorination improvements would include permanent sodium hypochlorite feed systems at Well Site 2R and Well Site 5R, including chemical feed pumps, storage tanks, containment, injection equipment, online chlorine analyzers, and SCADA integration. Well Site 2R is relatively favorable for implementation because the building was designed with space to accommodate future chlorine feed equipment. Well Site 5R would require modifications to the existing chemical storage and feed arrangement. At the Zone 3 Booster Station, the conceptual design includes chlorine residual monitoring and a small supplemental hypochlorite feed system intended for contingency use, not routine continuous chlorination.

The estimated capital cost to implement the conceptual improvements is approximately $260,000, including administrative, engineering, permitting, construction, and contingency costs. The major components include approximately $74,000 for Well Site 2R, $70,000 for Well Site 5R, $46,000 for Horizontal Well Nos. 1 & 2, $36,000 for the Zone 3 Booster Station, and $32,000 in administrative and planning costs, including the chlorination study, permit amendment, engineering report, DBP siting and sampling plan, and Operations Plan update. These estimates are budget-level and should be refined during detailed design.

Estimated annual operation and maintenance costs are approximately $10,600 per year. This includes sodium hypochlorite, laboratory testing, analyzer reagents and maintenance. The estimate assumes a nominal chlorine dose of 0.5 mg/L, annual production similar to recent years, quarterly DBP monitoring, and approximately two hours per week of additional operator time for chemical handling, equipment inspection, calibration, testing, and reporting.

Overall, the study finds that full-time chlorination of the OVPSD potable water system is feasible using conventional sodium hypochlorite feed equipment and monitoring systems. The District's source water quality is favorable for chlorination, and bench-scale testing indicates low DBP formation potential. Implementation would provide an added barrier for public health protection and distribution system water quality, but would also introduce new regulatory, operational, cost, and public communication responsibilities.

Implementation of full-time chlorinatin would involve the following steps: confirm the regulatory path with DDW, proceed with detailed design, prepare the required permit amendment and monitoring plans, conduct customer outreach, and complete construction and startup and monitoring of chlorine residuals and DBP concentrations in the system.

1.0 Purpose and Scope

This study was conducted in response to a requirement by the California State Water Resources Control Board, Division of Drinking Water (DDW), included in the September 2025 compliance inspection report for the Olympic Valley Public Service District (OVPSD or District), PWS No. CA3110020. The requirement followed a history of four total coliform detections in the OVPSD distribution system. DDW directed the District to evaluate the feasibility of implementing full-time chlorination of its potable water distribution system.

The study addresses the following:

- A description of the existing water system, including sources of supply, pressure zones, storage, and current disinfection practice;
- A review of the District's bacteriological water quality history, including the coliform events that preceded this study;
- A survey of potable water systems in the Tahoe-Truckee area, examining the bacteriological and disinfection byproduct (DBP) experience of both chlorinated and unchlorinated systems in the region;
- An assessment of the potential benefits and drawbacks of transitioning to full-time chlorination;
- Bench-top water quality testing conducted to characterize chlorine decay and DBP formation potential using OVPSD source water; and
- Conceptual design and capital and operations and maintenance cost estimates for chlorination facilities at Well Site 2R, Well Site 5R, Horizontal Well Nos. 1 & 2 and the Zone 3 Booster Station.

2.0 System Description

This section provides an overview of the OVPSD water system including its service area, water sources, existing chemical addition, distribution system, pressure zones, and storage facilities. This background is intended to provide context for the chlorination feasibility evaluation presented in subsequent sections of this report.

2.1 District Overview

The Olympic Valley Public Service District (OVPSD or District) is a California Special District. The OVPSD is responsible for providing potable water and sanitary sewer service within its service area. The service area comprises Olympic Valley which is located approximately seven miles northwest of Lake Tahoe and forty miles southwest of Reno, Nevada.

The OVPSD operates as a community water system (CWS) under California's Drinking Water Program (PWS No. CA3110020) and is regulated by the State Water Resources Control Board, Division of Drinking Water (DDW), Sacramento District.

As of 2025, the District provides service to 908 metered customers. With the Valley being a resort community, the District serves a mix of residential and commercial customers. The District tracks meter types for all its customers, breaking them down into commercial, residential, and multi-family residential categories and subcategories, including irrigation-only meters, fire services, meters for homeowner associations (HOA), and metered connections to the Tahoe City Public Utility District (TCPUD) Tahoe Truckee Forest Tract Water System. A breakdown of customer service categories is presented in Table 2-1

Table 2-1- OVPSD Service Category Summary

Meter Type	Number of Services
Commercial	42
Commercial – Fire Service	16
Commercial – Irrigation	31
H/L (Compound Meters)	3
HOA – Irrigation	14
HOA – Laundry	6
Multi-Family	302
Multi-Family – HOA	2
Multi-Unit Buildings	6
Residential	413
Residential – Multi-Unit	36
Residential – Irrigation	31
Residential – Pool/Spa	2
Split – Commercial/Condo	2
TCPUD	2
System Total	**908**

Source: Draft Water Master Plan

The District's service area is adjacent to the Olympic Valley Mutual Water Company (OVMWC), a separate privately operated water system. In 2024, OVPSD and OVMWC completed construction of an emergency intertie connecting the two water systems. The intertie includes a booster pump station capable of transferring water from the OVPSD distribution system into the OVMWC system under higher-pressure conditions, and a pressure reducing valve (PRV) station to allow water to flow from the OVMWC system into OVPSD at a regulated pressure. The interties are for emergency conditions and not routinely used.

2.2 Sources of Supply

OVPSD's water supply is derived entirely from groundwater. The system draws from the aquifer underlying Olympic Valley. The water is high quality with low natural organic matter (NOM) content - directly relevant to the disinfection byproduct (DBP) formation potential discussion in Section 6 of this report. There are no surface water sources and the wells are not classified as groundwater under the direct influence of surface water (GWUDI), which would require treatment.

Four wells are currently in active service: Well 1R, Well 2R, Well 3, and Well 5R. Wells 1R and 3 discharge to a common manifold at the Well 2R site. The OVPSD measures well production at each well. Well 5R operates independently from its own well house. The District also operates two (2) horizontal well sources, Horizontal Wells 1 and 2.

The active wells collectively provide an estimated production capacity of approximately 1,200 to 1,300 gpm (2025 Water and Sewer System Report). Well capacity at Well 2R varies seasonally, influenced by local aquifer levels. When in operation, the horizontal wells provide a combined capacity of up to 60 gpm based on historical SCADA data.

The District currently adds sodium hydroxide (caustic soda) to the water supply to adjust pH which is normally adjusted to approximately 7.5 for corrosion control. Caustic soda is injected at the manifold at Well Building 2R (serving Wells 1R, 2R, and 3) and at the discharge line at Well Building 5R. Both well buildings are equipped with SCADA telemetry, and existing chemical feed infrastructure for caustic soda (day tanks, metering pumps, and an injector). Secondary containment is provided for the caustic soda storage facilities.

The Well 2R building was designed and constructed with space provisions to accommodate future addition of chlorine feed equipment, which reduces the complexity of adding sodium hypochlorite injection at that site. Well 5R will require modification to the existing caustic soda storage and feed systems if full time chlorination is implemented. Table 2-2 summarizes the active production sources.

Table 2-2- OVPSD Active Groundwater Sources

Source ID	Status	Avg. Capacity (gpm)	Zone Served/Discharge Point	Existing Chemical Feed
Well 1R	Active	420	Zone 1/Well 2R Building (manifold)	(a)
Well 2R	Active	340	Zone 1/Well 2R Building	NaOH (at manifold)
Well 3	Active	115	Zone 1/Well 2R Building (manifold)	(a)
Well 5R	Active	425	Zone 1/Well 5R Building	NaOH (at discharge)
Horizontal Wells 1 & 2[(b)]	Active	60	Zone 2/Zone 2 Distribution	None

Notes:

a) Well water is treated at Well Site 2R.

b) Horizontal wells are approved sources with active status but are currently used as a standby source. Capacity is based on review of historical SCADA data.

Annual production from all sources for 2023 through 2025 is included in Table 2-3. This information was used to estimate chemical costs in Section 8. Data was obtained from the OVPSD Annual Water and Sewer Reports.

Table 2-3 - Annual Production – All Sources

Year	Production, Mgal
2023	97.8
2024	101.1
2025	103.5

2.3 Distribution System — Pressure Zones and Storage

The OVPSD distribution system operates across three pressure zones designated Zone 1, Zone 2, and Zone 3, which correspond to progressively higher elevations within the service area. Each zone is served by dedicated storage. Table 2-4 summarizes the pressure zone configuration.

Table 2-4- OVPSD Pressure Zone Configuration

Zone	Pressure Range (psi)	Water Sources	Storage Tank	Storage (gal)
Zone 1	100–120	Wells 1R, 2R, 3, 5R	West Tank	1,130,000
Zone 2	115–140	Horizontal Well; Zone 2 (East) Booster Pump Station from Zone 1	East Tank	500,000
Zone 3	100–105	Zone 3 Booster Pump Station from Zone 2	Zone 3 Tank	135,000

2.4 Existing Operations — Disinfection Practice

OVPSD operates as an unchlorinated groundwater system. Under normal operating conditions, no disinfectant is added and no chlorine residual is maintained in the distribution system. The District's wells discharge directly into the distribution system following pH adjustment with caustic soda; no further treatment is applied on a continuous basis. This operating mode has been the District's practice since its inception.

Periodically the OVPSD does add chlorine to the water supply. The addition of chlorine is limited in frequency and duration. Historically the addition of sodium hypochlorite occurs under two conditions.

1) 12.5% Sodium hypochlorite is added during annual system flushing over an approximately one-month period each year. Reported distribution system residuals ranged from 0.08 to 0.47 mg/L during flushing operations in 2025.
2) Sodium hypochlorite may be applied on an emergency or corrective basis when system conditions warrant, such as following a main break, repair, or positive bacteriological detection event requiring remediation.

Temporary/emergency chlorination equipment is in place at both Well sites 2R and 5R. Temporary sodium hypochlorite metering pumps and tanks are installed at Well Building 2R (serving the Wells 1R, 2R, and 3 manifold) and at Well Building 5R. The equipment supports temporary and emergency chlorination but is not intended to operate continuously. No chlorination equipment is currently installed at the Zone 3 Booster Pump Station, which is served downstream of Zones 1 and 2. Zone 3 chlorine residual is achieved by increasing the chlorine dose in Zone 1 and that water is pumped into Zone 3 during normal operations.

3.0 Bacteriological Water Quality Review

Routine bacteriological monitoring is conducted monthly in accordance with the District's Bacteriological Sample Siting Plan (BSSP). Over the period reviewed (2008–2024), four positive total coliform events have been recorded in the distribution system; E. coli was absent from all samples collected in each event. Each event is briefly described below, with additional sample data, regulatory actions, and corrective measures presented in Table 3-1.

E. coli and fecal coliform originate from the intestinal tracts of warm-blooded animals and indicate potential fecal contamination. The consistent absence of E. coli in samples from the OVPSD system suggests that positive detections reflect environmental or sampling-related sources rather than fecal contamination of the water supply in the four historical positive sampling events.

3.1 November 2008 Total Coliform Positive

Routine distribution system samples collected in November 2008 returned total coliform positive results at the Everline Resort (formerly Resort at Squaw Creek) sample sites. Investigation by the District identified inadequate sample tap flushing and compromised sample site conditions during the routine sample that tested total coliform positive at 400 Resort Road during the routine monthly sampling event. A repeat sample was collected at 410 Resort Road which also had a positive total coliform.

The cause of the positive sample at 400 Resort Road was believed to be insufficient flushing of the service line prior to the sample collection; the District formally requested invalidation of the sample from CDPH (then operating as California Department of Public Health). The positive result at the repeat location was thought to have been due to improper flushing of a bypass line at the sample site and the District requested the sample be invalidated. There is no record that the CDPH invalidated the samples in the project file. A public notification was issued by the OVPSD. Follow up samples were absent of total coliform; however, the CDPH issued a MCL violation of the Total Coliform Rule that was resolved and closed by the CDPH and the system was considered in compliance. No citation was issued by the CDPH.

3.2 November 2018 Total Coliform Positive

A total coliform positive result occurred during November 2018 routine sampling and a second positive result occurred during the repeat sampling and triggered a RTCR Level 1 Assessment completed November 28, 2018. The assessment identified inadequate flushing of the routine sample tap at 410 Forest Glen Road and a leaking tap stem at 390 Forest Glen Road as the probable cause of the contamination. No system contamination was identified. DDW determined that the two positive results constituted a violation of the total coliform MCL under CCR Title 22, Section 64426.1, and issued Citation No. 01-02-19C-003 on March 13, 2019, directing the District to comply with

monitoring requirements and notify all customers of the MCL violation. No E. coli was detected in any sample.

3.3 October 2023 Total Coliform Positive

Routine sampling in October 2023 returned a total coliform positive result at the Zone 3 Booster Station and the other at the Everline Resort sample site. An RTCR Level 1 Assessment was completed and submitted to DDW; repeat and source samples at Wells 1R, 2R, and 5R all returned absent results. No *E. coli* was detected in any sample.

Three deficiencies were identified in the Level 1 Assessment:

- Possible stagnant water in Zones 2 and 3
- Possible loss of "cookie" from contractor hot-tap on ductile iron pipe
- Possible contamination from tank divers/inspectors

District staff flushed and applied temporary chlorine into system. No citation or MCL violation was issued.

3.4 January 2024 Total Coliform Positive

A single total coliform positive result was detected at the Zone 3 Booster Station during routine sampling on January 2, 2024, with zero chlorine residual recorded at the sample site. All six repeat and triggered source samples collected on January 4, 2024 returned absent results for both total coliform and *E. coli*. No *E. coli* was detected. The positive total coliform sample did not cause an MCL violation. The project files did not include information regarding likely cause. No MCL violation or citation issued.

Table 3-1 – Total Coliform Sample Summary

Date	Initial Positive Sample	TC / E. coli Result	Cl_2 Residual	Repeat Samples (Location, Date, TC Result)	Triggered Source Samples (GWR)	Coliform Type	MCL Violation?	Probable Cause	Corrective Action	DDW Actions / Response	Outcome / Resolution	Source Documents
November 8, 2008	400 Squaw Creek Rd Routine sample	**TC:** Present **E. coli:** Absent	Not reported Presumed ND—zero Cl_2 system-wide	10 repeat samples collected 11/8/2008 1 TC+ at 390 Forest Glenn Rd; E. coli absent Original routine site and all other 9 repeats: TC absent Triggered well source samples: TC absent	Pre-GWR era—GWR not in effect; no triggered source sampling required	TC only (E. coli absent)	YES — MCL violated SDWIS Viol. No. 2009-902001 Period: Nov 1–30, 2008	Inadequate flushing of routine tap at 400 Squaw Creek Rd prior to sampling. Leaking stem valve at repeat sample tap at 410 Squaw Creek Rd (downstream of RP backflow preventer with corrosion inhibitor injection point) District requested sample invalidation for Sample No. 9172 (410 Squaw Creek Rd repeat)—DDW response not in project file	Notified CDPH 11/9/2008 upon receiving lab results Flushed distribution system in affected pressure zone Requested invalidation of Sample No. 9172 (repeat tap at 410 Squaw Creek Rd) Committed to re-plumb both sample sites and conduct operator retraining	Violation recorded with determination date 12/1/2008 No formal citation issued Compliance achieved 12/22/2008 per SDWIS Tier 2 public notification required (Note this predates the RTCR – no Level 1 or 2 Assessment) No citation issued.	Resolved SDWIS compliance achieved 12/22/2008 Invalidation outcome not confirmed in project file	Sample invalidation letter (J. McGraw to CDPH, 11/19/2008) Nov 2008 Monthly Summary of Distribution System Coliform Monitoring SDWIS Viol. No. 2009-902001 (CA Drinking Water Watch)
November 8, 2018	410 Forest Glen Rd Routine sample *Collected 11/6/2018*	**TC:** Present **E. coli:** Absent	Not reported in lab results Presumed ND—zero Cl_2 system-wide	7 repeat samples collected 11/8/2018 1 TC+ at 390 Forest Glenn Rd; E. coli absent Original routine site re-sample: TC absent All remaining 5 repeats: TC absent Additional check samples collected 11/13/2018: all TC absent	4 triggered source samples from active supply wells collected 11/8/2018 All TC absent, E. coli absent	TC only (E. coli absent)	**YES — MCL violated** SDWIS Viol. No. 2019-902002 Period: Nov 1–30, 2018 Determination date: 12/10/2018	Inadequate flushing of routine tap for initial routine positive sample. Water leaking around stem of repeat sample tap at 390 Forest Glenn Rd (also TC+) on the repeat.	Notified DDW 11/7/2018 upon receiving lab results Collected additional check samples 11/13/2018 (all TC absent) Submitted Level 1 Assessment 11/28/2018 Addressed both deficient sample taps Issued Tier 2 public notification to customers	Citation 01-02-19C-003 issued 3/13/2019 (S.W. Watson, P.E., Lassen District Engineer) District directed to: (1) comply with §64426/64426.1 in all future periods; (2) notify all customers of MCL violation by 4/10/2019 Level 1 Assessment submitted 11/28/2018 Tier 2 public notification required Compliance achieved 4/1/2019 per SDWIS	Resolved SDWIS compliance achieved 4/1/2019 Citation closed	Nov 2018 Monthly Summary of Distribution System Coliform Monitoring Lab results (Cranmer Engineering, Work Order 239625) State Citation No. 01-02-19C-003 (3/13/2019) SDWIS Viol. No. 2019-902002 (CA Drinking Water Watch) Tier 2 notice (project file)
Oct 2023	**(1) Zone 3 Booster Station** Routine; Sample GFJ0070-04 *Collected 10/3/2023, 8:25 AM* **(2) Resort at Squaw Creek**	**TC:** Present (both sites) **E. coli:** Absent (both sites) *2 of 3 routine sites positive*	ND at all 3 routine sample sites pH range: 7.20–7.32	9 repeat samples collected 10/5/2023 (Work Order GFJ0293): 1 TC+ at 3103 Sierra Ridge Place (GFJ0293-01); E. coli absent; Cl_2 ND 8 remaining repeats: all TC absent Additional repeats collected 10/9/2023 (1	3 triggered source samples collected 10/5/2023 (Work Order GFJ0293): Well 1R (GFJ0293-02): TC absent, E.	TC only (E. coli absent all samples)	UNCERTAIN — see note Monthly Summary form indicates MCL violated (box checked “No” for monthly MCL compliance); however, no	Three deficiencies identified in Level 1 Assessment: (1) Possible stagnant water in Zones 2 and 3 (2) Possible loss of “cookie” from contractor hot-tap on ductile iron pipe	Emergency disinfection of entire distribution system (completed 10/7/2023) Flushed all dead-end mains in each pressure zone (completed 10/16/2023) Required tank divers to perform future dives only during routine annual chlorination event (implemented 10/7/2023)	DDW received Level 1 Assessment prepared and submitted 10/26/2023 Tier 2 public notification issued DDW review of Oct 2023 and Jan 2024 events by S.W. Watson, P.E. and No formal citation issued; no SDWIS MCL violation recorded for this event	Chlorination feasibility study (this report) is DDW-directed outcome *⚠ MCL violation status to be confirmed with DDW*	Oct 2023 Monthly Summary of Distribution System Coliform Monitoring (GWR Triggered) Lab Work Orders GFJ0070 and GFJ0293 (Cranmer Engineering, Inc.) RTCR Level 1 Assessment form (signed 10/23/2023) BSSP Review Letter (DDW, 9/5/2023) CA Drinking Water Watch—no SDWIS violation recorded for 2023

Date	Initial Positive Sample	TC / E. coli Result	Cl_2 Residual	Repeat Samples (Location, Date, TC Result)	Triggered Source Samples (GWR)	Coliform Type	MCL Violation?	Probable Cause	Corrective Action	DDW Actions / Response	Outcome / Resolution	Source Documents
	Routine; Sample GFJ0070-03 Collected 10/3/2023, 8:45 AM 1810 Olympic Valley Rd: TC absent			site) and 10/11/2023 (2 sites): all TC absent Repeat sites included Zone 3 Booster, 272 Sierra Crest Tr, 3103 Sierra Ridge, Everline Resort, Everline Midrise, 3122 Mountain Links, 3013 Sierra Risge, 250 Sierra Crest	coli absent, Cl_2 ND Well 2R: TC absent, E. coli absent, Cl_2 ND Well 5 (GFJ0293-04): TC absent, E. coli absent, Cl_2 ND		violation recorded in SDWIS for 2023	(3) Possible contamination from Tank divers/inspectors				
Jan 2024	**Zone 3 Booster Station** Routine Sample Collected 1/2/2024 Other 2 routine sites (1810 Olympic Valley Rd; Everline Resort): TC absent	**TC:** Present **E. coli:** Absent Cl_2: ND, pH 7.61	ND at all 3 routine sample sites	Six repeat/triggered samples collected 1/4/2024 Zone 3 Booster TC absent, Cl_2 ND 272 Sierra Crest Trail : TC absent, Cl_2 ND 3103 Sierra Ridge Place: TC absent, Cl_2 ND All E. coli absent across all repeat samples	Triggered source samples collected 1/4/2024 Well 1R: TC absent, E. coli absent, Cl_2 ND Well 2R: TC absent, E. coli absent, Cl_2 ND Well 5R: TC absent, E. coli absent, Cl_2 ND	TC only (E. coli absent all samples)	NO MCL violation No SDWIS violation recorded	Probable cause not documented in project file for the January 2024 event Same location (Zone 3 Booster Station) as October 2023 event.	Repeat and triggered source sampling completed within 24-hour window required by RTCR All follow-up results negative No additional corrective actions separately documented for this event	DDW correspondence (Watson/Peterson) identified Jan 2024 TC+ as second treatment technique trigger within rolling 12-month period No formal citation issued; no SDWIS MCL violation recorded	Chlorination feasibility study (this report) is DDW-directed outcome	Jan 2024 Monthly Summary of Distribution System Coliform Monitoring (GWR Triggered) CA Drinking Water Watch—no SDWIS violation recorded for Jan 2024

Notes: All E. coli results were absent across all four events and all sample types. Chlorine residual was not detected (ND) at all distribution system sample sites in all events where reported, consistent with the District operating as an unchlorinated system. SDWIS data accessed May 2025 via CA Drinking Water Watch (PWS No. CA3110020). Abbreviations used in this table: TC = total coliform; ND = not detected; Cl_2 = chlorine residual; MPN = most probable number (col/100 mL); RP = reduced pressure (backflow preventer); GWR = Ground Water Rule.

4.0 Survey of Regional Systems

As part of this feasibility study, Hydros Engineering conducted a survey of potable water systems serving the Tahoe area. The intent of this survey was to investigate the effect of chlorination on bacteriological and DBP water quality in systems in the area with similar source water and operating environment.

Initial outreach to system operators by telephone was attempted but produced limited responses. The survey was therefore conducted primarily through review of publicly available regulatory data. Data sources included the California DDW State Drinking Water Information System (SDWIS), accessed through the DDW Drinking Water Watch portal; Consumer Confidence Reports (CCRs) retrieved directly from agency websites and the California DDW Electronic Annual Report (EAR) portal; and multi-year water quality averages from the Environmental Working Group (EWG) Tap Water Database.

A total of 20 public water systems were identified in the Tahoe-Truckee area for this survey. Of these, eleven systems operate with continuous or routine chlorination and nine operate without continuous disinfection. The size and number of connections served vary as discussed below.

4.1 Chlorinated Systems — Bacteriological and DBP Outcomes

Eleven of systems surveyed in the Tahoe-Truckee area were identified as operating with continuous chlorination. These included:

- Truckee-Donner Public Utility District (TDPUD), which serves the largest population in the region across its Truckee Main system and a small separate system in Hirschdale;
- Northstar Community Services District, which operates the Northstar system and the Martis Valley system;
- Tahoe City Public Utility District (TCPUD), which operates the Tahoe City Main, McKinney/Quail around the western and north shore of Lake Tahoe;
- North Tahoe Public Utility District (NTPUD) Dollar Cove system, which receives pre-chlorinated water from TCPUD and North Tahoe PUD's Carnelian Woods system
- Alpine Springs County Water District, and
- Olympic Valley Mutual Water Company (OVMWC) also applies chlorination as a preventative measure when the production wells are operated due to the age and conditions of the wells. The OVMWC relies on the horizontal well during low demand periods in the winter. The horizontal well is not chlorinated.

The bacteriological water quality record for the continuously chlorinated systems is generally strong. The largest systems - TDPUD Main, TDPUD Hirschdale, TCPUD Tahoe City Main, and NTPUD Dollar Cove - reported zero total coliform detections. Northstar's two systems have similar records with no coliform violations identified in available data. Alpine Springs County Water District chlorinates and had a total coliform violation in 2019.

OVMWC accumulated seven coliform MCL violations between 2003 and 2010 before implementing its current operational practices which include chlorination of the wells. The OVMWC implemented major capital improvement projects including replacement of old pipelines, replacement of a redwood tank with a new steel tank and rehabilitation of their wells. All these factored into the improved bacteriological water quality. The OVMWC chlorinates water from the two production wells when in use during the higher demand periods. During low demand periods through the cooler months the OVMWC system relies primarily on the horizontal well for water supply and the wells are used only periodically. The horizontal well is not chlorinated during that time.

Disinfection byproducts are a concern when a disinfectant is used. When chlorine is used for disinfection, the disinfection byproducts of most concern include total trihalomethanes (TTHMs) and haloacetic acids (HAA5s). TTHM and HAA5s form when chlorine reacts with naturally occurring organic material in water. The federal and state MCLs are 80 parts per billion (ppb) for TTHMs and 60 ppb for HAA5s. Among the surveyed chlorinated systems, measured TTHM concentrations ranged from non-detect to approximately 24 ppb, with most systems reporting values well below 30 ppb. HAA5 concentrations were similarly low, with the majority of systems reporting values under 5 ppb. No chlorinated system in the survey had a TTHM or HAA5 MCL violation in the period reviewed.

The low DBP concentrations observed across the region are consistent with the well-documented water quality characteristics of the Tahoe-Truckee area. The groundwater systems in this area draw from aquifers with very low concentrations of NOM - the primary precursor to DBP formation. TDPUD's Truckee Main system, for example, reported a 2024 average TTHM of 12 ppb. Even Tahoe City PUD's Tahoe City Main system with source water from wells (Highlands #1, Highlands #2, TC Well #2, TC Well #3, Well #4, Tahoe Tavern Well) that are chlorinated reported non-detect for disinfection byproducts in 2024.

4.2 Non-Chlorinated Systems — Bacteriological Outcomes

Nine of the 20 Tahoe-Truckee area systems surveyed operate without continuous disinfection. These include:

- OVPSD (the subject of this study),
- TCPUD Alpine Peaks, Tahoe Swiss Village, Glenridge, and Kilner Park.
- A number of smaller private and special district water companies serving the west and north shore communities. Together these systems serve a broad range of population sizes, from systems of fewer than 50 connections to OVPSD's approximately 900 connections.

Many of the unchlorinated systems have good bacteriological compliance records. TCPUD Alpine Peaks, McKinney Water District, and Ward Well Water Company all show either no coliform violations or only a single isolated event in the period reviewed. Where isolated events have occurred, the violations were generally resolved within weeks and have not recurred.

TCPUD's Timberland system, which applies chlorination only for corrective purposes and is not continuously disinfected, recorded three separate coliform MCL violations between 2018 and 2020 as well as a Level 1 Assessment trigger in 2024 related to a compromised storage tank vent.

However, a pattern does emerge when the violation history of the surveyed systems is reviewed. The non-chlorinated systems as a group have recorded coliform violations more frequently than the continuously chlorinated systems. Timberland recorded three MCL violations three between 2018 and 2020 and again in 2024), and all four were resolved with a single compliance agreement in 2024. Talmont Resort Improvement District recorded a coliform MCL violation in 2023. Tahoe Park Water Company recorded coliform violations in 2017 and earlier years. OVPSD itself recorded a coliform MCL violation in November 2018, followed by Level 1 Assessment triggers in October 2023 and January 2024.

It would be an overstatement to say that unchlorinated systems in the Tahoe-Truckee area are in persistent non-compliance - many have operated for years without incident. However, the data does suggest that, as a group, non-chlorinated systems in this region have experienced coliform events at a higher rate than their continuously chlorinated counterparts. Most of those events are isolated and attributable to specific triggering conditions such as distribution system disturbances, seasonal high flows, or infrastructure deficiencies rather than to the absence of chlorination alone. Nonetheless, the absence of a disinfectant residual means there is a persistent barrier against microbial regrowth or recontamination within the distribution system once water leaves the source.

Because the non-chlorinated systems do not apply disinfectant, they are not required to monitor for TTHMs or HAA5s.

4.3 Chlorinated vs Non-Chlorinated Service Count

Counted by the number of systems, the systems surveyed look almost evenly split between the two practices. That count, however, gives the same weight to a system serving one connection as to one serving more than 13,000. It does not reflect how many customers actually receive chlorinated water.

When the systems are compared by service connections, the picture changes considerably. The 20 systems serve approximately 27,100 connections in total. About 24,900 of these (92 percent) are served by systems that chlorinate full-time, and about 2,200 (8 percent) receive non-chlorinated water. The result does not depend on the region's largest system. Excluding Truckee-Donner PUD's Main system, chlorinated systems still serve about 11,100 connections, or 83 percent of the remaining total. Table 4-1 shows the breakdown based on the number of services within the systems.

Table 4-1 –Tahoe-Truckee Regional Systems Chlorination Practices

District Name	Connections	Water Source[(b)]		District Name	Connections	Water Source[(b)]
Truckee-Donner PUD (TDPUD) – Main	13,764	GW		Olympic Valley PSD (OVPSD)	908	GW
North Tahoe PUD (NTPUD) – Main	3,763	SW		TCPUD Tahoe Swiss Village	385	GW
Tahe City PUD (TCPUD) Tahoe City – Main	2,921	GW		Talmont Resort Improvement District	347	GW
Northstar CSD – Martis Valley	1,343	GW		Ward Well Water Company	226	GW
Northstar CSD	959	GW		TCPUD – Timberland	138	GW
Alpine Springs County Water District	672	GW		TCPUD – Alpine Peaks	98	GW
TCPUD - McKinney/Quail	571	SW		Tahoe Park Water Company	96	GW
NTPUD – Carnelian Woods	298	GW		TCPUD – Glenridge	46	GW
NTPUD – Dollar Cove	286	GW		TCPUD – Kilner Park	1	GW
Olympic Valley Mutual Water Co. (OVMWC)	270	GW				
TDPUD – Hirschdale	25	GW				
Total	**24,872**			**Total**	**2,245**	
Notes:						
a) Data source California Drinking Water System Area Boundaries (SABL) date range 2021-2026						
b) SW - Surface Water; GW - Ground Water						

The chlorinated systems include the region's largest utilities, and their median size is about 670 connections. The non-chlorinated systems are mostly small, with a median of about 140 connections; eight of the nine serve fewer than 400. OVPSD is the clear exception. At 908 connections, it is the largest non-chlorinated system in the survey, more than twice the size of the next largest (TCPUD Tahoe Swiss Village, 385). OVPSD alone accounts for about 40 percent of all non-chlorinated connections in the survey area. It is also larger than six of the eleven chlorinated systems.

Non-chlorinated service is concentrated in small systems, and OVPSD is an outlier among them in size. By connection count, OVPSD more closely resembles the systems that chlorinate than those that do not.

4.4 Summary of Truckee-Tahoe Systems Surveyed

The regional survey yields several observations that are relevant to OVPSD's evaluation:

- The 20 systems surveyed serve about 27,100 service connections in total. Systems that chlorinate full-time account for about 24,900 of them (92 percent), and the remaining 2,200 (8 percent) receive unchlorinated water.
- Routine chlorination is more common among the larger systems surveyed. Seven of the eight systems with more than 500 service connections utilize routine or continuous chlorination; OVPSD is the exception. This observation is specific to the systems surveyed and should not be interpreted as a regulatory requirement or universal industry practice.
- Positive coliform events occur in both chlorinated and unchlorinated systems. Chlorination reduces but does not eliminate the possibility of a coliform detection - distribution system conditions, infrastructure condition, and operational practices also play important roles. Among the surveyed systems, the coliform MCL violation rate was lower for continuously chlorinated systems than for unchlorinated systems, though the sample sizes are modest and the difference should not be overstated.
- DBP formation is not a significant concern in the Tahoe Region. Every chlorinated groundwater system for which data was available reported TTHM concentrations well

below the 80 ppb MCL, with most values below 25 ppb. HAA5 concentrations were similarly low. No chlorinated Tahoe-Truckee area system has recorded a TTHM or HAA5 MCL violation based on the data set evaluated.

- Sodium hypochlorite is the disinfectant of choice across the chlorinated systems in the region.

5.0 Assessment of Chlorination - Positives and Negatives

This section provides an evaluation of the potential benefits and drawbacks of transitioning to continuous, year-round chlorination as a primary disinfection strategy. The assessment is provided as information for consideration and is not a recommendation for or against implementation for full-time chlorination.

5.1 Potential Benefits of Full-Time Chlorination

The primary benefit of continuous chlorination is the addition of a sustained barrier against microbial contamination within the distribution system. The following summarizes the key protective benefits supported by the published literature. A summary of the references cited in this section is included in Appendix A.

5.1.1 Inactivation of Waterborne Pathogens

While OVPSD's groundwater sources have historically produced high-quality water, the absence of a disinfectant residual means there is no ongoing disinfectant defense against microbial contamination events (e.g. main or service line breaks, low system pressure and backflow events) after the well water enters the distribution system piping. The OVPSD has measures and emergency plans in place to prevent these events from occurring and means to respond to these types of situations to protect water quality within the system. Historically these procedures have been effective protecting water quality. The addition of full-time disinfection would provide an additional barrier against microbial contamination.

Chlorine has been used as a primary drinking water disinfectant for over a century and is widely regarded as the standard against which other disinfectants are measured (NRC, 1980 [Ref. 1]). It is effective against a broad range of bacteria and viruses under typical groundwater conditions. The CDC notes that low concentrations of chlorine used in drinking water treatment do not pose a health risk to consumers and are specifically intended to kill germs before water reaches the tap (CDC, 2024 [Ref. 2]).

A chlorine residual maintained throughout the distribution system provides additional protection against contamination that may be introduced at the source or after the point of treatment. This includes intrusion events associated with source contamination at wells, main and service line breaks, and cross-connections. Research cited by the EPA confirms that maintaining a disinfectant residual reduces the risk of contamination reaching customers and provides an indicator of system integrity (EPA, 2006 [Ref. 3]); (EPA, 2023 [Ref. 4]).

National CDC surveillance data covering 2015–2020 identified 214 drinking water outbreaks resulting in 2,140 illnesses, 563 hospitalizations, and 88 deaths. Among enteric illness outbreaks where the water source was known, wells accounted for 93 percent of cases. No disinfection was reported in the large majority of those enteric illness outbreaks (CDC/MMWR, 2024 [Ref. 5]). While OVPSD's well

infrastructure is of a different character than private wells or small noncommunity systems, the data underscore that groundwater is not inherently pathogen-free, particularly when the distribution or storage facilities have been compromised, and that the absence of disinfection is a recurring contributing factor in outbreak investigations. A continuous chlorine residual provides a safety margin that reduces, though does not eliminate, this risk.

5.1.2 Biofilm Control

All distribution systems develop biofilm communities on pipe interior surfaces over time. Without a disinfectant residual, biofilm can harbor and sustain pathogenic organisms, including Legionella and other pathogens. AWWA guidance identifies biofilm control as a critical function of a maintained disinfectant residual, and recent peer-reviewed research confirms that even low levels of chlorine meaningfully suppress bacterial communities within distribution system biofilms (AWWA, July 2025 [Ref. 6]). The District flushes the entire system annually and adds chlorine during the flushing to control biofilm in the system. This practice has been effective in managing water quality in the system.

5.1.3 Seasonal Demand Fluctuations and Water Quality

As a resort community, OVPSD sees large swings in water demand over the year. Demand is highest in summer, when irrigation drives usage, and spikes again during the winter ski season, when visitors occupy hotels, condominiums, and second homes. In between, the spring and fall shoulder seasons bring sharply lower demand. Much of the Valley's housing is second homes that sit unoccupied for extended periods, and hotels and short-term lodging serve a transient population whose water use rises and falls with visitation.

During low-demand periods, water moves slowly through the system and stays in the distribution mains, storage tanks, and service lines longer. EPA identifies this increased "water age" as a condition that raises the potential for microbial growth and degrades water quality; decreased water demand and dead-end mains are among its listed causes (EPA, 2023 [Ref. 4]). AWWA similarly identifies reducing water age, including during seasonal low-demand periods, as a primary strategy for protecting distribution system water quality (AWWA, July 2025 [Ref. 6]). OVPSD's own sampling history is consistent with this concern:

Timing of positive events. Three of the four total coliform positive events occurred during the fall shoulder season (November 2008, November 2018, and October 2023).

Stagnation cited as a cause. The October 2023 Level 1 Assessment identified possible stagnant water in Zones 2 and 3 as a contributing deficiency.

The same stagnation occurs on the customer side of the meter. Water can sit for weeks in:

- Service lines
- Plumbing in second homes that are vacant between visits
- Piping, storage, and hot water systems in large commercial buildings and hotels during periods of low occupancy.

Stagnant, warm water in building plumbing creates conditions favorable to bacterial growth, including opportunistic pathogens such as Legionella. CDC surveillance data for 2015–2020 identify stagnation from sporadic occupancy as a contributing factor in Legionella and other biofilm-associated drinking water outbreaks, and link hotels, motels, and lodges to 16 percent of those outbreaks (CDC/MMWR, 2024 [Ref. 5]).

A low chlorine residual maintained throughout the distribution system would help limit and slow bacterial growth during low-demand periods. It would also provide an ongoing barrier in the mains, tanks, and service lines, where water age is highest in the shoulder seasons (EPA, 2023 [Ref. 4]). Inside buildings, a residual entering from the distribution system will dissipate as water stagnates, so it is not a complete safeguard for customer plumbing. However, water that enters a building with a disinfectant residual starts from a better baseline than water that enters with none. Building owners remain responsible for managing water quality within their own plumbing systems.

5.2 Potential Drawbacks to Full-Time Chlorination

Transitioning to full-time chlorination will result in additional capital and operational costs, additional regulatory requirements and additional work for operations staff. A summary of drawbacks associated with full time chlorination is included below.

5.2.1 Operations and Maintenance

Continuous chlorination adds ongoing operator responsibilities: daily or weekly residual checks at monitoring points, chemical inventory management, equipment inspection, and periodic calibration of feed pumps and analyzers. The overall increase in O&M burden is expected to be modest and would integrate easily based on current operations. Estimated time and expenses related to staff time, purchase of chemicals and ongoing instrumentation costs are included in Section 8. – Implementation Costs.

5.2.2 Capital and Operating Costs

Implementing continuous chlorination requires capital investment in chemical feed and monitoring equipment, chemical storage tanks, and associated site modifications at Wells 2R and 5R and the Zone 3 Booster Pump Station. Ongoing costs for sodium hypochlorite purchases, routine equipment maintenance, and operator time will be necessary. A cost estimate for operation and maintenance is provided in Section 8.

5.2.3 Taste, Odor, and Public Perception

Some customers may notice a chlorine taste or odor, particularly at higher residual concentrations or at points of low water age in the system. Taste and odor sensitivity varies widely among individuals. Chlorine taste and odor is a common source of customer concern in communities with high-quality source water and can be a factor in customer concerns around chlorination decisions. At typical residual target levels considered by the OVPSD (e.g., 0.5 to 1.0 mg/L at the system entry point), minimal or no perceptible change is anticipated. Community outreach and providing information regarding improved water quality protection would be key to successful implementation.

5.2.4 Regulatory Reporting Requirements

A number of regulatory related items would be necessary as identified below.

- Water Supply Permit Amendment. A water supply permit amendment will be necessary prior to implementation of full-time chlorination. The amendment would include engineering documentation for the proposed system including engineering report and improvement plans. The amendment must be submitted to and approved by the DDW.
- Preparation of DBP Monitoring Plan. The DBP monitoring plan documents sample locations, the collection schedule, and the method for calculating compliance with TTHM and HAA5 MCLs based on the locational running average annual (LRAA). Once approved by DDW, the plan must be made available for public inspection, and any future revisions require DDW approval.
- Update the existing Operation and Maintenance Plan (O&M Plan). The O&M Plan must be updated to reflect the operational requirements associated with full-time chlorination and would include operating and maintenance guidance for the new system.
- Water Quality Testing. Additional water quality testing related to DBPs. DBP monitoring will be the most significant change to the current monitoring and reporting requirements.
- Regulatory Reporting. Additional residual reporting, monitoring for DBPs and public notification requirements will be required. The District will also be subject to the Maximum Residual Disinfectant Level (MRDL) for free chlorine of 4.0 mg/L. The SCADA and alarming system will need to incorporate the new monitoring and alarming functionality.
- Environmental. The installation of chlorination equipment at existing well sites should fall under CEQA Categorical Exemption Class 2 (Replacement or Reconstruction) or, more likely, Class 1 (Existing Facilities), as it involves minor alteration to existing public water utility structures with no expansion of use or capacity - a category DDW-directed water quality improvement projects routinely qualify under. Under an exemption the District is not required to prepare an Initial Study, Negative Declaration, or Environmental Impact Report, which eliminates a significant cost. The District should seek input from a qualified CEQA consultant.

These regulatory requirements are manageable, but will require additional staff time and coordination with DDW.

5.2.5 Disinfection Byproduct (DBP) Monitoring

When chlorine is added to water, it can react with naturally occurring organic carbon to form DBPs including TTHMs and HAA5. DBPs are subject to EPA and DDW MCL requirements. Quarterly monitoring will be necessary initially. If DBP levels are less than 50-percent of the MCLs for both TTHMs and HAA5s as calculated as the LRAA then reduced monitoring may be possible if approved by DDW. The quarterly monitoring would be reduced to once annually during the warmest month of the year if reduced monitoring were approved. Monitoring for DBP will be in accordance with the DBP Monitoring Plan which will be required.

