Site Management Plan
Kingsbury Landfill
Site No. 5-58-008

Revisions to Final Approved Site Management Plan:

Revision #	Submitted Date	Summary of Revision	NYSDEC Approval Date

Engineering Certification

I certify that I am currently a New York State registered professional engineer or Qualified Environmental Professional as defined in 6 NYCRR Part 375 and that this Site Management Plan was prepared in accordance with all applicable statues and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).

Respectfully submitted,
AECOM Technical Services Northeast, Inc.

November 19, 2015

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Date

Kingsbury Landfill
Washington County
Hudson Falls, New York
Site Management Plan

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List of Acronyms

AECOM	AECOM Technical Services Northeast, Inc.
AWQS	Ambient Water Quality Standards
Aztech	Aztech Technologies, Inc.
CAMP	Community Air Monitoring Plan
COC	Contaminant of Concern
DER	Division of Environmental Remediation
EC	Engineering Control
EE	Environmental Easement
EWP	Excavation Work Plan
ft bgs	Feet Below Ground Surface
gpm	Gallons per minute
GAC	Granular activated carbon
HASP	Health and Safety Plan
IC	Institutional Control
ILCTS	Interim Leachate Collection and Treatment System
LTMP	Long Term Monitoring Plan
NTU	Nephelometric Unit
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
O&M	Operation and Maintenance
OM&M	Operation, Maintenance and Monitoring
ORP	Oxidation-Reduction Potential
PPE	Personal Protective Equipment
ppm	Parts per Million
PRR	Periodic Review Report
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
RI/FS	Remedial Investigation and Feasibility Study
ROD	Record of Decision
SMP	Site Management Plan
SPDES	State Pollutant Discharge Elimination System

SVI	Soil Vapor Intrusion
TCLP	Toxicity Characteristic Leaching Procedure
µg/L	Micrograms per Liter
µg/m^3	Micrograms per Cubic Meter
USEPA	United States Environmental Protection Agency
VOCs	Volatile Organic Compounds

Executive Summary

The Kingsbury Landfill (Site) is an 18 acre closed landfill located on Burgoyne Avenue in the Village of Hudson Falls, Washington County, New York (Figure 1). The Site operated as a municipal dump prior to the establishment of regulations covering the operation and construction of waste facilities from 1930 to 1985. Regulated hazardous wastes disposed of at the Site include PCB-laden oil waste as well as halogenated solvents. Leachate generated at this site reached several surface water bodies adjacent to the site including the feeder/tow canal, Cutter Pond and a forested swamp. The New York State Department of Environmental Conservation (NYSDEC) has assigned the Site the ID No. 5-58-008, and applied the designation of a Type 4 inactive hazardous waste site. The Type 4 designation identifies the site as one that has been properly closed but requires continued site management, consisting of operation, maintenance and monitoring.

Environmental investigations revealed that the soil, sediments, groundwater, and surface water at and adjacent to the Site contained contaminants including PCBs, various metals, and halogenated solvents. The installed remedies include an interim leachate collection and treatment system (ILCTS), a soil-bentonite groundwater cut-off wall (slurry wall), and a low permeability clay cap with vegetation cover.

Site inspections are conducted twice a week by a technician during periods of ILCTS operation. Sampling of ILCTS influent and effluent is conducted bi-monthly during operation. Groundwater samples are collected every five quarters to monitor the effectiveness of the slurry wall.

No Record of Decision (ROD) containing remedial goals exists for Operable Unit (OU) 1, (on-site soil and groundwater contamination). In the absence of approved site specific remedial goals, the generic remedial goals presented in NYSDEC DER-10 guidance will be utilized. A ROD for OU2, (off site soil and sediment contamination), was finalized in March 2014. The selected remedy for OU2 is No Further Action, based on the implementation of several interim remedial actions that have been implemented at the site.

Site Identification: #5-58-008, Kingsbury Landfill, Burgoyne Avenue, Hudson Falls, NY

Institutional Controls:	1. The property is a closed municipal landfill
	2. All ECs must be operated and maintained as specified in this SMP; All ECs on the Site must be inspected and certified at a frequency and in a manner defined in the SMP; Groundwater and other environmental or public health monitoring must be performed as defined in this SMP; Data and information pertinent to Site Management for the Site must be reported at the frequency and in a manner defined in this SMP; and On-site environmental monitoring devices and treatment units must be protected and replaced as necessary to ensure the devices function in the manner specified in this SMP. All ECs must be inspected at a frequency and in a manner defined in the SMP.
Engineering Controls:	Landfill Cap and Drainage System Site Fencing, Gates and Signage Leachate treatment System Slurry Wall Leachate Collection and Leachate elevation Monitoring Landfill Off-Gas treatment Criteria for Completion of Remediation/Termination of Remedial Systems