5.2.6 Chemical Handling and Safety

Sodium hypochlorite (liquid bleach, typically 10 to 12.5-percent) is a moderately corrosive material requiring proper secondary containment, personal protective equipment, and safe storage practices. Although safety precautions must be in place, sodium hypochlorite does not pose a significant risk to the surrounding area like chlorine gas does. The District has a Hazardous Material Business Plan (HMBP) with Placer County and facilities are inspected annually by Placer County. The HMBP will need to be updated. District operators are already familiar with hypochlorite handling through the existing emergency and flushing chlorination protocols. Emergency eye wash and shower stations are already in place.

6.0 Bench-Top Water Quality Testing

The chlorination evaluation included an assessment of the potential for the decay of the chlorine residual over time and the formation of disinfection by products resulting from the interaction between chlorine and dissolved organic matter in the water.

6.1 Testing Objectives

Bench-top testing was conducted to characterize chlorine demand and decay in OVPSD source water and to assess the potential for disinfection byproduct formation following chlorination. The chlorine decay rate affects the initial chlorine dose necessary to ensure the chlorine residual remains present throughout the distribution system and as the chlorine reacts with organic matter DBPs are formed. DBPs have been shown to cause cancer and reproductive effects in lab animals, and epidemiological studies suggest an association with bladder cancer and reproductive effects in humans. An evaluation of both of these reactions was considered important if full-time chlorination is being considered.

The testing protocol used is based on the 2019 U.S. EPA Free Chlorine Distribution System Influent Hold Protocol, included in Appendix B along with the laboratory results from the testing.

6.2 Testing Protocol

The EPA Free Chlorine Distribution System Influent Hold Study (hold study) is a laboratory simulation used to predict how chlorine behaves and how disinfection byproducts form over time. Water is collected at the point where it enters the distribution system, divided into sealed amber glass bottles, and stored in the dark at the same temperature as the distribution system to closely mimic actual conditions. Each bottle is then opened and analyzed at progressively longer time intervals - from a few hours up to several days.

The following parameters are measured:

- Free and total chlorine residual
- pH
- DBP concentrations
- Total organic carbon
- Temperature

The data collected are entered into a spreadsheet developed by the EPA that generates projected chlorine decay curves and DBP formation over time. The testing provides an estimate of how long a measurable chlorine residual will persist throughout the system and the DBP concentrations that might develop at the far reaches of the distribution system. This information is used to determine whether the chlorine dose applied at the source is sufficient to maintain water quality protection at the customer's tap and a predictor of potentially high concentrations of TTHMs in the water.

HAA5 compounds are subject to biodegradation by bacteria naturally present in distribution system piping. Their concentrations can decrease over time in ways that a sealed bottle test cannot predict reliably and are not part of the predictive model, but were measured as part of the hold study.

6.3 Testing Results

Testing was conducted between May 18 and May 25, 2026. Samples were collected at Well 2R site after the addition of caustic soda for pH adjustment. Water from Wells 1R and 2R comingles through a common manifold at the Well 2R site and was composited as part of the sample tested. Water from Well 5R was not tested but has similar water quality characteristics to the other well water that was included in the sample.

OVPSD staff measured and recorded the field measurements and BSK, a certified laboratory, tested and reported the TOC and DBP results. Results are summarized in Table 6-1. The initial chlorine dose added to the sample was 0.56 mg/L. The samples were held and sampled over a seven-day period. The initial TTHM concentration was non-detect, meaning that the concentration of the TTHMs was lower than the laboratory's instrument's detection limit. After seven days the TTHM concentration increased to 2.7 ug/L. No HAA5s formed at concentrations that could be measured with the laboratory instruments.

Table 6-1 – Hold Study Water Quality Results

Date	Time	Sample Interval	Free Cl2 (mg/L)[a]	Total CL2 (mg/L)[a]	Temp (F)[a]	pH[a]	TOC (mg/L)[b]	TTHM (ug/L)[b]	HAA5 (ug/L)[b]
5/18/2026	830	Initial	0.56	0.63	49.3	7.52	1.3	---	---
5/18/2026	1430	6-HR	0.54	0.6	50	7.62	---	ND	ND
5/18/2026	2030	12-HR	0.57	0.58	52.9	7.48	---	ND	ND
5/19/2026	830	1-DAY	0.55	0.58	50.5	7.57	---	0.57	ND
5/21/2026	830	3-DAY	0.55	0.57	51.4	7.84	---	1.6	ND
5/25/2026	830	7-DAY	0.43	0.46	51	7.88	---	2.7	ND
Notes:									
(a) Field measurements									
(b) Laboratory measurements									

6.3.1 Disinfection Byproduct Formation Potential

When chlorine is added to drinking water, it reacts with naturally occurring organic matter to form disinfection byproducts, including total trihalomethanes (TTHMs). The hold study quantifies the chlorine consumption and TTHM concentrations in the samples at each time interval. The relationship between chlorine consumption and TTHM formation is determined by plotting measured TTHM concentrations against the amount of chlorine consumed at each sample time interval.

A best-fit line is drawn through those data points, and the slope of that line represents the TTHM formed per unit of chlorine consumed. That relationship is used to estimate TTHM concentrations forward in time. As the model predicts how much chlorine will be consumed by the time water

reaches the most remote point in the distribution system, it applies that same relationship to estimate the corresponding TTHM concentration at that time. The underlying assumption is that TTHM formation is proportional to chlorine demand - the more chlorine the water consumes, the more TTHMs it produces - and that this proportionality measured in the hold study provides an indication of the TTHM concentration in the distribution system.

An important limitation of this approach is that the test is conducted entirely in sealed glass bottles, so it only captures the reaction occurring within the water itself. In an actual distribution system, chlorine is also consumed by reactions with the interior surfaces of pipes, storage tanks, and other system infrastructure. That demand is not represented in the bottle test.

In practical terms the hold study will generally underestimate how quickly chlorine is consumed in the actual distribution system and will then likely underestimate TTHM formation at the far reaches of the distribution system with the greatest water age. For a groundwater system like OVPSD's, with relatively low organic carbon levels, this distinction is less critical than it would be for a surface water system but should be considered when interpreting the results.

Chlorine decay testing results and predicted decay are shown in Figure 6-1. The model predicts that free chlorine residuals would be maintained around 0.2 mg/L after 30-days. TTHM testing results and predicted concentrations are shown in Figure 6-2. The TTHM concentration was calculated to be about 7 ug/L at a water age of 30 days.

The actual chlorine residual will likely be lower, and TTHM concentration would likely be higher due to the reactions with organic material on the pipe and storage tank walls.

Figure 6-1 - Projected Chlorine Decay vs Time

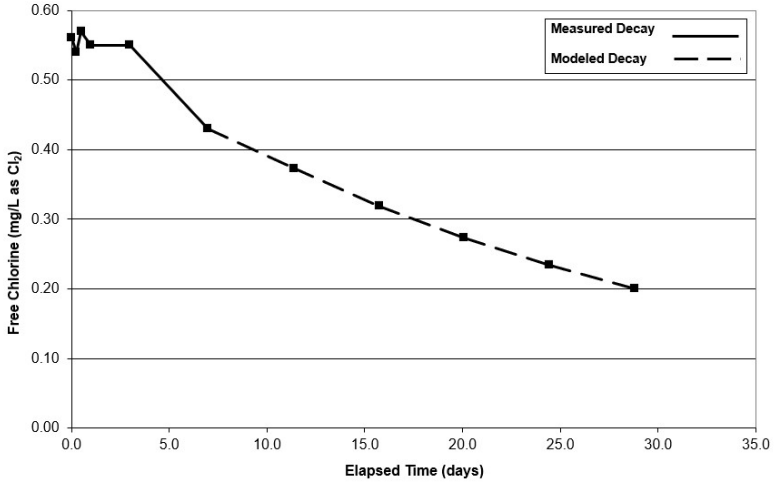
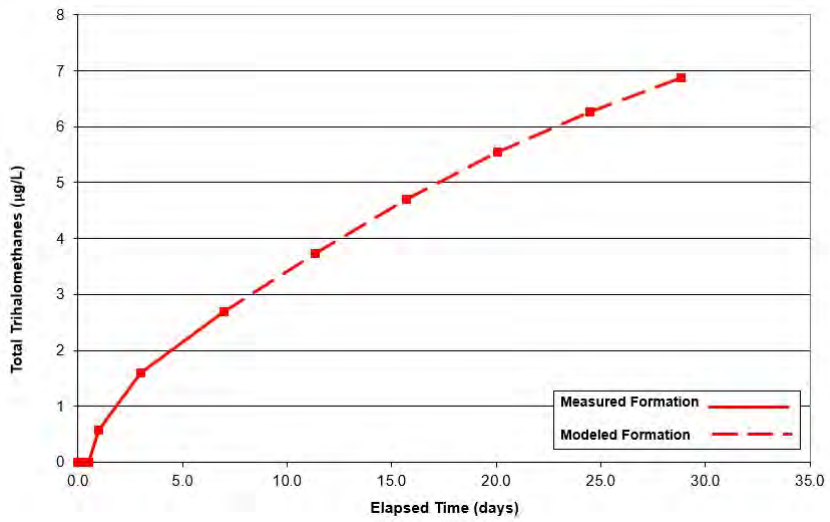


Figure 6-2 - Projected Total Trihalomethane Formation vs Time



6.4 Summary and Implications

Hold study results showed a measured TTHM concentration of 2.7 µg/L and a free chlorine residual of 0.43 mg/L after seven days. The chlorine residual used in this study is similar to the chlorine residual measured during annual flushing of the District's distribution system which ranged from 0.08 to 0.47 mg/L. Similar chlorine residual is anticipated if full-time chlorination is implemented in the system, and DBP formation is anticipated to be similar to results of this benchtop study. No HAA5 concentrations were detected at levels above the laboratory detection limit at any sample interval.

The EPA hold study spreadsheet model projected that a detectable free chlorine residual would persist at a simulated water age of approximately 29 days, and that TTHM concentrations at that water age would be approximately 6.9 µg/L - well below the regulatory MCL of 80 µg/L. It should be noted that the hold study is a predictive tool, not a substitute for field sampling, and that actual chlorine residuals in the distribution system will likely be somewhat lower - and TTHM concentrations somewhat higher - than model projections due to chlorine demand exerted by pipe walls, storage tank surfaces, and associated infrastructure not represented in the bottle test.

OVPSD's distribution system average water age is expected to be below the 30-day simulation period, though this has not been formally quantified as part of this evaluation. Given this, the hold study projections represent a conservative upper bound on TTHM formation potential under normal operating conditions. The low TOC content of OVPSD's source water is consistent with conditions observed across the Tahoe-Truckee region, where no chlorinated groundwater system has recorded a TTHM or HAA5 MCL violation based on the data reviewed in Section 4. Those regional results provide additional context for interpreting the hold study findings, and suggest that DBP formation following

chlorination of OVPSD's water supply would be expected to remain well within regulatory limits. Water from Well 5R was not included in the hold study sample but has similar source water quality characteristics to Wells 1R, 2R, and 3; comparable DBP formation potential would be expected when Well 5R is incorporated into full-system chlorination.

It is possible that upon initial startup of continuous chlorination, a temporary elevation in DBP concentrations is possible due to the mobilization of organic material accumulated in biofilms on pipe and tank walls. The significance of this effect is difficult to predict in advance and would depend on the condition of system infrastructure at the time chlorination is initiated. Annual flushing conducted by District staff reduces the accumulation of organic material in the distribution system and is expected to moderate this effect. The regional survey findings - where established chlorinated systems in the Tahoe-Truckee area consistently report very low DBP concentrations - suggest that long-term DBP formation in OVPSD's system would similarly stabilize at low levels once any initial transition period has passed.

7.0 Chlorination Facilities — Conceptual Design and Costs

This section presents the conceptual design for continuous chlorination at the four OVPSD facilities identified for chemical feed and monitoring: Well Site 2R, Well Site 5R, the Zone 3 Booster Station and Horizontal Well Nos. 1 & 2. Conceptual layout of the facilities is presented and will need to be confirmed as part of the detailed design of the systems.

7.1 Design Approach and Assumptions

Sodium hypochlorite (NaOCl, 12.5% concentration) will be used as the disinfectant at all four sites. This form of chlorine is widely used in small and medium water systems, is commercially available in the Tahoe region and does not require specialized handling equipment beyond standard chemical feed and storage improvements. Caustic soda is currently stored and dosed at both the Well 2R and 5R sites. The sodium hypochlorite should be stored in a separate containment area to prevent the chemicals from mixing in the event of a spill.

The chemical feed systems will operate on a flow-paced basis at Well Sites 2R and 5R, using the existing flow meter signal to adjust pump speed in proportion to flow while maintaining a fixed operator-set dose. The Zone 3 Booster Station chlorine feed system is controlled on a simple on/off basis tied to booster pump operation. Monitoring and control points are integrated into the existing SCADA system where available, allowing remote monitoring and adjustment of residual readings, pump status, and speed settings; the horizontal wells are the one exclusion. Improvements at each site are summarized below.

7.2 Well Site 2R — Chlorination System (Wells 1R, 2R, 3)

Well Site 2R serves as the primary collection point for water produced by Wells 1R, 2R, and 3, which discharge into a common manifold before entering the distribution system. This site has been previously configured for chlorination as part of a project completed in 2011. Facilities already in place include the chemical storage containment basin for secondary storage and conduits for the wiring and chemical feed tubing. Table 7-1 includes design criteria for the system.

The chlorine feed system would be installed within the designated containment area, physically separated from the existing caustic soda feed equipment. A single flow meter on the common manifold will provide the flow signal for dose pacing. A Hach CL17 colorimetric free chlorine analyzer would continuously monitor residual at the point of application. Analyzer sample water will be discharged to the sanitary sewer adjacent to the site. Discharge from the analyzer will be approximately 200 to 300 gallons per day from the instrument.

Chemical Feed Pump. The existing caustic feed system equipment is manufactured by ProMinent Pump. This brand is a reliable brand with good support. For consistency, ProMinent Pump was considered for this installation. Pre-manufactured skids are available that include:

- Strainer
- Backpressure valve
- Pressure gauges
- Pulsation dampener
- Pressure relief valve
- Calibration column
- Pump(s) (simplex and duplex are available)

Pre-manufactured skids are built at the factory on a mounting system. All the equipment is laid out neatly and includes all the appurtenances necessary. The ProMinent equipment package and quote are included in Appendix C. Simplex or duplex systems are available. Determination of the layout and preferred configuration can be made during detailed design. If a simplex configuration is utilized, keeping a spare pump on hand is recommended.

An optional flow monitor is also available and recommended on the chemical feed pump discharge. A pump malfunction or equipment failure or loss of prime would trigger an alarm notifying operations staff of a low flow condition which would underdose the chlorine in the system.

Mounting the pumps above the tank is recommended to avoid numerous penetrations in the chemical storage tank. Suction lifts from a tank up to the pump can cause issues maintaining prime to pump, but routine maintenance such as switching out the suction tubing, cleaning the strainer and ball checks minimize the problem. Figure 7-1 includes a conceptual layout of the equipment.

Chemical Storage Tank. The 120-gallon, double-contained tank is manufactured by Snyder Industries. The tank measures 34 inches in diameter by 49 inches in height and includes a 14-inch-diameter hatch. Opaque tanks are recommended for sodium hypochlorite to limit light exposure and reduce chemical degradation. A vent line will be routed from the tank to an exterior discharge point to minimize corrosion in the building from off-gassing. The inner tank and outer tanks are constructed of high-density linear polyethylene and are NSF/ANSI 61 compliant.

Although Well Site 2R was previously configured with a concrete secondary containment basin, a double-wall storage tank is still recommended for the hypochlorite system. The existing chemical storage area consists of a concrete containment basin with a fiberglass grating deck. The proposed hypochlorite tanks are relatively small in relation to the available containment footprint, which presents an opportunity for a practical installation arrangement.

A concrete pedestal would be poured within the containment basin, sized to support the tank at an elevation such that a portion of the tank projects above the grating deck. The grating would be cut to accommodate the tank diameter, with the tank seated through the opening and bearing on the pedestal below. This configuration offers two advantages. First, it provides a convenient and secure attachment point for seismic restraints at the grating elevation. Second, raising the pump skid to approximately chest height improves operator access for routine maintenance, chemical connections, and pump inspection.

Sodium hypochlorite is typically delivered in 5-gallon cube containers, 30 or 53-gallon drums, 275-330 gallons totes or bulk tank truck deliveries. For the purpose of this study utilizing drums and a drum pump to transfer sodium hypochlorite to the tanks is envisioned. A drum-dolly would be useful.

An ultrasonic level sensor is recommended for monitoring the level in the tanks. A scale would be complicated due to the seismic restraint system that would place a variable load on the tank. Flowline EchoPod or Endress + Hauser Prosonic units would be applicable.

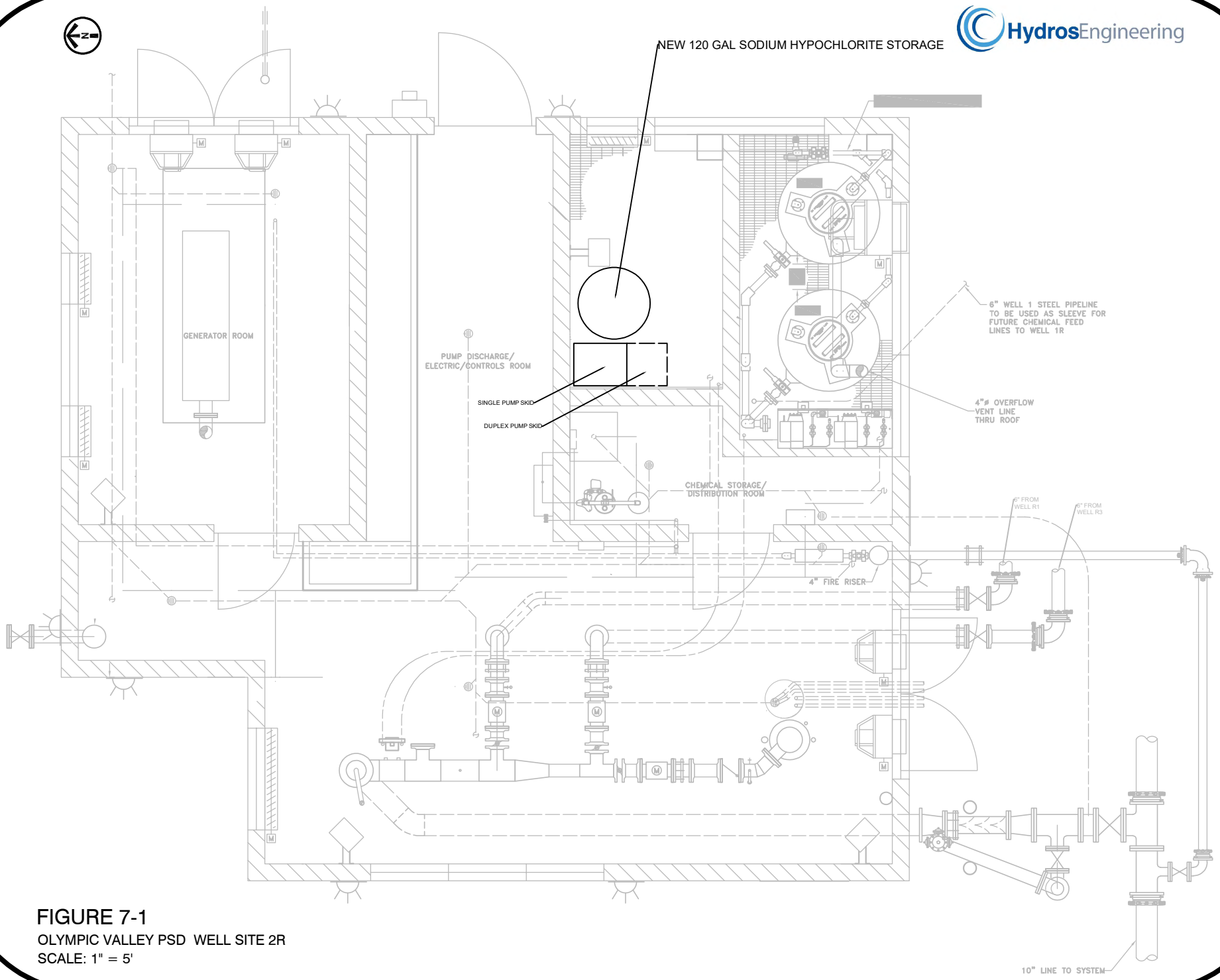


FIGURE 7-1

OLYMPIC VALLEY PSD WELL SITE 2R

SCALE: 1" = 5'

Table 7-1- Well Site 2R — Chlorination System Design Criteria

Parameter	Design Value / Basis
System description	
Water source	Wells 1R, 2R, and 3 — combined discharge to common manifold
Disinfectant	Sodium hypochlorite (NaOCl), 12.5% trade concentration
Site status	Previously configured for continuous chlorination — double-containment basin and chemical feed piping provisions in place
Flow criteria	
Maximum month demand	9.8 MG/month
Maximum day demand	515,000 gallons/day
Maximum instantaneous flow (Max Q)	875 gpm — Wells 1R, 2R and 3 pumping simultaneously
Flow metering for dose control	Single common manifold flow meter
Dose design	
Target applied dose	0.5 mg/L free chlorine – adjustable
Max Chem Feed[(b)]	
Based on Historical Max Day @ 12 hrs of runtime and 1 mg/L	20 ml/min
Based on Max Output of 875 gpm @ 1 mg/L	50 ml/min
Dose control method	Flow-paced — pump speed varies proportionally with manifold flow meter signal; fixed dose set point
Remote dose adjustment	Yes — via SCADA
Chemical storage	
Maximum monthly NaOCl consumption (12.5%)	90 gallons/month
Storage volume (nominal)	120 gallons
Storage basis	30-day supply at maximum month consumption
Tank type	HDPE, within existing double-containment basin
Secondary containment volume[(a)]	≥110% of tank volume
Seismic restraint	Tank tie-downs per California CBC
Chemical feed pump	
Pump type	Variable-speed peristaltic or diaphragm metering pump
Number of pumps	1 duty; 1 standby (confirm in detailed design)
Speed control signal	4–20 mA from manifold flow meter
Chlorine Residual Analyzer	
Hach Cl 17 with SC200	Colorimetric – discharge sample water to sanitary sewer

a) Notes: A dual containment tank is recommended due to seismic restraint requirement which is not available on the single wall tanks from the manufacturer.

b) Anticipated target does is 0.5 mg/L; design based on 1 mg/L to provide operational flexibility.

7.3 Well Site 5R — Chlorination System

Well Site 5R is a standalone site with one variable frequency drive (VFD) well pump. The site is space-constrained, and the existing caustic soda feed system occupies the same equipment room. The conceptual design provides for installation of a hypochlorite storage tank and chemical feed pump, with physical separation from the caustic soda system. The specific separation arrangement — whether by partition, dedicated secondary containment, or spatial segregation — would be confirmed during detailed design in coordination with applicable fire code. A Hach CL17 colorimetric free chlorine analyzer will monitor residual, with sample discharge to the existing sanitary sewer. A new sampling location will be necessary downstream of the injection point to allow for mixing for a representative sample. The OVPSD plans to add the ability of flow-pace using the flow meter signal as part of the SCADA upgrades project.

Chemical Feed Pump. The pumping equipment for Well Site 5R would be similar to that described for Well Site 2R. The space limitations at Well Site 5R may preclude the use of a duplex pump layout. In which case a simplex system could be installed with a spare pump kept on hand that could be easily switched out if the chemical feed pump failed. A conceptual equipment layout is included in Figure 7-2.

Chemical Storage Tank. The 60-gallon, double-contained tank is manufactured by Snyder Industries. The tank measures 26 inches in diameter by 41 inches in height and includes a 14-inch-diameter hatch. A vent line would be routed from the tank to an exterior discharge point to minimize corrosion in the building from off-gassing. The inner tank and outer tanks are constructed of high-density linear polyethylene and is NSF/ANSI 61 compliant.

A concrete pad to elevate the tank would aid in housekeeping along with a 6-8-inch curb around to ensure any leaks from the caustic storage and feed equipment do not mix with the sodium hypochlorite. The existing caustic storage tank piping will need to be modified and worked out during detailed design.

An ultrasonic level sensor is recommended for monitoring the level in the tank, similar to Well Site 2R.

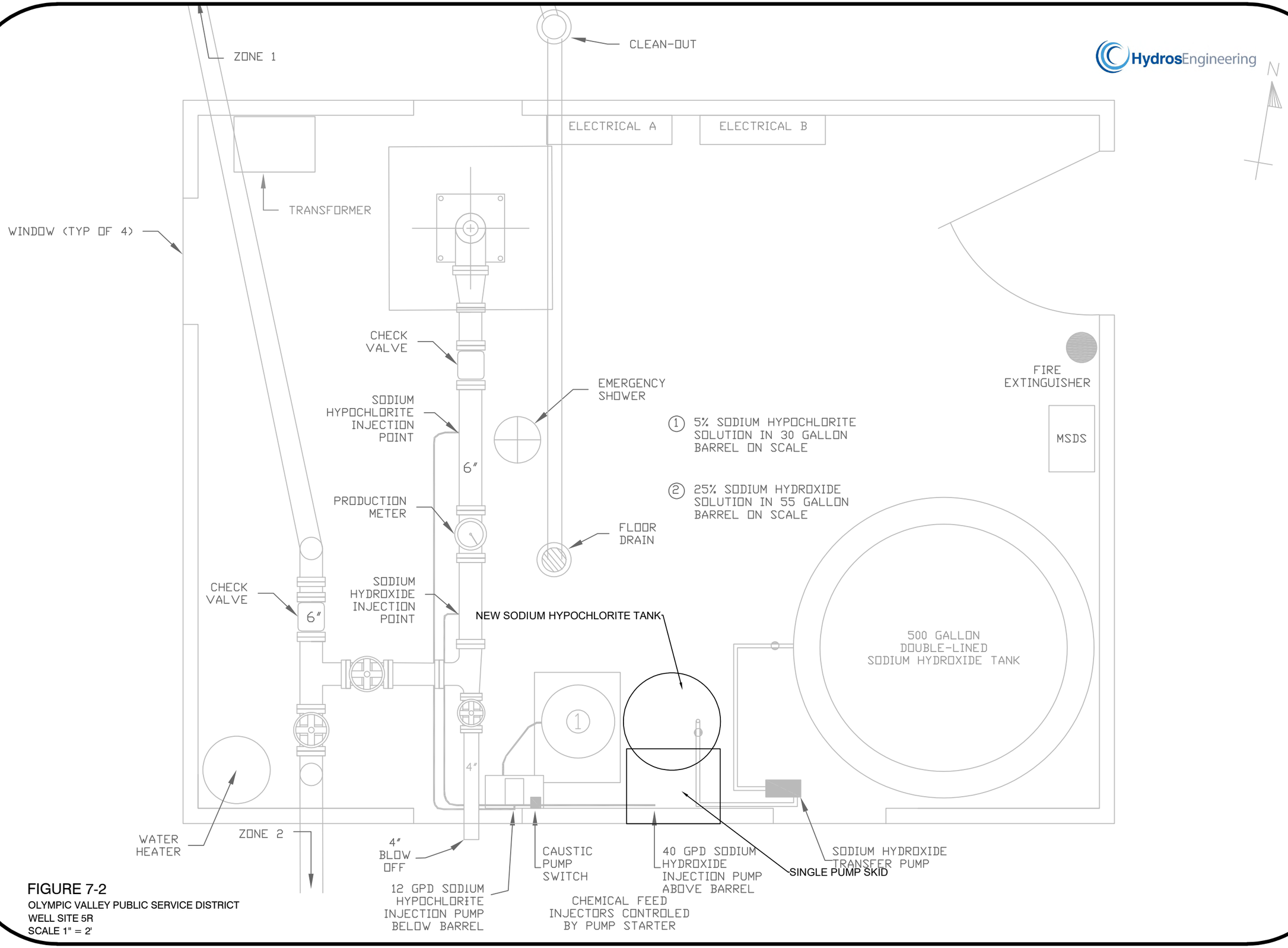


FIGURE 7-2

OLYMPIC VALLEY PUBLIC SERVICE DISTRICT
WELL SITE 5R
SCALE 1" = 2'

Table 7-2 - Well Site 5R - Chlorination System Design Criteria

Parameter	Design Value / Basis
System description	
Water source	Well 5R — standalone facility with VFD pump
Disinfectant	Sodium hypochlorite (NaOCl), 12.5% trade concentration
Site status	Space-constrained; chemical storage and feed to be installed within existing equipment room with physical separation from existing chemical system
Flow criteria	
Maximum month demand	5.0 MG/month
Maximum day demand	350,000 gallons/day
Maximum instantaneous flow (Max Q)	425 gpm
Flow metering for dose control	VFD pump flow meter
Dose design	
Target applied dose	0.5 mg/L free chlorine – adjustable
Max Chem Feed	
Based on Historical Max Day @ 12 hrs of runtime and 1 mg/L	13 ml/min
Based on Max Output of 425 gpm @ 1 mg/L	24 ml/min
Dose control method	Flow-paced — pump speed varies proportionally with VFD flow meter signal; fixed dose set point
Remote dose adjustment	Yes — via SCADA
Chemical storage	
Maximum monthly NaOCl consumption (12.5%)	50 gallons/month
Storage volume (nominal)	60 gallons
Storage basis	30-day supply at maximum month consumption
Tank type	HDPE, within new double-containment basin
Secondary containment volume	≥110% of tank volume
Seismic restraint	Tank tie-downs per California CBC
Chemical feed pump	
Pump type	Variable-speed peristaltic or diaphragm metering pump
Number of pumps	1 duty; 1 standby (confirm in detailed design)
Speed control signal	4–20 mA from manifold flow meter
Chlorine Residual Analyzer	
Hach Cl 17 with SC200	Colorimetric – discharge sample water to sanitary sewer

7.4 Horizontal Well Nos. 1 & 2

The existing horizontal wells are currently used as a stand-by source of water for the system. Improvements to provide chlorination when the wells are operated are identified below. Minimal controls are proposed at this time and they will not be integrated into the SCADA system. Operation will be simplified and basic on/off controls are proposed with manual measurement of the chlorine residual. Consideration should be given to integrating the chlorination system into the SCADA system and adding an analyzer if the horizontal wells will be used more frequently in the future.

Chemical Feed Pump. A ProMinent diaphragm pump with a capacity of 3 to 5 ml/min (0.05 gph) would be needed assuming sodium hypochlorite is fed at 100-percent strength. ProMinent has a number of pumps within this capacity range. The pump will be started manually and operated at a constant rate to provide the desired dose. The chemical pump would be mounted on a stand located in a hot-box with insulation and a small heater. Use of a fiberglass type enclosure with a with flip top lid would prevent corrosion and allow for easy access to the equipment (including the chlorine as discussed below). Hubble Power Systems manufactures several models – the HB3000 is 35”W x 44”L x 35”H and would likely be adequately sized and configured for operation and maintenance activities. Confirmation of the size and configuration of the enclosure should be made during design of the facilities.

Chemical Storage. Storage would be minimal due to the limited space in the pump station. Less than 1 gallon per day of sodium hypochlorite would be needed to dose at 1 mg/L. A five-gallon cube would provide plenty of storage and be easy to manage by operators. The suction line would extend directly into the container. Venting the container to the outside is not necessary due to the limited use. The chlorine container would be set on a spill-tray to contain any liquid chlorine leaks.

Chlorine Analyzer. No chlorine analyzer is proposed for this site. The horizontal wells are rarely operated and provide a stand-by source for additional capacity. Operators would collect grab samples at a new sampling station that would be installed about 20-feet from the injection point. If an analyzer were to be needed in the future, a zero discharge type instrument would be necessary due to a lack of sanitary sewer to dispose of the sample water. A non-discharge type unit is discussed in Section 7.5 for the Zone 3 Booster Pump chlorination system.

7.5 Zone 3 Booster Station — Chlorine Monitoring and Emergency Injection

The Zone 3 Booster Station pumps water from Zone 2 up into the Zone 3 Tank. The Zone 3 Tank is located at the far end of the distribution system. Water entering this zone will have already been chlorinated at the Well 2R/5R sites; however, the chlorine residual may decay to a low enough level through the system to necessitate re-chlorination. A chlorine analyzer is required in the pump station to monitor the chlorine residual. Boosting chlorine at this site is not anticipated to be necessary often, so a small simple temporary system is recommended. Improvements are described below.

Chemical Feed Pump. A ProMinent diaphragm pump with a capacity of 3 to 5 ml/min (0.05 gph) would be needed assuming sodium hypochlorite is fed at 100-percent strength. ProMinent has a

number of pumps within this capacity range. The pump would be set to start when the booster pump starts, and water is being pumped to the Zone 3 tank. This could be accomplished through SCADA or simply an outlet that energizes when the booster pump starts that energizes the chemical feed pump. The chemical pump would be mounted on a shelf with the suction line extending down to the storage container and the discharge to a saddle with an injection quill on the outlet line. All the equipment would be installed inside the pump station to avoid freezing.

Chemical Storage. Storage would be minimal due to the limited space in the pump station. Less than 1 gallon per day of sodium hypochlorite would be needed to dose at 1 mg/L. A five-gallon cube would provide plenty of storage and be easy to manage by operators. The suction line would extend directly into the container. Venting the container to the outside is not necessary due to the limited use. The chlorine container would be set on a spill-tray to contain any liquid chlorine leaks.

Chlorine Analyzer. There is no sewer to discharge sample water; therefore, a zero-discharge analyzer is necessary. Halogen Systems (Reno, NV) manufactures an inline probe for chlorine. The unit continuously monitors residual on the pump discharge. When the booster pumps are off, the probe sees static water and residual will drift; low and high chlorine alarms are locked out when the booster pump(s) is off to prevent nuisance alarms. Once flow through the pump station begins the analyzer and alarms would be active. The manufacturer confirmed that installing the probe in a pipe with intermittent flow is not a problem for the accuracy and longevity of the probe.

Chlorine feed at Zone 3 is intended as a contingency boost capability rather than a continuous process. The conceptual design provides for a small hypochlorite supply - nominally a five-gallon container on a secondary containment pallet - with a peristaltic feed pump that activates when the booster pumps run. Given the infrequent anticipated use, permanent tank installation is not planned at this time. The dose will be set manually by the operator based on observed residual trends. This arrangement will be reviewed during detailed design.

8.0 Capital and Operation and Maintenance Costs

Capital and O&M costs associated with converting the system to full-time chlorination are presented in this section. Costs are considered budget level until detailed design of the facilities is complete. Soft costs for design and administration are included in the capital costs. A 20-percent contingency was included for capital costs, along with a 20-percent allowance for design, administration and construction management.

8.1 Capital Costs

Capital costs encompass administrative, engineering and construction costs for modifying existing systems and constructing the improvements.

Administrative Costs

Administrative costs associated with project implementation are included in the capital cost estimate as shown in Table 8-1. These include:

- Cost of this study
- Permit Amendment to DDW for modification of facilities
- Engineering report to support the amendment
- Updating the operations plan to incorporate full-time chlorination and creation of a DBP Siting and Sampling Plan

Table 8-1 - Administrative Costs

Item	Cost
Chlorination Study[(a)]	$ 20,000
Permit Amendment	$ 1,000
Engineering Report	$ 5,000
Plan Updates	
DBP Siting and Sampling Plan	$ 1,000
Update Operations Plan	$ 5,000
Notes:	$ 32,000
(a) Current chlorination evaluation study.	

Well Site 2R Capital costs

Capital costs for the improvements at Well 2R are included in Table 8-2. The capital cost is based on outsourcing the construction of the work to a private contractor and assuming a crew is onsite for 2.5 days and assisted by OVPSD staff for approximately 20-hours. The estimated cost is $74,000.

Table 8-2 - Well Site 2R Capital Costs

Item	Quantity	Units	Unit Price	Cost Ext
Equipment				
Prominent Chemical Feed Skid w/ Flow Sensor	1	EA	$ 19,038	$ 19,100
Chlorine Analyzer Hach CL17/SC200	1	EA	$ 8,624	$ 8,700
120 gal Double Contained Storage Tank w/Stand	1	EA	$ 5,951	$ 6,000
Ultrasonic Level	1	LS	$ 710	$ 800
Injector and Tubing	1	EA	$ 2,000	$ 2,000
SCADA Integration	1	LS	$ 5,000	$ 5,000
Labor				$ -
Contractor	2.5	Day	$ 3,000	$ 7,500
Staff	2.5	Day	$ 640	$ 1,600
			Construction Total	**$ 50,700**
			Contingency @ 20%	$ 10,200
			Total with Contingency	$ 60,900
20-Percent - Administrative, Engineering, Construction Management, and Permitting				$ 13,000
			Total	**$ 73,900**
Notes:				
a) 20-Cities ENR August 2026 - 14,350				
b) Equipment includes tax, shipping and 10-percent mark-up				
c) Assumed 20-hours of staff time at $80/hr				

Well Site 5R Capital costs

Capital costs for the improvements at Well 5R are included in Table 8-3. The capital cost is based on outsourcing the construction of the work to a private contractor and assuming a crew is onsite for 2 days and assisted by OVPSD staff for approximately 12-hours. The estimated cost is approximately $71,000.

Table 8-3 - Well Site 5R Capital Costs

Item	Quantity	Units	Unit Price	Cost Ext
Equipment				
Prominent Chemical Feed Skid w/ Flow Sensor	1	EA	$ 19,038	$ 19,100
Chlorine Analyzer Hach CL17/SC200	1	EA	$ 8,624	$ 8,700
60 gal Double Contained Storage Tank w/Stand	1	EA	$ 5,951	$ 6,000
Ultrasonic Level	1	LS	$ 710	$ 800
Injector and Tubing	1	EA	$ 2,000	$ 2,000
SCADA Integration	1	LS	$ 5,000	$ 5,000
Labor				$ -
Contractor	2.0	Day	$ 3,000	$ 6,000
Staff	1.5	Day	$ 640	$ 1,000
			Construction Total	**$ 48,600**
			Contingency @ 20%	$ 9,800
			Total with Contingency	$ 58,400
20-Percent - Administrative, Engineering, Construction Management, and Permitting				$ 12,000
			Total	**$ 70,400**
Notes:				
a) 20-Cities ENR August 2026 - 14,350				
b) Equipment includes tax, shipping and 10-percent mark-up				
c) Assumed 20-hours of staff time at $80/hr				

Horizontal Well Nos. 1 & 2

Capital costs for the improvements at the wells are included in Table 8-4. Chlorine would be added when the horizontal wells are placed in service. No permanent storage facilities are planned; sodium hypochlorite would be stored in a 5-gallon cube.

Table 8-4 - Horizontal Well Nos. 1 & 2

Item		Quantity	Units	Unit Price		Cost Ext
Equipment						
	Prominent Chemical Feed Pump	1	EA	$ 3,311		$ 3,400
	Spill Tray	1	EA	$ 250		$ 250
	Enclosure	1	EA	$ 10,260		$ 10,300
	Injector and Tubing	1	EA	$ 1,000		$ 1,000
	Sample Station	1	EA	$ 5,000		$ 5,000
	Feed Line - approx 120'	1	EA	$ 3,000		$ 3,000
Labor						
	Contractor (Feed line and sampling station installation)	1	Day	$ 8,000		$ 8,000
	Staff	1	Day	$ 640		$ 700
					Construction Total	**$ 31,650**
					Contingency @ 20%	$ 6,400
					Total with Contingency	$ 38,050
					20-Percent - Administrative, Engineering, Construction Management, and Permitting	$ 8,000
					Total	**$ 46,050**
Noes:						
a)	20-Cities ENR August 2026 - 14,350					
b)	Equipment includes tax, shipping and 10-percent mark-up					
c)	Assumed 20-hours of staff time at $80/hr					

Zone 3 Booster Pump Station

Capital costs for the improvements at the Zone 3 Booster Pump Station are included in Table 8-5. Addition of chlorine at the pump station would be as needed if low chlorine residuals at the far end of the system drop below the desired concentration. No permanent storage facilities are planned; sodium hypochlorite would be stored in 5-gallon cubes and sit in a containment tray to capture any spills. The estimated cost for the installation of the equipment is $36,000.

Table 8-5 - Zone 3 Booster Pump Capital Cost

Item	Quantity	Units	Unit Price	Cost Ext
Equipment				
Prominent Chemical Feed Pump w/ Flow Sensor	1	EA	$ 3,311	$ 3,400
Spill Tray	1	EA	$ 250	$ 250
Chlorine Analyzer Halogen Non-Discharge Probe	1	EA	$ 10,879	$ 10,900
Injector and Tubing	1	EA	$ 1,000	$ 1,000
Misc Fittings for Chlorine Probe	1	LS	$ 500	$ 500
SCADA Integration	1	LS	$ 5,000	$ 5,000
Labor				$ -
Contractor	1.0	Day	$ 3,000	$ 3,000
Staff	1.0	Day	$ 640	$ 700
			Construction Total	**$ 24,750**
			Contingency @ 20%	$ 5,000
			Total with Contingency	$ 29,750
			20-Percent - Administrative, Engineering, Construction Management, and Permitting	$ 6,000
			Total	**$ 35,750**

Noes:

a) 20-Cities ENR June 2026 - 14,350

b) Equipment includes tax, shipping and 10-percent mark-up

c) Assumed 20-hours of staff time at $80/hr

The total estimated capital cost, including the one-time administrative costs, for the improvements is $260,000 to retrofit the sites for full-time chlorination.

8.2 Operation and Maintenance Costs

Costs associated with operation and maintenance are estimated in this section on an annual basis. Primary O&M duties consist of the following:

- Chemical purchases
- Reagents for instruments
- Laboratory costs for additional water quality testing
- Increased labor for operating and maintaining the sodium hypochlorite systems.

A summary of each of the components and assumptions are presented below and Table 8-6 includes a summary of O&M costs.