Inspections:	Frequency
Engineered Cover System	Monthly
Perimeter Fencing	Monthly
Monitoring	
Monitoring Wells (GMW-2, GMW-3, GMW-4, GMW-5, GMW-6, MW-90-2C, MW-90-3C, MW-90-4, MW-90-6C, MW-90-7C, MW-90-10C, MW-90-11C, MW-8, MW-8A, MW-15 and MW-RW-1)	5-Quarter basis
Lysimeters	Quarterly
Landfill Gas	Quarterly

Maintenance:	Frequency
Leachate Treatment System	Weekly During Operation
Grass Mowing	Annual (performed by the Town of Hudson Falls)
Reporting:	
Groundwater Sampling Reports	5-quarter basis
Site Inspection (full)	Annual (Q1 Quarterly Report)
OM&M Reports	Quarterly
PRRs	Annual

1.0 Introduction

1.1 General

The Kingsbury Landfill (the "Site") is a former municipal landfill that served the local communities of Washington County, New York. The Site is listed as a Class 4 site and has been issued site number 5-58-008 by the New York State Department of Environmental Conservation (NYSDEC).

1.2 Revisions

There are no revisions to this document.

1.3 Notifications

Notifications will be submitted by the property owner, O&M Contractor, or other entity to the NYSDEC as needed for the following reasons:

- If an inspection identifies damage to a component of the ECs in place at the site that may affect the effectiveness or protectiveness of the remedy, it shall be reported to DER if it is determined to be an emergency situation by noon of the following business day or if it is not an emergency situation, within five business days of the inspection;
- 30-day advance notice of any proposed ground-intrusive activities;
- Notice within 48-hours of any damage or defect to the foundations structures that reduces or has the potential to reduce the effectiveness of other ECs and likewise any action to be taken to mitigate the damage or defect;
- Notice within 48-hours of any emergency, such as a fire, flood, or earthquake that reduces or has the potential to reduce the effectiveness of ECs in place at the site, including a summary of actions taken, or to be taken, and the potential impact to the environment and the public; and
- Follow-up status reports on actions taken to respond to any emergency event requiring ongoing responsive action shall be submitted to the NYSDEC within 45 days and shall describe and document actions taken to restore the effectiveness of the ECs.

Notifications will be made to Payson Long, Remedial Bureau E, Section D, NYSDEC DER, 625 Broadway, Albany, NY 12233. In the event that NYSDEC develops a centralized notification system, that system will be used instead.

2.0 SUMMARY OF PREVIOUS INVESTIGATIONS AND REMEDIAL ACTIONS

2.1 Site Location and Description

The Site is located on Burgoyne Avenue in the Village of Hudson Falls, Washington County, New York. The Site is an 18-acre closed municipal landfill (Figure 1). An aerial photograph of the Site (dated 2008) is included as Figure 1A. There are two operable units (OU) at the Site: OU1, which consist of all soil and groundwater inside the property boundary; and OU2 which consists of all off-site groundwater, soil, surface water and sediment contamination.

2.2 Physical Setting

2.2.1 Land Use

Land use at the Site is currently a closed municipal landfill.

2.2.2 Geology

The Site lies within the Hudson-Champlain Lowland, a broad bedrock depression formed in the Paleozoic (Middle Ordovician), Snake Hill Formation. The broad bedrock depression became a depositional outlet for retreating Wisconsinan Stage glaciers. The Hudson Champlain Lowland became occupied by a series of lakes where silt and clays were deposited in the low energy environments. Large deltas of sand and gravel were deposited where tributaries of the Glacial Hudson River delivered sediment to the lakes.

The Site is underlain by broad deltaic sand deposits of the Oakville soil series, which are continuous across the majority of the site, then thin and grade into silt and clay deposits of the Vergennes and Kingsbury soil series in the southern portion of the site. The deltaic sand varies in thickness from 60 feet to absent near the groundwater - surface water interface. The deltaic sands have proven to be a part of the most productive aquifer in the area. The silt and clay deposits underlie the aquifer in sufficient thickness to create an effective aquitard between the glacial soil aquifer and the bedrock aquifer. The bedrock underlying the soil is considered a poor aquifer due to its narrow productive joints and inconsistent yield.

2.2.3 Hydrogeology

There are currently 44 monitoring wells installed around the Site. Locations are shown on Figure 2. Groundwater elevations from the most recent five-quarterly sampling event (December 2013) are shown on Table 1. A groundwater contour map is shown on Figure 4. Groundwater flow beneath the Kingsbury landfill appears to be in an east-southeasterly direction, primarily through the delta sand deposits. The groundwater elevations intersect the ground surface elevation immediately to the south

of the landfill feeding a number of springs which form wetlands in any low-lying areas. The soil profile changes at or near this southern portion of the site with the sand deposits grading into clay soils creating the groundwater - surface water interface. A cross section is presented in Figure 3.

Groundwater flow beneath the landfill is estimated to be on the order of 20,000 gallons per day moving at a rate of 0.67 feet per day toward the south/southeast (E.C. Jordan, December 1991).