Chemical Costs

The chemical use depends on the total amount of water produced and the dosage. To estimate chemical use the production data from 2023 to 2025 was used and ranged from 98 to 104 Mgal of water produced. Chemical dose is based on a nominal concentration of 0.5 mg/L of chlorine and would vary in direct proportion of the dose. Thatcher Chemical quoted a price of $10.50 per gallon when purchasing 53 gallon drum of 12.5-percent sodium hypochlorite.

Monitoring/Laboratory Costs

Quarterly DBP sampling for TTHM and HAA5 would be required. If results are less than half of the MCL, the OVPSD could request reduced sampling. If approved by the DDW the sampling frequency could be reduced to once per year. A unit cost of $300 per test was used each quarter.

The online chlorine analyzers at Well 2R and 5R will require reagents from Hach. The current cost is $90/month for each site. The analyzer at the Zone 3 Site would require annual probe replacement at a cost of $1,200 per year.

Labor Costs

Operations staff would be required to operate and maintain the chlorine injection systems including filling chemicals, calibrating and verifying equipment and maintaining the pumps and storage facilities. Some additional time would also be necessary for testing and reporting water quality. An average of two hours per week is estimated. Existing staff will be able to complete the additional labor, and no additional labor costs are anticipated for annual operation and maintenance.

Summary of Annual O&M Costs

Table 8-6 includes a summary of the estimated O&M costs based on the assumptions presented above.

Table 8-6 Estimated Annual Operation and Maintenance Costs

Item		Cost
Chemical Costs		$ 6,000
Monitoring/Lab Costs		$ -
Laboratory		$ 1,200
Reagents		$ 3,400
Total		**$ 10,600**

Appendix A

Literature References – Section 5

Ref. 1

National Research Council (US) Safe Drinking Water Committee. (1980). Drinking Water and Health: Volume 2, Chapter II – The Disinfection of Drinking Water. Washington, DC: National Academies Press.

Cited in-text as "NRC, 1980."

Ref. 2

Centers for Disease Control and Prevention (CDC). (2024). Water Treatment – Healthy Water. Atlanta, GA: U.S. Department of Health and Human Services.

Cited in-text as "CDC, 2024."

Ref. 3

U.S. EPA, Office of Water, Office of Ground Water and Drinking Water. (2006). The Effectiveness of Disinfectant Residuals in the Distribution System. Total Coliform Rule (TCR) Issue Paper. Prepared by HDR Engineering, Inc. and The Cadmus Group, Inc. (EPA Contract No. 68-C-00-113, Work Assignment No. 2-10).

Cited in-text as "EPA, 2006."

Ref. 4

U.S. EPA, Office of Water. Distribution System Water Quality: Maintaining a Disinfectant Residual. EPA 815-F-21-003.

Cited in-text as "EPA, 2023."

Ref. 5

Centers for Disease Control and Prevention (CDC). Surveillance of Waterborne Disease Outbreaks Associated with Drinking Water — United States, 2015–2020. Morbidity and Mortality Weekly Report (MMWR) Surveillance Summaries, 73(1), March 14, 2024.

Cited in-text as "CDC/MMWR, 2024."

Ref. 6

American Water Works Association (AWWA). Maintaining a Numeric Minimum Disinfectant Residual in the Distribution System: A Framework for Strategy Selection and Evaluation. Denver, CO: AWWA.

Cited in-text as "AWWA, July 2025."

Appendix B

Bench-Top Testing Laboratory Results

Cranmer Engineering, Inc.
Integrated Engineering Services

Sample Results

Olympic Valley P.S.D
PO Box 2026
Olympic Valley, CA 96146

Work Order: GIE1382
Received: 05/28/26 15:56
Reported: 06/09/26 14:31

Non Compliance Chemical

System Number: 3110020

Term and Qualifier Definitions

Item	Definition
ND	None detected at or above the reporting limit

Field testing falls outside the scope of laboratory accreditation, and no certification is available for such activities. Accordingly, CEI cannot validate or endorse any field testing results conducted by non-CEI personnel.

Subcontracted Analyses

Sample Site: Well 1 Treated Initial **Date Collected:** 5/18/2026 8:30:00AM
Sample Number GIE1382-01 **Collected by:** NM
Source Type: Title 22 Designation:

Analyzing Laboratory: 49er Water Report with Method References attached.
Analysis Total Organic Carbon (TOC)

Sample Site: 6-HR **Date Collected:** 5/18/2026 2:30:00PM
Sample Number GIE1382-02 **Collected by:** NM
Source Type: Title 22 Designation:

Analyzing Laboratory: BSK Laboratory Report with Method References attached.
Analysis Trihalomethanes (THMs)
Analysis Haloacetic Acids (HAA5s)

Sample Site: 12-HR **Date Collected:** 5/18/2026 8:30:00PM
Sample Number GIE1382-03 **Collected by:** NM
Source Type: Title 22 Designation:

Analyzing Laboratory: BSK Laboratory Report with Method References attached.
Analysis Trihalomethanes (THMs)
Analysis Haloacetic Acids (HAA5s)

Sample Site: 1-DAY **Date Collected:** 5/19/2026 8:30:00AM
Sample Number GIE1382-04 **Collected by:** NM
Source Type: Title 22 Designation:

Analyzing Laboratory: BSK Laboratory Report with Method References attached.
Analysis Trihalomethanes (THMs)
Analysis Haloacetic Acids (HAA5s)

Sample Site: 3-DAY **Date Collected:** 5/21/2026 8:30:00AM
Sample Number GIE1382-05 **Collected by:** NM
Source Type: Title 22 Designation:

Analyzing Laboratory: BSK Laboratory Report with Method References attached.
Analysis Trihalomethanes (THMs)
Analysis Haloacetic Acids (HAA5s)

Sample Site: 7-DAY **Date Collected:** 5/25/2026 8:30:00AM
Sample Number GIE1382-06 **Collected by:** NM
Source Type: Title 22 Designation:

Analyzing Laboratory: 49er Water Report with Method References attached.
Analysis Total Organic Carbon (TOC)

Analyzing Laboratory: BSK Laboratory Report with Method References attached.

Analysis Trihalomethanes (THMs)

Analysis Haloacetic Acids (HAA5s)

Sample Site: 305 Distribution **Date Collected:** 5/28/2026 8:00:00AM

Sample Number GIE1382-07 **Collected by:** NM

Source Type: Title 22 Designation:

Analyzing Laboratory: BSK Laboratory Report with Method References attached.

Analysis Trihalomethanes (THMs)

Analysis Haloacetic Acids (HAA5s)

Michelle Harlin For Justin Smith

Laboratory Manager

Cranmer Engineering, Inc.
Integrated Engineering Services
1188 East Main Street Grass Valley, CA 95945
Phone: (530) 273-7284
Email: lab@cranmerengineeringinginc.com

Turn Around Time Request
☐ Standard - 10 Business days
☐ Rush (Surcharge may apply)
Date needed:_____

ANALYT
CHAIN OF C

GIE1382

Required Fields*

Company/Client Name*:	Report Attention*:	Invoice To*:	Phone*: 530-583-4692
Olympic Valley PSD	Nic Massetani Additional cc's:	PO#:	Email*: nmassetani@ovpsd.org

Address*:	City*:	State*:	Zip*:
P.O. Box 2026	Olympic Valley	CA	96146

Project Name:	Project #:	Regulatory Compliance*
Chlorine Cl_2 Hold Study		☐ YES ☒ NO

Notes:	*Regulatory Carbon Copies	System Number*:
NON-REGULATORY	Yes / No	CA 3110020
Sampler Name (Printed/Signature): Nic Massetani	Agency _____	☐ Geotracker #:

Matrix Types: WW=Waste Water DW=Drinking Water SO=Solid

Preservation: A= Cold; B= HNO_3; C = HCL; D = H_2SO_4; E= NaOH; F=NaThio; G= H_2PO_4; H= NH_4Cl; I= Sterile

#	Sample Descriptions*	Sampled* Date	Sampled* Time	Matrix*	Comments/Station Code/ WTRAX / Title 22 Designation	Preservation	Analysis Required*: TOC	TTHM	HAA_5
3	Well I treated Initial	5/18/26	0830	DW		A	X		
4	6-HR	5/18/26	1430	"		"		X	X
4	12-HR	5/18/26	2030	"		"		X	X
4	1-DAY	5/19/26	0830	"		"		X	X
4	3-DAY	5/21/26	0830	"		"		X	X
7	7-DAY	5/25/26	0830	"		"	X	X	X
4	305 Distribution	5/28/26	0800	DW		A		X	X

Relinquished By: (Signature and Printed Name)	Company	Date	Time	Received by: (Signature and Printed Name)	Company	Date/Time
Nic Massetani	OVPSD	5/28/26	0900	STUART UKHOA	CEI	5/28/26 1130
Relinquished By: (Signature and Printed Name)	Company	Date	Time	Received by: (Signature and Printed Name)	Company	Date/Time

Received for Lab by: (Signatue and Printed Name)	Date	Time	Payment Received at Delivery Date:	Amount:	PIA#:	Card	Check	Cash	Init
STUART UKHOA	5/28/26	1606							

Shipping Method: ONTRAC UPS GSO WALK-IN FED EX Courier

Cooling Method: Wet Blue None

Temp: 2.5 °C, Probe ID: IR005 @1520

Custody Seal: Y / N

Chilling Begun: Y / N

CEI strives for excellence and would appreciate your feedback. Please email the lab at lab@cranmerengineeringinginc.com or call our office.

GIE11382

Sample Receiving and Integrity Log

CEI-DOC-CR066

Sample Receiving/Integrity

Received by: SJ Logged by: SJ *Sample Acceptance Yes ☒ No ☐

*(If sample is not accepted, explain in the comment section below the reason for rejection of the sample)

Any answer of "No" should be accompanied by a comment in the comment section.

☒ Verify Sample Date, Time, and Sampler on CofC.

Sample Received within Hold Time? No☐ Yes☒ if no, did client approve analysis outside hold time?

Sample taken today? No☐ Yes☒ If No, does sample meet temp Requirements**? No☐ Yes☐

**Micro <10 C and Chemicals <6 C (except metals)

Surface Water Bacteria Sample within Temp Range***? No☐ Yes☐ N/A☒

***A sample that has a temp, upon receipt, of >10 C, whether iced or not, shall be qualified unless the time since sample collection has been less than two hours.

Bottle/Sample Analysis Information

Do the number of bottles agree with the CoC? No☐ Yes☒

Were the samples received intact? (i.e., no broken bottles, leaks, etc.) No☐ Yes☒

Was the correct preservation used for Analysis Requested? No☐ Yes☒ N/A☐

If no, did Client approve CEI to preserve and qualify Sample? No☐ Yes☐

*If no, sample shall be rejected.

Circle Preservation used: HNO3 H2SO4 (HCl) NaOH Other: VOA Preservation Lot #_____

Confirm Preservation: pH<2 pH>12 pH Strip ID:_____ AMM·CHLORIDE

Sufficient sample volume provided? No☐ Yes☒ If no, did client approve analysis with possible qualifiers?

If Orthro-phosphate was requested was the PO4 filtered within 15 minutes after sampling event?

No☐ Yes☐ N/A☒ If no, did client approve analysis with possible qualifiers?

Was headspace present in microbiology samples of at least ≥1inch? No☐ Yes☐ N/A☒ If no, did client approve analysis with possible qualifiers?

Were VOA Vials free of bubbles or <1cm? No☐ Yes☒ N/A☐

Additional Comments/Instructions:_____

BSK Associates Sacramento
9332 Tech Center Dr, Suite 100
Sacramento, CA 95826
916.853.9293 (Main)

SJF0041
6/08/2026
Invoice: SJ03701

Justin Smith
Cranmer Analytical Laboratory
1188 E. Main St.
Grass Valley, CA 95945

RE: Report for SJF0041 General

Dear Justin Smith,

Thank you for using BSK Associates for your analytical testing needs. In the following pages, you will find the test results for the samples submitted to our laboratory on 6/1/2026. The results have been approved for release by our Laboratory Director as indicated by the authorizing signature below.

The samples were analyzed for the test(s) indicated on the Chain of Custody (see attached) and the results relate only to the samples analyzed. BSK certifies that the testing was performed in accordance with the quality system requirements specified in the 2016 TNI Standard. Any deviations from this standard or from the method requirements for each test procedure performed will be annotated alongside the analytical result or noted in the Case Narrative. Unless otherwise noted, the sample results are reported on an “as received” basis.

If additional clarification of any information is required, please contact your Client Services Representative, Sarah K. Guenther , at (916) 853-9293.

Thank you again for using BSK Associates. We value your business and appreciate your loyalty.

Sincerely,

Sarah K. Guenther, Senior Project Manager

Case Narrative

Project and Report Details		Invoice Details	
Client:	Cranmer Analytical Laboratory	**Invoice To:**	Cranmer Analytical Laboratory
Report To:	Justin Smith	**Invoice Attn:**	Michelle Harlin
Project #:	GIE1382 - #3110020	**Project PO#:**	-
Received:	6/01/2026 - 13:50		
Report Due:	6/15/2026		

Sample Receipt Conditions

Cooler: Default Cooler
Temperature on Receipt ºC: 1.7

Containers Intact
COC/Labels Agree
Received On Ice
Sample(s) were received in temperature range.
Initial receipt at BSK-SAC

Data Qualifiers

The following qualifiers have been applied to one or more analytical results:

HT1.1 Holding time exceeded. Sample was received at the lab with inadequate time remaining to meet the holding time.
HT1.3 Holding time exceeded. Sample was analyzed past the holding time.

Report Distribution

Recipient(s)	Report Format	CC:
Justin Smith	FINAL.RPT	
Reporting	FINAL.RPT	

Certificate of Analysis

Sample ID: SJF0041-01
Sampled By: Client
Sample Description: GIE1382-02 // 6-HR

Sample Date - Time: 05/18/2026 - 14:30
Matrix: Drinking Water
Sample Type: Grab

BSK Associates Laboratory Fresno

Organics

Analyte	Method	Result	RL	Units	RL Mult	Batch	Prepared	Analyzed	Qual
Trihalomethanes by GC-MS								**Analysis Qualifier(s):**	**HT1.3**
Bromodichloromethane	EPA 524.4	ND	0.50	ug/L	1	AJF0414	06/03/26	06/03/26	
Bromoform	EPA 524.4	ND	0.50	ug/L	1	AJF0414	06/03/26	06/03/26	
Chloroform	EPA 524.4	ND	0.50	ug/L	1	AJF0414	06/03/26	06/03/26	
Dibromochloromethane	EPA 524.4	ND	0.50	ug/L	1	AJF0414	06/03/26	06/03/26	
Total Trihalomethanes		ND	0.50	ug/L					
Surrogate: 1,2-Dichlorobenzene-d4	EPA 524.4	103 %	*Acceptable range:*		*70-130 %*				
Surrogate: Methyl tert-butyl ether-d3	EPA 524.4	92 %	*Acceptable range:*		*70-130 %*				
Surrogate: Bromofluorobenzene	EPA 524.4	99 %	*Acceptable range:*		*70-130 %*				
Haloacetic Acids by GC-MS								**Analysis Qualifier(s):**	**HT1.1**
Dibromoacetic Acid (DBAA)	EPA 552.3	ND	1.0	ug/L	1	AJF0412	06/03/26	06/04/26	
Dichloroacetic Acid (DCAA)	EPA 552.3	ND	1.0	ug/L	1	AJF0412	06/03/26	06/04/26	
Monobromoacetic Acid (MBAA)	EPA 552.3	ND	1.0	ug/L	1	AJF0412	06/03/26	06/04/26	
Monochloroacetic Acid (MCAA)	EPA 552.3	ND	2.0	ug/L	1	AJF0412	06/03/26	06/04/26	
Trichloroacetic Acid (TCAA)	EPA 552.3	ND	1.0	ug/L	1	AJF0412	06/03/26	06/04/26	
Total Haloacetic Acids		ND	2.0	ug/L					
Surrogate: 2-Bromobutanoic Acid	EPA 552.3	120 %	*Acceptable range:*		*70-130 %*				

Certificate of Analysis

Sample ID: SJF0041-02
Sampled By: Client
Sample Description: GIE1382-03 // 12-HR

Sample Date - Time: 05/18/2026 - 20:30
Matrix: Drinking Water
Sample Type: Grab

BSK Associates Laboratory Fresno

Organics

Analyte	Method	Result	RL	Units	RL Mult	Batch	Prepared	Analyzed	Qual
Trihalomethanes by GC-MS								**Analysis Qualifier(s):**	**HT1.3**
Bromodichloromethane	EPA 524.4	ND	0.50	ug/L	1	AJF0414	06/03/26	06/03/26	
Bromoform	EPA 524.4	ND	0.50	ug/L	1	AJF0414	06/03/26	06/03/26	
Chloroform	EPA 524.4	ND	0.50	ug/L	1	AJF0414	06/03/26	06/03/26	
Dibromochloromethane	EPA 524.4	ND	0.50	ug/L	1	AJF0414	06/03/26	06/03/26	
Total Trihalomethanes		ND	0.50	ug/L					
Surrogate: 1,2-Dichlorobenzene-d4	EPA 524.4	103 %	*Acceptable range: 70-130 %*						
Surrogate: Methyl tert-butyl ether-d3	EPA 524.4	103 %	*Acceptable range: 70-130 %*						
Surrogate: Bromofluorobenzene	EPA 524.4	98 %	*Acceptable range: 70-130 %*						
Haloacetic Acids by GC-MS								**Analysis Qualifier(s):**	**HT1.1**
Dibromoacetic Acid (DBAA)	EPA 552.3	ND	1.0	ug/L	1	AJF0412	06/03/26	06/04/26	
Dichloroacetic Acid (DCAA)	EPA 552.3	ND	1.0	ug/L	1	AJF0412	06/03/26	06/04/26	
Monobromoacetic Acid (MBAA)	EPA 552.3	ND	1.0	ug/L	1	AJF0412	06/03/26	06/04/26	
Monochloroacetic Acid (MCAA)	EPA 552.3	ND	2.0	ug/L	1	AJF0412	06/03/26	06/04/26	
Trichloroacetic Acid (TCAA)	EPA 552.3	ND	1.0	ug/L	1	AJF0412	06/03/26	06/04/26	
Total Haloacetic Acids		ND	2.0	ug/L					
Surrogate: 2-Bromobutanoic Acid	EPA 552.3	119 %	*Acceptable range: 70-130 %*						

Certificate of Analysis

Sample ID: SJF0041-03
Sampled By: Client
Sample Description: GIE1382-04 // 1-DAY

Sample Date - Time: 05/19/2026 - 08:30
Matrix: Drinking Water
Sample Type: Grab

BSK Associates Laboratory Fresno

Organics

Analyte	Method	Result	RL	Units	RL Mult	Batch	Prepared	Analyzed	Qual
Trihalomethanes by GC-MS								**Analysis Qualifier(s):**	**HT1.3**
Bromodichloromethane	EPA 524.4	ND	0.50	ug/L	1	AJF0414	06/03/26	06/03/26	
Bromoform	EPA 524.4	ND	0.50	ug/L	1	AJF0414	06/03/26	06/03/26	
Chloroform	EPA 524.4	ND	0.50	ug/L	1	AJF0414	06/03/26	06/03/26	
Dibromochloromethane	EPA 524.4	**0.57**	0.50	ug/L	1	AJF0414	06/03/26	06/03/26	
Total Trihalomethanes		**0.57**	0.50	ug/L					
Surrogate: 1,2-Dichlorobenzene-d4	EPA 524.4	104 %	*Acceptable range:*		*70-130 %*				
Surrogate: Methyl tert-butyl ether-d3	EPA 524.4	103 %	*Acceptable range:*		*70-130 %*				
Surrogate: Bromofluorobenzene	EPA 524.4	95 %	*Acceptable range:*		*70-130 %*				
Haloacetic Acids by GC-MS								**Analysis Qualifier(s):**	**HT1.1**
Dibromoacetic Acid (DBAA)	EPA 552.3	ND	1.0	ug/L	1	AJF0412	06/03/26	06/04/26	
Dichloroacetic Acid (DCAA)	EPA 552.3	ND	1.0	ug/L	1	AJF0412	06/03/26	06/04/26	
Monobromoacetic Acid (MBAA)	EPA 552.3	ND	1.0	ug/L	1	AJF0412	06/03/26	06/04/26	
Monochloroacetic Acid (MCAA)	EPA 552.3	ND	2.0	ug/L	1	AJF0412	06/03/26	06/04/26	
Trichloroacetic Acid (TCAA)	EPA 552.3	ND	1.0	ug/L	1	AJF0412	06/03/26	06/04/26	
Total Haloacetic Acids		ND	2.0	ug/L					
Surrogate: 2-Bromobutanoic Acid	EPA 552.3	115 %	*Acceptable range:*		*70-130 %*				

Certificate of Analysis

Sample ID: SJF0041-04
Sampled By: Client
Sample Description: GIE1382-05 // 3-DAY

Sample Date - Time: 05/21/2026 - 08:30
Matrix: Drinking Water
Sample Type: Grab

BSK Associates Laboratory Fresno

Organics

Analyte	Method	Result	RL	Units	RL Mult	Batch	Prepared	Analyzed	Qual
Trihalomethanes by GC-MS									
Bromodichloromethane	EPA 524.4	**0.68**	0.50	ug/L	1	AJF0414	06/03/26	06/03/26	
Bromoform	EPA 524.4	ND	0.50	ug/L	1	AJF0414	06/03/26	06/03/26	
Chloroform	EPA 524.4	ND	0.50	ug/L	1	AJF0414	06/03/26	06/03/26	
Dibromochloromethane	EPA 524.4	**0.88**	0.50	ug/L	1	AJF0414	06/03/26	06/03/26	
Total Trihalomethanes		**1.6**	0.50	ug/L					
Surrogate: 1,2-Dichlorobenzene-d4	EPA 524.4	103 %	*Acceptable range: 70-130 %*						
Surrogate: Methyl tert-butyl ether-d3	EPA 524.4	103 %	*Acceptable range: 70-130 %*						
Surrogate: Bromofluorobenzene	EPA 524.4	98 %	*Acceptable range: 70-130 %*						
Haloacetic Acids by GC-MS									
Dibromoacetic Acid (DBAA)	EPA 552.3	ND	1.0	ug/L	1	AJF0412	06/03/26	06/04/26	
Dichloroacetic Acid (DCAA)	EPA 552.3	ND	1.0	ug/L	1	AJF0412	06/03/26	06/04/26	
Monobromoacetic Acid (MBAA)	EPA 552.3	ND	1.0	ug/L	1	AJF0412	06/03/26	06/04/26	
Monochloroacetic Acid (MCAA)	EPA 552.3	ND	2.0	ug/L	1	AJF0412	06/03/26	06/04/26	
Trichloroacetic Acid (TCAA)	EPA 552.3	ND	1.0	ug/L	1	AJF0412	06/03/26	06/04/26	
Total Haloacetic Acids		ND	2.0	ug/L					
Surrogate: 2-Bromobutanoic Acid	EPA 552.3	117 %	*Acceptable range: 70-130 %*						

Certificate of Analysis

Sample ID: SJF0041-05
Sampled By: Client
Sample Description: GIE1382-06 // 7-DAY

Sample Date - Time: 05/25/2026 - 08:30
Matrix: Drinking Water
Sample Type: Grab

BSK Associates Laboratory Fresno

Organics

Analyte	Method	Result	RL	Units	RL Mult	Batch	Prepared	Analyzed	Qual
Trihalomethanes by GC-MS									
Bromodichloromethane	EPA 524.4	**0.92**	0.50	ug/L	1	AJF0414	06/03/26	06/03/26	
Bromoform	EPA 524.4	**0.68**	0.50	ug/L	1	AJF0414	06/03/26	06/03/26	
Chloroform	EPA 524.4	ND	0.50	ug/L	1	AJF0414	06/03/26	06/03/26	
Dibromochloromethane	EPA 524.4	**1.1**	0.50	ug/L	1	AJF0414	06/03/26	06/03/26	
Total Trihalomethanes		**2.7**	0.50	ug/L					
Surrogate: 1,2-Dichlorobenzene-d4	EPA 524.4	103 %	*Acceptable range: 70-130 %*						
Surrogate: Methyl tert-butyl ether-d3	EPA 524.4	86 %	*Acceptable range: 70-130 %*						
Surrogate: Bromofluorobenzene	EPA 524.4	98 %	*Acceptable range: 70-130 %*						
Haloacetic Acids by GC-MS									
Dibromoacetic Acid (DBAA)	EPA 552.3	ND	1.0	ug/L	1	AJF0412	06/03/26	06/04/26	
Dichloroacetic Acid (DCAA)	EPA 552.3	ND	1.0	ug/L	1	AJF0412	06/03/26	06/04/26	
Monobromoacetic Acid (MBAA)	EPA 552.3	ND	1.0	ug/L	1	AJF0412	06/03/26	06/04/26	
Monochloroacetic Acid (MCAA)	EPA 552.3	ND	2.0	ug/L	1	AJF0412	06/03/26	06/04/26	
Trichloroacetic Acid (TCAA)	EPA 552.3	ND	1.0	ug/L	1	AJF0412	06/03/26	06/04/26	
Total Haloacetic Acids		ND	2.0	ug/L					
Surrogate: 2-Bromobutanoic Acid	EPA 552.3	116 %	*Acceptable range: 70-130 %*						

Certificate of Analysis

Sample ID: SJF0041-06
Sampled By: Client
Sample Description: GIE1382-07 // 305 Distribution

Sample Date - Time: 05/28/2026 - 08:00
Matrix: Drinking Water
Sample Type: Grab

BSK Associates Laboratory Fresno

Organics

Analyte	Method	Result	RL	Units	RL Mult	Batch	Prepared	Analyzed	Qual
Trihalomethanes by GC-MS									
Bromodichloromethane	EPA 524.4	ND	0.50	ug/L	1	AJF0414	06/03/26	06/03/26	
Bromoform	EPA 524.4	ND	0.50	ug/L	1	AJF0414	06/03/26	06/03/26	
Chloroform	EPA 524.4	ND	0.50	ug/L	1	AJF0414	06/03/26	06/03/26	
Dibromochloromethane	EPA 524.4	**0.73**	0.50	ug/L	1	AJF0414	06/03/26	06/03/26	
Total Trihalomethanes		**0.73**	0.50	ug/L					
Surrogate: 1,2-Dichlorobenzene-d4	EPA 524.4	102 %	*Acceptable range: 70-130 %*						
Surrogate: Methyl tert-butyl ether-d3	EPA 524.4	100 %	*Acceptable range: 70-130 %*						
Surrogate: Bromofluorobenzene	EPA 524.4	99 %	*Acceptable range: 70-130 %*						
Haloacetic Acids by GC-MS									
Dibromoacetic Acid (DBAA)	EPA 552.3	ND	1.0	ug/L	1	AJF0412	06/03/26	06/04/26	
Dichloroacetic Acid (DCAA)	EPA 552.3	ND	1.0	ug/L	1	AJF0412	06/03/26	06/04/26	
Monobromoacetic Acid (MBAA)	EPA 552.3	ND	1.0	ug/L	1	AJF0412	06/03/26	06/04/26	
Monochloroacetic Acid (MCAA)	EPA 552.3	ND	2.0	ug/L	1	AJF0412	06/03/26	06/04/26	
Trichloroacetic Acid (TCAA)	EPA 552.3	ND	1.0	ug/L	1	AJF0412	06/03/26	06/04/26	
Total Haloacetic Acids		ND	2.0	ug/L					
Surrogate: 2-Bromobutanoic Acid	EPA 552.3	117 %	*Acceptable range: 70-130 %*						

BSK Associates Laboratory Fresno

Organics Quality Control Report

Analyte	Result	RL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Date Analyzed	Qual
EPA 524.4 - Quality Control											
Batch: AJF0414										Prepared: 6/3/2026	
Prep Method: no prep-volatiles										Analyst: JIR	
Blank (AJF0414-BLK1)											
Bromodichloromethane	ND	0.50	ug/L							06/03/26	
Bromoform	ND	0.50	ug/L							06/03/26	
Chloroform	ND	0.50	ug/L							06/03/26	
Dibromochloromethane	ND	0.50	ug/L							06/03/26	
Total Trihalomethanes	ND	0.50	ug/L							06/03/26	
Surrogate: 1,2-Dichlorobenzene-d4	*51*			*50*		*103*	*70-130*			06/03/26	
Surrogate: Methyl tert-butyl ether-d3	*46*			*50*		*91*	*70-130*			06/03/26	
Surrogate: Bromofluorobenzene	*51*			*50*		*103*	*70-130*			06/03/26	
Duplicate (AJF0414-DUP1), Source: BJF0025-01											
Bromodichloromethane	ND	0.50	ug/L		ND				30	06/03/26	
Bromoform	ND	0.50	ug/L		ND				30	06/03/26	
Chloroform	ND	0.50	ug/L		ND				30	06/03/26	
Dibromochloromethane	ND	0.50	ug/L		ND				30	06/03/26	
Surrogate: 1,2-Dichlorobenzene-d4	*52*			*50*		*103*	*70-130*			06/03/26	
Surrogate: Methyl tert-butyl ether-d3	*42*			*50*		*84*	*70-130*			06/03/26	
Surrogate: Bromofluorobenzene	*49*			*50*		*98*	*70-130*			06/03/26	
Matrix Spike (AJF0414-MS1), Source: BJF0025-02											
Bromodichloromethane	9.1	0.50	ug/L	10	ND	91	50-150			06/03/26	
Bromoform	8.9	0.50	ug/L	10	ND	89	50-150			06/03/26	
Chloroform	9.4	0.50	ug/L	10	ND	94	50-150			06/03/26	
Dibromochloromethane	8.8	0.50	ug/L	10	ND	88	50-150			06/03/26	
Surrogate: 1,2-Dichlorobenzene-d4	*51*			*50*		*102*	*70-130*			06/03/26	
Surrogate: Methyl tert-butyl ether-d3	*48*			*50*		*96*	*70-130*			06/03/26	
Surrogate: Bromofluorobenzene	*50*			*50*		*100*	*70-130*			06/03/26	
EPA 552.3 - Quality Control											
Batch: AJF0412										Prepared: 6/3/2026	
Prep Method: EPA 552.3										Analyst: RXD	
Blank (AJF0412-BLK1)											
Dibromoacetic Acid (DBAA)	ND	1.0	ug/L							06/04/26	
Dichloroacetic Acid (DCAA)	ND	1.0	ug/L							06/04/26	
Monobromoacetic Acid (MBAA)	ND	1.0	ug/L							06/04/26	
Monochloroacetic Acid (MCAA)	ND	2.0	ug/L							06/04/26	
Trichloroacetic Acid (TCAA)	ND	1.0	ug/L							06/04/26	
Total Haloacetic Acids	ND	2.0	ug/L							06/04/26	
Surrogate: 2-Bromobutanoic Acid	*11*			*10*		*107*	*70-130*			06/04/26	
Duplicate (AJF0412-DUP1), Source: AJE3016-02											
Dibromoacetic Acid (DBAA)	ND	1.0	ug/L		ND				30	06/04/26	
Dichloroacetic Acid (DCAA)	17	1.0	ug/L		17			1	30	06/04/26	
Monobromoacetic Acid (MBAA)	ND	1.0	ug/L		ND				30	06/04/26	

BSK Associates Laboratory Fresno

Organics Quality Control Report

Analyte	Result	RL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Date Analyzed	Qual
EPA 552.3 - Quality Control											
Batch: AJF0412										Prepared: 6/3/2026	
Prep Method: EPA 552.3										Analyst: RXD	
Duplicate (AJF0412-DUP1), Source: AJE3016-02											
Monochloroacetic Acid (MCAA)	ND	2.0	ug/L		ND				30	06/04/26	
Trichloroacetic Acid (TCAA)	23	1.0	ug/L		22			2	30	06/04/26	
Total Haloacetic Acids	40	2.0	ug/L		39			1	30	06/04/26	
Surrogate: 2-Bromobutanoic Acid	*11*			*10*		*107*	*70-130*			06/04/26	
Matrix Spike (AJF0412-MS1), Source: AJE3016-01											
Dibromoacetic Acid (DBAA)	9.6	1.0	ug/L	10	ND	96	70-130			06/04/26	
Dichloroacetic Acid (DCAA)	26	1.0	ug/L	10	16	99	70-130			06/04/26	
Monobromoacetic Acid (MBAA)	9.3	1.0	ug/L	10	ND	93	70-130			06/04/26	
Monochloroacetic Acid (MCAA)	20	2.0	ug/L	20	2.3	87	70-130			06/04/26	
Trichloroacetic Acid (TCAA)	31	1.0	ug/L	10	21	102	70-130			06/04/26	
Surrogate: 2-Bromobutanoic Acid	*11*			*10*		*105*	*70-130*			06/04/26	

Certificate of Analysis

Notes:

- The Chain of Custody document and Sample Integrity Sheet are part of the analytical report.
- Any remaining sample(s) for testing will be disposed of according to BSK's sample retention policy unless other arrangements are made in advance.
- All positive results for EPA Methods 504.1 and 524.2 require the analysis of a Field Reagent Blank (FRB) to confirm that the results are not a contamination error from field sampling steps. If Field Reagent Blanks were not submitted with the samples, this method requirement has not been performed.
- Samples collected by BSK Analytical Laboratories were collected in accordance with the BSK Sampling and Collection Standard Operating Procedures.
- J-value is equivalent to DNQ (Detected, not quantified) which is a trace value. A trace value is an analyte detected between the MDL and the laboratory reporting limit. This result is of an unknown data quality and is only qualitative (estimated). Baseline noise, calibration curve extrapolation below the lowest calibrator, method blank detections, and integration artifacts can all produce apparent DNQ values, which contribute to the un-reliability of these values.
- (1) - Residual chlorine and pH analysis have a 15 minute holding time for both drinking and waste water samples as defined by the EPA and 40 CFR 136. Waste water and ground water (monitoring well) samples must be field filtered to meet the 15 minute holding time for dissolved metals.
- Field tests are outside the scope of laboratory accreditation and there is no certification available for field testing.
- Summations of analytes (i.e. Total Trihalomethanes) may appear to add individual amounts incorrectly, due to rounding of analyte values occurring before or after the total value is calculated, as well as rounding of the total value.
- RL Multiplier is the factor used to adjust the reporting limit (RL) due to variations in sample preparation procedures and dilutions required for matrix interferences.
- Due to the subjective nature of the Threshold Odor Method, all characterizations of the detected odor are the opinion of the panel of analysts. The characterizations can be found in Standard Methods 2170B Figure 2170:1.
- The MCLs provided in this report (if applicable) represent the primary MCLs for that analyte.
- (2) - Formerly known as Bis(2-Chloroisopropyl) ether.
  Unless otherwise noted, TOC results by SM 5310C method do not include purgeable organic carbon, which is removed along with the inorganic carbon interference. The POC contribution to TOC is considered to be negligible.

Certificate of Analysis

Definitions

mg/L:	Milligrams/Liter (ppm)	MDL:	Method Detection Limit	MDA95:	Min. Detected Activity
mg/Kg:	Milligrams/Kilogram (ppm)	RL:	Reporting Limit: DL x Dilution	MPN:	Most Probable Number
µg/L:	Micrograms/Liter (ppb)	ND:	None Detected below MRL/MDL	CFU:	Colony Forming Unit
µg/Kg:	Micrograms/Kilogram (ppb)	pCi/L:	PicoCuries per Liter	Absent:	Less than 1 CFU/100mLs
%:	Percent	RL Mult:	RL Multiplier	Present:	1 or more CFU/100mLs
NR:	Non-Reportable	MCL:	Maximum Contaminant Limit	U:	The analyte was not detected at or above the reported sample quantitation limit.

Please see the individual Subcontract Lab's report for applicable certifications.

Certificate of Analysis

Certifications: **Please refer to our website for a copy of our Accredited Fields of Testing under each certification.**

Bakersfield

State of California - ELAP	1180-S3

Fresno

State of California - ELAP	1180	State of Hawaii	4021
Los Angeles CSD	9254479	NELAP certified	4021-027
State of Nevada	NV-C25-00264	State of Oregon - NELAP	4021-027
EPA UCMR5	CA00079	State of Washington	C997-26

Sacramento

State of California - ELAP	1180-S1

San Bernardino

State of California - ELAP	1180-S2	Los Angeles CSD	9254478
NELAP certified	4119-010	State of Oregon - NELAP	4119-010

Vancouver

NELAP certified	WA100008-022	State of Oregon - NELAP	WA100008-022
State of Washington	C824-25		

Cranmer Engineering, Inc.
Integrated Engineering Services

SJF0041 Cranm7284 06/01/2026 10

SUBCONTRACT ORDER

Sending Laboratory:

CEI
PO Box 1240
Grass Valley, CA 95945
Phone: 530-273-7284
Fax: -

Project Manager: Justin Smith

Subcontracted Laboratory:

BSK Laboratory
687 N Laverne Avenue
Fresno, CA 93706
Phone: (559) 497-2888
Fax:

MDL

non compliance

EDT Upload YES ☐ NO ☒

Alexander ortiz	6/1/26 13:50		611/26 13:50
Released By	Date	Received By	Date

Cranmer Engineering, Inc.
Integrated Engineering Services

SJF0041 Cranm7284 06/01/2026 10

1.7°C
cf Icp
walk In
IR71

SUBCONTRACT ORDER
(Continued)

Work Order: GIE1382

Project # 3110020

Analysis	Comments	Source ID

(1) **Sample ID: GIE1382-02 6-HR**
Drinking Water Sampled: 05/18/2026 14:30

NO TRIP BLANK PROVIDED BY CLIENT

Trihalomethanes (THMs)
Haloacetic Acids (HAA5s)

Containers Supplied:
125 mL Amber Glass w/Amn VOA, amber w/NaThio (B) VOA, amber w/NaThio (C) VOA, amber w/NaThio (D)

(2) **Sample ID: GIE1382-03 12-HR**
Drinking Water Sampled: 05/18/2026 20:30

NO TRIP BLANK PROVIDED BY CLIENT

Trihalomethanes (THMs)
Haloacetic Acids (HAA5s)

Containers Supplied:
125 mL Amber Glass w/Amn VOA, amber w/NaThio (B) VOA, amber w/NaThio (C) VOA, amber w/NaThio (D)

(3) **Sample ID: GIE1382-04 1-DAY**
Drinking Water Sampled: 05/19/2026 08:30

NO TRIP BLANK PROVIDED BY CLIENT

Trihalomethanes (THMs)
Haloacetic Acids (HAA5s)

Containers Supplied:
125 mL Amber Glass w/Amn VOA, amber w/NaThio (B) VOA, amber w/NaThio (C) VOA, amber w/NaThio (D)

(4) **Sample ID: GIE1382-05 3-DAY**
Drinking Water Sampled: 05/21/2026 08:30

NO TRIP BLANK PROVIDED BY CLIENT

Trihalomethanes (THMs)
Haloacetic Acids (HAA5s)

Containers Supplied:
125 mL Amber Glass w/Amn VOA, amber w/NaThio (B) VOA, amber w/NaThio (C) VOA, amber w/NaThio (D)

(5) **Sample ID: GIE1382-06 7-DAY**
Drinking Water Sampled: 05/25/2026 08:30

NO TRIP BLANK PROVIDED BY CLIENT

Trihalomethanes (THMs)
Haloacetic Acids (HAA5s)

Containers Supplied:
125 mL Amber Glass w/Amn VOA, amber w/NaThio (D) VOA, amber w/NaThio (E) VOA, amber w/NaThio (F)

EDT Upload YES ☐ NO ☒

Alexander Ortiz — Released By — 6/1/26 13:50 — Date
Jade Stubbs — Received By — 6/1/26 13:50 — Date

Cranmer Engineering, Inc.
Integrated Engineering Services

SJF0041 Cranm7284 06/01/2026 10

SUBCONTRACT ORDER
(Continued)

Work Order: GIE1382 (Continued)

Project # 3110020

Analysis	Comments	Source ID

Sample ID: GIE1382-07 305 Distribution
Drinking Water Sampled: 05/28/2026 08:00

NO TRIP BLANK PROVIDED BY CLIENT

Trihalomethanes (THMs)
Haloacetic Acids (HAA5s)

Containers Supplied:
125 mL Amber Glass w/Amn VOA, amber w/NaThio (B) VOA, amber w/NaThio (C) VOA, amber w/NaThio (D)

EDT Upload YES ☐ NO ☒

Alexander Ortiz — Released By — 6/1/26 13:50 — Date
Jack Stokes — Received By — 6/1/26 13:50 — Date

SJF0041 Cranm7284 06/01/2026 10

Sample Integrity

BSK Bottles: Yes No Page 1 of 1

COC Info

Was temperature within range? Chemistry ~~≤ 6°C~~ Micro < 8°C	Yes No NA	Were correct containers and preservatives received for the tests requested?	Yes No
If samples were taken today, is there evidence that chilling has begun?	Yes No NA	Bubbles Present VOAs (VOCs/TTHM/TCP)? TB Received?	Yes No NA Yes No NA
Did all bottles arrive unbroken and intact?	Yes No	Was a sufficient amount of sample received?	Yes No
Did all bottle labels agree with COC?	Yes No	**Do samples have a hold time <72 hours?**	Yes No
Was sodium thiosulfate added to CN sample(s) until chlorine was no longer present?	Yes NA	Was PM notified of discrepancies? PM: dt: email scan copy	Yes No NA

Bottles Received

"—" means preservation/chlorine checks are either N/A or are performed in the lab

250ml(A) 500ml(B) 1Liter(C) 40mlVOA(V) 125ml(D)	Checks*	Passed?	1-6 each				
Bacti $Na_2S_2O_3$	—	—					
None (P) White Label	—	—					
Cr6 (P) Lt. Green Label/Blue Cap NH4OH(NH4)2SO4 **DW**	Cl, pH > 8	P F					
Cr6 (P) Pink Label/Blue Cap NH4OH(NH4)2SO4 **WW**	pH 9.3-9.7	P F					
Cr6 (P) Black Label/Blue Cap NH4OH(NH4)2SO4 **7199** ***24 HOUR HOLD TIME***	pH 9.0-9.5	P F					
HNO_3 (P) Red Label or HCl (P) Purple Cap/Lt. Blue Label	—	—					
H_2SO_4 (P) or (AG) Yellow Label	pH < 2	P F					
NaOH (P) Green Cap/Label	Cl, pH >10	P F					
NaOH + ZnAc (P)	pH > 9	P F					
Dissolved Oxygen 300ml (g)	—	—					
None (AG) 608/8081/8082, 625, 632/8321, 8151, 8270	—	—					
HCl (AG) Lt. Blue Label O&G, Diesel	—	—					
Ascorbic, EDTA, KH_2Ct (AG) Pink Label 525	—	—					
Na_2SO_3 (AG) Neon Green Label 515	—	—					
$Na_2S_2O_3$ 1 Liter (Brown P) 549	—	—					
$Na_2S_2O_3$ (AG) Blue Label 548	—	—	3V				
$Na_2S_2O_3$ (CG) Blue Label 504, 505, 547	—	—					
$Na_2S_2O_3$ + MCAA (CG) Orange Label 531	pH < 3	P F					
NH_4Cl (AG) Purple Label 552	—	—	1D				
EDA (P) or (AG) Brown Label DBPs	—	—					
HCL (CG) BTEX,Gas, MTBE, 8260/624	—	—					
Ascorbic Acid (AG) **TCP DWRL**	—	—					
Maleic + Ascorbic (AG) 524.4 & THM	—	—					
Buffer pH 4 (CG)	—	—					
H_3PO_4 (CG) Salmon Label	—	—					
Trizma – EPA 537.1 Light Blue Label **FB**	---	---					
Ammonia Acetate - EPA 533 Purple Label **FB**	---	---					
Bottle Water	—	—					
Clear Glass: Jar / VOA	—	—					
OTHER:	—	—					

JS 6/1/26

Split

	Container	Preservative	Lot #	Initials	Date/Time	Preservation Check
S P						pH Lot #
S P						Cl Lot #

Comments

*Preservation check completed by lab performing analysis.

Labeled by: **Checked by:**

Scanned: _____ Rush/Short HT Page: _____ Time: _____

SAMPLE TRANSIT ORDER

SJF0041

Sarah K. Guenther

Receipt temp @ FAL: 5.0 Thermometer/ IR Gun ID: 53

SENDING LABORATORY:

BSK Associates Sacramento
3140 Gold Camp Drive #160
Rancho Cordova, CA 95670
916.853.9293 (Main)
916.853.9297 (FAX)

Project Manager: Sarah K. Guenther
E-mail: sguenther@bskassociates.com

RECEIVING LABORATORY:

BSK Associates Laboratory Fresno
687 N. Laverne Avenue
Fresno, CA 93727
559-497-2888 (Main)

Turnaround (Days): Standard
QC Deliverables: I Std III IV

Client: Cranmer Analytical Laboratory

Sample ID	Samp Desc		Sample Date
SJF0041-01	**GIE1382-02**	**Client Matrix** Drinking Water	**05/18/2026 14:30**
Lab Matrix:	Water		
	Analysis:		
	EPA 524.4 - THMs EPA 552.3 - Haloacetic Acid Subtest		
SJF0041-02	**GIE1382-03**	**Client Matrix** Drinking Water	**05/18/2026 20:30**
Lab Matrix:	Water		
	Analysis:		
	EPA 524.4 - THMs EPA 552.3 - Haloacetic Acid Subtest		
SJF0041-03	**GIE1382-04**	**Client Matrix** Drinking Water	**05/19/2026 08:30**
Lab Matrix:	Water		
	Analysis:		
	EPA 524.4 - THMs EPA 552.3 - Haloacetic Acid Subtest		
SJF0041-04	**GIE1382-05**	**Client Matrix** Drinking Water	**05/21/2026 08:30**
Lab Matrix:	Water		
	Analysis:		
	EPA 524.4 - THMs EPA 552.3 - Haloacetic Acid Subtest		
SJF0041-05	**GIE1382-06**	**Client Matrix** Drinking Water	**05/21/2026 08:30**
Lab Matrix:	Water		
	Analysis:		
	EPA 524.4 - THMs EPA 552.3 - Haloacetic Acid Subtest		
SJF0041-06	**GIE1382-07**	**Client Matrix** Drinking Water	**05/28/2026 08:00**
Lab Matrix:	Water		
	Analysis:		
	EPA 524.4 - THMs EPA 552.3 - Haloacetic Acid Subtest		

Containers Included

SJF0041-01	A	40mL VOA AG / Na2S203
SJF0041-01	B	40mL VOA AG / Na2S203
SJF0041-01	C	40mL VOA AG / Na2S203
SJF0041-01	D	125mL AG / NH4CL
SJF0041-02	A	40mL VOA AG / Na2S203
SJF0041-02	B	40mL VOA AG / Na2S203
SJF0041-02	C	40mL VOA AG / Na2S203
SJF0041-02	D	125mL AG / NH4CL
SJF0041-03	A	40mL VOA AG / Na2S203
SJF0041-03	B	40mL VOA AG / Na2S203
SJF0041-03	C	40mL VOA AG / Na2S203
SJF0041-03	D	125mL AG / NH4CL
SJF0041-04	A	40mL VOA AG / Na2S203
SJF0041-04	B	40mL VOA AG / Na2S203
SJF0041-04	C	40mL VOA AG / Na2S203
SJF0041-04	D	125mL AG / NH4CL
SJF0041-05	A	40mL VOA AG / Na2S203
SJF0041-05	B	40mL VOA AG / Na2S203
SJF0041-05	C	40mL VOA AG / Na2S203
SJF0041-05	D	125mL AG / NH4CL
SJF0041-06	A	40mL VOA AG / Na2S203
SJF0041-06	B	40mL VOA AG / Na2S203
SJF0041-06	C	40mL VOA AG / Na2S203
SJF0041-06	D	125mL AG / NH4CL

Released By	Date	Received By	Date
	6.2.26		
Released By	Date	Received By	Date
			6.2.26 1418

SAMPLE TRANSIT INTEGRITY

PM: Sarah K. Guenther

SJF0041
06/01/2026
Cranm7284
10

BSK Bottles: (Yes) No Page 1 of 1

COC Info

Was temperature within range? Chemistry ≤ 6ºC Micro< 8ºC	(Yes) No NA	Were correct containers and preservatives received for the tests requested?	(Yes) No NA
Did all bottles arrive unbroken and intact?	(Yes) No	Bubbles Present VOAs (524.2/TCP/TTHM)?	Yes (No) NA
Was a sufficient amount of sample received?	(Yes) No	TB Received? (Check Method Below)	Yes (No) NA
Do samples have a hold time <72 hours?	Yes (No)	Was PM notified of discrepancies? PM: By/Time:	Yes No (NA)
Was sodium thiosulfate added to CN sample(s) until chlorine was no longer present?	Yes No (NA)		

Bottles Received "---" means preservation/chlorine checks are either N/A or are performed in the lab

	Checks	Passed?						
250ml(A) 500ml(B) 1Liter(C) 125mL(D) 40ml VOA(V)			1-6					
Bacti Na2S2O3	---	---						
None (P) White Cap	---	---						
Cr6 (P) Lt. Green Label/Blue Cap NH4OH(NH4)SO4 **DW**	Cl, pH> 8	P F						
Cr6 (P) Pink Label/Blue Cap NH4OH(NH4)SO4 **WW**	pH 9.3 - 9.7	P F						
Cr6 (P) Black Label/Blue Cap NH4OH(NH4)SO4 **7199** ***24 HOUR HOLD TIME***	pH 9.0 - 9.5	P F					6.22	
HNO3 (P) Red Cap or HCl (P) Purple Cap/Lt. Blue Label	---	---						
H2SO4 (P) or (AG) Yellow Cap/Label	pH < 2	P F						
NaOH (P) Green Cap	Cl, pH> 10	P F						
NaOH + ZnAc (P)	pH > 9	P F						
Dissolved Oxygen 300ml (g)	---	---						
None (AG) 608/8081/8082, 625, 632/8321, 8151, 8270	---	---						
HCl (AG) Lt. Blue Label O&G, Diesel	---	---						
Ascorbic, EDTA, KH2Ct (AG) Pink Label 525	---	---						
Na2SO3 (AG) Neon Green Label 515	---	---						
Na2S2O3 1 Liter (Brown P) 549	---	---						
Na2S2O3 (AG) Blue Label 548, THM, 524	---	---	3U					
Na2S2O3 (CG) Blue Label 504, 505, 547	---	---						
Na2S2O3 + MCAA (CG) Orange Label 531	pH < 3	P F						
NH4Cl (AG) Purple Label 552	---	---	1D					
EDA (AG) Brown Label DBPs	---	---						
HCL (CG) 524.2, BTEX, Gas, MTBE, 8260/624	---	---						
Buffer pH 4 (CG)	---	---						
H3PO4 (CG) Salmon Label	---	---						
250mL P / Trizma 537.1	---	---						
250mL P/Ammonium Acetate - EPA533	---	---						
Asbestos 1L (P) / LL Metals Bottle	---	---						
Bottled Water	---	---						
Clear Glass Jar/VOA	---	---						
Solids: Brass / Steel / Plastic Bag	---	---						
Ascorbic Acid (AG) TCP DWRL	---	---						
Other:	---	---						

Split

	Container	Preservative/Lot#	Date/Time/Initials		Container	Preservative/Lot#	Date/Time/Initials
S P				S P			
S P				S P			

Comments

✓ **Indicates Blanks Received**

504_____524.2_____TCP_____

TTHM_____537_____8260/624_____

Preservation Check: pH Lot# _____ Cl Lot# _____

Labels Checked by: YH @ 1946 Scanned by: KH @ _____ RUSH Paged by: _____ @ _____

SR-FL-0052-02

245 New York Ranch Rd, Suite A, Jackson, CA 95642 (209) 868-2100
email: shane@49erwaterlab.com / www.49erwaterlab.com

06/09/2026

Cranmer Engineering
1188 East Main Street
Grass Valley, CA 95945

Please find the attached report for your water analysis for **Order #36083**. Your sample(s) were received on 06/02/2026 14:00. Your sample(s) were analyzed in accordance with your request with use of AWWA, EPA, ISO/IEC 17025:2017, 2016 TNI Standard and/or approved ELAP methods. All Quality Control results are within acceptable limits except where noted as a notation and/or case summary.

Please feel free to contact us if you have any questions regarding your report(s) or invoice.

We value and thank you for your business.

Sincerely,

Shane Burr
Lab Director

CA ELAP Certification #3036

49ER WATER
A FULL SERVICE ENVIRONMENTAL LAB
245 New York Ranch Rd, Suite A, Jackson, CA 95642 (209)868-2100
shane@49erwaterlab.com / www.49erwaterlab.com

Client:	Cranmer Engineering	**Reported:**	06/09/2026
Report To:	1188 East Main Street Grass Valley, CA 95945	**Order No:**	36083

Analysis Report

Sample Description: *Cranmer Engineering* - Drinking Water **Sample No:** 93507
Location: Laboratory Sample ID: GIE1382-01
Point of Collection: Client Sample ID: Well 1 Treated Initial
Sampled: 05/18/2026 08:30 **Received:** 06/02/2026 14:00

Analyte	Category	Results	Units	MDL	RL	Prepared	Analyzed	Method
Total Organic Carbon	Wet Chemistry	**1.25**	mg/l	0.3	0.5	06/05/26 16:30	06/06/26 13:16	SM5310B-2014/2000

Sample Description: *Cranmer Engineering* - Drinking Water **Sample No:** 93508
Location: Laboratory Sample ID: GIE1382-06
Point of Collection: Client Sample ID: 7-Day
Sampled: 05/25/2026 08:30 **Received:** 06/02/2026 14:00

Analyte	Category	Results	Units	MDL	RL	Prepared	Analyzed	Method
Total Organic Carbon	Wet Chemistry	**1.30**	mg/l	0.3	0.5	06/05/26 16:30	06/06/26 13:16	SM5310B-2014/2000

Quality Control Data

Analyte	Result	RL	Units	Spike Level	Source Result	MDL	% REC	% REC Limits	RPD	RPD Limit	Notes

Signature of Completion:

Shane Burr
Lab Director

Definitions

J - Detection of analyte above MDL but below RL
ND - Non-Detection of analyte at MDL
MDL - Method detection limit for analyte
RL - Reporting limit for analyte
RPD - Recovery % Different
LCS/BS - Laboratory Control Sample or Blank Standard
MS/MSD - Matrix Spike
ICV - Initial Calibration Value
CCV - Completion Calibration Value
TNTC - Too Numerous to Count

Cranmer Engineering, Inc.
Integrated Engineering Services

SUBCONTRACT ORDER

Sending Laboratory:

CEI
PO Box 1240
Grass Valley, CA 95945
Phone: 530-273-7284
Fax: -

Project Manager: Justin Smith

Subcontracted Laboratory:

49er Water
245 New York Ranch Rd, Ste A
Jackson, CA 95642
Phone: (209) 418-3175
Fax:

GS

Work Order: GIE1382

Project # 3110020

Analysis	Comments	Source ID
Sample ID: GIE1382-01 Well 1 Treated Initial *Drinking Water Sampled: 05/18/2026 08:30*	non compliance	
Total Organic Carbon (TOC)		
Containers Supplied: VOA w/HCl (A) VOA w/HCl (B) VOA w/HCl (C)		
Sample ID: GIE1382-06 7-DAY *Drinking Water Sampled: 05/25/2026 08:30*		
Total Organic Carbon (TOC)		
Containers Supplied: VOA w/HCl (B) VOA w/HCl (C) VOA w/HCl (G)		

EDT Upload YES ☐ NO ☒

Released By — Date 6/2/26

Received By — Date 6/4/26

Work Order # (Sample #): _____

Sample Receiving/Integrity

Received By: _____ **Logged By:** _____ **Sample Accepted:** ☒Yes/☐No (If No explain in Comment/Status section reason for rejection of sample)

Date/Time: 6/2/26 : 1400

Customer Info: CEI

Sample Transport: ☐ONTRAC ☐UPS ☐USPS ☐Walk-in ☒Courier ☐FedEx ☐Other: _____

Transported in: ☒Ice Chest ☐Box ☐Ziploc/Plastic Bag ☐Hand Delivery ☐ Other: _____

Has Chilling Process begun: ☒Y/☐N Samples Received: ☐Chilled to Touch ☐Ambient ☒On Ice ☐In Storage Fridge

Temperature of Sample (°C): 3.6 Ice Chest Temperature: 0.8 Field Temperature: _____

*Corrected temperature is recorded, after taking temp, make the +/- from IR1 label & record temperature. (O) Observed (C) Corrected

Bottle/Sample Analysis Information

	Yes	No	N/A	Comments
Did bottles arrive unbroken and intact?	X			
Sample is within Hold Time?	X			
Did bottle labels agree with COC?	X			
Correct containers used?	X			Bottle Lot# if from Lab:
Were correct preservatives used for tests requested?	X			
Was there a sufficient sample volume?	X			
Were bubbles present in VOA Vials? (Volatile methods only)		X		
Chlorine Residual Check (Bacteriological ONLY)			X	

Turn-Around Time: ☐1 Day Rush ☐5 Day Rush ☒Standard COC completed: ☒Y/☐N/☐N/A

Payment Information: Paid ☐Y/☒N Bill ☒Y/☐N _____

Report Request via: ☐Mail ☒Email ☒Portal Email: _____

	Comments/Status
Due Date:	
Samples in Order:	COC/Sample Receiving and Integrity: Scanned and Attached
Notification needed? (for bacteria and exceed of limits for Drinking H2O)	☐Yes ☐No ☐N/A

49ER WATER
A FULL SERVICE ENVIRONMENTAL LAB
245 New York Ranch Rd, Suite A, Jackson, CA 95642 (209) 418-3175
email: atranle@49erwaterlab.com / www.49erwaterlab.com

Batch #: 14060 Prepared - 6/5/2026 Analyzed - 6/6/2026

Total Organic Carbon SM 5310B-2000/SM 5310B-2011

Analyte	Results	Units	Spike Level	Source Results	RL	MDL	% REC	% REC Limits	RPD	RPD Limits	Source/Notes
Blank	0.536	mg/L	0		0.5	0.3					B
BS1	1.95	mg/L	2		0.5	0.3	97.5	80-120		20	
BS2	5.06	mg/L	5		0.5	0.3	101	90-110		20	
BS3		mg/L	10		0.5	0.3	0	85-115		20	
MS	12.4	mg/L	10	2.58	0.5	0.3	98.2	80-120		20	92905
MSD	13.1	mg/L	10	2.58	0.5	0.3	105	80-120	5.5	20	92905
MSD		mg/L	10		0.5	0.3	0	80-120		20	
Dup1	1.8	mg/L		1.78	0.5	0.3	101	85-115	1.1	20	93479
Dup2	0.453	mg/L		0.66	0.5	0.3	68.6	85-115	37	20	93646-D
Dup3		mg/L			0.5	0.3	#####	85-115	###	20	
BS CCV	9.86	mg/L	10		0.5	0.3	98.6	85-115	1.4	20	

B - Blank value out of acceptable limits

D - Duplicate value out of acceptable limts

C - CCV value out of acceptable limits

S - Standard spike level out of acceptable limits

M- Matrix spike level out of acceptable limits

- denotes no value/results for calculations in section

Appendix C

Chlorination Equipment Packages and Quote

Prominent Package

PRICE QUOTE

April 28, 2026

To: Hydros Engineering

Attn: Gerry LaBudde

Subject: ProMinent Gamma X Pump Metering Skid

GENERAL NOTES:
A) This proposal is based on information and specifications you provided. Completeness and accuracy of scope of supply, and fulfillment of specification requirements, is ultimately your responsibility.

B) Field startup and training are not included in this quotation. Typical start-up charges are $2000/day .

C) Drawing Submittals:
Allow 15 days ARO for engineering drawings to be created. Our Price includes one set of shop drawings and component cut sheets (available in electronic format from our website). One set of standard equipment manuals will be shipped with equipment. Customer is responsible for binder assembly and special documentation. A full submittal package is additional and price will be based on actual documentation requirements. Material procurement/production will not begin until submittal drawings are returned and marked approved.

Should you have any additional questions, please do not hesitate to contact us immediately.

TERMS & CONDITIONS

Payment: Net 30 days
Price: US Dollars, Ex Works,

Delivery: 4-6 Weeks ARO and Drawing/Submittal Approvals.
Offer Validity: 90 Days

Price overview

#	Material #	Description	Qty	Ext. Net
	Prominent Configurable Dosing Skid System			
1	DSSASS2GXKE0APCV11F1PBRSRDTB SS2-GXA-A-PCV-PD1-CC1-F1-PB-RS-RD-TB			$15,277.90
1.1	GMXA1009PVT70000UVC030BEN07			
1.1.1			1	
1.1.2			1	
1.1.3			1	
1.1.4			1	
1.1.5			1	
1.2	SS2_A_PB_RS_RD_F	STAND, SS2, 46" X 44" X 20", BLACK PP/PE	1	
1.3				
1.3.1	DPA_A2A_PCV_PB_F1			
1.3.1.1	BPV_PCV_A	1/2in PVC/Teflon Back Pressure Valve	1	
1.3.1.2	PGI_160_PCV_A	160PSI CPVC/Teflon Pressure Gauge and Isolator 1/2in	1	
1.3.2	PPA_A_X_050OD_PCV_F1			
1.3.2.1	PD_164_PCV	164ML PVC/Viton Pulsation Dampener	2	
1.3.2.2	PRV_PCV_A	1/2in PVC/Teflon Pressure Relief Valve	2	
1.3.3	SPA_A2A_PCV_F1			
1.3.3.1	YS_PCV_A	1/2in PVC/Viton Wye Strainer	1	
1.3.4	BV_PCV_A1	PVC/Viton Ball Valves (Vented)	1	
1.3.5	CCA_PCV_A_F1			
1.3.5.1	CC_100_PCV_A	100ML PVC Calibration Column	1	

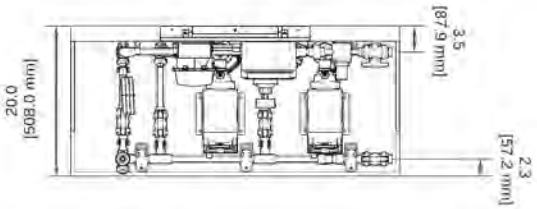
#	Material #	Description	Qty	Ext. Net
1.4	CP_TB_2F	Two Pump Terminal Box Assy	1	
	Prominent Configurable Dosing Skid System			
2	DSSASS1GXKE0APCV11F1SDRSRDTB SS1-GXA-A-PCV-PD1-CC1-F1-SD-RS-RD-TB			$10,320.30
2.1	GMXA1009PVT70000UVC030BEN07			
2.1.1			1	
2.1.2			1	
2.1.3			1	
2.1.4			1	
2.2	SS1_A_SD_RS_RD_F	STAND, SS1-A, 46" X 25" X 20", BLACK PP/PE	1	
2.3				
2.3.1	DPA_A1A_PCV_SD_F1			
2.3.1.1	BPV_PCV_A	1/2in PVC/Teflon Back Pressure Valve	1	
2.3.1.2	PGI_160_PCV_A	160PSI CPVC/Teflon Pressure Gauge and Isolator 1/2in	1	
2.3.2	PPA_A_X_050OD_PCV_F1			
2.3.2.1	PD_164_PCV	164ML PVC/Viton Pulsation Dampener	1	
2.3.2.2	PRV_PCV_A	1/2in PVC/Teflon Pressure Relief Valve	1	
2.3.3	SPA_A1A_PCV_F1			
2.3.3.1	YS_PCV_A	1/2in PVC/Viton Wye Strainer	1	
2.3.4	BV_PCV_A1	PVC/Viton Ball Valves (Vented)	1	
2.3.5	CCA_PCV_A_F1			
2.3.5.1	CC_100_PCV_A	100ML PVC Calibration Column	1	
2.4	CP_TB_1F	One Pump Terminal Box Assy	1	

#	Material #	Description	Qty	Ext. Net
	Total price			**$25,598.20**

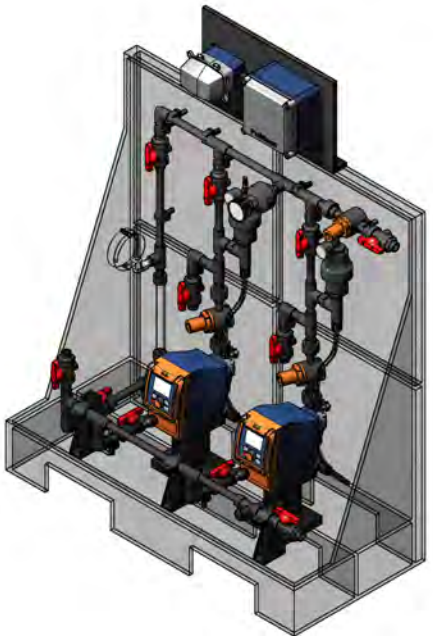
DWG No	REV
SS2-GXA-A-PCV-PD1-CC1-F1-PB-RS-RD-TB -200	0

NOTES:

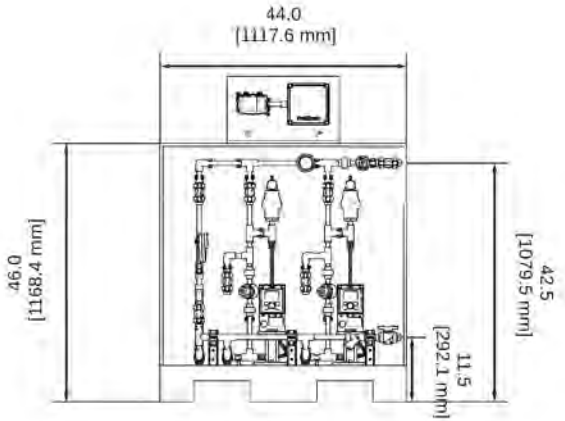
1. CHEMICAL SERVICE: Sodium Hypochlorite (12.5%)
2. PIPING MATERIAL: PVC / Viton SEALS UNLESS OTHERWISE REQUIRED BY COMPONENTS.
3. PUMPS: Solenoid Control, GMXA1009PVT70000UVC030BEN07, Rated 1.59 gph @ 145.00 psi / 6.00 lph @ 10.00 bar
4. TOLERANCES ON ALL DIMENSIONS ARE +/- 3/8" (10mm).



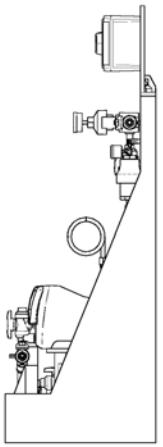
PLAN VIEW



ISOMETRIC VIEW



FRONT VIEW



SIDE VIEW

REV	DATE	DESCRIPTION	BY	APPD	REVD
0	04/28/26	FIRST ISSUE	GJS		

REVISIONS

CUSTOMER: Customer Not Specified

JOB No | PURCHASE ORDER No

TITLE: SS2-GXA-A-PCV-PD1-CC1-F1-PB-RS-RD-TB
GENERAL ARRANGMENT

ENGINEERS SEAL

ProMinent

PITTSBURGH, PA USA WWW.PROMINENT.US

PROMINENT FLUID CONTROLS LTD.
490 SOUTHGATE DRIVE.
GUELPH, ONTARIO, CANADA
N1H 6J3
TEL. 519 836 5692 FAX. 519 836 5226

PROMINENT FLUID CONTROLS INC.
RIDC PARK WEST
136 INDUSTRY DRIVE,
PITTSBURGH P.A., USA. 15275
TEL. 412 787 2484 FAX. 412 787 0704

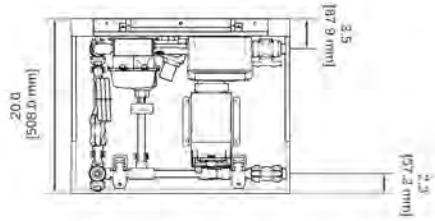
DESIGNED	GJS
DRAWN	GJS
CHECKED	KH
APPROVED	KH
SCALE	N. T. S.
DATE	04/28/26

DWG No	REV	PAGE
SS2-GXA-A-PCV-PD1-CC1-F1-PB-RS-RD-TB-200	0	1/1

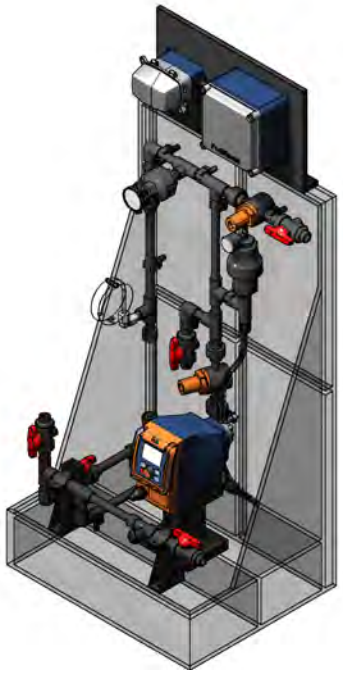
DWG No	REV
SS1-GXA-A-PCV-PD1-CC1-F1-SD-RS-RD-TB -200	0

NOTES:

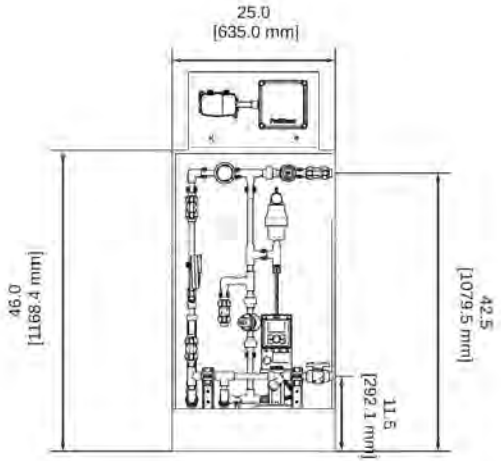
1. CHEMICAL SERVICE: Sodium Hypochlorite (12.5%)
2. PIPING MATERIAL: PVC / Viton SEALS UNLESS OTHERWISE REQUIRED BY COMPONENTS.
3. PUMPS: Solenoid Control, GMXA1009PVT70000UVC030BEN07, Rated 1.59 gph @ 145.00 psi / 6.00 lph @ 10.00 bar
4. TOLERANCES ON ALL DIMENSIONS ARE +/- 3/8" (10mm).



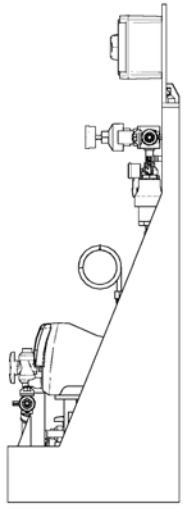
PLAN VIEW



ISOMETRIC VIEW



FRONT VIEW



SIDE VIEW

0	04/28/26	FIRST ISSUE	GJS		
REV	DATE	DESCRIPTION	BY	APPD	REVD

REVISIONS

CUSTOMER: Customer Not Specified

JOB No | PURCHASE ORDER No

TITLE: SS1-GXA-A-PCV-PD1-CC1-F1-SD-RS-RD-TB
GENERAL ARRANGMENT

ENGINEERS SEAL

ProMinent

PITTSBURGH, PA USA WWW.PROMINENT.US

PROMINENT FLUID CONTROLS LTD.
490 SOUTHGATE DRIVE.
GUELPH, ONTARIO, CANADA
N1H 6J3
TEL. 519 836 5692 FAX. 519 836 5226

PROMINENT FLUID CONTROLS INC.
RIDC PARK WEST
136 INDUSTRY DRIVE,
PITTSBURGH P.A., USA. 15275
TEL. 412 787 2484 FAX. 412 787 0704

DESIGNED	GJS	APPROVED	KH
DRAWN	GJS	SCALE	N. T. S.
CHECKED	KH	DATE	04/28/26

DWG No	REV	PAGE
SS1-GXA-A-PCV-PD1-CC1-F1-SD-RS-RD-TB-200	0	1/1

ProMod Systems Designer

System Component Data Sheets

ProMod Systems Designer

Component Data Sheets

Metering Pumps

ProMinent®

solenoid-driven metering pumps

ProMinent® gamma/ X Solenoid Diaphragm Metering Pumps

Overview: gamma/ X

The **gamma/ X** solenoid diaphragm metering pump incorporates a wealth of eXcellent ingenuity! With integrated pressure measurement, it ensures the smooth running of your metering process. The **gamma/ X** is ideal for all chemical metering applications. (see page 143 for spare parts)

- Capacity range from 0.24 GPH to 11.9 GPH, maximum discharge pressure up to 363 psi
- Simple adjustment of the capacity directly in GPH
- Configurable discharge stroke, continuous or pulsed dosing
- Configurable suction stroke duration
- Stroke rate adjustable from 1 – 12,000 strokes per hour
- Electronic stroke length adjustment, continuous from 0 - 100% (recommended range 30 - 100%)
- Suitable for continuous micro-metering from 1 ml/hr thanks to the innovative solenoid control
- Integrated pressure measurement allows for detection of blocked discharge line, broken discharge lines and air or gas bubbles trapped in the dosing head
- Acrylic/PVC, PVT (PVDF) and Stainless Steel liquid end material versions
- Auto degassing liquid ends in Acrylic/ PVC and PVT
- High viscosity liquid ends (PVT4) for viscosities of up to 3000 cP
- Large backlit graphic display and status LED's
- External control via voltage-free contacts with pulse multiplier/divider function
- External control via standard 4-20 mA signal, and scalable adjustment of mA signal to stroke rate
- Standard internal programmable timer for real-time dependent dosing routines i.e biocides, cooling towers etc.
- Standard pump capable of accepting 2-stage tank level sensor input, flow monitor input, diaphragm rupture sensor input and control cable input.
- NSF/ANSI 61 Approved Liquid ends
- Bluetooth, PROFIBUS, CANbus interface as an optional feature (see page 151 for PROFIBUS)

PROFIBUS

Bluetooth

ProMinent® gamma/ X Solenoid Diaphragm Metering Pumps

Capacity Data

Capacity data: gamma/ X

Pump Version	Capacity at Maximum Backpressure					Max. Stroking Rate	Tubing Connectors O.D. x I.D	Pre-Primed Suction Lift **		SS Liquid end connections FNPT	Shipping Weight lbs	
	psig	(bar)	GPH*	(l/h)	ml/stroke	Strokes/min	in	ft	(m)	in	NP/PV	SS
gamma/ X: with standard liquid ends												
1602	232	(16)	0.61	(2.3)	0.19	200	1/4 x 3/16	19.6	(6)	1/4	7.9	9
1604	232	(16)	0.95	(3.6)	0.30	200	1/4 x 3/16	16.4	(5)	1/4	7.9	9
0708	102	(7)	2.0	(7.6)	0.63	200	1/2 x 3/8	13.1	(4)	1/4	8.1	11
0414	58	(4)	3.56	(13.5)	1.13	200	1/2 x 3/8	9.8	(3)	1/4	8.1	11
0220	29	(2)	5.2	(19.7)	1.64	200	1/2 x 3/8	6.5	(2)	3/8	8.1	11
2504	363	(25)	1.0	(3.8)	0.32	200	(8 x 4mm)	13.1	(4)	1/4	10.8	12.1
1009	145	(10)	2.38	(9.0)	0.75	200	1/2 x 3/8	9.8	(3)	1/4	11.2	14.3
0715	102	(7)	3.83	(14.5)	1.21	200	1/2 x 3/8	9.8	(3)	1/4	11.2	14.3
0424	58	(4)	6.34	(24)	2.00	200	1/2 x 3/8	9.8	(3)	3/8	11.2	14.3
0245	29	(2)	11.9	(45)	3.70	200	1/2 x 3/8	6.5	(2)	3/8	11.5	15.4
gamma/ X: with auto-degassing liquid ends NPB9/ NPE9												
1602	232	(16)	0.34	(1.30)	0.11	200	1/4 x 3/16	6.9	(2.1)	~	7.9	~
1604	232	(16)	0.63	(2.40)	0.21	200	1/2 x 3/8	8.8	(2.7)	~	7.9	~
0708	101	(7)	1.8	(6.80)	0.57	200	1/2 x 3/8	6.5	(2)	~	8.1	~
0414	58	(4)	3.17	(12)	1.00	200	1/2 x 3/8	6.5	(2)	~	8.1	~
0220	29	(2)	4.75	(18)	1.5	200	1/2 x 3/8	6.5	(2)	~	8.1	~
1009	145	(10)	2.11	(8)	0.67	200	1/2 x 3/8	9.8	(3)	~	11.2	~
0715	101	(7)	3.56	(13.5)	1.00	200	1/2 x 3/8	8.2	(2.5)	~	11.2	~
0424	58	(4)	5.28	(20)	1.67	200	1/2 x 3/8	8.2	(2.5)	~	11.2	~
gamma/ X: with self-bleeding liquid ends, 2-port without bypass (PVT7)												
1604	232	(10)	0.42	(1.6)	0.13	200	1/4 x 3/16	6	(1.8)	~	7.9	~
0708	101	(7)	1.50	(5.7)	0.48	200	1/2 x 3/8	6	(1.8)	~	8.1	~
0414	58	(4)	3.17	(12.0)	1.00	200	1/2 x 3/8	6	(1.8)	~	8.1	~
0220	29	(2)	4.60	(17.4)	1.45	200	1/2 x 3/8	6	(1.8)	~	8.1	~
1009	145	(10)	1.58	(6.0)	0.50	200	1/2 x 3/8	6	(1.8)	~	11.2	~
0715	101	(7)	3.40	(12.9)	1.08	200	1/2 x 3/8	6	(1.8)	~	11.2	~
0424	58	(4)	5.07	(19.2)	1.60	200	1/2 x 3/8	6	(1.8)	~	11.2	~

gamma/ X metering pumps with high viscosity liquid ends (PVT 4) have a 10 – 20 % lower capacity rating and are not self-priming.

Positive suction is recommended and pumps supplied with ½" MNPT connections.

Permissible ambient temperature: 14 °F to 113 °F | Average power consumption: 78 W | Degree of protection: IP 66

** Capacity data represents minimum values, tested using water at 68 ºF (room temperature)*

*** Suction lift with pre-primed suction line and liquid end*

Materials In Contact With Chemicals

Liquid end materials in contact with media

	Pump head	Suction/discharge valve	Ball seat	Seals	Balls
NPE	Clear Acrylic	PVC	EPDM	EPDM	Ceramic
NPB	Clear Acrylic	PVC	FKM	FKM	Ceramic
PPT	Polypropylene	PVDF	PTFE	PTFE	Ceramic
PVT	PVDF	PVDF	PVDF	PTFE	Ceramic
SST	Stainless Steel	Stainless Steel	Ceramic	PTFE	Ceramic

Auto-degassing liquid ends in NP with a valve spring made of Hastelloy C and a PVDF valve insert. PVT7 version with PVDF/ PTFE wetted parts. Diaphragm with a PTFE face.

Permissible ambient temperature: 14 °F - 113 °F / Average power consumption: 25/30 W / Degree of protection: IP 66/NEMA 4X

FKM = fluorine rubber

ProMinent® gamma/ X
Solenoid Diaphragm Metering Pumps

Specifications

Maximum stroke length:	For 70mm solenoid approx. .05” For 85mm solenoid approx. .06”
Materials of construction	
Housing:	Fibreglass reinforced PPE (Polyphenylene Ether)
Diaphragm:	PTFE faced EPDM with plastic core
Liquid end options:	Acrylic/PVC, PVDF, Stainless Steel
Enclosure rating:	IP 65
Power supply:	100 – 230 VAC 1 Phase 50 / 60 Hz ± 10%
Power consumption:	1602 / 1604 / 0708 / 0414 / 0220 25 W 2504 / 1009 / 0715 / 0424 / 0245 30 W
Check valves:	Double ball suction / discharge (PVT4 with spring loaded single ball)
Power cord:	6ft
Relay cable (optional):	6ft
Relay Options	
Identcode Option 1:	Relay contact rated 230 VAC 2 A Max
Identcode Option 4:	Both relay contacts rated 24 V, 100 mA Max
Identcode Option C:	Isolated 4 – 20 mA output can drive up to 300 Ω maximum impedance Relay contact rated 24 V 100 mA
Ambient temperature range	
In operation:	14 °F to 113 °F
Storage & Transport:	-4 °F to 140 °F
Max. fluid operating temp:	**Material / Constant / Short Term*** Acrylic/PVC / 113 °F / 140 °F PVDF / 113 °F / 248 °F SS / 113 °F / 248 °F *15 minutes at 29 psi maximum
Climate:	95% Relative humidity – non-condensing
Sound pressure level:	LpA < 70 dB according to EN ISO 20361
Warranty:	2 years on pump drive, 1 year on liquid end
Valve threads:	NP / PVT M20 x 1.5 (provided with adapters for tubing)
Standard production test:	All pumps are tested for capacity at maximum pressure prior to shipment
Max solids size in fluid:	Versions 1602 / 1604 / 2504 = 15µ Versions 0708 / 0414 / 0220 / 1009 / 0715 / 0424 / 0245 = 50 µ
Contact input	
Minimum pulse duration:	20 ms
Maxiumum pulse input:	25 pulses / second
Analog Input Impedance:	120 Ohms
Recommended Viscocity:	Max. 200 cPs for standard liquid end Max. 500 cPs for valve with springs Max. 50 cPs for auto-degassing liquid ends Max. 3000 cPs for high-viscosity liquid ends

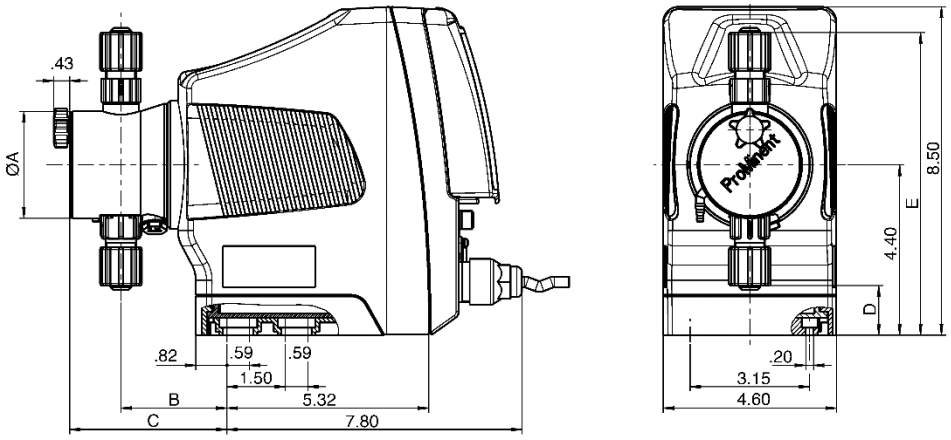
ProMinent® gamma/ X
Solenoid Diaphragm Metering Pumps

Identcode Ordering System

GMXa	Gamma/ X															
	Version	**Capacity**		**Version**	**Capacity**		**Version**	**Capacity**								
	1602	0.61 gph (2.3 l/h), 232 psi (16 bar)		0220	5.2 gph (19.7 l/h), 29 psi (2 bar)		0424	6.34 gph (24 l/h), 58 psi (4 bar)								
	1604	0.95 gph (3.6 l/h), 232 psi (16 bar)		2504	1.0 gph (3.8 l/h), 363 psi (25 bar)		0245	11.9 gph (45 l/h), 29 psi (2 bar)								
	0708	2.0 gph (7.6 l/h), 102 psi (7 bar)		1009	2.38 gph (9.0 l/h), 145 psi (10 bar)											
	0414	3.56 gph (13.5 l/h), 58 psi (4 bar)		0715	3.83 gph (14.5 l/h), 102 psi (7 bar)											
		Liquid end material:														
		NP	Clear acrylic /PVDF, for auto-degassing version Clear acrylic / PVC													
		PP	Polypropylene													
		PV	PVDF/PVDF													
		SS	Stainless Steel													
		TT	PTFE Carbon-loaded													
			O-rings:													
			B	FKM-B/PFTE coated												
			E	EPDM/PTFE coated												
			T	PTFE/PTFE coated												
				Liquid end version:												
				0	Non-bleed version, no valve spring only with NP, TT and SS and type 0245											
				1	Non-bleed version, with valve spring only with NP, TT and SS and type 0245											
				2	Bleed function, no valve springs only with PV, NP not for type 0245											
				3	Bleed function, with valve springs only with PV, NP not for type 0245											
				4	Version for highly viscous media only with PV, types 1604, 0708, 0414, 2504, 1009, 0715, 0424											
				7	Self-bleeding without bypass, only with PV, not for versions 2504, 0245, and 1602											
				9	Auto-degassing with bypass (SEK), only with NP, not for types 2504 and 0245											
					Hydraulic connections:											
					6	Standard (SS/TT)										
					M	1/4" x 3/16"										
					N	3/8" x 1/4"										
					O	1/2" x 1/4" for 2504 only										
					Q	1/2" x 3/8"										
						Diaphragm rupture indicator:										
						0	Without diaphragm rupture indicator									
						1	With diaphragm rupture indicator, optical sensor									
							Version:									
							0	Standard								
								Logo:								
								0	Standard, with logo							
									Electrical Connection:							
									U	100-230 V, ±10 %, 50/60 Hz						
										Cable and plug with 6ft (2m) power cord, single phase:						
										A	European plug					
										D	N. American plug, 115 V					
											Relay, pre-set to:					
											0	Without relay				
											1	1 x changeover contact 230 V – 2 A, fault indicating relay N/C				
											4	2 x N/O 24 V – 100 mA, such as 1 + pacing relay				
											C	1 x N/O 24 V – 100 mA, such as 1 + 4 – 20 mA output				
											F	Auto degassing module (not available for version 2504)				
											G	Auto degassing module + fault relay (not available for version 2504), comes with panel				
												Accessories:				
												0	Not included (for PVDF, TT, SS)			
												1	With foot and injection valve, 5 ft PVC suction tubing, 10 ft PE discharge tubing			
													Control Variants:			
													0	Manual + external 1:1 with pulse control		
													3	Manual + external with pulse control + analogue 0/4 - 20 mA		
													5	Options 3 + 4 week process timer		
													C	Options 3 + CANopen		
													R	Options 3 + PROFIBUS® DP interface, M12 Note: no relay with PROFIBUS® version "R"		
														Metering Monitor:		
														0	Pulse signal input	
															Bluetooth connection:	
															0	Not included
															B	Included
																Language:
																EN Standard
GMXa	1601	PP	E	1	M	0	0	0	U	D	1	0	0	0	0	EN

ProMinent® gamma/ X
Solenoid Diaphragm Metering Pumps

Dimensional Drawings



Material design **PPT**

Type	Ø A	B	C	D	E
0245	4.30	3.00	–	.55	8.22
0424, 0220	3.50	3.00	4.33	.95	7.95
0715, 0414	3.50	2.91	4.21	.95	7.95
1009, 0708	3.50	2.91	4.25	.95	7.95
1604	2.75	2.80	4.17	1.25	7.80
1602	2.75	2.80	4.17	1.25	7.80

Material design **NPT**

Type	Ø A	B	C	D	E
0245	4.30	3.00	4.13	.55	8.27
0424, 0220	3.50	3.00	4.09	.90	7.87
0715, 0414	3.50	3.00	4.09	.90	7.87
1009, 0708	3.50	2.91	4.01	.90	7.87
1604	2.75	3.03	4.13	1.30	7.52
1602	2.75	3.03	4.13	1.30	7.52

Material design **PVT**

Type	Ø A	B	C	D	E
0245	4.30	3.00	–	.55	8.22
0424, 0220	3.50	3.11	3.50	.98	8.00
0715, 0414	3.50	2.87	3.50	.98	8.00
1009, 0708	3.50	2.95	3.62	.98	8.00
1604	2.75	2.80	3.31	1.42	7.72
1602	2.75	2.80	3.31	1.42	7.72

Technical Data
BPV_PCV_A

ProMod Systems Designer

Component Data Sheets

Backpressure & Pressure Relief Valves

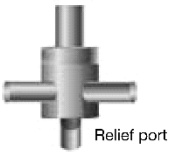
ProMinent®

Pump & Systems Accessories

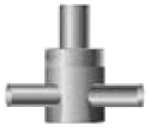
Backpressure Valves

Pressure Relief Valves

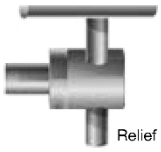
Backpressure, antisiphon and pressure relief valves



In-line pressure relief valve (3 port)



Backpressure valve (2 port)



Backpressure valve on tee for pressure relief

Backpressure (2-port) valves may be used in-line to provide a constant discharge pressure for protection from siphoning, or they may be teed off of the discharge line for pressure relief, discharging back to the source tank or to the pump suction line to create a bypass.