2.3 Investigation and Remedial History

The Site operated as a municipal dump from 1930 to 1985, prior to the establishment of regulations covering the operation and construction of waste facilities. New York State enacted Title 6 NYCRR Part 360 regulations regarding solid waste management requiring a permit to continue to construct and operate the landfill. A permit was granted by the NYSDEC to construct and operate as a Municipal Solid Waste Landfill (Permit issued 1985) until such time as the local municipality could develop a solid waste disposal plan that provided an appropriate alternative to the Site. Leachate generated at this landfill reached several surface water bodies adjacent to the site including the feeder/tow canal, Cutter Pond and a forested swamp. Environmental investigations revealed that the soil, sediments, groundwater and surface water in adjacent to the Site had become contaminated with polychlorinated biphenyls (PCBs), various metals, and halogenated solvents.

In 1989 a settlement between GE and the NYSDEC established requirements for actions to be completed at the Site in order to remediate the identified negative environmental impacts as well as mitigate the potential for ongoing and future environmental degradation. Remedial investigations were conducted in response to reports of leachate discharging from the Site. The investigations identified PCBs and halogenated compounds as contaminants of concern. Affected media included contaminated surface water, sediments, and groundwater in the area adjacent to the landfill.

Landfill closure activities were completed in 1989. These activities included: the construction of a slurry wall; a low permeability clay cap and cover system; a passive landfill gas venting system; a leachate collection and treatment system; and the installation of groundwater monitoring wells. The on-site remediation eliminated direct exposure to hazardous waste disposed at the facility. Installation of the soil-bentonite groundwater cut-off wall and the low permeability clay cap and cover system is meant to effectively cut off the waste mass and leachate from the surrounding environment. The leachate collection system is utilized to allow leachate to accumulate in piping and sumps then be pumped to the treatment system, controlling the leachate elevation within the landfill. The passive landfill gas venting system was installed to allow relief of pressure caused by gas generation from the waste mass to control migration. The closure activities were meant to bring the facility construction to standards appropriate for a waste disposal site.

The slurry wall is constructed of a soil bentonite mixture and surrounds the waste mass forming a barrier to leachate escaping into permeable soils. The wall elevation and depth of construction varies to match the geologic conditions encountered. The depth of slurry wall placement is controlled by the underlying clay surface, with trenching terminating six feet into the underlying clay in order to create

an impermeable seal. The slurry was placed without failing any required quality control testing, but was required to be extended deeper in areas to address localized permeable soils.

A soil cap was installed at the Site consisting of a 42-inch layer of compacted clay, a 12-inch layer of silty loam, and a 6-inch layer of top soil. The cap was designed to prevent infiltration of precipitation into the landfill. The compacted soil cap depends on a vegetative cover to maintain the cohesion of the soil. Rip-rip filled drainage ditches channel runoff away from the landfill towards the east.

Four pan lysimeters were installed below the cap to allow measurement of precipitation infiltration through the cap. Lysimeters are constructed of a vessel with a riser that extends through the cap to the surface where it is capped to prevent direct filling. The lysimeter vessel allows water to infiltrate through its upper surface, storing it until it is removed for measurement.

The passive gas venting system is constructed of slotted polyvinyl chloride (PVC) laterals connected to solid risers which to vent gas generated by the waste mass. Landfill gas generated within the enclosed waste mass will build pressure potentially causing slope stability issues, or migrating from the waste mass through leachate collection piping or the subsurface. Venting provides a control measure to direct landfill gas out of the enclosed waste mass into the atmosphere. The system consists of three laterals, a main trunk and three vents. The laterals are installed below the cap following the slope extending across the waste mass. The laterals join the main trunk which runs perpendicular to the laterals along the crest of the landfill. The vents rise from the main trunk through the cap, and are evenly spaced along the peak of the landfill.

The landfill gas is treated through activated carbon units integrated into the vent risers. The activated carbon units remove volatile chemicals from the passively discharged landfill gas. Pressure gauges are installed at each location to monitor fouling of the carbon, identified by increasing pressure gauge readings.

The installation of an environmental monitoring network consisting of monitoring wells, landfill gas vents, and pan lysimeters established a system allowing for periodic measurement and sampling in order to assess the effectiveness of the remedial measures completed at the Site. Periodic monitoring has been conducted utilizing portions of the available network to provide analytical data necessary to determine whether the remedial activities completed at the Site remain effective in protecting the environment and human health.

In 1988 and 1989, the leachate collection system was upgraded to increase the collection rate in response to leachate seeps appearing along the junction of the cap and cut-off wall.

Accumulation of large volumes of leachate following slurry wall construction lead to the determination that active leachate extraction was necessary in order to avoid slope instability and the release of leachate into the environment. In 1988 and 1989, upgrades were completed to the leachate collection system and an Interim Leachate Collection and Treatment System (ILCTS)

was installed to evacuate and treat leachate from the landfill. The ILCTS was designed to reduce the leachate head in the landfill thereby protecting the integrity of the engineered cap and cover system and mitigating the potential for leachate release into the environment. The ILCTS was designed for a maximum capacity of 30 gallons per minute (gpm) estimated to be sufficient to maintain the leachate elevation at or below the 202 foot action level. The leachate collection system was renovated in response to operational problems in 1995, and again in 2008.