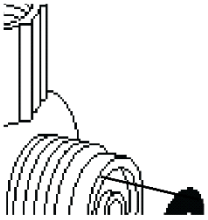
Pressure relief (3-port) valves are mounted in the discharge line, featuring a separate relief port which discharges back to the source tank or to the pump suction line to create a bypass.

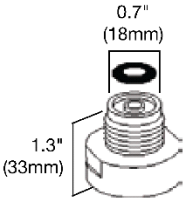
Backpressure valves provide several functions: they improve repeatability by providing a constant discharge pressure; they provide antisiphon protection for discharge into pressurized water lines or vacuums, or where suction head exceeds discharge head; and they minimize pulsation when used in conjunction with a pulsation dampener.

In-line backpressure/antisiphon and pressure relief valves

These adjustable backpressure (2-port) and pressure relief (3-port) valves have FNPT ports and require tubing adapters for use with flexible tubing.

Can be adjusted with screwdriver.





Adapter included with all back-pressure/pressure relief valves. Optional use in the event of diaphragm failure.

DIMENSIONS: 1/4" to 2" valves

D	A (in)	B (in)	C (in)
1/4"	4.90	2.6	1.2
*1/4"	*3.5	*2.375	*0.75
1/2"	4.9	2.6	1.2
*1/2"	*5.5	*3.5	*1.125
3/4"	5.4	3.5	1.1
1"	5.7	3.9	1.4
1-1/2"	8.5	4.6	2.2
2"	8.5	4.6	2.2v

***Note:** Dimensions apply to SS and PTFE valves only.

DIMENSIONS (for replacement valves only): 1/4" to 2" valves - SEE PG. 8

D	A (in)	B (in)	C (in)
1/4"	3.9	2.375	0.75
*1/4"	*3.5	*2.375	*0.75
1/2"	4.6	2.375	1.125
*1/2"	*5.5	*3.5	*1.125
3/4"	5.5	3.5	1.125
1"	5.8	3.5	1.25
1-1/2"	9.0	4.5	2.1
2"	9.0	5.0	2.1

***Note:** Dimensions apply to SS, PVDF and PTFE valves only.

Technical data

Size:
1/2"

Diaphragm Materials:
PTFE-faced EPDM

Liquid Handling Materials:
PP, PVC, PTFE, PVDF
316 Stainless Steel

Pressure Adjustment:
0-150 psig (0-10.3 bar)

Flow rates @ 45 psig (3.1 bar):
1/4" - 132 U.S. gph (500 L/h)
1/2" - 132 U.S. gph (500 L/h)

Flow rates @ 150 psig:
1/2" (PP, PVC) - 200 U.S. gph (757 L/h)
1/2" (PVDF, TT, SS) - 300 U.S. gph (1135 L/h)
3/4" - 300 U.S. gph (1135 L/h)
1" - 500 U.S. gph (1893 L/h)
1-1/2" - 900 U.S. gph (3407 L/h)
2" - 1200 U.S. gph (4542 L/h)

Max. Temperature:
PP - 195°F (90°C)
PVC - 140°F (60°C)
PTFE - 250°F (121°C)
PVDF - 250°F (121°C)
316 Stainless - 250°F (121°C)
Max. Pressure Rating 170 psig @ 120°F

Technical Data
PGI_160_PCV_A

ProMod Systems Designer

Component Data Sheets

Pressure Gauge with Isolator

BOTTOM CONNECTED ALL STAINLESS GAUGES

Model BR301L

RANGE	CODE	MAJOR INC.	MINOR INC.
30/0" VAC	A	5	0.5
30/0/15	CB	5	0.5
30/0/30	CC	10	1
30/0/60	CD	10	1
30/0/100	CE	20	2
30/0/150	CF	20	2
30/0/300	CH	50	10
0/15	B	2	0.2
0/30	C	5	0.5
0/60	D	10	1
0/100	E	20	2
0/160	F	20	2
0/200	G	40	4
0/300	H	50	5
0/400	I	50	5
0/500	J	100	10
0/600	K	100	10
0/800	L	100	10
0/1000	M	200	20
0/1500	N	200	20
0/2000	O	400	50
0/3000	P	500	50
0/4000	Q	500	50
0/5000	R	1000	100
0/6000	S	2000	200
0/10,000	U	2000	200
0/15,000	V	2000	200

MODEL BR301L

FEATURES:

The Model BR301L Series from Blue Ribbon Corporation is a high-quality line of liquid-filled bottom connected all stainless steel gauges. Their glycerine filling helps to dampen the effects of vibration, which will extend the life of the gauge.

This gauge is typically used on hydraulic & pneumatic systems, as well as any commercial or industrial application not corrosive to 316L stainless steel wetted parts, or where glycerine filling is suitable for use.

SPECIFICATIONS:

- Stainless Steel Case and Bezel
- Stainless Steel Internals
- 316 Stainless Steel Bourdon Tube & Connection
- IP65 Enclosure
- Liquid Filled (Dry Available)
- Accuracy
  - 2½" Dial: 1.6%
  - 4" and 6" Dials: 1%
- Dual Scale: PSI & BAR (x100=kPa)
- Single Scale (PSI) Available
- Ambient Temperature
  - Filled: +30 °F to +160 °F
  - Dry: -30 °F to +180 °F

FIELD OPTIONS:

- Dial Sizes
  - 2½", 4", and 6"
- Connection Sizes
  - ¼"(M) NPT on 2½" and 4"
  - ½"(M) NPT on 4" and 6"
- Safety Glass Lens
- Welded Socket
- Overpressure Limit: 30% FSO
- Working Pressure: 75% FSO

Toll Free: +1.877.774.4751 Tel: +1.716.773.9300 Fax: +1.716.773.5019 Email: BRsales@blueribboncorp.com Web: www.blueribboncorp.com

BR-Gauges-BR301L-062015

SIGMAMOTOR INC.

PRESSURE GAUGE ISOLATOR with switch

Provides Isolation From Hazardous Or Corrosive Liquids

SIGMAMOTOR Pressure Gauge Isolators allow standard pressure gauges to be used in corrosive services.

The upper section (gauge side) is filled with glycerin, mineral oil, silicone or halocarbon. A diaphragm separates the glycerin from the lower section which connects to the pressure source.

A 1/2" port is provided for connection to the pressure source.

Features

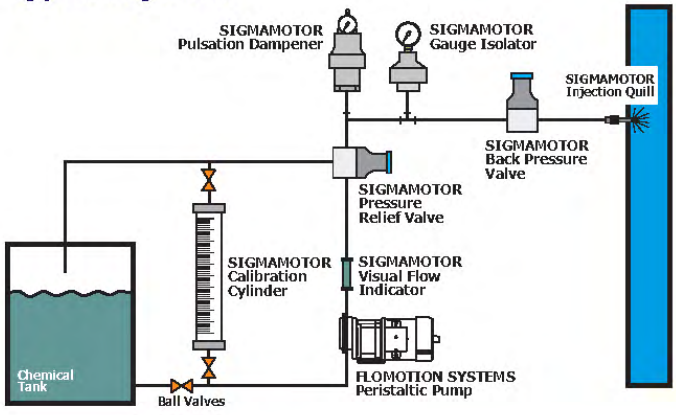
- CNC precision machined parts
- Variety of materials available
- Various pressure ranges available
- Cost effective and reliable
- 2.5" Dial (4" dial optional)
- Pre-filled with glycerin between gauge and diaphragm
- Optional adjustable pressure switch* can be adjusted from 2% to 90% of full scale value. Reed switch. Max switching voltage: 75VDC / 50 VAC. Max switching current: 0.5A DC or AC with resistive load. Max switching hysteresis: 2.5%.

*Front facing gauge only

316 SS

POLYPROPYLENE

Typical System



Bayonet ring twists off for easy pressure switch acjustment. Simply move the red indicator.

Shown with optional pressure switch

SIGMAMOTOR PRESSURE GAUGE ISOLATOR

NSF-61 Approved Materials

GI: N - 160 - CP - T - CBM
1 2 3 4 5

Example: GI-N-030C-P-V-SS

INLET CONNECTION TYPE 1	
NPT	N
SOCKET	S
FLANGED	F
UNION	U

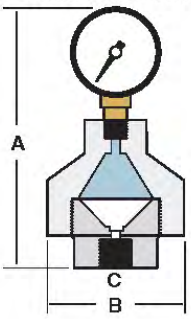
SIZE 2								
SELECT:	C030	030	060	100	160	200	200S	300
PSI RATING	-30,0,30	0-30	0-60	0-100	0-160	0-200	0-200	0-300
A-Height (in) front facing gauge	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6
A-Height (in) top facing gauge	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
B-Diameter (in)	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2
C-Connection (in)	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2
SPECIAL	Com-pound						With Switch*	

ISOLATOR BODY MATERIAL 3	
PVC	P
POLYPROPYLENE	PP
CPVC	CP
PTFE	T
Kynar® PVDF	K
316 SS	S
ALLOY 20	A
HASTELLOY C276	H

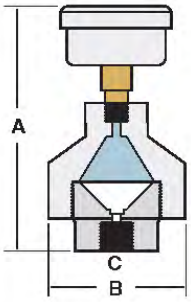
DIAPHRAGM MATERIAL 4	
VITON	V
EPDM	E
PTFE	T

OPTIONS 5	
STANDARD GAUGE	
ALL 316 STAINLESS STEEL GAUGE	SS
CENTER BACK MOUNT GAUGE	B
HALOCARBON	H
SILICONE	S
MINERAL OIL	M

FRONT FACING GAUGE



CENTER BACK MOUNT GAUGE



* Front facing gauge only

Material:	PVC	CPVC	PP	PVDF	PTFE	METAL
Maximum Pressure:	150 psi	150 psi	150 psi	150 psi	150 psi	350 psi
Maximum Temperature:	140 °F	195 °F	195 °F	285 °F	480 °F	300 °F

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SIGMAMOTOR INC.

Technical Data

ProMod Systems Designer

Component Data Sheets

Pulsation Dampener

PD_164_PCV

SIGMAMOTOR INC.

PULSATION DAMPENERS

NSF

Minimize pulsating output on positive displacement pumps

SIGMAMOTOR FL Series Pulsation Dampeners offer an inexpensive solution to protect chemical feed systems from harmful effects of pulsating flows.

- Simple chargeable design
- Robust CNC precision machined body
- Provides steady flows for better flow metering accuracy
- Eliminates vibrations in pipes reducing the potential for leaks
- Smooths flows in spray applications

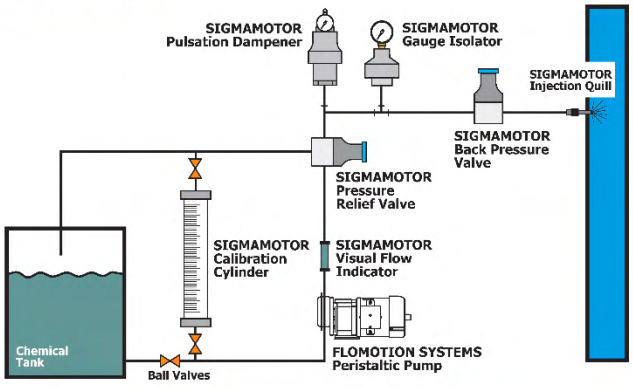
Features

- Capacity - 12, 40 or 85 cu in
- Variety of materials available
- Various Bladder materials
- Charging Valve - Schrader Type

85 cu in

40 cu in

Typical System



12 cu in

SIGMAMOTOR PULSATION DAMPENER

NSF-61 Approved Materials

FL: N (1) - 12 (2) - CP (3) - E (4) - __ (5)

Example: FL-N-12-P-V-SS

INLET CONNECTION TYPE	1
NPT	N
SOCKET	S
FLANGED	F
UNION	U

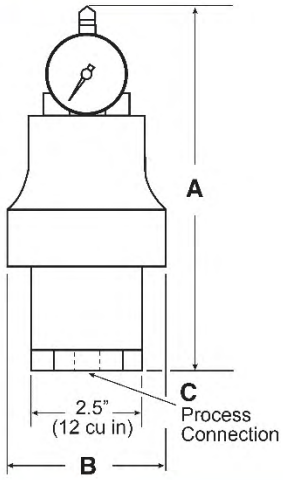
SIZE	2		
SELECT:	12	40	85
CU IN SIZE	12	40	85
ML SIZE (in)	200	660	1400
A-Height (in)	7.8	8.25	11.5
B-Diameter (in)	3.45	5.5	5.5
C-Connection (in)	1/2	1	1

DAMPENER BODY MATERIAL	3
PVC	P
POLYPROPYLENE	PP
CPVC	CP
PTFE	T
Kynar® PVDF	K
316 SS	S
ALLOY 20	A
HASTELLOY C276	H

BLADDER MATERIAL	4
VITON	V
EPDM	E
PTFE (12 CU IN ONLY)	T

GAUGE OPTIONS	5
STANDARD GAUGE	
ALL STAINLESS STEEL	SS

DIMENSIONS



Material:	PVC	CPVC	PP	PVDF	METAL
Maximum Pressure:	150 psi	150 psi	150 psi	150 psi	350 psi
Maximum Temperature:	140 °F	195 °F	195 °F	300 °F	300 °F

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SIGMAMOTOR INC.

Technical Data

ProMod Systems Designer

Component Data Sheets

Wye Strainer

YS_PCV_A

HAYWARD®

YS Series Y-Strainers

1/2" - 2" PVC, CLEAR PVC AND CPVC
2-1/2" - 4" PVC AND CPVC

KEY FEATURES

- Available in PVC, CPVC and Clear PVC
- Horizontal or Vertical Installation
- FPM O-Ring Seals
- 2:1 Open Area Ratio
- Hex Cap for Easy Access to Screen
- Standard Screen has 1/32" Perforation

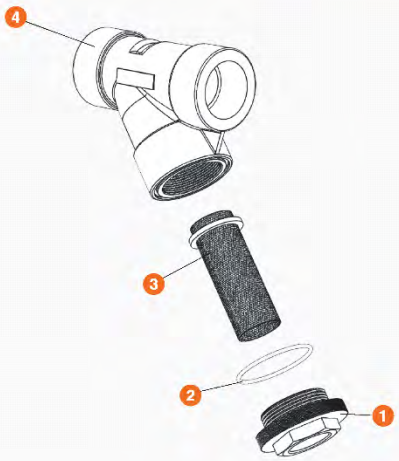
OPTIONS

- Stainless Steel Perforated or Mesh Strainer Screens Available in Various Sizes and Alloy Materials

MATERIALS

- PVC Cell Class 12454 per ASTM D1784
- Clear PVC Cell Class 12454 per ASTM D1784
- CPVC Cell Class 23447 per ASTM D1784
- FPM and EPDM O-Ring Seals

TECHNICAL INFORMATION



SELECTION CHART

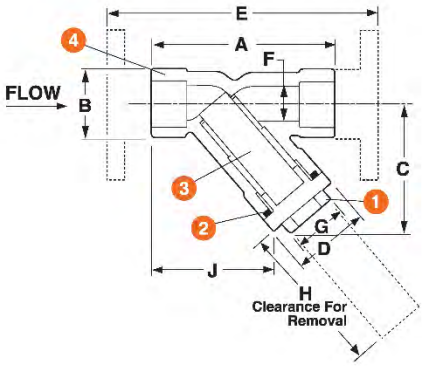
SIZE	MATERIAL	END CONNECTION	SEALS	PRESSURE RATING
1/2" – 1" (DN15 – DN25)	PVC, CPVC or Clear PVC	Socket or Threaded	FPM and EPDM	150 PSI @ 70°F 10 Bar @ 21°C Non-Shock
1–1/4" (DN32)	PVC and Clear PVC			
1–1/2" (DN40)	PVC, CPVC or Clear PVC			
2" (DN50)				
2–1/2" (DN65)	PVC	Socket, Threaded or Flanged		
3–4" (DN80-DN100)	PVC and CPVC			

* PVC and CPVC socket ends available to ISO 727-1 and threaded ends to BS21. Flanged ends available in DIN / EN PN10.

YS Series
Y-Strainers
1/2" - 2" PVC, CLEAR PVC AND CPVC
2-1/2" - 4" PVC AND CPVC

TECHNICAL INFORMATION, *CONTINUED*

PARTS LIST
1. Cap
2. O-Ring Seal
3. Screen
4. Body



SCREEN OPTIONS

PERFORATION SIZES	MESH SIZES	SCREEN MATERIAL
1/32"	20	SSTL, Hastelloy, Monel and Titanium
1/16"	40	
1/8"	60	
5/32"	80	
3/16"	100	
1/4"	200	
3/8"	325	
1/32"	N/A	PVC and CPVC
1/16"		
1/8"		
3/16"		

DIMENSIONS

SIZE in / DN	A in / mm	B in / mm	C in / mm	D in / mm	E in / mm	F in / mm	G in / mm	H in / mm	J in / mm	WEIGHT lbs / kg SOC / THD	WEIGHT lbs / kg FLANGED
1/2 / 15	3.38 / 86	1.38 / 35	2.25 / 57	1.50 / 38	N/A	.56 / 14	1.00 / 25	2.13 / 54	2.50 / 64	.25 / .11	N/A
3/4 / 20	4.18 / 106	1.69 / 43	2.88 / 73	2.00 / 51	N/A	.81 / 21	1.25 / 32	2.75 / 70	3.00 / 76	.63 / .29	N/A
1 / 25	5.19 / 132	2.00 / 51	3.63 / 92	2.16 / 55	N/A	1.00 / 25	1.50 / 38	3.30 / 84	3.32 / 84	.88 / .40	N/A
1-1/4 / 32	6.63 / 168	2.63 / 67	4.50 / 114	2.94 / 75	N/A	1.25 / 32	2.00 / 51	4.50 / 114	4.45 / 113	1.75 / .79	N/A
1-1/2 / 40	6.63 / 168	2.63 / 67	4.50 / 114	2.94 / 75	N/A	1.56 / 40	2.00 / 51	4.50 / 114	4.45 / 113	1.63 / .74	N/A
2 / 50	7.63 / 194	3.38 / 86	5.38 / 137	3.75 / 95	11.00 / 279	2.00 / 51	2.38 / 60	5.06 / 129	4.88 / 124	3.00 / 1.36	5.00 / 2.27
2-1/2 / 65	10.31 / 262	4.69 / 119	7.25 / 184	5.25 / 133	N/A	2.90 / 74	3.50 / 89	6.60 / 168	6.54 / 166	7.75 / 3.52	N/A
3 / 80	10.31 / 262	4.69 / 119	7.25 / 184	5.50 / 140	14.37 / 365	2.90 / 74	3.50 / 89	6.60 / 168	6.54 / 166	7.50 / 3.40	12.25 / 5.56
4 / 100	12.81 / 325	5.75 / 146	8.88 / 226	6.18 / 157	17.73 / 450	3.78 / 96	4.25 / 108	8.00 / 203	8.58 / 218	9.50 / 4.30	17.50 / 7.94

Dimensions are subject to change without notice – consult factory for installation information

Cv VALUES*

SIZE in / DN	Cv VALUES	SIZE in / DN	Cv VALUES
1/2 / 15	4.0	2 / 50	28
3/4 / 20	6.8	2-1/2 / 65	40
1 / 25	9.0	3 / 80	65
1-1/4 / 32	12	4 / 100	100
1-1/2 / 40	28		

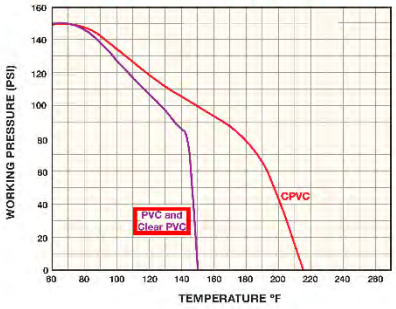
* With 1 / 32" plastic screen

PRESSURE LOSS CALCULATION FORMULA

$$\Delta P = \left[\frac{Q}{Cv}\right]^2$$

ΔP = Pressure Drop
Q = Flow in GPM
Cv = Flow Coefficient

OPERATING TEMPERATURE/PRESSURE



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Visit us at: haywardflowcontrol.com

120

Technical Data

ProMod Systems Designer

Component Data Sheets

Ball Valves

BV_PCV_A1

Specifications

Sizes: 1/2" – 6"
Models: PVC & CPVC: Socket Threaded and Flanged (ANSI)
PP & PVDF: IPS and Metric (DIN) Socket, Threaded, Butt and Flanged (ANSI)
Bodies: PVC, CPVC, PP and PVDF
Seats: PTFE backed with EPDM or FKM
Seals: EPDM or FKM or AFLAS®‡

Sizes 1/2" - 4" PVC/EPDM/FKM Models
NSF-61 Certified

‡ Trademark of Asahi Glass Co., Ltd.

Standard Features (Sizes 1/2" – 6")

- Pressure rated up to 230psi (PVC, CPVC, PVDF)
- Double O-ring seals on stem for added protection
- Full bore, sizes 1/2" – 2"
- Full vacuum rated, all sizes
- Blocks in two directions, upstream and downstream, leaving full pressure on the opposite end of the valve
- Integrally molded ISO mounting pad for both manual and actuated operations
- Integrally molded base pad to mount valves securely or panel mounting
- PTFE seats with elastomeric backing cushions ensure bubble tight shut-off and a low fixed torque, while at the same time compensating for wear
- True union design for easier installation or repairs without expanding the pipe system
- Built-in spanner wrench on the handle for valve disassembly and assembly
- Two sets of end connectors (socket and threaded) included with all PVC and CPVC valves in sizes 1/2"– 2"
- CPVC threaded end connectors on sizes 1/2" – 1" come with stainless steel reinforcing rings
- New PTFE seat design – Facilitates easier field maintenance if required
- Tapered O-ring groove – Helps to keep the end connector O-rings on the valve body during installation
- Body flats – Flats have been added to either side of the valve body where a wrench can be applied to prevent the valve body from turning when the union nuts are tightened
- 1/2 - 2 " PVC and CPVC T-21A design

Options

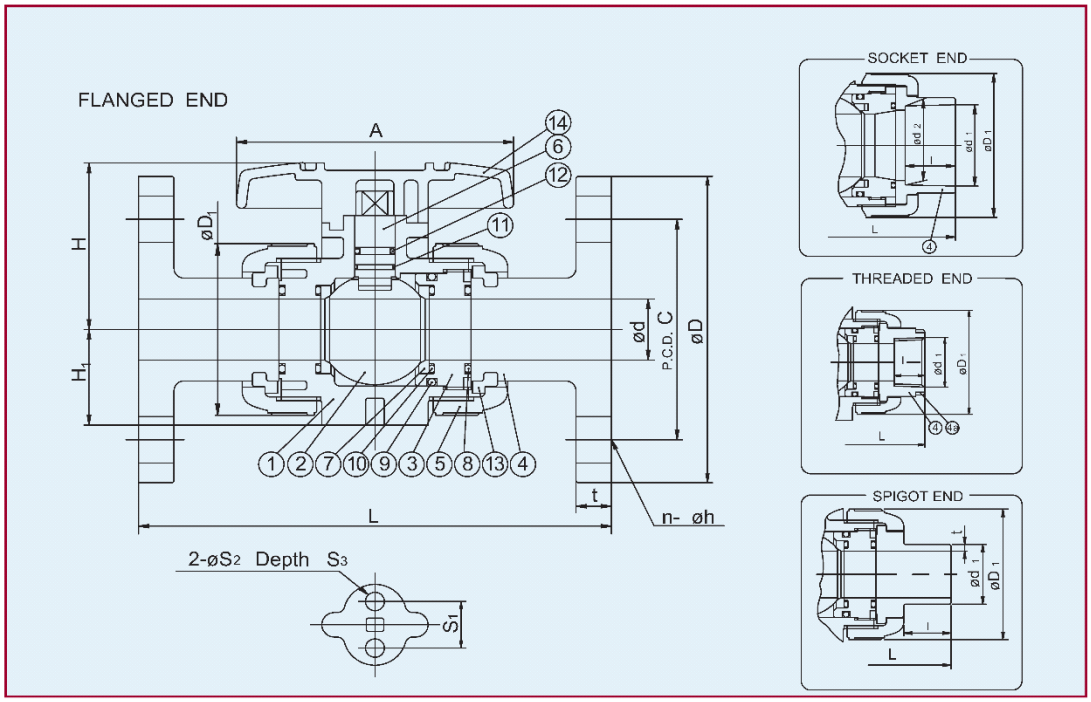
- Pneumatic and electric actuators and accessories
- Stem extensions
- 2" square operating nut or "T" nut
- Locking handles
- Limit switches
- Vented ball

Parts List (Sizes 1/2" – 2")

PARTS			
NO.	DESCRIPTION	PCS.	MATERIAL
1	Body	1	PVC, CPVC, PP, PVDF
2	Ball	1	PVC, CPVC, PP, PVDF
3	Carrier	1	PVC, CPVC, PP, PVDF
4	End Connector	2	PVC, CPVC, PP, PVDF
5	Union Nut	2	PVC, CPVC, PP, PVDF
6	Stem	1	PVC, CPVC, PP, PVDF
7	Seat	2	PTFE
8	O-Ring (A)	2	EPDM, FKM, Others
9	O-Ring (B)	1	EPDM, FKM, Others
10	O-Ring (C)	2	EPDM, FKM, Others
11	O-Ring (D)	1	EPDM, FKM, Others
12	O-Ring (E)	1	EPDM, FKM, Others
13	Stop Ring*	2	PVDF
14	Handle	1	ABS
4a	Ring**	2	304 Stainless Steel

* Used for flanged end.
** Used for CPVC body, threaded end, 1/2"–1".

Type-21/21A Ball Valves



Dimensions (Sizes 1/2" – 2") (in.)

NOMINAL SIZE			FLANGED						SOCKET										
			ANSI CLASS 150						PVC, CPVC				PP, PVDF (DIN)				PP, PVDF (IPS)		
									ASTM SCH 80				DIN 16962						
INCHES	mm	d	D	C	n	h	L	t	d1	d2	l	L	d1	d2	l	L	d1	l	L
1/2	15	0.59	3.50	2.38	4	0.62	5.63	0.47	0.848	0.836	0.875	4.45	0.768	0.760	0.57	3.90	0.83	0.87	4.45
3/4	20	0.79	3.88	2.75	4	0.62	6.77	0.55	1.059	1.046	1.000	5.08	0.965	0.957	0.63	4.45	1.03	1.00	5.08
1	25	0.98	4.25	3.12	4	0.62	7.36	0.55	1.325	1.310	1.125	5.75	1.240	1.232	0.71	4.84	1.30	1.13	5.75
1-1/4	32	1.26	4.62	3.50	4	0.62	7.48	0.63	1.670	1.655	1.250	6.46	1.553	1.543	0.81	5.47	1.65	1.25	6.46
1-1/2	40	1.57	5.00	3.88	4	0.62	8.35	0.63	1.912	1.894	1.375	7.24	1.947	1.937	0.93	5.87	1.89	1.37	7.24
2	50	2.01	6.00	4.75	4	0.75	9.21	0.63	2.387	2.369	1.500	8.23	2.461	2.445	1.08	6.93	2.36	1.50	8.23

NOMINAL SIZE		THREADED			SPIGOT (BUTT END)												
					PP,PVDF												
					DIN 3442		PP	PVDF									
INCHES	mm	d1	l	L	d1	l	t	t	L	D1	H	H1	A	S1	S2	S3	
1/2	15	1/2 - 14 NPT	0.59	4.02	0.787	0.728	0.098	0.075	4.882	1.89	2.03	1.14	3.62	0.75	0.29	0.43	
3/4	20	3/4 - 14 NPT	0.67	4.72	0.984	0.866	0.106	0.075	5.669	2.36	2.34	1.38	3.94	0.75	0.29	0.43	
1	25	1 - 11-1/2 NPT	0.79	5.16	1.260	0.886	0.118	0.094	6.063	2.76	2.68	1.54	4.33	0.75	0.29	0.43	
1-1/4	32	1-1/4 - 11-1/2 NPT	0.87	5.91	1.575	1.024	0.146	0.094	6.850	3.23	3.17	1.85	4.76	1.18	0.35	0.59	
1-1/2	40	1-1/2 - 11-1/2 NPT	0.98	6.42	1.968	1.260	0.181	0.118	7.638	3.94	3.50	2.17	5.16	1.18	0.35	0.59	
2	50	2 - 11-1/2 NPT	1.10	7.76	2.480	1.417	0.228	0.118	8.819	4.96	4.04	2.60	6.26	1.18	0.35	0.59	

Note: The shape and appearance of assembly differ a little with nominal size compared to this drawing.

Type-21/21A Ball Valves

Pressure vs. Temperature (psi, water, non-shock)

NOMINAL SIZE		PVC				CPVC						PP				PVDF				
INCHES	mm	30° F 70° F	71° F 105° F	106° F 120° F	121° F 140° F	30° F 70° F	71° F 105° F	106° F 120° F	121° F 140° F	141° F 175° F	176° F 195° F	- 5° F 85° F	86° F 120° F	121° F 140° F	141° F 175° F	- 5° F 70° F	71° F 105° F	106° F 140° F	141° F 175° F	176° F 210° F
1/2-2	15-50	230	170	150	30	230	170	150	120	75	55	150	110	90	55	230	185	150	115	85
2-1/2	65	230	170	150	NA	230	170	150	120	75	55	150	95	70	40	230	185	150	115	85
3	80	230	170	150	NA	230	170	150	85	55	40	150	95	70	40	230	185	150	100	70
4-6	100-150	150	150	150	NA	150	150	150	85	55	40	150	95	70	40	150	150	150	100	70

Sample Specification

All Type-21/21A ball valves, sizes 1/2" to 4", shall be of true union design with two-way blocking capability. All O-rings shall be EPDM or FKM with PTFE seats. PTFE seats shall have elastomeric backing cushion of the same material as the valve seals. Stem shall have double O-rings and be of blowout-proof design. The valve handle shall double as carrier removal and/or tightening tool. ISO mounting pad shall be integrally molded to valve body for actuation. PVC conforming to ASTM D1784 Cell Classification 12454A, CPVC conforming to ASTM D1784 Cell Classification 23567-A, PP conforming to ASTM D4101 Cell Classification PP0210B67272 and PVDF conforming to ASTM D3222 Cell Classification Type II. The ball valves, except PP, shall have a pressure rating of 230psi for sizes 1/2" to 3" and 150psi for 4" (150psi for PP, all sizes) at 70° F. Type-21/21A ball valves must carry a two year guarantee, as manufactured by Asahi/America, Inc.

Cv Values

NOMINAL SIZE		Cv
INCHES	mm	
1/2	15	14
3/4	20	29
1	25	47
1-1/4	32	72
1-1/2	40	155
2	50	190
2-1/2	65	365
3	80	410
4	100	680

Weight (lbs.)

NOMINAL SIZE		SOCKET	FLANGED
INCHES	mm	THREADED	
1/2	15	0.44	1.10
3/4	20	0.66	1.54
1	25	1.1	2.70
1-1/4	32	1.54	3.30
1-1/2	40	2.64	4.40
2	50	4.4	8.15
2-1/2	65	6.17	8.80
3	80	9.7	13.00
4	100	24.00	26.67

Caution

- Never remove valve from pipeline under pressure.
- Always wear protective gloves and goggles.
- Watch out for trapped fluid in valve. It is safe to close valve before removing it from the pipeline.

Caution

- Do not use ball valves where media has suspended particles. Use the following valves:
  - Butterfly valves – PVDF disc is most abrasion resistant. Make sure of chemical compatibility.
  - Diaphragm valves – Elastomeric diaphragm is designed for handling suspended particles.
- Volatile fluids such as sodium hypochlorite (NaClO) and hydrogen peroxide (H_2O_2) could be trapped and gasified within the valve. We can provide you with a Type-21 ball valve with a vented ball to relieve pressure build-up inside the valve.

Troubleshooting

What if the fluid still flows when valve is closed?

1. Carrier is not properly tightened. Tighten it.
2. PTFE seat is damaged or worn. Replace seat.
3. Foreign material is caught between ball and PTFE seat. Remove material and clean.
4. Ball is damaged or worn. Change ball.

What if fluid leaks outside of valve?

1. Union nut not properly tightened. Retighten.
2. Carrier is not properly tightened. Thread it in firmly.
3. Carrier or face O-ring is damaged, worn, or missing. Replace O-ring.

What if handle does not rotate smoothly?

1. Foreign material has formed on the ball or seat. Clean both.
2. Internal part(s) chemically attacked or swollen. Refer to Asahi/America Chemical Resistance Chart for compatibility. Replace part(s) as required.
3. Carrier overtightened. Retighten properly.

What if handle rotates too freely?

1. Stem is damaged. Replace stem.
2. Handle is not engaged with stem. Disassemble and reengage. Inspect.
3. Engaging part of stem and/or ball is damaged. Change stem and/or ball.

ProMod Systems Designer

Component Data Sheets

Calibration Column

CC_100_PCV_A

SIGMAMOTOR INC.

PVC
CALIBRATION CYLINDERS

Graduated Calibration Cylinders for Accurate Calibration of Chemical Metering Pumps

Verified Accuracy

SIGMAMOTOR Calibration Cylinders will enhance your feed systems by allowing verification of the flow rate of the feed pump.

- CNC precision machined ends
- Clear tube for easy GPH reading
- Sealed top
- Quick-off top for cleaning (optional)
- Loose top (optional)
- NSF-61 Approved materials

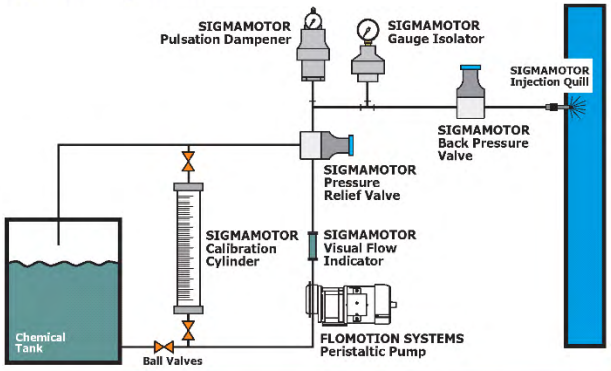
Calibration Cylinders are installed on the suction side of the metering pump. The top of the cylinder is vented back to the supply tank or drain. The calibration cylinder is filled to the top mark then the valve from the tank is closed. Turning on the metering pump will draw down the liquid providing a simple means to verify the accuracy of the pump flow rate. USGPH (Gallons Per Hour) and ML are shown on the cylinder.

SIGMAMOTOR Calibration Cylinders are critical to accurate determination of your system flow rate, either at start-up or following maintenance. Sigmamotor Calibration Cylinders are made from clear PVC with gray PVC ends.

Rugged PVC Sigmamotor Calibration Cylinders are clearly marked in US GPH and milliliters for accurate drawdown calibrations.

Glass cylinders are also available.

Typical System



SIGMAMOTOR PVC CALIBRATION CYLINDERS

NSF-61 Approved Materials

PROCESS CONNECTION TYPE	1
NPT	N
SOCKET	S
FLANGED	F
UNION	U

CP: S - 100 - S - __
1 2 3 4

Example: CP-N-100-S-V

SIZE	2											
SELECT:	100	200	250	500	500S	1K	2K	4K	5K	7K	10K	20K
Size (ml)	100	200	250	500	500	1000	2000	4000	5000	7000	10,000	20,000
A-Height (in)	11	19	10.75	13	7	22.25	20.25	37.5	29.25	19.5	25.75	47.75
B-Diameter (in)	1.5	1.5	2.1	2.5	3.7	2.5	3.7	3.7	4.88	7.25	7.25	7.25
C-Connection (in)	1/2	1/2	1/2	3/4	1/2	3/4	1	1	1.5	2	2	2
Capacity (GPH)	3.2	6.4	8	16	16	32	64	128	158	220	320	640
Scale (ml)	1	2	2	5	10	5	10	10	100	100	100	100
Scale (gph)	0.1	0.1	0.25	0.2	1	0.2	1	1	5	5	5	5

CAP STYLE	3
SEALED	S
LOOSE	L
QUICK OFF	Q

O-RING MATERIAL Quick Off & Union Only	4
VITON	V
EPDM	E
PTFE ENCAPSULATED	T

SEALED CAP (S)

Cap is permanently fixed to the top of the cylinder and includes a vent or NPT process connection. Used in applications requiring a positive suction head.

LOOSE CAP (L)

Cap is loose and easily removed for cleaning and manual filling Used in applications where the cylinder must be filled from the top with no positive suction head.

QUICK OFF CAP (Q)

Cap is sealed with an O-ring and includes an NPT vent connection. Used in applications where frequent cleaning is required, such as polymer, alum, ferric chloride or chlorine.

Maximum Pressure:	150 psi
Maximum Temperature:	140 °F

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SIGMAMOTOR INC.