The ILCTS was first operated in 1991 removing and treating almost two million gallons of leachate. The ILCTS was modified in 1995 in response to a number of operational problems. After the renovation, the plant was prepared for an indeterminate period of inactivity based on measurements that indicated leachate elevations in the landfill did not rise to the action level as quickly as anticipated.

Since 1991, the leachate elevation within the landfill has been monitored periodically, and found to have reached the 200 foot action level in some of the wells in 1999. The elevation fluctuated and then continued to rise and stay above 200 ft. The NYSDEC restarted the leachate treatment system in August of 2002 and operated until late fall. The following year it was restarted in May 2003 and operated until late fall. The ILCTS was not operated in 2004 and was restarted in August 2005. ILCTS process improvements were made in the seasons mentioned above. The ILCTS was operated for several months each year (Spring through Fall) during the years 2002, 2003, 2005, 2007, 2008, and 2009 removing and treating more than 5.6 million gallons of leachate.

The ILCTS has been operating continuously since 2009. In April 2011, a video inspection of the leachate drain lines was conducted. The inspection indicated that both the shallow and deep drains lines were partially to completely blocked with sediment. An effort was made in 2011 to drawn down the leachate level in the landfill in order to access the drain lines which have become clogged. The pumping rate was increased from approximately 3 gpm to almost 10 gpm in August 2011. Bids for the drain line lancing were solicited from specialty subcontractors. Further discussions on drain lancing with NYSDEC resulted in the postponement of the operation pending a review of other alternatives.

During a routine carbon changeout in March 2012, the carbon in the ILCTS was found to be hardened. Chemical testing indicated that the carbon was calcified. Aztech brought in a specialty contractor, Redux Technology, to provide technical expertise on how to address the carbon fouling problem. A chemical treatment system was selected and installed in March 2013. The chemical injection system consists of a low flow metering pump, Teflon lined tubing and an injection point into the existing water treatment system. The chemical injection product is Redux 390, an aqueous blended deposit control agent. Redux 390 consists of 90.0% water, 6.0% poly carboxylic acid, and 4.0% organophosphorous compound. The objective of the chemical injection is to sequester water hardness components such as calcium (Ca^{2+}) and magnesium (Mg^{2+}), allowing these components to remain in suspension and pass through the bag filters and granular activated carbon (GAC) treatment portions of the water treatment system. By sequestering the hardness components, this

will prevent scaling and fouling along the bag filters and carbon treatment system, resulting in the increased operation life of the bag filters and GAC media and therefore decreasing operation costs of the treatment system.

Following closure activities conducted in 1987 and 1988 at the landfill, a leachate stream, estimated to be flowing at up to 30 gallons per minute, continued to drain from the site. Blasland and Bouck Engineers, P.C. was contracted by the NYSDEC to design the interim leachate collection and treatment system (ILCTS). Renovations by E.C. Jordan Co. were completed in 1991. The renovations included installing a Sandpiper diaphragm pump, air compressor, acid metering pump, and filter feed tank mixer.

Between November 12, and November 30, 1990, E.C. Jordan Co. conducted a full scale treatability study for the NYSDEC. The full scale treatability study followed a bench scale treatability study performed in October, 1990. The objectives of the full scale treatability study were to collect and interpret information to optimize leachate treatment and to lower operation and maintenance (O&M) costs by reducing chemical dosages and preventing scale buildup.

Following an Alternative Analysis Report for Treatment and Disposal of Leachate prepared by Clough, Harbour and Associates (CHA) in April 1995, the NYSDEC instructed CHA to perform renovations to the ILCTS. The renovations were performed in the summer of 1995. The renovations consisted of installing new filter feed pumps, recharge sump pump, carbon filters, piping and valves, flow meters, alarm dialer, carbon filter backwash system, controls and electrical wiring.

At the direction of NYSDEC, AECOM (formerly Earth Tech) and its subcontractor, Aztech Technologies, performed another round of renovations to the ILCTS in 2007 and 2008. This round of renovations included:

- Design and completion of engineering drawings for the complete system electrical schematic, main control panel, switch / indicator light panel, load center layout, sized conduit map with all infill wires, sizes, and functions.
- Deconstruct pipe bridge, relocation of pipes and conduits underground, re-valving of the new pipes (including a vacuum relief valve in the influent line) and removal of the control panel outside at the wells with control now integrated into the new programmable logic controller (PLC).
- Replacement of the clarifier media and resurfacing of the clarifier tank.
- Replacement of old low-pressure carbon vessels with new high-pressure units including new liquid-phase activated carbon media. This also included the removal of several pressure reducing and pressure controlling valves.
- Removal of several existing small control panels, disconnect switches, and 480V transformer.

- Installation of new conduits and wires to several areas inside and outside the treatment building to accommodate the existing and new sensors as well as the expanded control capabilities.

- Relocation all control equipment to a central location in the treatment building, centralizing power distribution of 480V, 120/240V, and DC voltages to the same area.

- Replacement of rudimentary, decentralized, line-voltage control setup with a new PLC that:

    - Allows plain-language programming, password-protection, and remote access.

    - Replaces existing alarm autodialer with a daily fax report of all system readings and functions, supplemented by alarm faxes when necessary.

    - Supports remote system login for status, adjustment of alarm levels, and remote startup/shutdown.

    - Incorporates data logging with remote access for recordkeeping and system troubleshooting.

    - Reutilizing existing equipment wherever possible, including existing float sensors, pumps, blowers, and conduits.

- Between September 2012 and April 2013 additional renovations were performed under approval from the NYSDEC. AECOM (formerly Earth Tech) and its subcontractor, Aztech Technologies, performed another round of renovations to the blower or front room portion of the ILCTS building. This round of renovations included: Removal of old animal damaged fiberglass insulation.
- Reconstruction of the east wall of the room to replace rotted studs, sills and sheathing and relocation of the door.
- Installation of spray foam insulation (including fire-retardant paint covering) to the interior of the entire portion of the system building that had formerly been insulated with fiberglass batting.
- Removal of an interior wall
- Installation of plywood wall sheathing in this portion of the system building.
- The ILCTS electrical system was upgraded and the efficiency improved. The three-phase power supply feed was upgraded to bring the system into code compliance and provide a main power disconnect outside the build for shot-off in the event of an emergency. National Grid also replaced the electrical power meter for the system.

The entire layout of the room was updated to improve efficiency of the space and the operation of the ILCTS.

The ILCTS has been treating leachate collected by the underdrain system from March 1989 to the present. The ILCTS treated approximately 2 million gallons, 1.5 million gallons, and 1.9 million gallons of leachate during 1989, 1990 and 1991, respectively. The system was inactive from 1992 to 2002 due to low leachate levels. In August 2002, the system was re-started due to rising leachate

levels and was operated seasonally through 2009. The system has run continuously since June 2009.

Soil based investigations for OU2 (Off-Site Soil and Sediment) identified the primary contaminants of concern in soil and sediments as PCBs. Soils along the banks of the Feeder Canal, Cutter Pond and Brown Pond were analyzed for PCBs. Only the soils along the banks of Brown Pond, located directly to the north of Kingsbury landfill (shown in Figure 1A), had levels of PCBs above the soil clean-up objective (SCO) for protection of ecological resources for PCBs. PCB levels in soil ranged from non-detect to 1.3 ppm. In addition, sediments in Brown Pond were impacted by PCBs with concentrations ranging from non-detect to 34 ppm. From October 17, 2011 to October 29, 2011 an Interim Remedial Measure (IRM) was conducted to remove the contamination from the banks and sediment of Brown Pond.

During the implementation of the IRM, surface water from the pond was pumped from the pond prior to excavation work. The pumped water was passed through a treatment system using a granular activated carbon/duplex bag filter assembly. Initially, the water was conveyed to a poly storage tank. Once sample results confirmed acceptable treatment and compliance with the SPDES equivalent permit, the water was discharged to the east side of the Brown Pond towards Cutter Pond. Approximately 80,000 gallons of water was treated and discharged.

Sediment was removed to a depth of 2 feet in most areas of the pond. Based on samples collected at the bottom of the excavation, additional sediment was removed in the southern section of the pond. This section was excavated to a depth of 7 feet. Soil was removed to a depth of 1 to 2 feet along the pond bank. The horizontal extent of excavation was extended along the western pond bank based on sidewall samples. Sampling confirmed that remaining levels of PCBs were below 1 ppm. Approximately 266 tons of PCB contaminated material was handled, transported and disposed of off-site at a permitted landfill. Following excavation, the pond and banks were backfilled with clean material and restored to the original grades.

A Record of Decision was issued for OU2 in March 2014. Based on the implementation of several interim remedial actions conducted at the Site, the selected remedy for the Site is No Further Action.

2.4 Remedial Action Objectives

Remedial investigations were conducted in response to reports of leachate discharging from the Site. The investigations identified PCBs and halogenated compounds as contaminants of concern. Affected media included contaminated surface water, sediments, and groundwater in the area adjacent to the landfill.

Closure activities were conducted at the Kingsbury Landfill between 1987 and 1989. Closure activities included the construction of a groundwater cutoff wall around the perimeter of the landfill and the placement of a low permeability compacted soil cap over the entire 17 acre area. The cutoff wall is keyed into a glacial clay deposit at depths ranging between 25 and 85 feet below the ground

surface. The cap covering the top of the landfill inhibits infiltration of precipitation. Precipitation runoff is collected in drainage swales at the base of the landfill, and is eventually discharges into the Feeder Tow Canal.

As there is no ROD for OU1, there are no finalized remedial objectives for OU1. Remedial objectives for OU-2 were presented in the March 2014 ROD: at a minimum, the remedy shall eliminate or mitigate all significant threats to public health and the environment presented by the contamination identified at the site.