Technical Data

ProMod Systems Designer

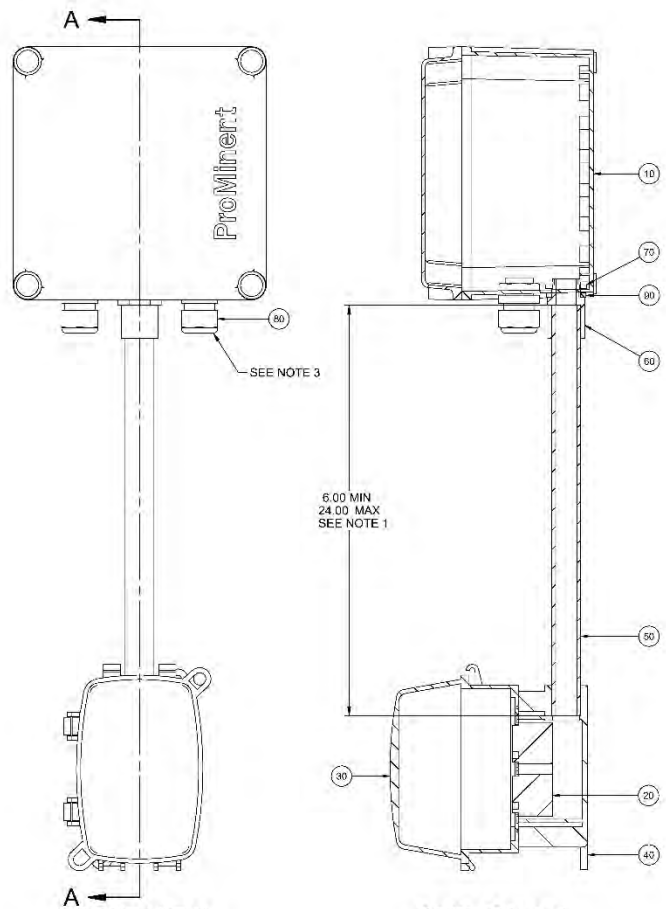
Component Data Sheets

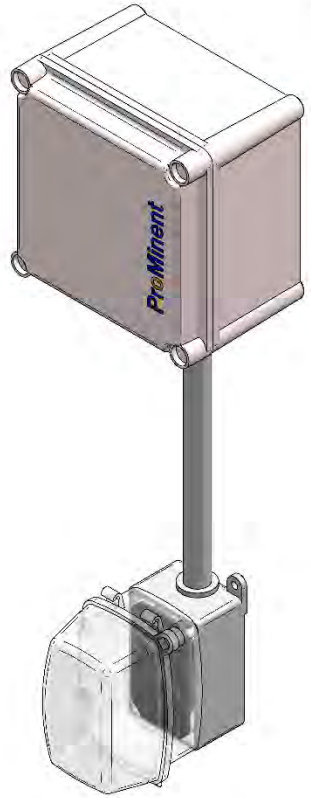
Control Panels and/or Terminal Boxes

CP_TB_2F

DWG No	REV
7745880-200	C

ITEM NUMBER	QUANTITY	UOM	PART NUMBER	PART DESCRIPTION
10	1	PC	7745262	PFC TERMINAL BOX 2 PUMP
20	1	PC	7740230	HUBBEL 20A/120VAC HBL5362 DUPLEX RECPT
30	1	PC	7745264	RECEPTACLE COVER, RAINTIGHT, MULTI USE
40	1	PC	7740236	SINGLE PVC ELECT. GANG BOX W/1/2" PORT
50	2	FT	7744055	1/2" PVC SCH40 RIDGID CONDUIT GRAY
60	1	PC	7740232	ADAPTOR MALE, ELECTRICAL, PVC 1/2
70	1	PC	7735087	GALV ROMEX NUT 1/2" FOR STRAIN RELIEF
80	2	PC	7744578	1/2" CORD GRIP 2 HOLE X 0.24"
90	1	PC	7744415	1/2" RNC FLAT WASHER
100	6	FT	7746072	SD1.5X1" SOLID BLACK WIRE DUCT
110	6	FT	7746073	TC1.5" SOLID BLACK WIRE DUCT COVER
120	2	PC	7500284	5/8" PVC, SOLID SQUARE BAR STOCK





NOTES:

1. THIS DIMENSION CAN VARY FROM 6.00" TO 24.00" DEPENDING UPON THE APPLICATION.
2. ALL DIMENSIONS ARE IN INCHES AND ARE SHOWN FOR REFERENCE ONLY.
3. THE LOCATION OF ITEM 80 WILL VARY WITH EACH SKID AND WILL BE DETERMINED BY THE SKID LAYOUT DURING INSTALLTION..
4. ITEMS 100, 110 AND 120 ARE NOT SHOWN. THE LOCATION OF THESE ITEMS WILL VARY WITH EACH SKID AND WILL BE DETERMINED BY THE SKID LAYOUT DURING INSTALLATION.
5. WHEN ORDERED WITH AS PART OF A SKID. ALL PARTS WILL BE CUT AND INSTALLED ON THE SKID. OTHERWISE, ALL PARTS WILL BE CUT AND INSTALLED IN THE FIELD.

REV	DATE	DESCRIPTION	BY	APPD	REVD
C	02/22/11	CHANGED TO 20 AMP RECEPTACLE	ALS		
B	02/27/08	UPDATED ITEM DESCRIPTION	GJS		
A	07/03/07	UPDATED BOM TO CURRENT STANDARDS	GJS		
0	08/15/06	FIRST ISSUE	GJS		

REVISIONS

CUSTOMER: PROMINENT FLUID CONTROLS INC.

JOB No: 7745880 PURCHASE ORDER No:

TITLE: 2 PUMP TERMINAL BOX KIT WITH NON-GFCI RECEPTACLE GENERAL ARRANGEMENT

ENGINEERS SEAL

ProMinent®
THE PROMINENT GROUP OF COMPANIES

PITTSBURGH, PA USA WWW.PROMINENT.US

PROMINENT FLUID CONTROLS LTD.
480 SOUTHGATE DRIVE
GUELPH, ONTARIO, CANADA
N1G 4S2
TEL: 519.836.2840 FAX: 519.836.2843

PROMINENT FLUID CONTROLS INC.
SIDC PARK WEST
136 INDUSTRY DRIVE
PITTSBURGH P.A., USA. 15275
TEL: 12.787.8141 FAX: 412.787.8144

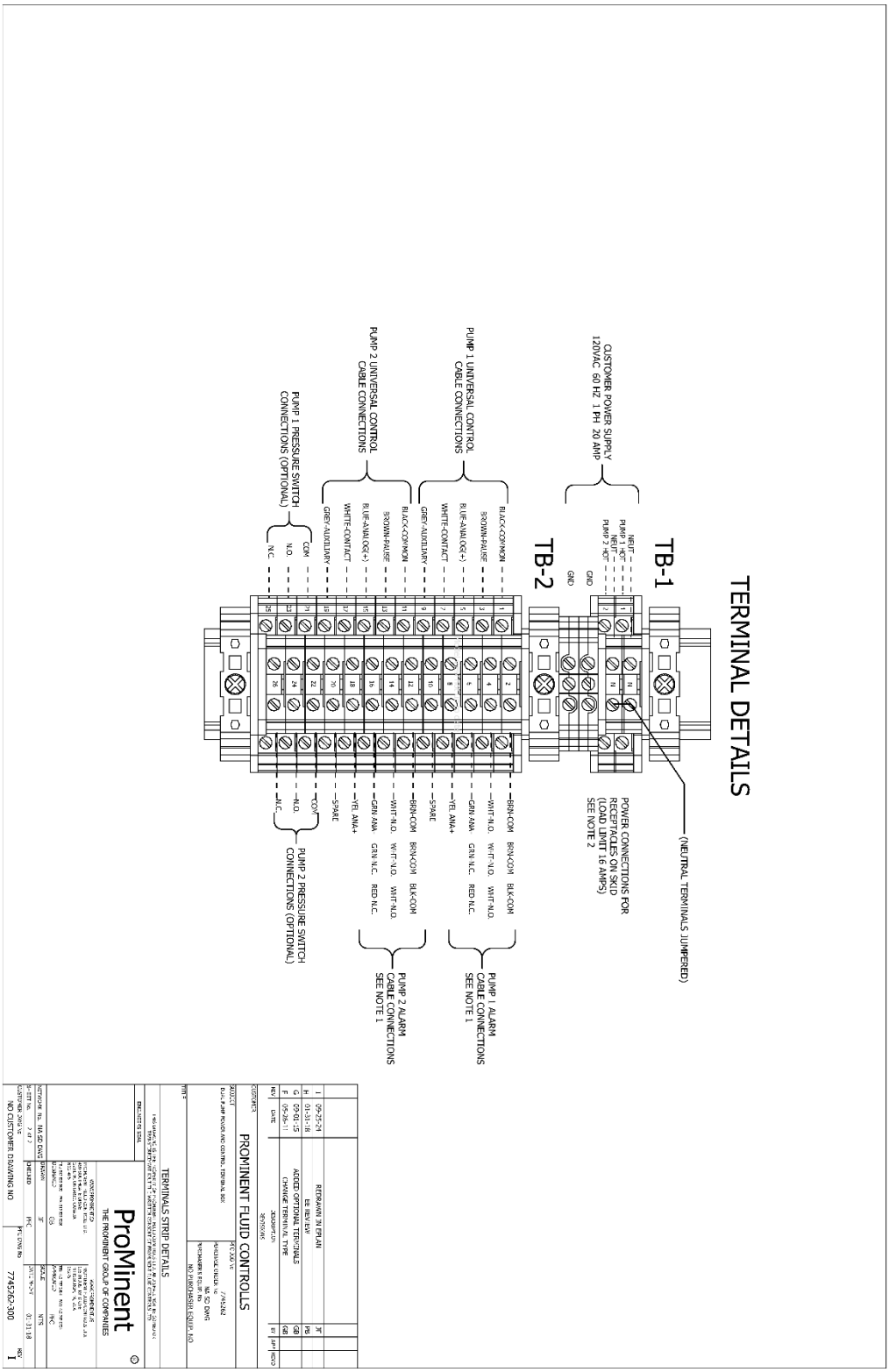
DESIGNED	GJS	APPROVED	
DRAWN	GJS	SCALE	N.T.S.
CHECKED	JMS	DATE	08/15/06

DWG No	REV	PAGE
7745880-200	C	1/1

NOTES:
1. ALARM CABLE COLOR CODE DEPENDANT ON THE CABLE SELECTED FOR PROJECT. LABEL ATTACHED TO CABLE WILL INDICATE THE COLOR CODE AND SIGNAL DESIGNATION.
2. POWER CONNECTION JUMPERS DEPENDANT ON APPLICATION. ADD JUMPER ON TERMINALS 1 & 2 FOR SINGLE POWER SUPPLY.

Bill Of Materials

Manufacturer	Quantity	Description	Part Number	PFC P/N USA	Device Tag
AUTO	1	DIN rail	0810733	774503	-DIN RAIL-
FERAX	1	7.5 x 7.5 x 5 "PC" ENCLOSURE	PC1919 13 G-2FSH	774539	-ENCL_1
PMC	2	Cross-connector for terminal block	0803250	1079583	-JMPR-1;-JMPR-2
IPC	1	4" BLUE PROMINENT LOGO W/ORANGE "O"	7741777	774177	-PC_LOGO_
PMC	2	SLIDING PARTITION PLATE FOR DOUBLE LEVEL TERMINAL	2770791	774576	-TB1;-TB2
PMC	3	End bracket for terminal block	0806986	774051	-TB1;-TB2
PMC	2	SLIDING PARTITION PLATE FOR DOUBLE LEVEL TERMINAL	2770024	774577	-TB1;-TB2
PMC	15	DOUBLE STACK TERMINAL BLOCK	2770017	774574	-TB1;-TB2
PMC	2	Ground terminal block	0441594	774575	-TB1



Technical Data
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ProMod Systems Designer

System Component Data Sheets

ProMod Systems Designer

Component Data Sheets

Metering Pumps

ProMinent®

solenoid-driven metering pumps

ProMinent® gamma/ X Solenoid Diaphragm Metering Pumps

Overview: gamma/ X

The **gamma/ X** solenoid diaphragm metering pump incorporates a wealth of eXcellent ingenuity! With integrated pressure measurement, it ensures the smooth running of your metering process. The **gamma/ X** is ideal for all chemical metering applications. (see page 143 for spare parts)

- Capacity range from 0.24 GPH to 11.9 GPH, maximum discharge pressure up to 363 psi
- Simple adjustment of the capacity directly in GPH
- Configurable discharge stroke, continuous or pulsed dosing
- Configurable suction stroke duration
- Stroke rate adjustable from 1 – 12,000 strokes per hour
- Electronic stroke length adjustment, continuous from 0 - 100% (recommended range 30 - 100%)
- Suitable for continuous micro-metering from 1 ml/hr thanks to the innovative solenoid control
- Integrated pressure measurement allows for detection of blocked discharge line, broken discharge lines and air or gas bubbles trapped in the dosing head
- Acrylic/PVC, PVT (PVDF) and Stainless Steel liquid end material versions
- Auto degassing liquid ends in Acrylic/ PVC and PVT
- High viscosity liquid ends (PVT4) for viscosities of up to 3000 cP
- Large backlit graphic display and status LED's
- External control via voltage-free contacts with pulse multiplier/divider function
- External control via standard 4-20 mA signal, and scalable adjustment of mA signal to stroke rate
- Standard internal programmable timer for real-time dependent dosing routines i.e biocides, cooling towers etc.
- Standard pump capable of accepting 2-stage tank level sensor input, flow monitor input, diaphragm rupture sensor input and control cable input.
- NSF/ANSI 61 Approved Liquid ends
- Bluetooth, PROFIBUS, CANbus interface as an optional feature (see page 151 for PROFIBUS)

PROFIBUS

Bluetooth™

ProMinent® gamma/ X Solenoid Diaphragm Metering Pumps

Capacity Data

Capacity data: gamma/ X

Pump Version	Capacity at Maximum Backpressure					Max. Stroking Rate	Tubing Connectors O.D. x I.D	Pre-Primed Suction Lift **		SS Liquid end connections FNPT	Shipping Weight lbs	
	psig	(bar)	GPH*	(l/h)	ml/stroke	Strokes/min	in	ft	(m)	in	NP/PV	SS
gamma/ X: with standard liquid ends												
1602	232	(16)	0.61	(2.3)	0.19	200	1/4 x 3/16	19.6	(6)	1/4	7.9	9
1604	232	(16)	0.95	(3.6)	0.30	200	1/4 x 3/16	16.4	(5)	1/4	7.9	9
0708	102	(7)	2.0	(7.6)	0.63	200	1/2 x 3/8	13.1	(4)	1/4	8.1	11
0414	58	(4)	3.56	(13.5)	1.13	200	1/2 x 3/8	9.8	(3)	1/4	8.1	11
0220	29	(2)	5.2	(19.7)	1.64	200	1/2 x 3/8	6.5	(2)	3/8	8.1	11
2504	363	(25)	1.0	(3.8)	0.32	200	(8 x 4mm)	13.1	(4)	1/4	10.8	12.1
1009	145	(10)	2.38	(9.0)	0.75	200	1/2 x 3/8	9.8	(3)	1/4	11.2	14.3
0715	102	(7)	3.83	(14.5)	1.21	200	1/2 x 3/8	9.8	(3)	1/4	11.2	14.3
0424	58	(4)	6.34	(24)	2.00	200	1/2 x 3/8	9.8	(3)	3/8	11.2	14.3
0245	29	(2)	11.9	(45)	3.70	200	1/2 x 3/8	6.5	(2)	3/8	11.5	15.4
gamma/ X: with auto-degassing liquid ends NPB9/ NPE9												
1602	232	(16)	0.34	(1.30)	0.11	200	1/4 x 3/16	6.9	(2.1)	~	7.9	~
1604	232	(16)	0.63	(2.40)	0.21	200	1/2 x 3/8	8.8	(2.7)	~	7.9	~
0708	101	(7)	1.8	(6.80)	0.57	200	1/2 x 3/8	6.5	(2)	~	8.1	~
0414	58	(4)	3.17	(12)	1.00	200	1/2 x 3/8	6.5	(2)	~	8.1	~
0220	29	(2)	4.75	(18)	1.5	200	1/2 x 3/8	6.5	(2)	~	8.1	~
1009	145	(10)	2.11	(8)	0.67	200	1/2 x 3/8	9.8	(3)	~	11.2	~
0715	101	(7)	3.56	(13.5)	1.00	200	1/2 x 3/8	8.2	(2.5)	~	11.2	~
0424	58	(4)	5.28	(20)	1.67	200	1/2 x 3/8	8.2	(2.5)	~	11.2	~
gamma/ X: with self-bleeding liquid ends, 2-port without bypass (PVT7)												
1604	232	(10)	0.42	(1.6)	0.13	200	1/4 x 3/16	6	(1.8)	~	7.9	~
0708	101	(7)	1.50	(5.7)	0.48	200	1/2 x 3/8	6	(1.8)	~	8.1	~
0414	58	(4)	3.17	(12.0)	1.00	200	1/2 x 3/8	6	(1.8)	~	8.1	~
0220	29	(2)	4.60	(17.4)	1.45	200	1/2 x 3/8	6	(1.8)	~	8.1	~
1009	145	(10)	1.58	(6.0)	0.50	200	1/2 x 3/8	6	(1.8)	~	11.2	~
0715	101	(7)	3.40	(12.9)	1.08	200	1/2 x 3/8	6	(1.8)	~	11.2	~
0424	58	(4)	5.07	(19.2)	1.60	200	1/2 x 3/8	6	(1.8)	~	11.2	~

gamma/ X metering pumps with high viscosity liquid ends (PVT 4) have a 10 – 20 % lower capacity rating and are not self-priming.

Positive suction is recommended and pumps supplied with ½" MNPT connections.

Permissible ambient temperature: 14 °F to 113 °F | Average power consumption: 78 W | Degree of protection: IP 66

** Capacity data represents minimum values, tested using water at 68 ºF (room temperature)*

*** Suction lift with pre-primed suction line and liquid end*

Materials In Contact With Chemicals

Liquid end materials in contact with media

	Pump head	Suction/discharge valve	Ball seat	Seals	Balls
NPE	Clear Acrylic	PVC	EPDM	EPDM	Ceramic
NPB	Clear Acrylic	PVC	FKM	FKM	Ceramic
PPT	Polypropylene	PVDF	PTFE	PTFE	Ceramic
PVT	PVDF	PVDF	PVDF	PTFE	Ceramic
SST	Stainless Steel	Stainless Steel	Ceramic	PTFE	Ceramic

Auto-degassing liquid ends in NP with a valve spring made of Hastelloy C and a PVDF valve insert. PVT7 version with PVDF/ PTFE wetted parts. Diaphragm with a PTFE face.

Permissible ambient temperature: 14 °F - 113 °F / Average power consumption: 25/30 W / Degree of protection: IP 66/NEMA 4X

FKM = fluorine rubber

ProMinent® gamma/ X
Solenoid Diaphragm Metering Pumps

Specifications

Maximum stroke length:	For 70mm solenoid approx. .05” For 85mm solenoid approx. .06”
Materials of construction	
Housing:	Fibreglass reinforced PPE (Polyphenylene Ether)
Diaphragm:	PTFE faced EPDM with plastic core
Liquid end options:	Acrylic/PVC, PVDF, Stainless Steel
Enclosure rating:	IP 65
Power supply:	100 – 230 VAC 1 Phase 50 / 60 Hz ± 10%
Power consumption:	1602 / 1604 / 0708 / 0414 / 0220 25 W 2504 / 1009 / 0715 / 0424 / 0245 30 W
Check valves:	Double ball suction / discharge (PVT4 with spring loaded single ball)
Power cord:	6ft
Relay cable (optional):	6ft
Relay Options	
Identcode Option 1:	Relay contact rated 230 VAC 2 A Max
Identcode Option 4:	Both relay contacts rated 24 V, 100 mA Max
Identcode Option C:	Isolated 4 – 20 mA output can drive up to 300 Ω maximum impedance Relay contact rated 24 V 100 mA
Ambient temperature range	
In operation:	14 °F to 113 °F
Storage & Transport:	-4 °F to 140 °F
Max. fluid operating temp:	**Material** **Constant** **Short Term***
	Acrylic/PVC 113 °F 140 °F
	PVDF 113 °F 248 °F
	SS 113 °F 248 °F
	*15 minutes at 29 psi maximum
Climate:	95% Relative humidity – non-condensing
Sound pressure level:	LpA < 70 dB according to EN ISO 20361
Warranty:	2 years on pump drive, 1 year on liquid end
Valve threads:	NP / PVT M20 x 1.5 (provided with adapters for tubing)
Standard production test:	All pumps are tested for capacity at maximum pressure prior to shipment
Max solids size in fluid:	Versions 1602 / 1604 / 2504 = 15µ Versions 0708 / 0414 / 0220 / 1009 / 0715 / 0424 / 0245 = 50 µ
Contact input	
Minimum pulse duration:	20 ms
Maxiumum pulse input:	25 pulses / second
Analog Input Impedance:	120 Ohms
Recommended Viscocity:	Max. 200 cPs for standard liquid end Max. 500 cPs for valve with springs Max. 50 cPs for auto-degassing liquid ends Max. 3000 cPs for high-viscosity liquid ends

ProMinent® gamma/ X
Solenoid Diaphragm Metering Pumps

Identcode Ordering System

GMXa Gamma/ X

Version	Capacity	Version	Capacity	Version	Capacity
1602	0.61 gph (2.3 l/h), 232 psi (16 bar)	0220	5.2 gph (19.7 l/h), 29 psi (2 bar)	0424	6.34 gph (24 l/h), 58 psi (4 bar)
1604	0.95 gph (3.6 l/h), 232 psi (16 bar)	2504	1.0 gph (3.8 l/h), 363 psi (25 bar)	0245	11.9 gph (45 l/h), 29 psi (2 bar)
0708	2.0 gph (7.6 l/h), 102 psi (7 bar)	1009	2.38 gph (9.0 l/h), 145 psi (10 bar)		
0414	3.56 gph (13.5 l/h), 58 psi (4 bar)	0715	3.83 gph (14.5 l/h), 102 psi (7 bar)		

Liquid end material:

NP	Clear acrylic /PVDF, for auto-degassing version Clear acrylic / PVC
PP	Polypropylene
PV	PVDF/PVDF
SS	Stainless Steel
TT	PTFE Carbon-loaded

O-rings:

B	FKM-B/PFTE coated
E	EPDM/PTFE coated
T	PTFE/PFTE coated

Liquid end version:

0	Non-bleed version, no valve spring only with NP, TT and SS and type 0245
1	Non-bleed version, with valve spring only with NP, TT and SS and type 0245
2	Bleed function, no valve springs only with PV, NP not for type 0245
3	Bleed function, with valve springs only with PV, NP not for type 0245
4	Version for highly viscous media only with PV, types 1604, 0708, 0414, 2504, 1009, 0715, 0424
7	Self-bleeding without bypass, only with PV, not for versions 2504, 0245, and 1602
9	Auto-degassing with bypass (SEK), only with NP, not for types 2504 and 0245

Hydraulic connections:

6	Standard (SS/TT)
M	1/4" x 3/16"
N	3/8" x 1/4"
O	1/2" x 1/4" for 2504 only
Q	1/2" x 3/8"

Diaphragm rupture indicator:

0	Without diaphragm rupture indicator
1	With diaphragm rupture indicator, optical sensor

Version:

0	Standard

Logo:

0	Standard, with logo

Electrical Connection:

U	100-230 V, ±10 %, 50/60 Hz

Cable and plug with 6ft (2m) power cord, single phase:

A	European plug
D	N. American plug, 115 V

Relay, pre-set to:

0	Without relay
1	1 x changeover contact 230 V ~ 2 A, fault indicating relay N/C
4	2 x N/O 24 V – 100 mA, such as 1 + pacing relay
C	1 x N/O 24 V – 100 mA, such as 1 + 4 – 20 mA output
F	Auto degassing module (not available for version 2504)
G	Auto degassing module + fault relay (not available for version 2504), comes with panel

Accessories:

0	Not included (for PVDF, TT, SS)
1	With foot and injection valve, 5 ft PVC suction tubing, 10 ft PE discharge tubing

Control Variants:

0	Manual + external 1:1 with pulse control
3	Manual + external with pulse control + analogue 0/4 - 20 mA
5	Options 3 + 4 week process timer
C	Options 3 + CANopen
R	Options 3 + PROFIBUS® DP interface, M12 Note: no relay with PROFIBUS® version "R"

Metering Monitor:

0	Pulse signal input

Bluetooth connection:

0	Not included
B	Included

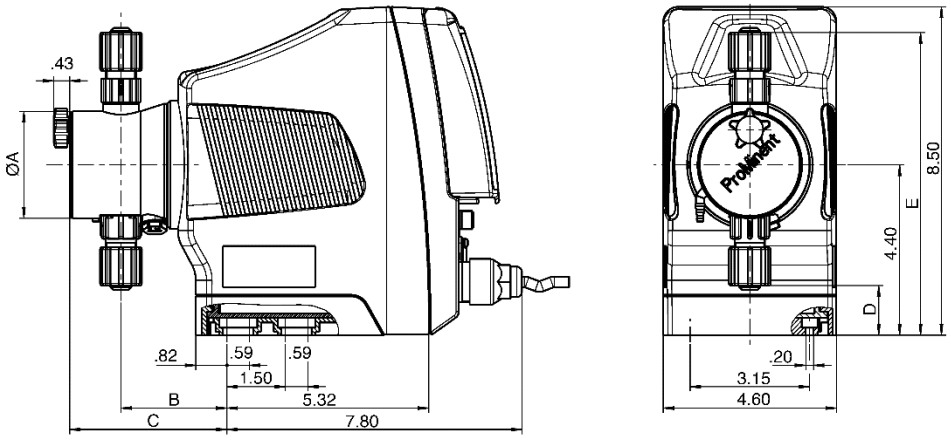
Language:

EN	Standard

GMXa	1601	PP	E	1	M	0	0	0	U	D	1	0	0	0	0	EN

ProMinent® gamma/ X
Solenoid Diaphragm Metering Pumps

Dimensional Drawings



Material design **PPT**

Type	Ø A	B	C	D	E
0245	4.30	3.00	–	.55	8.22
0424, 0220	3.50	3.00	4.33	.95	7.95
0715, 0414	3.50	2.91	4.21	.95	7.95
1009, 0708	3.50	2.91	4.25	.95	7.95
1604	2.75	2.80	4.17	1.25	7.80
1602	2.75	2.80	4.17	1.25	7.80

Material design **NPT**

Type	Ø A	B	C	D	E
0245	4.30	3.00	4.13	.55	8.27
0424, 0220	3.50	3.00	4.09	.90	7.87
0715, 0414	3.50	3.00	4.09	.90	7.87
1009, 0708	3.50	2.91	4.01	.90	7.87
1604	2.75	3.03	4.13	1.30	7.52
1602	2.75	3.03	4.13	1.30	7.52

Material design **PVT**

Type	Ø A	B	C	D	E
0245	4.30	3.00	–	.55	8.22
0424, 0220	3.50	3.11	3.50	.98	8.00
0715, 0414	3.50	2.87	3.50	.98	8.00
1009, 0708	3.50	2.95	3.62	.98	8.00
1604	2.75	2.80	3.31	1.42	7.72
1602	2.75	2.80	3.31	1.42	7.72

Technical Data
BPV_PCV_A

ProMod Systems Designer

Component Data Sheets

Backpressure & Pressure Relief Valves

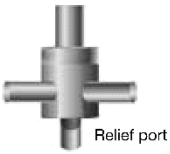
ProMinent®

Pump & Systems Accessories

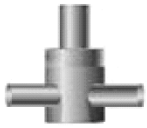
Backpressure Valves

Pressure Relief Valves

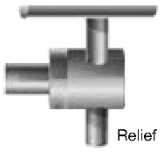
Backpressure, antisiphon and pressure relief valves



In-line pressure relief valve (3 port)



Backpressure valve (2 port)



Backpressure valve on tee for pressure relief

Backpressure (2-port) valves may be used in-line to provide a constant discharge pressure for protection from siphoning, or they may be teed off of the discharge line for pressure relief, discharging back to the source tank or to the pump suction line to create a bypass.

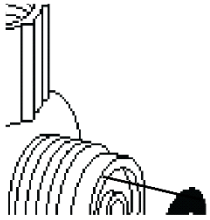
Pressure relief (3-port) valves are mounted in the discharge line, featuring a separate relief port which discharges back to the source tank or to the pump suction line to create a bypass.

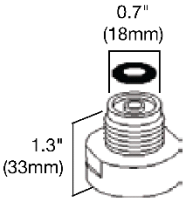
Backpressure valves provide several functions: they improve repeatability by providing a constant discharge pressure; they provide antisiphon protection for discharge into pressurized water lines or vacuums, or where suction head exceeds discharge head; and they minimize pulsation when used in conjunction with a pulsation dampener.

In-line backpressure/antisiphon and pressure relief valves

These adjustable backpressure (2-port) and pressure relief (3-port) valves have FNPT ports and require tubing adapters for use with flexible tubing.

Can be adjusted with screwdriver.





Adapter included with all back-pressure/pressure relief valves. Optional use in the event of diaphragm failure.

Technical data

Size:
1/2"

Diaphragm Materials:
PTFE-faced EPDM

Liquid Handling Materials:
PP, PVC, PTFE, PVDF
316 Stainless Steel

Pressure Adjustment:
0-150 psig (0-10.3 bar)

Flow rates @ 45 psig (3.1 bar):
1/4" - 132 U.S. gph (500 L/h)
1/2" - 132 U.S. gph (500 L/h)

Flow rates @ 150 psig:
1/2" (PP, PVC) - 200 U.S. gph (757 L/h)
1/2" (PVDF, TT, SS) - 300 U.S. gph (1135 L/h)
3/4" - 300 U.S. gph (1135 L/h)
1" - 500 U.S. gph (1893 L/h)
1-1/2" - 900 U.S. gph (3407 L/h)
2" - 1200 U.S. gph (4542 L/h)

Max. Temperature:
PP - 195°F (90°C)
PVC - 140°F (60°C)
PTFE - 250°F (121°C)
PVDF - 250°F (121°C)
316 Stainless - 250°F (121°C)
Max. Pressure Rating 170 psig @ 120°F

DIMENSIONS: 1/4" to 2" valves

D	A (in)	B (in)	C (in)
1/4"	4.90	2.6	1.2
*1/4"	*3.5	*2.375	*0.75
1/2"	4.9	2.6	1.2
*1/2"	*5.5	*3.5	*1.125
3/4"	5.4	3.5	1.1
1"	5.7	3.9	1.4
1-1/2"	8.5	4.6	2.2
2"	8.5	4.6	2.2v

***Note:** Dimensions apply to SS and PTFE valves only.

DIMENSIONS (for replacement valves only): 1/4" to 2" valves - SEE PG. 8

D	A (in)	B (in)	C (in)
1/4"	3.9	2.375	0.75
*1/4"	*3.5	*2.375	*0.75
1/2"	4.6	2.375	1.125
*1/2"	*5.5	*3.5	*1.125
3/4"	5.5	3.5	1.125
1"	5.8	3.5	1.25
1-1/2"	9.0	4.5	2.1
2"	9.0	5.0	2.1

***Note:** Dimensions apply to SS, PVDF and PTFE valves only.

Technical Data
PGI_160_PCV_A

ProMod Systems Designer

Component Data Sheets

Pressure Gauge with Isolator

BOTTOM CONNECTED ALL STAINLESS GAUGES

MODEL BR301L

Model BR301L

RANGE	CODE	MAJOR INC.	MINOR INC.
30/0" VAC	A	5	0.5
30/0/15	CB	5	0.5
30/0/30	CC	10	1
30/0/60	CD	10	1
30/0/100	CE	20	2
30/0/150	CF	20	2
30/0/300	CH	50	10
0/15	B	2	0.2
0/30	C	5	0.5
0/60	D	10	1
0/100	E	20	2
0/160	F	20	2
0/200	G	40	4
0/300	H	50	5
0/400	I	50	5
0/500	J	100	10
0/600	K	100	10
0/800	L	100	10
0/1000	M	200	20
0/1500	N	200	20
0/2000	O	400	50
0/3000	P	500	50
0/4000	Q	500	50
0/5000	R	1000	100
0/6000	S	2000	200
0/10,000	U	2000	200
0/15,000	V	2000	200

FEATURES:

The Model BR301L Series from Blue Ribbon Corporation is a high-quality line of liquid-filled bottom connected all stainless steel gauges. Their glycerine filling helps to dampen the effects of vibration, which will extend the life of the gauge.

This gauge is typically used on hydraulic & pneumatic systems, as well as any commercial or industrial application not corrosive to 316L stainless steel wetted parts, or where glycerine filling is suitable for use.

SPECIFICATIONS:

- Stainless Steel Case and Bezel
- Stainless Steel Internals
- 316 Stainless Steel Bourdon Tube & Connection
- IP65 Enclosure
- Liquid Filled (Dry Available)
- Accuracy
  - 2½" Dial: 1.6%
  - 4" and 6" Dials: 1%
- Dual Scale: PSI & BAR (x100=kPa)
- Single Scale (PSI) Available
- Ambient Temperature
  - Filled: +30 °F to +160 °F
  - Dry: -30 °F to +180 °F

FIELD OPTIONS:

- Dial Sizes
  - 2½", 4", and 6"
- Connection Sizes
  - ¼"(M) NPT on 2½" and 4"
  - ½"(M) NPT on 4" and 6"
- Safety Glass Lens
- Welded Socket
- Overpressure Limit: 30% FSO
- Working Pressure: 75% FSO

Toll Free: +1.877.774.4751 Tel: +1.716.773.9300 Fax: +1.716.773.5019 Email: BRsales@blueribboncorp.com Web: www.blueribboncorp.com

BR-Gauges-BR301L-062015

SIGMAMOTOR INC.

PRESSURE GAUGE ISOLATOR with switch

Provides Isolation From Hazardous Or Corrosive Liquids

SIGMAMOTOR Pressure Gauge Isolators allow standard pressure gauges to be used in corrosive services.

The upper section (gauge side) is filled with glycerin, mineral oil, silicone or halocarbon. A diaphragm separates the glycerin from the lower section which connects to the pressure source.

A 1/2" port is provided for connection to the pressure source.

Features

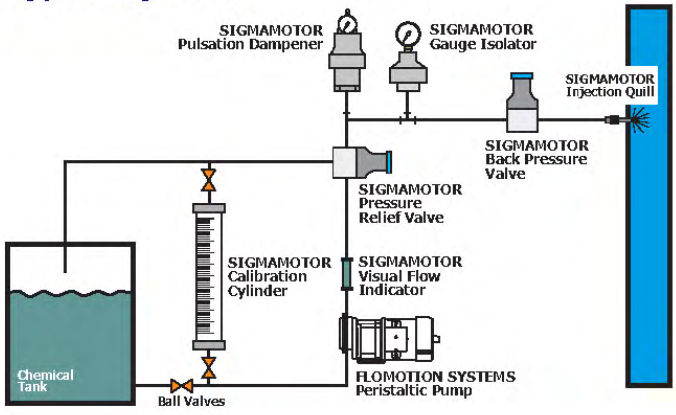
- CNC precision machined parts
- Variety of materials available
- Various pressure ranges available
- Cost effective and reliable
- 2.5" Dial (4" dial optional)
- Pre-filled with glycerin between gauge and diaphragm
- Optional adjustable pressure switch* can be adjusted from 2% to 90% of full scale value. Reed switch. Max switching voltage: 75VDC / 50 VAC. Max switching current: 0.5A DC or AC with resistive load. Max switching hysteresis: 2.5%.

*Front facing gauge only

316 SS

POLYPROPYLENE

Typical System



Bayonet ring twists off for easy pressure switch acjustment. Simply move the red indicator.

Shown with optional pressure switch

SIGMAMOTOR PRESSURE GAUGE ISOLATOR

NSF-61 Approved Materials

GI: N - 160 - CP - T - CBM
1 2 3 4 5

Example: GI-N-030C-P-V-SS

INLET CONNECTION TYPE 1	
NPT	N
SOCKET	S
FLANGED	F
UNION	U

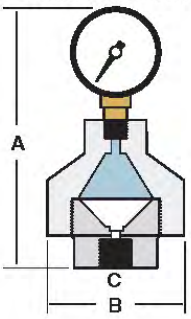
SIZE 2								
SELECT:	C030	030	060	100	160	200	200S	300
PSI RATING	-30,0,30	0-30	0-60	0-100	0-160	0-200	0-200	0-300
A-Height (in) front facing gauge	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6
A-Height (in) top facing gauge	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
B-Diameter (in)	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2
C-Connection (in)	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2
SPECIAL	Com-pound						With Switch*	

ISOLATOR BODY MATERIAL 3	
PVC	P
POLYPROPYLENE	PP
CPVC	CP
PTFE	T
Kynar® PVDF	K
316 SS	S
ALLOY 20	A
HASTELLOY C276	H

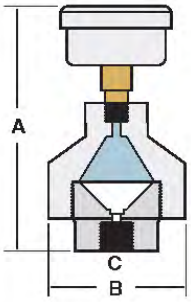
DIAPHRAGM MATERIAL 4	
VITON	V
EPDM	E
PTFE	T

OPTIONS 5	
STANDARD GAUGE	
ALL 316 STAINLESS STEEL GAUGE	SS
CENTER BACK MOUNT GAUGE	B
HALOCARBON	H
SILICONE	S
MINERAL OIL	M

FRONT FACING GAUGE



CENTER BACK MOUNT GAUGE



* Front facing gauge only

Material:	PVC	CPVC	PP	PVDF	PTFE	METAL
Maximum Pressure:	150 psi	150 psi	150 psi	150 psi	150 psi	350 psi
Maximum Temperature:	140 °F	195 °F	195 °F	285 °F	480 °F	300 °F

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www.SigmamotorInc.com

SIGMAMOTOR INC.

Technical Data

ProMod Systems Designer

Component Data Sheets

Pulsation Dampener

PD_164_PCV

SIGMAMOTOR INC.

PULSATION DAMPENERS

NSF

Minimize pulsating output on positive displacement pumps

SIGMAMOTOR FL Series Pulsation Dampeners offer an inexpensive solution to protect chemical feed systems from harmful effects of pulsating flows.

- Simple chargeable design
- Robust CNC precision machined body
- Provides steady flows for better flow metering accuracy
- Eliminates vibrations in pipes reducing the potential for leaks
- Smooths flows in spray applications

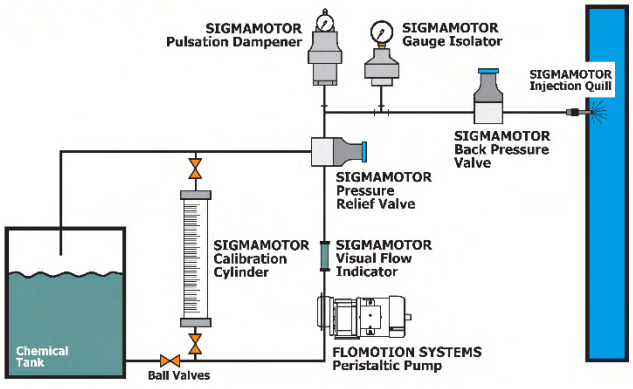
Features

- Capacity - 12, 40 or 85 cu in
- Variety of materials available
- Various Bladder materials
- Charging Valve - Schrader Type

85 cu in

40 cu in

Typical System



12 cu in

SIGMAMOTOR PULSATION DAMPENER

NSF-61 Approved Materials

FL: N - 12 - CP - E - __
1 2 3 4 5

Example: FL-N-12-P-V-SS

INLET CONNECTION TYPE	1
NPT	N
SOCKET	S
FLANGED	F
UNION	U

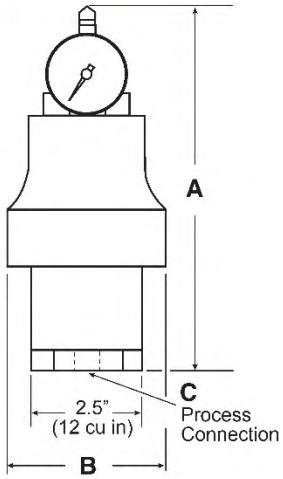
SIZE	2		
SELECT:	12	40	85
CU IN SIZE	12	40	85
ML SIZE (in)	200	660	1400
A-Height (in)	7.8	8.25	11.5
B-Diameter (in)	3.45	5.5	5.5
C-Connection (in)	1/2	1	1

DAMPENER BODY MATERIAL	3
PVC	P
POLYPROPYLENE	PP
CPVC	CP
PTFE	T
Kynar® PVDF	K
316 SS	S
ALLOY 20	A
HASTELLOY C276	H

BLADDER MATERIAL	4
VITON	V
EPDM	E
PTFE (12 CU IN ONLY)	T

GAUGE OPTIONS	5
STANDARD GAUGE	
ALL STAINLESS STEEL	SS

DIMENSIONS



Material:	PVC	CPVC	PP	PVDF	METAL
Maximum Pressure:	150 psi	150 psi	150 psi	150 psi	350 psi
Maximum Temperature:	140 °F	195 °F	195 °F	300 °F	300 °F

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SIGMAMOTOR INC.

Technical Data

ProMod Systems Designer

Component Data Sheets

Wye Strainer

YS_PCV_A

HAYWARD®

YS Series
Y-Strainers

1/2" - 2" PVC, CLEAR PVC AND CPVC
2-1/2" - 4" PVC AND CPVC

KEY FEATURES

- Available in PVC, CPVC and Clear PVC
- Horizontal or Vertical Installation
- FPM O-Ring Seals
- 2:1 Open Area Ratio
- Hex Cap for Easy Access to Screen
- Standard Screen has 1/32" Perforation

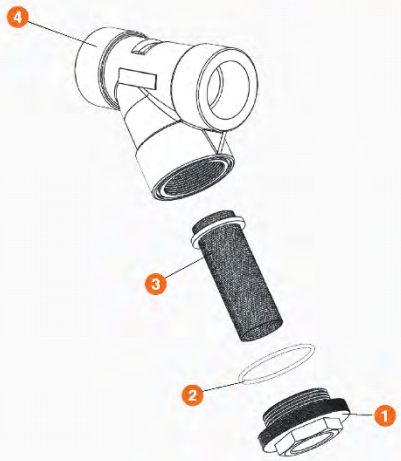
OPTIONS

- Stainless Steel Perforated or Mesh Strainer Screens Available in Various Sizes and Alloy Materials

MATERIALS

- PVC Cell Class 12454 per ASTM D1784
- Clear PVC Cell Class 12454 per ASTM D1784
- CPVC Cell Class 23447 per ASTM D1784
- FPM and EPDM O-Ring Seals

TECHNICAL INFORMATION



SELECTION CHART

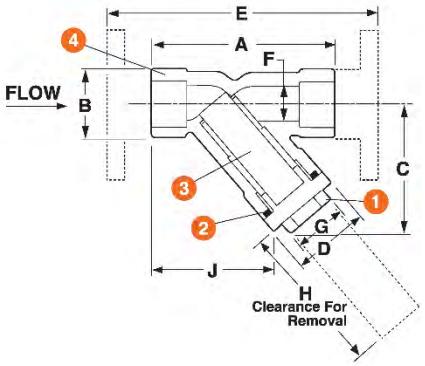
SIZE	MATERIAL	END CONNECTION	SEALS	PRESSURE RATING
1/2" – 1" (DN15 – DN25)	PVC, CPVC or Clear PVC	Socket or Threaded	FPM and EPDM	150 PSI @ 70°F 10 Bar @ 21°C Non-Shock
1–1/4" (DN32)	PVC and Clear PVC			
1–1/2" (DN40)	PVC, CPVC or Clear PVC			
2" (DN50)				
2–1/2" (DN65)	PVC	Socket, Threaded or Flanged		
3–4" (DN80-DN100)	PVC and CPVC			

* PVC and CPVC socket ends available to ISO 727-1 and threaded ends to BS21. Flanged ends available in DIN / EN PN10.