2.5 Remaining Contamination

Contaminated materials were not removed from the Site during remedial activities. The slurry wall was constructed around the existing landfill and keyed into a subsurface clay layer beneath the waste mass. A soil cap was constructed over the waste mass and tied into the slurry wall to prevent infiltration.

Contaminated materials, including PCBs and volatile organic compounds (VOCs), remain at the Site encapsulated by the slurry wall and soil cap. Historic records indicate that approximately 1,900 tons of regulated hazardous waste generated by GE had been accepted into the facility for disposal prior to acceptance of the Class 2 permit requirements for the Site. The regulated hazardous waste generated by GE represents approximately 87% of the total hazardous waste disposed here, with an additional 287 tons coming from unidentified generators. Regulated hazardous wastes disposed of at the Site include PCB-laden and oil impregnated waste as well as halogenated solvents.

Remaining contamination at the site is currently only actively remediated during the treatment of removed leachate prior to discharge. Treatment requirements are detailed in the Discharge Permit (Appendix I).

Contaminants of Concern and Cleanup Criteria by Media

Compound	Groundwater µg/L	Soil - Industrial mg/kg	Sediment mg/kg
PCBs	0.09	25	<0.1
Trichloroethene	5	400	<1.8
cis-1,2-Dichloroethene	5	1,000	NC
1,1-Dichloroethene	5	480	NC
Vinyl Chloride	2	27	NC
1,1-Dichloroethane	5	1,000	NC
1,2-Dichloroethane	0.6	60	NC
1,3-Dichlorobenzene	3	560	<1.8
1,4-Dichlorobenzene	3	250	<0.72
Benzene	1	89	<0.35
Chlorobenzene	5	1,000	NC
Chromium	50	6,800	<43
Iron	300	NC	NC
Magnesium	35,000	NC	NC
Manganese	300	10,000	NC
Sodium	20,000	NC	NC

Notes:

Groundwater - NYSDEC Technical and Operational Guidance Series (1.1.1)

Soil - 6 NYCRR Part 375-6.8(b)

Sediment - Screening and Assessment of Contaminated Sediment, NYSDEC June 2014

NC - No criteria

2.5.1 Soil

Contaminated soils remain at the site beneath the landfill cap.

2.5.2 Sediment

Sediments in Brown Pond were remediated in 2014 as discussed in Section 2.3.

2.5.3 Groundwater

Groundwater contamination is present inside the slurry wall at the Site and is currently being treated by the ILCTS.

3.0 Institutional and Engineering Control Plan

3.1 General

Since remaining contaminated soil and groundwater exists beneath the site, institutional controls (ICs) and engineering controls (ECs) are required to protect human health and the environment. This IC/IC/EC Plan describes the procedures for the implementation and management of all IC/ECs at the site. The IC/IC/EC Plan is one component of the SMP and is subject to revision by NYSDEC.

The purpose of this IC/EC Plan is to provide:

- A description of all IC/ECs on the site;
- The basic operation and intended role of each implemented IC/EC;
- A description of the features that should be evaluated during each periodic inspection and compliance certification period;
- A description of plans and procedures to be followed for implementation of IC/ECs;
- Any other provisions necessary to identify or establish methods for implementing the IC/ECs required by the site remedy, as determined by the NYSDEC; and
- A description of the reporting requirements for these controls.

3.2 Institutional Controls

A series of ICs are required by the NYSDEC to: (1) implement, maintain and monitor EC systems; (2) prevent future exposure to remaining contamination by controlling disturbances of the subsurface contamination; and, (3) limit the use and development of the site. Adherence to these ICs on the Site is required by the NYSDEC and will be implemented under this SMP. These ICs are:

- All ECs must be operated and maintained as specified in this SMP;
- All ECs on the Site must be inspected and certified at a frequency and in a manner defined in the SMP;
- Groundwater and other environmental or public health monitoring must be performed as defined in this SMP;
- Data and information pertinent to Site Management for the Site must be reported at the frequency and in a manner defined in this SMP; and
- On-site environmental monitoring devices and treatment units must be protected and replaced as necessary to ensure the devices function in the manner specified in this SMP.

The Environmental Easement (Appendix H) gave rights to NYSDEC to perform the following functions:

- Exclusive use and occupancy of the property;
- Secure the site with fencing;
- Construction, reconstruction and operation of a work area;
- Grading;
- Clearing and grubbing of trees, brush, debris and structures;
- Construction, reconstruction and operation of all structures, facilities and other works to necessitated by the implementation of the Kingsbury Toxic Waste Site Remedial Plan;
- Excavation, removal and/or placement of fill; and
- Provide ingress, egress and regress to the NYSDEC and its agents for the performance of the operation of the site.

3.3 Engineering Controls

3.3.1 Landfill Cap and Drainage

A soil cap was installed at the Site consisting of a 42-inch layer of compacted clay, a 12-inch layer of silty loam, and a 6-inch layer of top soil. The purpose of the cap is to prevent precipitation from infiltrating into the landfill. The compacted soil cap depends on a vegetative cover to maintain the cohesion of the soil. Rip-rip filled drainage ditches channel runoff away from the land fill toward the east.