YS Series
Y-Strainers
1/2" - 2" PVC, CLEAR PVC AND CPVC
2-1/2" - 4" PVC AND CPVC

TECHNICAL INFORMATION, *CONTINUED*

PARTS LIST
1. Cap
2. O-Ring Seal
3. Screen
4. Body



SCREEN OPTIONS

PERFORATION SIZES	MESH SIZES	SCREEN MATERIAL
1/32"	20	SSTL, Hastelloy, Monel and Titanium
1/16"	40	
1/8"	60	
5/32"	80	
3/16"	100	
1/4"	200	
3/8"	325	
1/32"	N/A	PVC and CPVC
1/16"		
1/8"		
3/16"		

DIMENSIONS

SIZE in / DN	A in / mm	B in / mm	C in / mm	D in / mm	E in / mm	F in / mm	G in / mm	H in / mm	J in / mm	WEIGHT lbs / kg SOC / THD	WEIGHT lbs / kg FLANGED
1/2 / 15	3.38 / 86	1.38 / 35	2.25 / 57	1.50 / 38	N/A	.56 / 14	1.00 / 25	2.13 / 54	2.50 / 64	.25 / .11	N/A
3/4 / 20	4.18 / 106	1.69 / 43	2.88 / 73	2.00 / 51	N/A	.81 / 21	1.25 / 32	2.75 / 70	3.00 / 76	.63 / .29	N/A
1 / 25	5.19 / 132	2.00 / 51	3.63 / 92	2.16 / 55	N/A	1.00 / 25	1.50 / 38	3.30 / 84	3.32 / 84	.88 / .40	N/A
1-1/4 / 32	6.63 / 168	2.63 / 67	4.50 / 114	2.94 / 75	N/A	1.25 / 32	2.00 / 51	4.50 / 114	4.45 / 113	1.75 / .79	N/A
1-1/2 / 40	6.63 / 168	2.63 / 67	4.50 / 114	2.94 / 75	N/A	1.56 / 40	2.00 / 51	4.50 / 114	4.45 / 113	1.63 / .74	N/A
2 / 50	7.63 / 194	3.38 / 86	5.38 / 137	3.75 / 95	11.00 / 279	2.00 / 51	2.38 / 60	5.06 / 129	4.88 / 124	3.00 / 1.36	5.00 / 2.27
2-1/2 / 65	10.31 / 262	4.69 / 119	7.25 / 184	5.25 / 133	N/A	2.90 / 74	3.50 / 89	6.60 / 168	6.54 / 166	7.75 / 3.52	N/A
3 / 80	10.31 / 262	4.69 / 119	7.25 / 184	5.50 / 140	14.37 / 365	2.90 / 74	3.50 / 89	6.60 / 168	6.54 / 166	7.50 / 3.40	12.25 / 5.56
4 / 100	12.81 / 325	5.75 / 146	8.88 / 226	6.18 / 157	17.73 / 450	3.78 / 96	4.25 / 108	8.00 / 203	8.58 / 218	9.50 / 4.30	17.50 / 7.94

Dimensions are subject to change without notice – consult factory for installation information

Cv VALUES*

SIZE in / DN	Cv VALUES	SIZE in / DN	Cv VALUES
1/2 / 15	4.0	2 / 50	28
3/4 / 20	6.8	2-1/2 / 65	40
1 / 25	9.0	3 / 80	65
1-1/4 / 32	12	4 / 100	100
1-1/2 / 40	28		

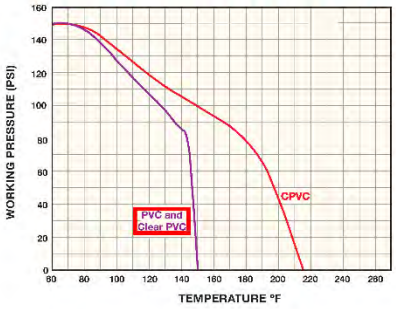
* With 1 / 32" plastic screen

PRESSURE LOSS CALCULATION FORMULA

$$\Delta P = \left[\frac{Q}{Cv}\right]^2$$

ΔP = Pressure Drop
Q = Flow in GPM
Cv = Flow Coefficient

OPERATING TEMPERATURE/PRESSURE



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Visit us at: haywardflowcontrol.com

120

Technical Data

ProMod Systems Designer

Component Data Sheets

Ball Valves

BV_PCV_A1

Specifications

Sizes: 1/2" – 6"
Models: PVC & CPVC: Socket Threaded and Flanged (ANSI)
PP & PVDF: IPS and Metric (DIN) Socket, Threaded, Butt and Flanged (ANSI)
Bodies: PVC, CPVC, PP and PVDF
Seats: PTFE backed with EPDM or FKM
Seals: EPDM or FKM or AFLAS®‡

Sizes 1/2" - 4" PVC/EPDM/FKM Models
NSF-61 Certified

‡ Trademark of Asahi Glass Co., Ltd.

Standard Features (Sizes 1/2" – 6")

- Pressure rated up to 230psi (PVC, CPVC, PVDF)
- Double O-ring seals on stem for added protection
- Full bore, sizes 1/2" – 2"
- Full vacuum rated, all sizes
- Blocks in two directions, upstream and downstream, leaving full pressure on the opposite end of the valve
- Integrally molded ISO mounting pad for both manual and actuated operations
- Integrally molded base pad to mount valves securely or panel mounting
- PTFE seats with elastomeric backing cushions ensure bubble tight shut-off and a low fixed torque, while at the same time compensating for wear
- True union design for easier installation or repairs without expanding the pipe system
- Built-in spanner wrench on the handle for valve disassembly and assembly
- Two sets of end connectors (socket and threaded) included with all PVC and CPVC valves in sizes 1/2"– 2"
- CPVC threaded end connectors on sizes 1/2" – 1" come with stainless steel reinforcing rings
- New PTFE seat design – Facilitates easier field maintenance if required
- Tapered O-ring groove – Helps to keep the end connector O-rings on the valve body during installation
- Body flats – Flats have been added to either side of the valve body where a wrench can be applied to prevent the valve body from turning when the union nuts are tightened
- 1/2 - 2 " PVC and CPVC T-21A design

Options

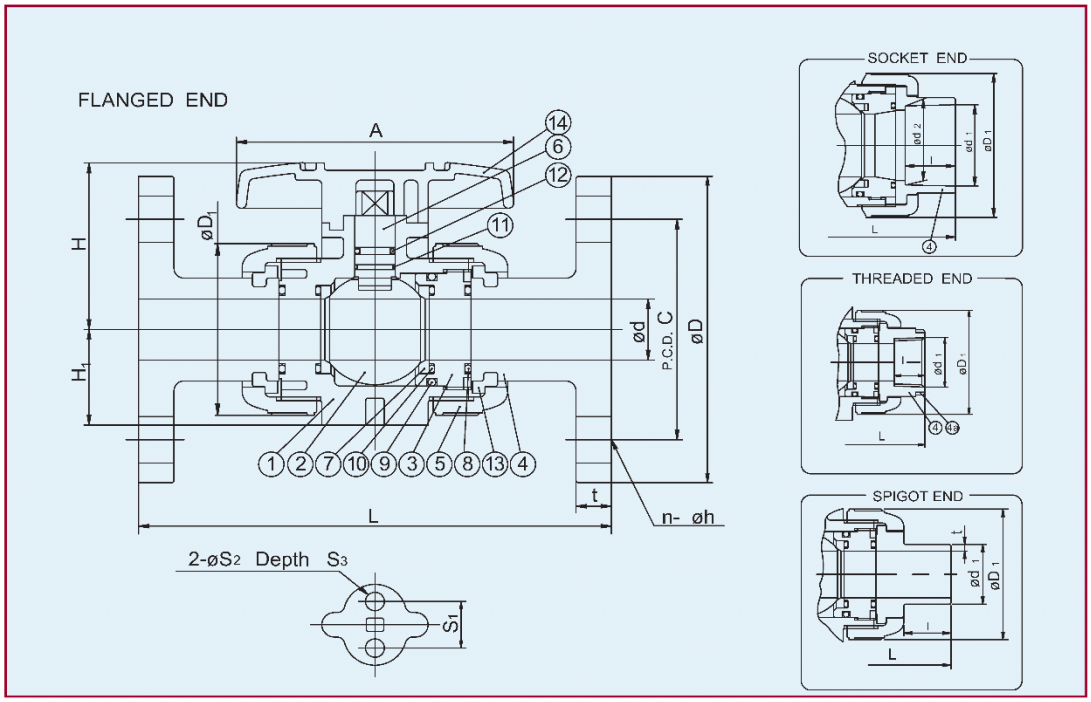
- Pneumatic and electric actuators and accessories
- Stem extensions
- 2" square operating nut or "T" nut
- Locking handles
- Limit switches
- Vented ball

Parts List (Sizes 1/2" – 2")

PARTS			
NO.	DESCRIPTION	PCS.	MATERIAL
1	Body	1	PVC, CPVC, PP, PVDF
2	Ball	1	PVC, CPVC, PP, PVDF
3	Carrier	1	PVC, CPVC, PP, PVDF
4	End Connector	2	PVC, CPVC, PP, PVDF
5	Union Nut	2	PVC, CPVC, PP, PVDF
6	Stem	1	PVC, CPVC, PP, PVDF
7	Seat	2	PTFE
8	O-Ring (A)	2	EPDM, FKM, Others
9	O-Ring (B)	1	EPDM, FKM, Others
10	O-Ring (C)	2	EPDM, FKM, Others
11	O-Ring (D)	1	EPDM, FKM, Others
12	O-Ring (E)	1	EPDM, FKM, Others
13	Stop Ring*	2	PVDF
14	Handle	1	ABS
4a	Ring**	2	304 Stainless Steel

* Used for flanged end.
** Used for CPVC body, threaded end, 1/2"–1".

Type-21/21A Ball Valves



Dimensions (Sizes 1/2" – 2") (in.)

NOMINAL SIZE			FLANGED						SOCKET										
			ANSI CLASS 150						PVC, CPVC				PP, PVDF (DIN)				PP, PVDF (IPS)		
									ASTM SCH 80				DIN 16962						
INCHES	mm	d	D	C	n	h	L	t	d1	d2	l	L	d1	d2	l	L	d1	l	L
1/2	15	0.59	3.50	2.38	4	0.62	5.63	0.47	0.848	0.836	0.875	4.45	0.768	0.760	0.57	3.90	0.83	0.87	4.45
3/4	20	0.79	3.88	2.75	4	0.62	6.77	0.55	1.059	1.046	1.000	5.08	0.965	0.957	0.63	4.45	1.03	1.00	5.08
1	25	0.98	4.25	3.12	4	0.62	7.36	0.55	1.325	1.310	1.125	5.75	1.240	1.232	0.71	4.84	1.30	1.13	5.75
1-1/4	32	1.26	4.62	3.50	4	0.62	7.48	0.63	1.670	1.655	1.250	6.46	1.553	1.543	0.81	5.47	1.65	1.25	6.46
1-1/2	40	1.57	5.00	3.88	4	0.62	8.35	0.63	1.912	1.894	1.375	7.24	1.947	1.937	0.93	5.87	1.89	1.37	7.24
2	50	2.01	6.00	4.75	4	0.75	9.21	0.63	2.387	2.369	1.500	8.23	2.461	2.445	1.08	6.93	2.36	1.50	8.23

NOMINAL SIZE		THREADED			SPIGOT (BUTT END)												
					PP,PVDF												
					DIN 3442		PP	PVDF									
INCHES	mm	d1	l	L	d1	l	t	t	L	D1	H	H1	A	S1	S2	S3
1/2	15	1/2 - 14 NPT	0.59	4.02	0.787	0.728	0.098	0.075	4.882	1.89	2.03	1.14	3.62	0.75	0.29	0.43
3/4	20	3/4 - 14 NPT	0.67	4.72	0.984	0.866	0.106	0.075	5.669	2.36	2.34	1.38	3.94	0.75	0.29	0.43
1	25	1 - 11-1/2 NPT	0.79	5.16	1.260	0.886	0.118	0.094	6.063	2.76	2.68	1.54	4.33	0.75	0.29	0.43
1-1/4	32	1-1/4 - 11-1/2 NPT	0.87	5.91	1.575	1.024	0.146	0.094	6.850	3.23	3.17	1.85	4.76	1.18	0.35	0.59
1-1/2	40	1-1/2 - 11-1/2 NPT	0.98	6.42	1.968	1.260	0.181	0.118	7.638	3.94	3.50	2.17	5.16	1.18	0.35	0.59
2	50	2 - 11-1/2 NPT	1.10	7.76	2.480	1.417	0.228	0.118	8.819	4.96	4.04	2.60	6.26	1.18	0.35	0.59

Note: The shape and appearance of assembly differ a little with nominal size compared to this drawing.

Type-21/21A Ball Valves

Pressure vs. Temperature (psi, water, non-shock)

NOMINAL SIZE		PVC				CPVC						PP				PVDF				
INCHES	mm	30° F 70° F	71° F 105° F	106° F 120° F	121° F 140° F	30° F 70° F	71° F 105° F	106° F 120° F	121° F 140° F	141° F 175° F	176° F 195° F	- 5° F 85° F	86° F 120° F	121° F 140° F	141° F 175° F	- 5° F 70° F	71° F 105° F	106° F 140° F	141° F 175° F	176° F 210° F
1/2-2	15-50	230	170	150	30	230	170	150	120	75	55	150	110	90	55	230	185	150	115	85
2-1/2	65	230	170	150	NA	230	170	150	120	75	55	150	95	70	40	230	185	150	115	85
3	80	230	170	150	NA	230	170	150	85	55	40	150	95	70	40	230	185	150	100	70
4-6	100-150	150	150	150	NA	150	150	150	85	55	40	150	95	70	40	150	150	150	100	70

Sample Specification

All Type-21/21A ball valves, sizes 1/2" to 4", shall be of true union design with two-way blocking capability. All O-rings shall be EPDM or FKM with PTFE seats. PTFE seats shall have elastomeric backing cushion of the same material as the valve seals. Stem shall have double O-rings and be of blowout-proof design. The valve handle shall double as carrier removal and/or tightening tool. ISO mounting pad shall be integrally molded to valve body for actuation. PVC conforming to ASTM D1784 Cell Classification 12454A, CPVC conforming to ASTM D1784 Cell Classification 23567-A, PP conforming to ASTM D4101 Cell Classification PP0210B67272 and PVDF conforming to ASTM D3222 Cell Classification Type II. The ball valves, except PP, shall have a pressure rating of 230psi for sizes 1/2" to 3" and 150psi for 4" (150psi for PP, all sizes) at 70º F. Type-21/21A ball valves must carry a two year guarantee, as manufactured by Asahi/America, Inc.

Cv Values

NOMINAL SIZE		Cv
INCHES	mm	
1/2	15	14
3/4	20	29
1	25	47
1-1/4	32	72
1-1/2	40	155
2	50	190
2-1/2	65	365
3	80	410
4	100	680

Weight (lbs.)

NOMINAL SIZE		SOCKET	FLANGED
INCHES	mm	THREADED	
1/2	15	0.44	1.10
3/4	20	0.66	1.54
1	25	1.1	2.70
1-1/4	32	1.54	3.30
1-1/2	40	2.64	4.40
2	50	4.4	8.15
2-1/2	65	6.17	8.80
3	80	9.7	13.00
4	100	24.00	26.67

Caution

- Never remove valve from pipeline under pressure.
- Always wear protective gloves and goggles.
- Watch out for trapped fluid in valve. It is safe to close valve before removing it from the pipeline.

Caution

- Do not use ball valves where media has suspended particles. Use the following valves:
  - Butterfly valves – PVDF disc is most abrasion resistant. Make sure of chemical compatibility.
  - Diaphragm valves – Elastomeric diaphragm is designed for handling suspended particles.
- Volatile fluids such as sodium hypochlorite (NaClO) and hydrogen peroxide (H_2O_2) could be trapped and gasified within the valve. We can provide you with a Type-21 ball valve with a vented ball to relieve pressure build-up inside the valve.

Troubleshooting

What if the fluid still flows when valve is closed?

1. Carrier is not properly tightened. Tighten it.
2. PTFE seat is damaged or worn. Replace seat.
3. Foreign material is caught between ball and PTFE seat. Remove material and clean.
4. Ball is damaged or worn. Change ball.

What if fluid leaks outside of valve?

1. Union nut not properly tightened. Retighten.
2. Carrier is not properly tightened. Thread it in firmly.
3. Carrier or face O-ring is damaged, worn, or missing. Replace O-ring.

What if handle does not rotate smoothly?

1. Foreign material has formed on the ball or seat. Clean both.
2. Internal part(s) chemically attacked or swollen. Refer to Asahi/America Chemical Resistance Chart for compatibility. Replace part(s) as required.
3. Carrier overtightened. Retighten properly.

What if handle rotates too freely?

1. Stem is damaged. Replace stem.
2. Handle is not engaged with stem. Disassemble and reengage. Inspect.
3. Engaging part of stem and/or ball is damaged. Change stem and/or ball.

ProMod Systems Designer

Component Data Sheets

Calibration Column

CC_100_PCV_A

SIGMAMOTOR INC.

PVC
CALIBRATION CYLINDERS

Graduated Calibration Cylinders for Accurate Calibration of Chemical Metering Pumps

Verified Accuracy

SIGMAMOTOR Calibration Cylinders will enhance your feed systems by allowing verification of the flow rate of the feed pump.

- CNC precision machined ends
- Clear tube for easy GPH reading
- Sealed top
- Quick-off top for cleaning (optional)
- Loose top (optional)
- NSF-61 Approved materials

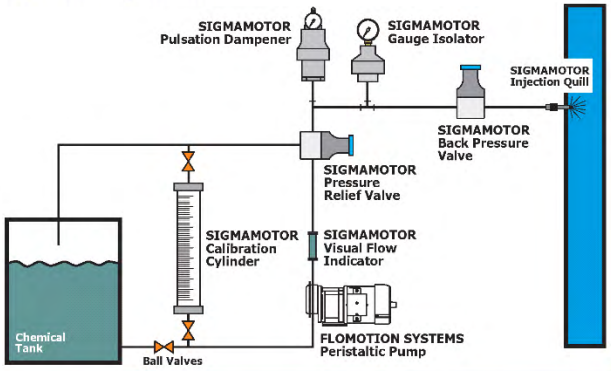
Calibration Cylinders are installed on the suction side of the metering pump. The top of the cylinder is vented back to the supply tank or drain. The calibration cylinder is filled to the top mark then the valve from the tank is closed. Turning on the metering pump will draw down the liquid providing a simple means to verify the accuracy of the pump flow rate. USGPH (Gallons Per Hour) and ML are shown on the cylinder.

SIGMAMOTOR Calibration Cylinders are critical to accurate determination of your system flow rate, either at start-up or following maintenance. Sigmamotor Calibration Cylinders are made from clear PVC with gray PVC ends.

Rugged PVC Sigmamotor Calibration Cylinders are clearly marked in US GPH and milliliters for accurate drawdown calibrations.

Glass cylinders are also available.

Typical System



SIGMAMOTOR PVC CALIBRATION CYLINDERS

NSF-61 Approved Materials

PROCESS CONNECTION TYPE	1
NPT	N
SOCKET	S
FLANGED	F
UNION	U

CP: S - 100 - S - __
1 2 3 4

Example: CP-N-100-S-V

SIZE	2											
SELECT:	100	200	250	500	500S	1K	2K	4K	5K	7K	10K	20K
Size (ml)	100	200	250	500	500	1000	2000	4000	5000	7000	10,000	20,000
A-Height (in)	11	19	10.75	13	7	22.25	20.25	37.5	29.25	19.5	25.75	47.75
B-Diameter (in)	1.5	1.5	2.1	2.5	3.7	2.5	3.7	3.7	4.88	7.25	7.25	7.25
C-Connection (in)	1/2	1/2	1/2	3/4	1/2	3/4	1	1	1.5	2	2	2
Capacity (GPH)	3.2	6.4	8	16	16	32	64	128	158	220	320	640
Scale (ml)	1	2	2	5	10	5	10	10	100	100	100	100
Scale (gph)	0.1	0.1	0.25	0.2	1	0.2	1	1	5	5	5	5

CAP STYLE	3
SEALED	S
LOOSE	L
QUICK OFF	Q

O-RING MATERIAL Quick Off & Union Only	4
VITON	V
EPDM	E
PTFE ENCAPSULATED	T

SEALED CAP (S)

Cap is permanently fixed to the top of the cylinder and includes a vent or NPT process connection. Used in applications requiring a positive suction head.

LOOSE CAP (L)

Cap is loose and easily removed for cleaning and manual filling Used in applications where the cylinder must be filled from the top with no positive suction head.

QUICK OFF CAP (Q)

Cap is sealed with an O-ring and includes an NPT vent connection. Used in applications where frequent cleaning is required, such as polymer, alum, ferric chloride or chlorine.

Maximum Pressure:	150 psi
Maximum Temperature:	140 °F

SigmaMotor Inc.
PO Box 298, 3 North Main Street
Middleport, NY 14105
Tel: 716.735.3115 Fax: 716.735.3425
info@sigmamotorinc.com
www.SigmamotorInc.com

SIGMAMOTOR INC.

Technical Data

ProMod Systems Designer

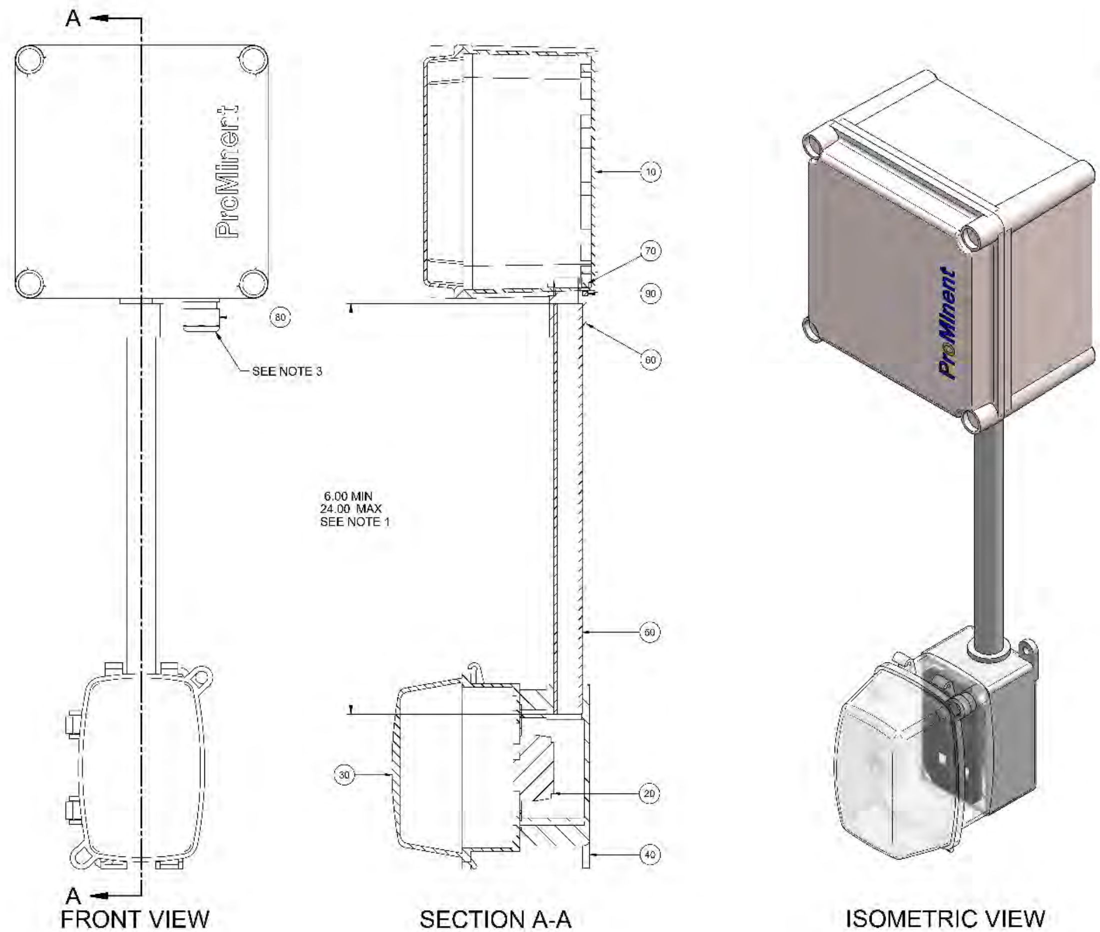
Component Data Sheets

Control Panels and/or Terminal Boxes

CP_TB_1F

DWG No. 7745878-200 REV C

ITEM NUMBER	QUANTITY	UOM	PART NUMBER	PART DESCRIPTION
10	1	PC	7745824	TERMINATION BOX 1 PUMP w AUX EQUP
20	1	PC	7746272	HUBBELL 20A/120VAC HBL5361 SINGLE RECPT
30	1	PC	7745264	RECEPTACLE COVER, RAINTIGHT, MULTI USE
40	1	PC	7740236	SINGLE PVC ELECT. GANG BOX W/1/2" PORT
50	2	FT	7744055	1/2" PVC SCH40 RIDGID CONDUIT GRAY
60	1	PC	7740232	ADAPTOR MALE, ELECTRICAL, PVC 1/2
70	1	PC	7735087	GALV ROMEX NUT 1/2" FOR STRAIN RELIEF
80	1	PC	7744578	1/2" CORD GRIP 2 HOLE X 0.24"
90	1	PC	7744415	1/2" RNC FLAT WASHER
100	3	FT	7746072	SD1.5X1" SOLID BLACK WIRE DUCT
110	3	FT	7746073	TC1.5" SOLID BLACK WIRE DUCT COVER
120	1	PC	7500284	5/8" PVC, SOLID SQUARE BAR STOCK



NOTES:

1. THIS DIMENSION CAN VARY FROM 6.00" TO 24.00" DEPENDING UPON THE APPLICATION.
2. ALL DIMENSIONS ARE IN INCHES AND ARE SHOWN FOR REFERENCE ONLY.
3. THE LOCATION OF ITEM 80 WILL VARY WITH EACH SKID AND WILL BE DETERMINED BY THE SKID LAYOUT DURING INSTALLTION..
4. ITEMS 100, 110 AND 120 ARE NOT SHOWN. THE LOCATION OF THESE ITEMS WILL VARY WITH EACH SKID AND WILL BE DETERMINED BY THE SKID LAYOUT DURING INSTALLATION.
5. WHEN ORDERED WITH AS PART OF A SKID, ALL PARTS WILL BE CUT AND INSTALLED ON THE SKID. OTHERWISE, ALL PARTS WILL BE CUT AND INSTALLED IN THE FIELD.

REV	DATE	DESCRIPTION	BY	APPD RCVD
C	05/14/15	UPGRADED TO 20A RECEPTACLE	CDJ	
B	05/07/15	ITEM 20 WAS 7744435	GJS	
A	07/03/07	UPDATED BOM TO CURRENT STANDARDS	GJS	
0	08/15/06	FIRST ISSUE	GJS	

REVISIONS

CUSTOMER: PROMINENT FLUID CONTROLS INC.

JOB No. 7745878 PURCHASE ORDER No.

TITLE: 1 PUMP TERMINAL BOX KIT WITH NON-GFCI RECEPTACLE GENERAL ARRANGEMENT

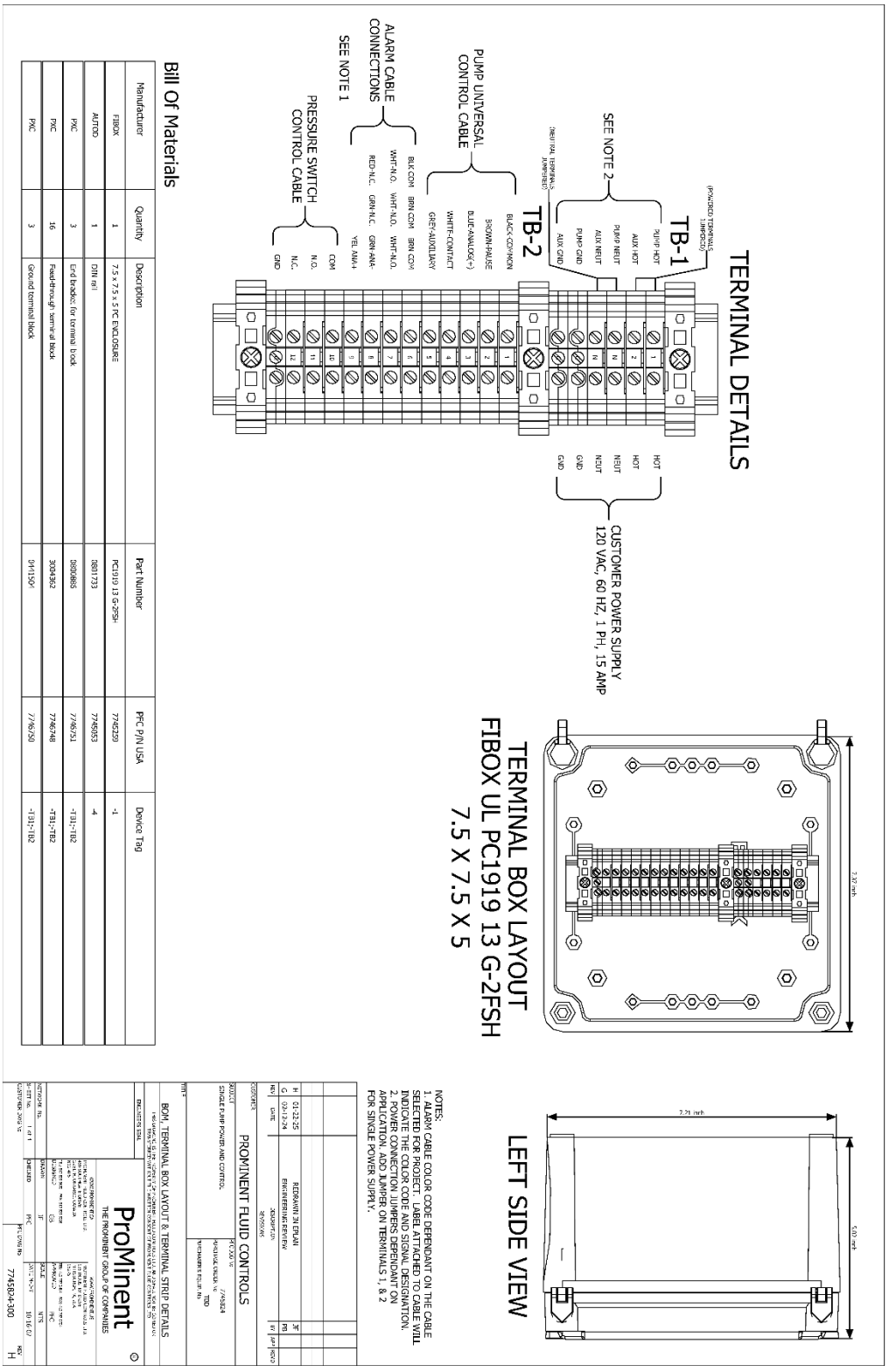
ENGINEERS SEAL

ProMinent® HE-PROMINENT GROUP OF COMPANIES

PITTSBURGH, PA USA WWW.PROMINENT.US

DESIGNED	GJS	APPROVED	
DRAWN	GJS	SCALE	N.T.S.
CHECKED	JMS	DATE	08/15/06

DWG No. 7745878-200 REV C PAGE 1/1



NOTES:
1. ALARM CABLE COLOR CODE DEPENDANT ON THE CABLE SELECTED FOR PRODUCT. LABEL ATTACHED TO CABLE WILL SHOW COLOR CODE DESIGNATION.
2. POWER CONNECTION JUMPERS DEPENDANT ON APPLICATION. ADD JUMPER ON TERMINALS 1 & 2 FOR SINGLE POWER SUPPLY.

Bill Of Materials

Manufacturer	Quantity	Description	Part Number	PFC P/N USA	Device Tag
FIBOX	1	7.5 x 7.5 x 5 PCE ENCLOSURE	PC1919 13 G-2FSH	774529	-1
AUTDO	1	DIN rail	0811733	774503	-4
PVC	3	End bracket for terminal block	0808865	774573	-TB1-TB2
PVC	16	Feed-through terminal block	3004362	774574	-TB1-TB2
PVC	3	Ground terminal block	1911509	774650	-TB1-TB2

TERMS AND CONDITIONS

The following Terms and Conditions are an integral part of Goble Sampson Associates, Inc., attached offer to sell equipment or services stated in this Proposal for use specifically on this project**.**

A. **SHIPMENT:** Estimated shipment is per Manufacturer's estimate. Goble Sampson Associates, Inc. is not responsible for delays in shipment or delivery of any kind beyond our control.

B. **TERMS:** The prices quoted by Goble Sampson Associates, Inc. are subject to the following payment terms:

1. Net amount is due in thirty (30) days after date of each invoice on all orders. Purchaser's payment of invoices shall not be contingent or dependent upon prior receipt of any payment to Purchaser from third parties.
2. Any invoice unpaid after 30 days from invoice date will be subject to interest charges of 1.5% per month, compounded.
3. No Retainer is Allowed per the Terms and Conditions of this offer to sell.
4. Lien laws and Bonding Company requirements are such that Goble Sampson Associates, Inc. must file claim with City, Bonding Company and Engineer within 60 days from date of invoice on unpaid accounts in order to protect reserve of amounts to cover supplier's unpaid invoice. This is in no way reflective of Contractor's ability to pay only a required action dictated by State Lien Laws and Bonding Companies. Therefore, Goble Sampson claim forms will be filed with the City, Bonding Company and Engineer 10 days before any account receivable becomes 60 days old.
5. Equipment cannot be returned and an order, once accepted and approved, cannot be canceled, without prior written consent. In case of cancellation, Buyer agrees to reimburse Goble Sampson Associates, Inc. for all costs incurred plus a mark-up of 20% for overhead expenses.

C. **TAXES:** We do not include in this Quotation any Federal, State or Municipal Sales, Use or Gross Income Tax which may be chargeable against the equipment offered. Any such tax which the Seller shall be liable for the payment or collection of shall be paid by the Buyer, although not specifically set out as an Item in this Proposal.

D. **PENALTIES**: There are no penalties or liquidated damages assessed except as may be specifically provided for in this Proposal.

E. **CLAIMS FOR LOSS OR DAMAGE IN TRANSIT**: Since material is sold "FOB Factory" or "FOB Factory, freight allowed to destination", the responsibility for filing claims for loss or damage in transit is the Buyers. We will assist and cooperate with the Buyer in handling such problems.

F. **WARRANTY & SERVICE:** Goble Sampson Associates, Inc. warranties on equipment are limited to the warranty provided to the Purchaser by the Manufacturer of the specific equipment contained in this Proposal. Start-up or operation of equipment containing electrical or electronic components by unauthorized persons and damage resulting from unauthorized operation will be sufficient grounds to void all warranties on that equipment unless it has been previously checked out and operated by qualified personnel of the manufacturer or their representatives. If such failure is attributable to defects in the material furnished and found to have existed at the time of delivery, the Seller's liability shall be limited to furnishing necessary replacement material or parts. No liability is assumed by Goble Sampson Associates, Inc. under any conditions for installation, labor or materials associated with the installation of Seller's materials, unless installation is an integral part of this Proposal and are supplied by Goble Sampson Associates, Inc. This Proposal is for equipment only, and unless stipulated otherwise, does not include field service of any kind. Two weeks minimum advance notice in writing for start-up service is required. Start-up or supervision service will not be provided by Manufacturer or Goble Sampson Associates, Inc. on equipment covered by this Proposal if payment for equipment is not current, per Item B(1) of these Terms and Conditions.

G. **ACCEPTANCE OF THE PROPOSAL:** This proposal is subject to Buyer's offer to purchase and to the subsequent acceptance of an Officer of Goble Sampson Associates, Inc. Thereupon it will become the entire Agreement between Buyer and the Seller notwithstanding any previous communications or negotiations, whether oral or written. There are no covenants, agreements, inducements, guarantees, warranties, additions or considerations other than as set out specifically in this Proposal. The parties intend to be legally bound by this Agreement and to be governed by Utah law upon the execution of this instrument as a contract. In the event the Buyer issues his own purchase order or prepares a contract based on this Proposal, the Terms and Conditions of this Proposal shall be deemed to be incorporated in the said purchase order or contract unless exception is specifically taken.

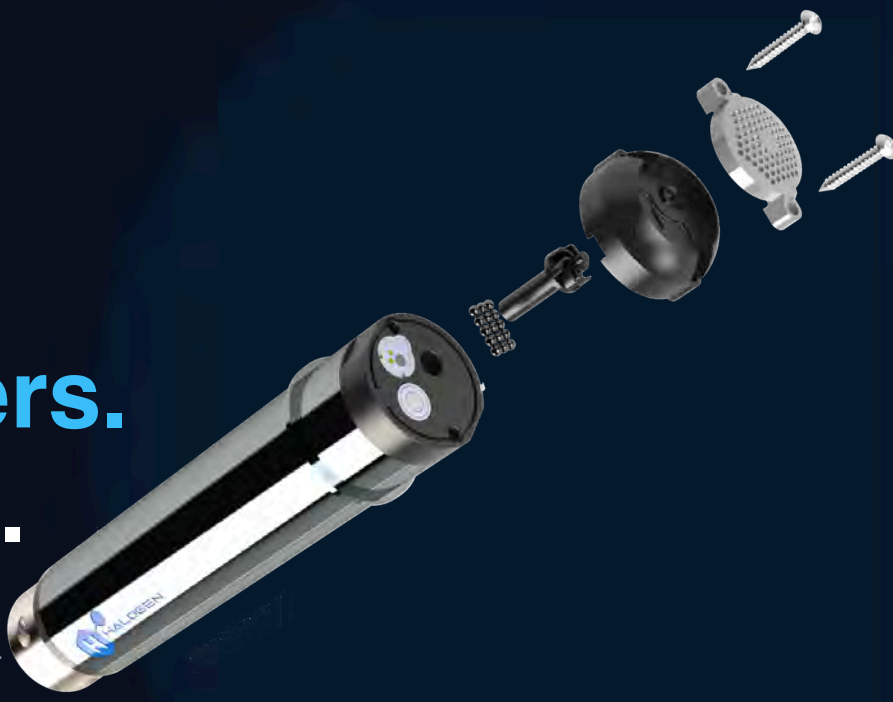
H. **SPECIAL CONDITIONS:** No back charges or delay in payment of equipment shipped or services performed will be accepted by Goble Sampson Associates, Inc. unless authorized in advance and confirmed in writing by Goble Sampson Associates, Inc. We wish to assure you that Goble Sampson Associates, Inc., will do its utmost to meet your required delivery dates; however, we cannot be held responsible for delays and shortages of material caused by conditions beyond our control.

HALOGEN PACKAGE

HALOGEN SYSTEMS

MULTIPARAMETER CHLORINE ANALYZER

The MP5-A. Five parameters. Zero reagents.



Bare-electrode amperometric technology with SensiCLENE self-cleaning. EPA Method 334.0 compliant. NSF-61 certified.

10ppb	±5%	6 mo
DETECTION LIMIT	ACCURACY(DPD)	CAL STABILITY

Why operators are switching to MP5-A

01

No Reagents. No Membranes.

Bare-electrode amperometric measurement eliminates consumable costs and the risk of running dry between visits.

02

No Waste Stream

Saveupto 70,000 gallonsof non-revenue water per year. No sample line, no drain connection.

03

Self-Cleaning

SensiCLENE captive beads continuously polish electrodes and pH glass for months of unattended operation.

04

Free Chlorine

Real-time compensation for pH, temperature, and conductivity gives you the real free chlorine number.

05

Flow Independent

Integrated micro-pumpdelivers accurate readings regardless of line velocity (0-4 m/s).

06

NSF-61 & EPA 334.0

Certifiedfor directdrinkingwater contact. Report-ready compliance data.

Wet Tap
D-H2WT-P

Immersion
D-H2LF-P

PVC Tee
D-H2MF-P

Panel Mount Kit
MKIT-0001

Technical Specifications

Measurement Method	Bare electrode amperometric
Chlorine Range	0 - 20 ppm
Limit of Detection	10 ppb (0.01 ppm)
Limit of Quantitation	40 ppb (0.04 ppm)
Resolution	0.001 ppm (1 ppb)
Chlorine Accuracy	±5% (DPD) pH 6.5-8.75
Temp Accuracy	±4% from 15-45C
Conductivity Accuracy	±4% from 200-10K uS
Calibration Stability	6 months typical
Measurement Interval	60 seconds
pH range (chlorine)	

pH (chlorine) Range	6.5 - 8.75
Conductivity Range	50 - 10,000 uS
Pressure Rating	10 bar (145 psi)
Operating Temp	1 - 50C (33 - 122F)
Storage Temp	-20 - 60C (-4 - 140F)
Max Flow Velocity	0 - 4 m/s
Max Immersion Depth	130 ft+ / 145 psi
Power	24VDC +/-10% @ 50mA
Cable Length	M12 4-pin, 5ft std (100ft max)
Dimensions Weight /	1.75" x 12" (45 mm x 305 mm)
Warranty	12 months
Weight	400 grams

MKIT-0001 - Complete Panel Mount System

Flowcell assembly, wall-mountpanel, and D20 controller with120 VAC power verything for a turnkey side-stream installation. Pair with D20-C cellular option for cloud monitoring and mobile alerts.