The cap will be inspected monthly for signs of failure including cracks, slumping, lack of vegetative cover, and ponding of water. The NYSDEC project manager should be notified if ponded areas, or cracks in excess of 4 inches (width or depth) are noted. The cap will be repaired to prevent failure.

The vegetative cover is to be cut once per year by the Town of Kingsbury. A path to the monitoring wells will be maintained as necessary to allow access to the monitoring well to collect groundwater level measurements.

Four pan lysimeters have been installed at the Site to monitor infiltration of the cap. The lysimeters are currently damaged and will need to be replaced with new units. The Long Term Monitoring Plan (LTMP) for the Site (Section 3 of this SMP) includes monitoring of the lysimeters to provide data on the effectiveness of the landfill cap.

3.3.2 Site Fencing, Gates, and Signage

An eight foot high chain link security fence is in place around the perimeter of the Site. The fence is topped with three rows of barbed wire to deter unauthorized persons from entering the Site. The main access to the Site is through a gate on Burgoyone Avenue. A sign on the gate identifies the Site.

Additional gates are located on the south and west ends of the landfill. Pad locks are used to secure all of the gates on the Site.

The fencing, gates and signage will be inspected monthly. Any brakes in the fence or gates will be repaired as soon as possible. Signage is to be inspected and replaced as needed.

3.3.3 Leachate Treatment System

The leachate treatment system is housed in a building located near the main gate at the southern end of the Site. The building has three doors and a rolling overhead door. All of the doors are secured with locks.

Procedures for operating and maintaining the leachate treatment system are documented in the O&M Plan (Section 4 of this SMP). Procedures for monitoring the system are included in the LTMP (Section 3 of this SMP).

3.3.4 Slurry Wall, Leachate Collection, and Leachate Elevation Monitoring

A soil-bentonite slurry wall has been installed around the perimeter of the landfill. The purpose of the slurry wall is to prevent the infiltration of groundwater into the landfill and to contain leachate within the landfill. The leachate level is to be maintained at an elevation below 202 feet in order to prevent leachate leakage over the slurry wall and to maintain the integrity of the landfill. Leachate levels at the following monitoring points within the confines of the slurry wall will be gauged as out lined in Section 3.

The leachate collection system consists of shallow and deep drains located along the south corner of the landfill. Currently leachate is only captured from the shallow drain. The location of the drain line manholes is shown on Figure 3.

3.3.5 Landfill Off Gas Treatment

The current landfill off gas carbon drums will be replaced with turbine vents. The vent piping will be inspected monthly for deterioration and damage. Care will be taken during mowing operations not to hit the vent piping.

3.3.6 Criteria for Completion of Remediation/Termination of Remedial Systems

The ILCTS will be operated in response to liquid levels in the landfill. If liquid levels in the landfill are below the action level of 200 ft, the system can remain off. If levels rise above 200 ft, the system will be reactivated until pumping reduces the level.

4.0 Monitoring and Sampling Plan

4.1 General

Monitoring of the environment at and around the Site will provide a basis for evaluating the remedial systems effectiveness in protecting human health and the environment from further exposure or contamination. Monitoring will be performed on the media that is potentially affected by further releases of contaminants from the facility, as well as those media that may contribute additional contaminants to the environment.

4.2 Site-Wide Inspection

The Kingsbury Landfill Site will be inspected during each sampling event (five quarter basis). The inspection will include the Site perimeter fence, slurry wall, soil cap and all site monitoring well locations. An inspection form will be completed during each event detailing the condition of the fence and asphalt cap. Monitoring Well Inspection Logs will be used to document the condition of each well. Copies of these forms are provided in Appendix D. The forms will provide sufficient information to assess the following:

- Compliance with all ICs;
- An evaluation of the condition and continued effectiveness of all ECs;
- General site conditions at the time of inspection;
- The Site management activities being conducted including confirmation sampling and health and safety inspections; and
- Confirmation that site records are up to date.

Periodic inspections of all remedial components installed at the site will be conducted at the frequency specified in Section 5.1.1 of this SMP. A comprehensive site-wide inspection will be conducted annually, regardless of the frequency of the Periodic Review Report (PRR). The inspections will determine and document the following:

- Whether ECs continue to perform as designed;
- If these ECs continue to be protective of human health and the environment;
- Compliance with requirements of this SMP and the Environmental Easement;
- Achievement of remedial performance criteria;
- Sampling and analysis of appropriate media during monitoring events;
- If site records are complete and up to date; and
- Changes, or needed changes, to the remedial or monitoring system.

Inspections will be conducted in accordance with the procedures set forth in Section 5.0 of this SMP, using the Site-Wide Inspection Form. The reporting requirements are also outlined in Section 5.

If an emergency, such as a natural disaster or an unforeseen failure of any of the ECs occurs, an inspection of the site will be conducted within five days of the event to verify the effectiveness of the IC/ECs implemented at the site by a qualified environmental professional as determined by NYSDEC.