Accessories & Options

D20-H
D20 Controller 120/240V

PT-01
CPVC Pipe Adapter (2" Tee)

D20-OTA-H
D20 OTA Controller

RMR-WT
Wet Tap Remover (2" Corp Stop)

RMVRTL
Sensor Remover Tool

SensiCLENE Self-Cleaning Technology

The MP5-A features an integrated long-life pump that maintains consistent flow across the sensor electrodes, delivering accurate readings even in pipes with varying or zero flow.

Captive cleaning beads continuously polish electrode surfaces and pH glass, enabling months of unattended, maintenance-free operation. Combined with electrochemical cleaning cycles, the MP5-A maintains calibration accuracy far longer than membrane or reagent-based systems.

NSF-61/372 Certified | EPA Method 334.0 Compliant | CE Compliant | BABA Compliant | Factory Calibrated

Wet Tap Sensor

Installation Manual

Critical Safety Information

NOTICE

The manufacturer is not responsible for any damages due to misapplication or misuse of this product including, without limitation, direct, incidental, and consequential damages, and disclaims such damages to the full extent permitted under applicable law. The user is solely responsible to identify critical application risks and install appropriate mechanisms to protect processes during a possible equipment malfunction.

Please read this entire manual before unpacking, setting up or operating this equipment. Pay attention to all danger and caution statements. Failure to do so could result in serious injury to the operator and/or damage to the equipment.

Make sure that the protection provided by this equipment is not impaired. Do not use or install this equipment in any manner other than that specified in this manual.

Use of hazard information

DANGER

Indicates a potentially or imminently hazardous situation which, if not avoided, will result in death or serious injury.

Contents

Product Description

The Wet Tap Sensor consists of the sensor probe, and a drinking water mounting system, referred to as the remover assembly.

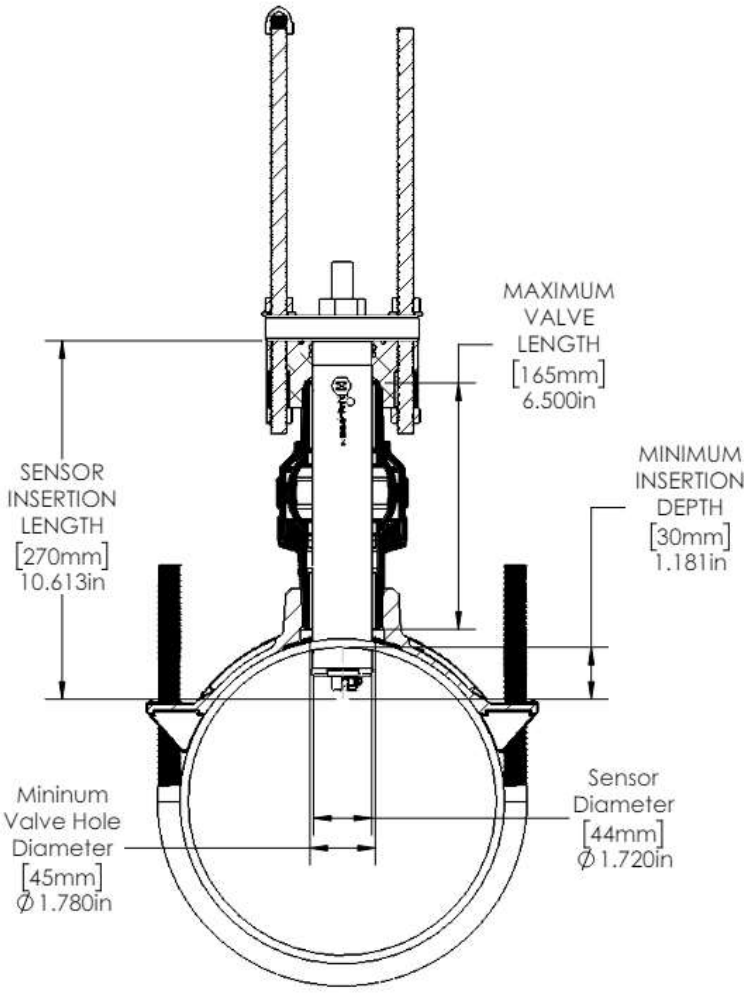
The sensor can be connected or implemented to a system by either:

1. Using a Display/Transmitter powered with 24VDC
2. To a SCADA system using Modbus RTU protocol and 24VDC

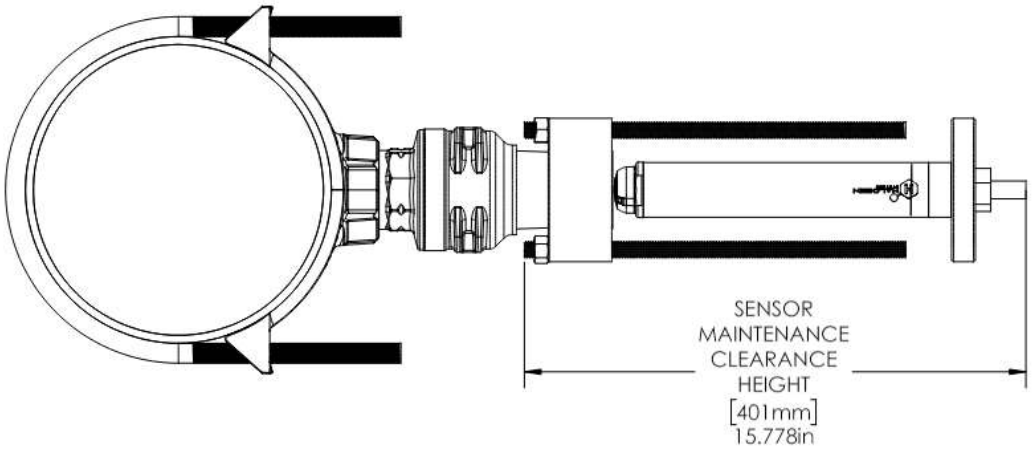
Depending on your product configuration, you can mount the remover assembly onto a **Corp Stop Male x Male valve** with British Standard Pipe – Tapered (BSPT) threads or National Pipe – Tapered (NPT) threads.

KITS-WT10: Remover Assembly with **2" Female NPT Threads**
KITS-WT20: Remover Assembly with Female **Rc 2 BSPT Threads**

The minimum insertion depth of the sensor must be 30mm from the sensor end to the inner diameter of the process pipe as shown below:



Install the wet tap sensor in a location where it can be maintained, refer below for the clearance height of the wet tap sensor.



1. Features

- Minimal maintenance.
- Reduced downtime with replaced wear parts
- No membrane and electrolyte required.
- No waste stream or flow control needed.
- Direct pipe insertion.
- Self-cleaning.
- 316 stainless steel sensor housing.

1.1 Specifications

Sensor Sample Requirements

Sample Pressure	-0.7 to 10 Bar
Sample Temperature	1 to 50° C
Sample pH	pH 6.5 to 8.75
Suspended Solids	Up to 3,000 ppm
Sample Flowrate	Variable from 0 to 5 m/Second
Sample Conductivity	50 to 10,000 µS at 0 to 25°C

2. Sensor Installation

DANGER

Multiple hazards. Only qualified personnel must conduct the tasks described in this section of the document.

Location of Components

Outlet Port

The outlet port, or ejection port, is responsible for ejecting the process water back into the system. The orientation of the outlet port within a pipe must be carefully considered. Instructions for the alignment of the outlet port have been laid out in **sections 2.2 and 2.3**. The image below displays how to identify the sensor outlet port.

TRO Sensor

1. Located in a straight length of pipe at least 1.5 times the pipe diameter.
2. The tip of the sensor should protrude into the pipe a minimum of 30mm.

2.1 Component Labels

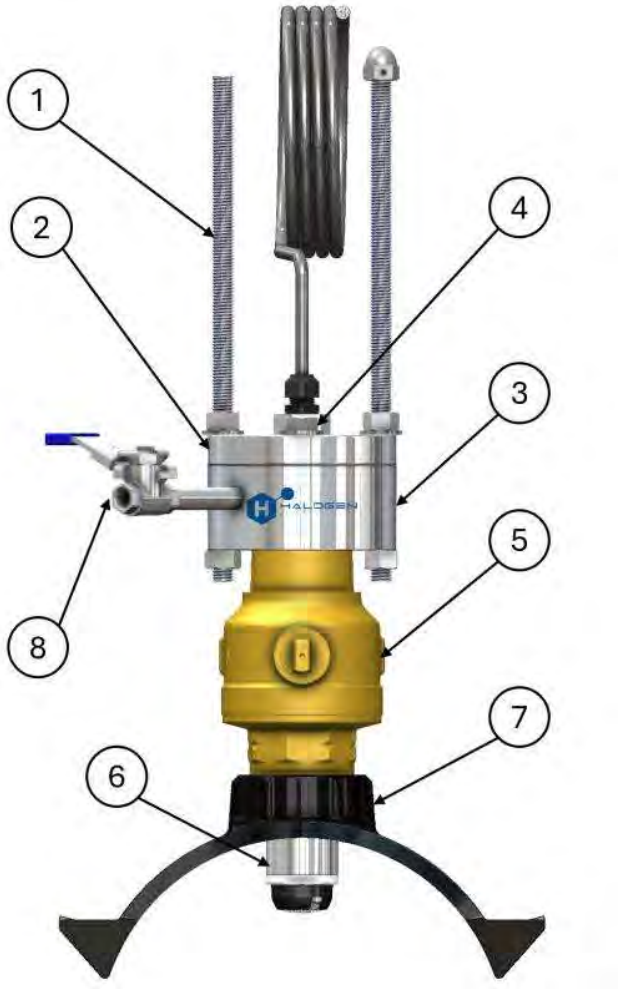


Figure 1. Drinking Water unit installed in pipe and detail of installation components.

No.	Part Description
1	Threaded Rod
2	Cap Mater
3	Remover Cap (configurable to NPT or BSPT threads)
4	Hex Bolt and Washer
5	Corp Stop Male x Male Valve (not included)
6	Sensor
7	Female Pipe Saddle (not included)
8	Sample Port

Depending on your product configuration, the Drinking water Assembly is designed to be installed in a Corp Stop Male x Male valve with 2" NPT threads or Rc 2 BSPT threaded valve. These instructions assume that a Wet Tap Valve and the appropriate saddle have been successfully installed.

2.2 Vertical Installation

For vertical installations, where a pipe is installed along a vertical wall, the sensor must not be inserted into a segment of the pipe where the water flows downward Figure 2 (b).

For vertical installations, water must flow upwards, and the Wet Tap Sensor must align with the direction of flow as shown in Figure 2 (a).

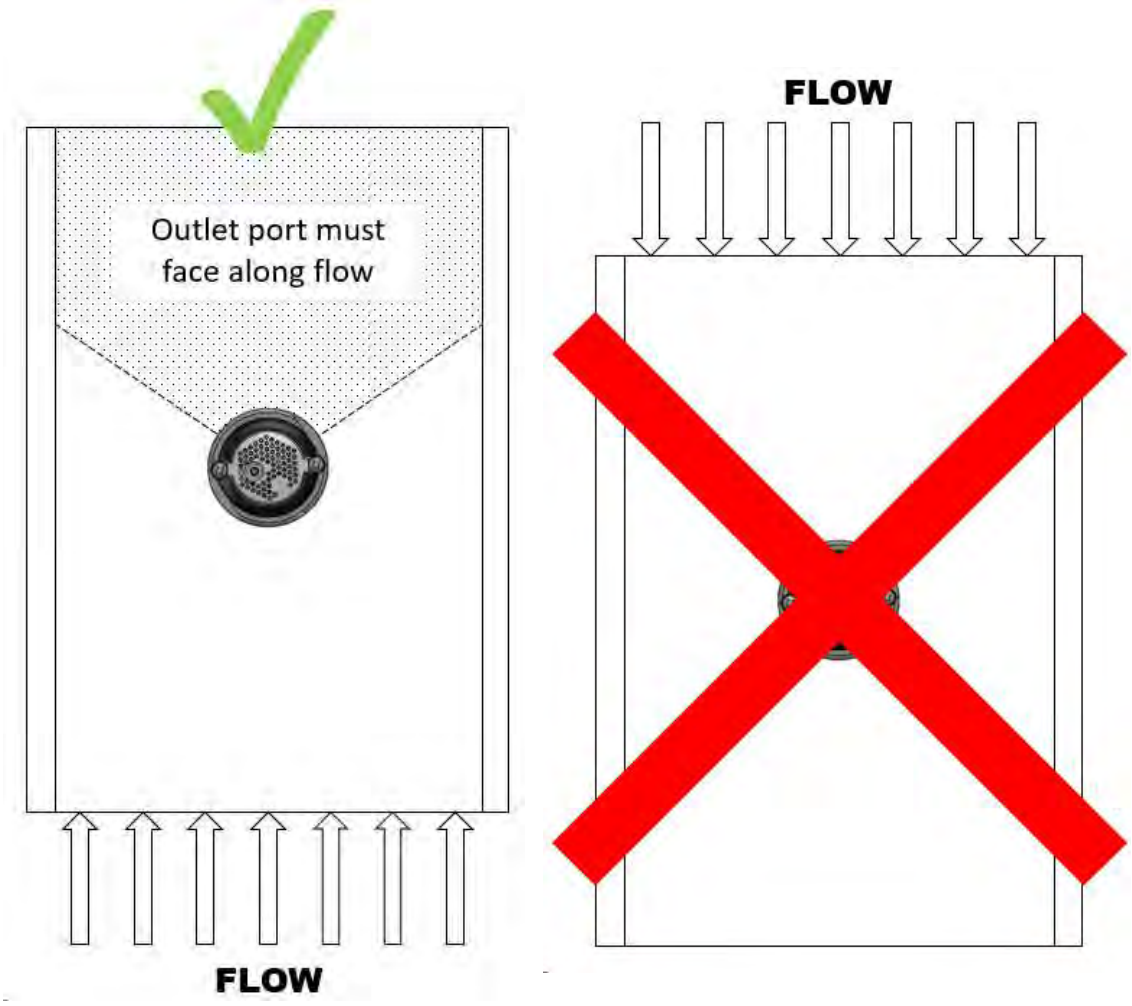


Figure 2. Front-facing cross-sectional views of vertical pipe installations. (a) Displays a correct installation of a Wet Tap Sensor, the outlet port must face in the marked region, along the direction of water flow. For clarity, (b) Depicts an incorrect installation of a Wet Tap Sensor, the direction of water flow must be upward.

2.3 Horizontal Installation

For horizontal installations, the Wet Tap Sensor must not be installed vertically as shown in flow-facing views of Figure 2 (c), and (d). The sensor must be installed **within +/- 45° from horizontal** as shown in figure 3 (a), and (b).

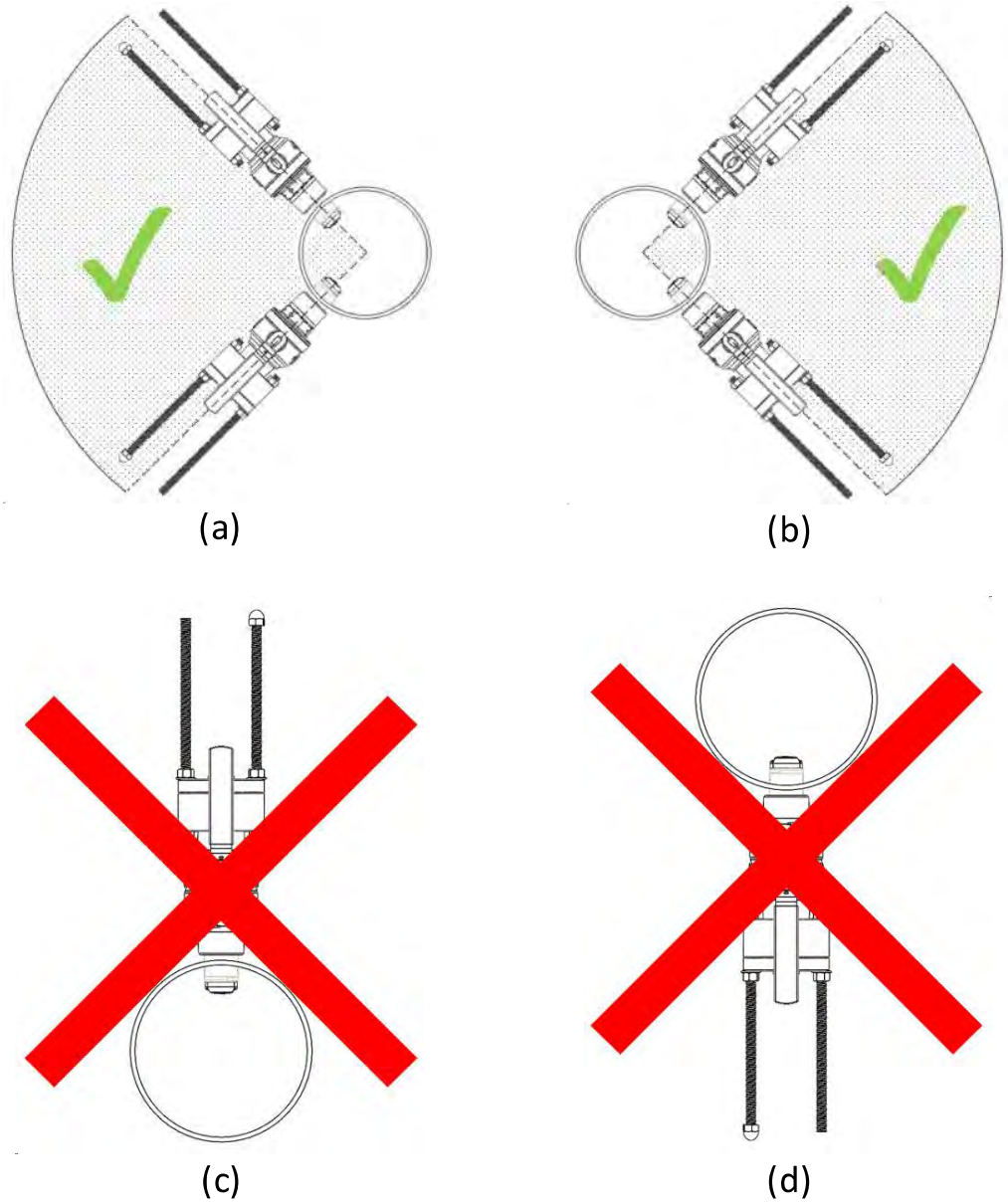


Figure 3. Flow-facing cross-sectional views of horizontal pipe installations. (a) and (b) display the acceptable range in which the Wet Tap Sensor can be installed onto a horizontal pipe. The Wet Tap Sensor must be installed within +/- 45° from horizontal. For clarity, (c) and (d) display incorrect installations of a Wet Tap Sensor.

Additionally, the outlet port must align with the direction of water flow and upwards, given the direction of flow, Figure 4 demonstrates where the outlet port should point.

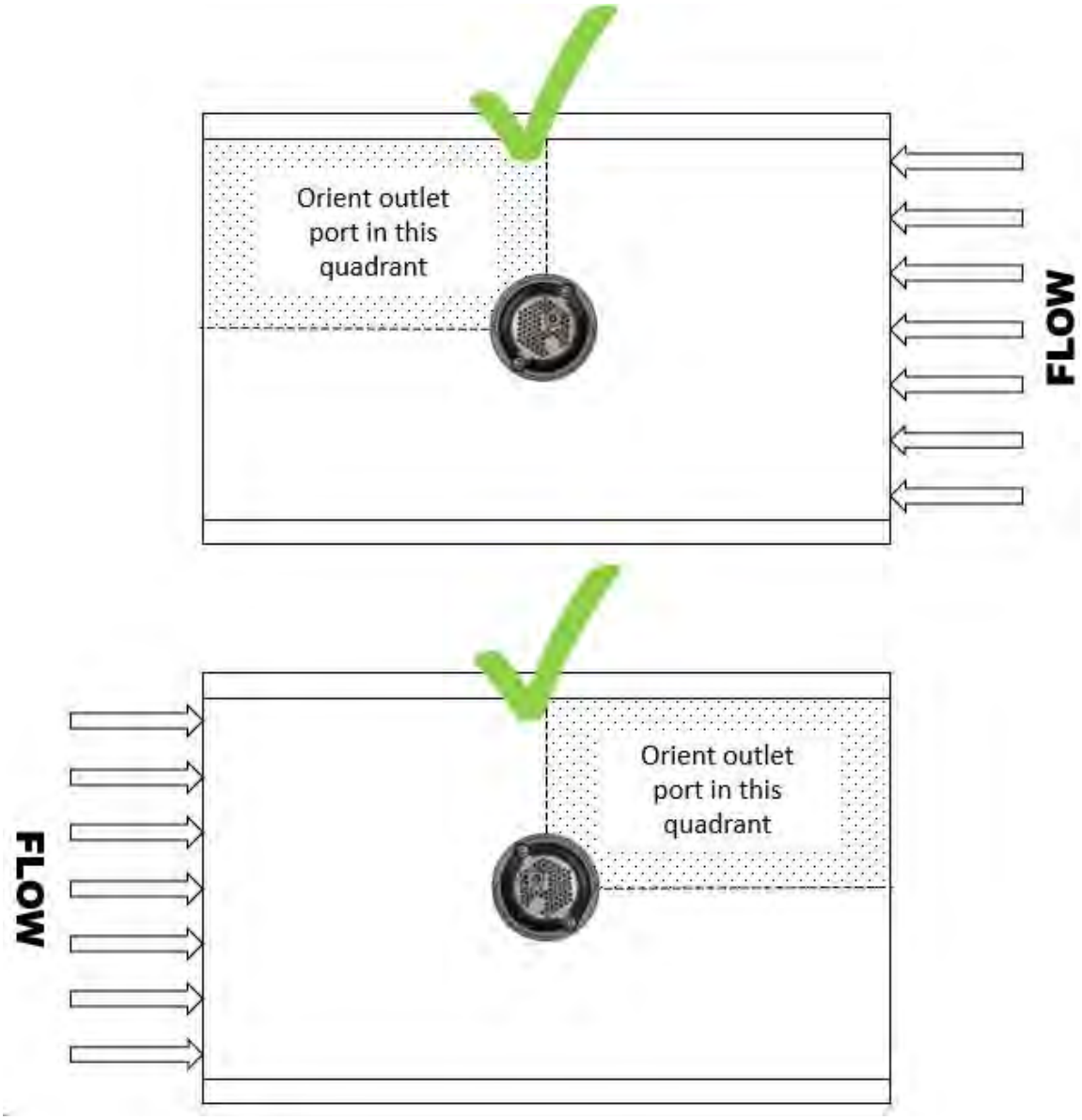


Figure 4. Front-facing cross-sectional views of correct outlet port orientation. The outlet must be directed upwards and along the flow.

2.4 Initial Installation

This installation assumes that a ⑤ **Valve** and ⑦ **Pipe Saddle** have been installed in the desired location in the pipeline. Ensure that the threads on the Corp Stop Male x Male Valve and Female Pipe Saddle are compatible. Valve I.D. must be 2" [50mm]

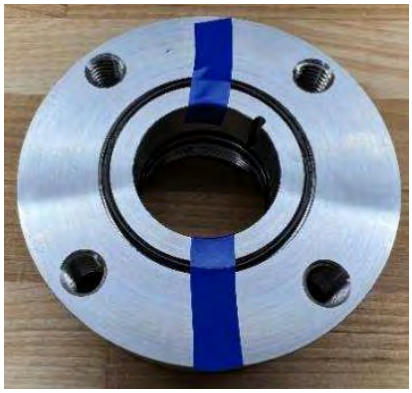


Figure 5. Blue tape location on cap.

1. Remove blue tape from the ③**Remover Cap**.
2. Install ③**Remover Cap** onto ⑤ **Corp Stop Male x Male Valve**.
3. Install ⑧**Sampling Port** onto ③**Remover Cap**.

Figure 6. Installation of sampling port fitting.

⚠ WARNING
To avoid leaking or damaging the sealing O-ring. Do NOT overtighten the sampling port fitting onto the remover cap

Note: When sampling water, please allow a minimum of 200mL of water to be dispensed before collecting a sample.

4. Install the two ①**All-thread Rods** into the ③**Remover Cap** until protruding from the other side by about 3/4" [19mm]. Thread hex nuts onto protruding threads.

Figure 7. Demonstration of All-thread Rod protruding ¾" from the other side of the Remover Cap.

5. The outlet port aligns with the sticker shown in Figure 9. Correctly orient ⑥**Sensor** by rotating the ②**Cap Mater**. **Review sections 2.2 and 2.3 for correct outlet port orientation.**

Figure 8. The outlet port aligns with the sticker shown.

Figure 9. How to identify the outlet port in a Wet Tap Sensor.

6. Slide ⑥**Sensor** assembly into cap using ③**All-thread Rods** as guide. Ensure sensor sleeves are pushed past the two O-rings located inside mater.

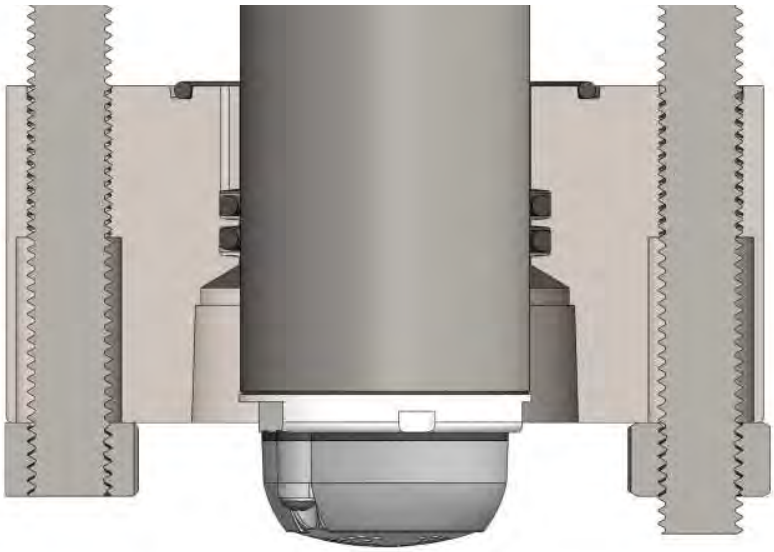


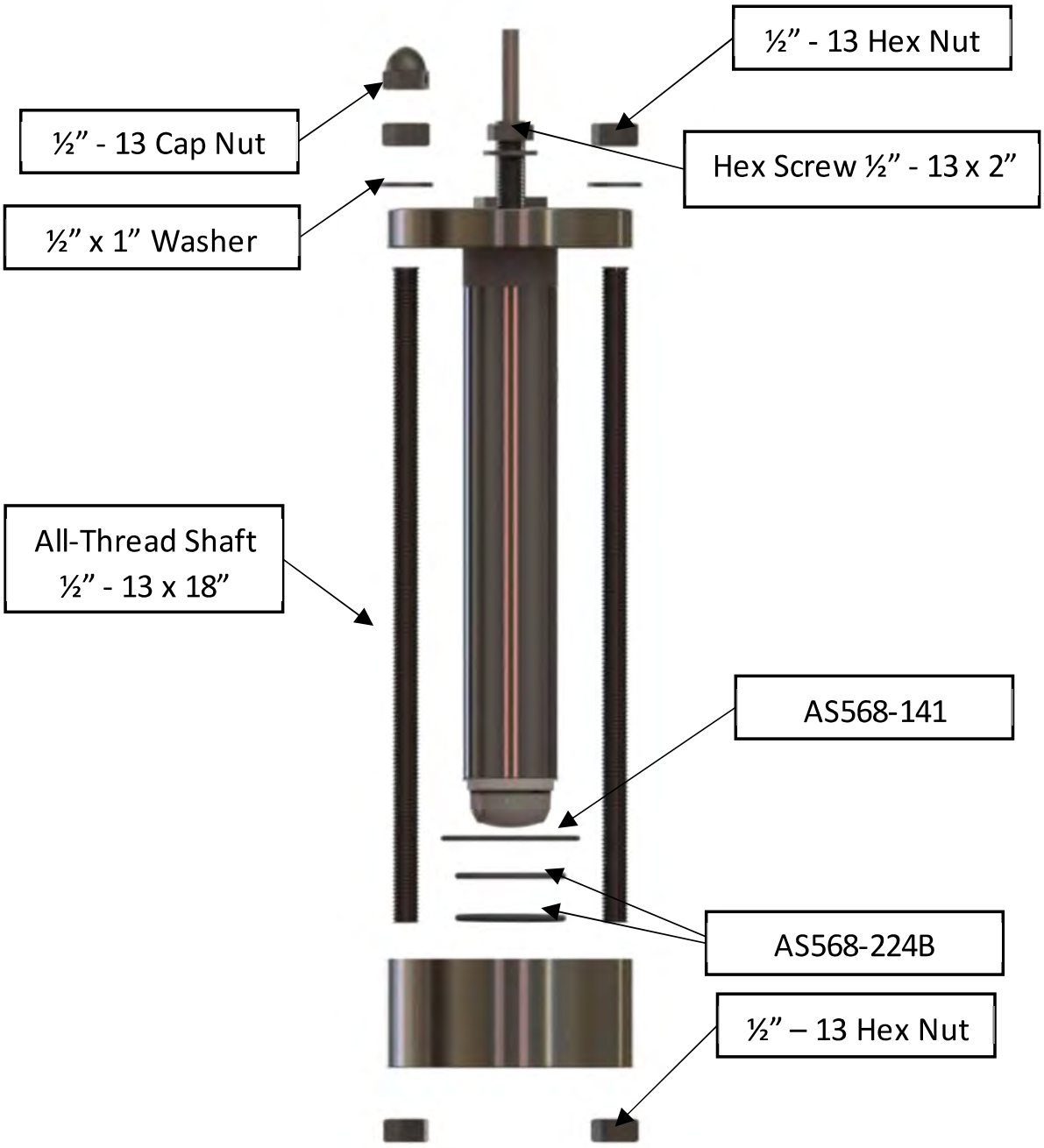
Figure 10. Cross-Section of Cap with sensor end pushed passed both internal O-rings.

7. While the valve is still closed, place the washers and nuts onto the ①**All-thread Rods** until they are flush with ②**Cap mater.**

Figure 11. Orientation arrow depicting location of ejection port on sensor end. Line up perpendicular to flow direction.

8. Open ⑤**Valve** and insert ⑥**Sensor/Mater** assembly. completely into process stream. The ②**Cap Mater** should be completely flush with ③**Remover Cap** (as shown in figure 1).
9. Secure the ③**Cap** and ②**Mater** using the ④**two hex nuts** and washers. Tighten hex nuts all the way to mater wrench tight.
10. Add locking cap nut to one threaded rod. This serves to prevent accidentally removing the retaining nuts completely.

3. Replacement Part Descriptions



4. Limited Warranty

Halogen Systems warrants its products against material workmanship defects for a period of one (1) year from the date of shipment.

In the event that a defect is discovered during the warranty period, Halogen Systems agrees, at its option, to repair or replace the defective product. Any product repaired or replaced under this warranty will be warranted only for the remainder of the original product warranty period.

Products may not be returned without authorization from Halogen Systems. To obtain authorization, please call Halogen Systems for a return material authorization number.

Limitations:

This warranty does not cover:

1) Damage caused by misuse, neglect (lack of appropriate maintenance), alteration, accident, or improper application or installation.
2) Damage caused by any repair or attempted repair not authorized by Halogen Systems.
3) Any product not used in accordance with the instructions furnished by Halogen Systems.
4) Damage caused by acts of God, natural disaster, acts of war (declared or undeclared), acts of terrorism, work actions, or acts of any governmental jurisdiction.
5) Freight charges to return merchandise to Halogen Systems.
6) Travel fees associated with on-site warranty repair.

This warranty is the sole expressed warranty made by Halogen Systems in connection with its product. All other warranties, whether expresses or implied, including without limitation, the warranties of merchantability and fitness for a particular purpose, are expressly disclaimed.

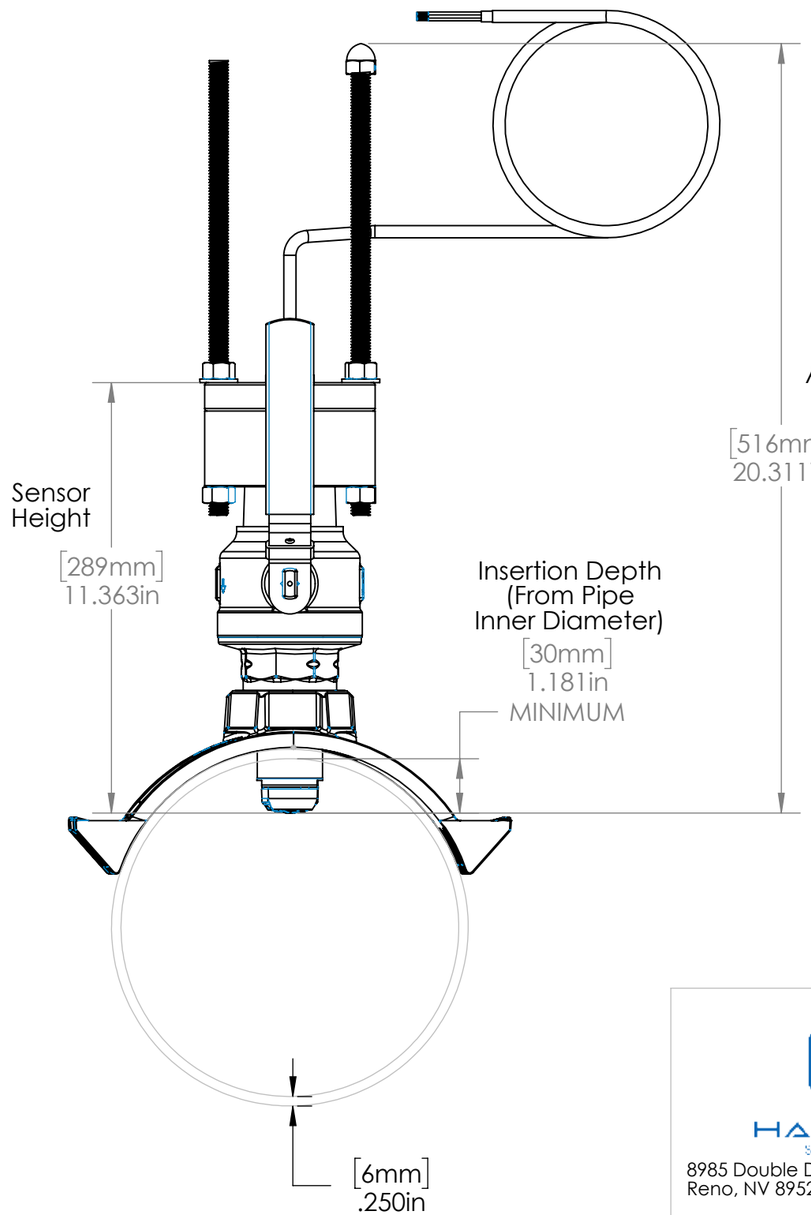
The liability of Halogen Systems shall be limited to the cost of the item giving rise to the claim. In no event shall Halogen Systems be liable for incidental or consequential damages.

This warranty is the sole and complete warranty for Halogen Systems. No person is authorized to make any warranties or representations on behalf of Halogen Systems.

Halogen Systems reserves the right to change or modify this warranty at any time.

NOTE:

1. Parts must be cleaned before assembly
2. Incoming Inspection at AQL Level I



HALOGEN SYSTEMS
8985 Double Diamond Parkway,Unit B-10
Reno, NV 89521

Fax: (775)-548-8558
Voice: (775)-832-0495
Email: mikes@halogensys.com

Weight: g
Volume: in^3
Density: lb/in^3

PARENT ASSEMBLY: XXXX-####	
PART CATEGORY	
MATERIAL	

UNLESS OTHERWISE SPECIFIED:

DIMENSIONS ARE IN INCHES
TOLERANCES:
FRACTIONAL ± 1/8"
ANGULAR: MACH ± .5 BEND ± .020"
TWO PLACE DECIMAL ±.020"
THREE PLACE DECIMAL ±.005"

INTERPRET GEOMETRIC TOLERANCING PER:

FINISH

	NAME	DATE
DRAWN	JL	01/19/2024
CHECKED	MS	01/19/2024
ENG APPR.	MS	01/19/2024
MFG APPR.	MS	01/19/2024
Q.A.	MS	01/19/2024
REGULATORY APPROVAL	MS	01/19/2024

Comments:

Description:

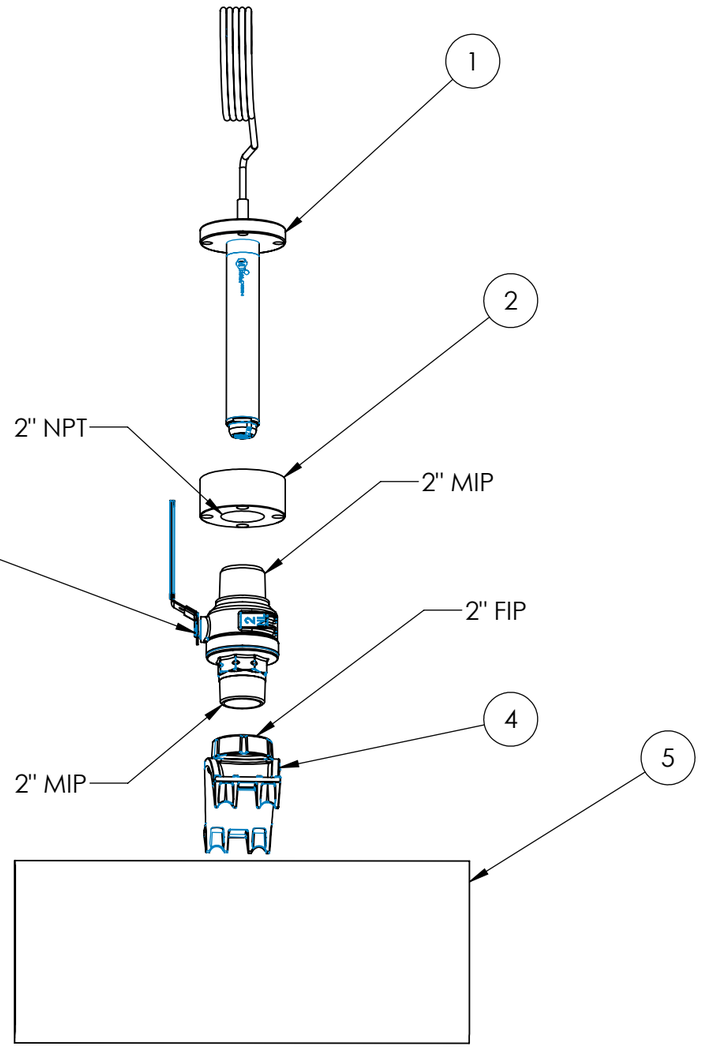
FULLY ASSEMBLY OVERVIEW

SIZE	Part No.	REV
B	D-H1WT-P	A1

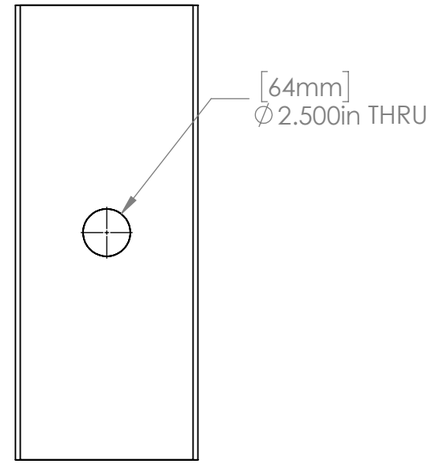
SCALE: 1:8 | SHEET 1 OF 2

NOTE:

1. MIP threads are compatible with NPT Threads, sealing compound must used between all thread interactions.



TOP VIEW OF PROCESS PIPE



ITEM NO.	PART NO.	DESCRIPTION	QUANTITY
1	D-H1WT-P	TRO Sensor	1
2	RKIT-0005	Remover Cap	1
3	FB500-7-TA-NL	2IN Ball Valve MIP x MIP	1
4	FCD202-XXXX-IP7-Q	SADDLE 2IN FIP - Size to match process pipe	1
5		Process Pipe - Size varies, customer driven	1

HALOGEN SYSTEMS

8985 Double Diamond Parkway,Unit B-10
Reno, NV 89521

Fax: (775)-548-8558
Voice: (775)-832-0495
Email: mikes@halogensys.com

Weight: g
Volume: in^3
Density: lb/in^3

PARENT ASSEMBLY: XXXX-####

PART CATEGORY

MATERIAL

UNLESS OTHERWISE SPECIFIED:

DIMENSIONS ARE IN INCHES
TOLERANCES:
FRACTIONAL ± 1/8"
ANGULAR: MACH ± .5 BEND ± .020"
TWO PLACE DECIMAL ±.020"
THREE PLACE DECIMAL ±.005"

INTERPRET GEOMETRIC TOLERANCING PER:

FINISH

	NAME	DATE
DRAWN	JL	01/19/2024
CHECKED	MS	01/19/2024
ENG APPR.	MS	01/19/2024
MFG APPR.	MS	01/19/2024
Q.A.	MS	01/19/2024
REGULATORY APPROVAL	MS	01/19/2024

Comments:

Description:

ASSEMBLY EXPLODED VIEW

SIZE	Part No.	REV
B	D-H1WT-P	A1

SCALE: 1:16 SHEET 2 OF 2