Copies of the Site-Wide Inspection Form completed during each Periodic Inspection will be included with the next PRR.

Media to be sampled, schedule for sampling and the analysis that will be conducted are listed below.

Monitoring and Inspection Schedule

Monitoring Program	Frequency*	Matrix	Analysis
Environment	5-quarter	Groundwater (17 wells)	Routine Parameters [1]
Environment	5-years	Surface water	Routine Parameters [1]
Environment	5-years	Sediment	Routine Parameters [1]
Environment	Monthly	Leachate	Routine Parameters [1]
EC	Quarterly	Stormwater (Lysimeter)	Volume
EC	Quarterly	Landfill Gas	Explosive gas
EC	Monthly	Engineered Cover System	Integrity
EC	Monthly	Perimeter Fencing	Integrity/Security

Notes:

1) Routine parameters include VOCs, PCBs, metals, biologic oxygen demand (BOD), chemical oxygen demand (COD), oil & grease, and total organic carbon (TOC); varies by well.
2) ILCTS sampling is documented in Section 4.3.1

4.3 Treatment System Monitoring and Sampling

4.3.1 Soil Cover System Monitoring

The soil cover will be inspected monthly. The purpose of the inspections will be to determine the integrity of the soil cover. The inspections will look for seeps, sloughing, wet spots, spongy soil, and areas of stressed vegetation.

4.3.2 Sediment Sampling

Collect sediment samples (and co-located surface water samples) at historic locations in Brown Pond east of the Site (Figure 1A). Samples will be collected during the next groundwater sampling event (June 2016) then once every five years or as directed by NYSDEC to monitor conditions in the pond.

4.3.3 Groundwater Monitoring

The monitoring well network consists of 45 wells, and sampling will be conducted on 19 wells to monitor groundwater constituents inside and outside the slurry wall and both upgradient and downgradient of the waste mass. These wells include: GMW-2, GMW-3, GMW-4, GMW-5, GMW-6, MW-90-2C, MW-90-3C, MW-90-4, MW-90-14, MW-90-6C, MW-90-7C, MW-90-10C, MW-90-11C, MW-8, MW-8A, MW-15, MW-18, MW-RW-1 and MW-RW-2. The well locations are included on Figure 2. A summary of groundwater sampling events is provided in Table 2. Comprehensive sampling from wells constructed to monitor the various groundwater regimes present at the Site (deltaic sand, interbedded silt and sand, and lacustrine clay) and groundwater quality both upgradient and downgradient of the waste mass will provide the necessary data to allow for monitoring of the Site environment and comparative analysis of any environmental degradation attributable to the waste mass. Sampling will be conducted in a manner that allows for consistent repetition of the events on the schedule established in Section 5.1.1. Adhering to a consistent sampling schedule and protocol will provide data that is able to be properly analyzed for any measurable changes in constituent concentrations at a particular location (intra-well), or between locations (inter-well).

Periodic sampling has been conducted at the Site since the landfill cap and cut-off wall were installed. Currently, groundwater samples are collected every five quarters and analyzed for VOCs, SVOCs, PCBs, metals, BOD, COD, oil & grease, and TOC. A summary of VOCs detected in groundwater during the sampling events conducted since 2007 is included as Figure 5. PCBs sample results from groundwater samples collected since 2007 are shown on Figure 6.

4.3.4 Surface Water Sampling

Collect surface water samples (and co-located sediment samples) at historic locations in Brown Pond east of the Site (Figure 1A). Samples will be collected during the next groundwater sampling event (June 2016) then once every five years or as directed by NYSDEC to monitor conditions in the pond.

During sample collection portable monitoring equipment will be used to measure groundwater quality parameters including, pH, temperature, conductivity, ORP, and turbidity. Surface water quality parameters will be measured prior to sample collection. Sampling will be conducted by directly filling the laboratory provided bottle ware with the use of a laboratory supplied unpreserved bottle. Proper generally accepted decontamination procedures (non-phosphate cleanser bath followed by deionized water rinse) shall be applied between uses for any equipment that is used in sampling more than one location. Once the samples are collected, they will be shipped to the laboratory via courier or overnight express service. Proper chain of custody procedures will be followed throughout each sampling event. Sampling results will be reported as indicated in Section 4.3.3.

4.3.5 Monitoring and Sampling Protocol

Prior to groundwater sampling, a synoptic round of water levels will be collected. At each well location, a NYSDEC Monitoring Well Field Inspection Log will be completed prior to sampling. Groundwater sampling will be performed in accordance with the procedures outline below.

The number and frequency of the samples that will be collected for laboratory analysis from monitoring wells are listed in Section 4.3.3. The required equipment and supplies are as follows:

- Field book
- Project plans
- Personal protective equipment (PPE) in accordance with the HASP
- Electronic oil/water interface probe
- Flow through cell (temperature, pH, conductivity, dissolved oxygen [DO], oxygen reduction potential [ORP], and turbidity)
- Decontamination supplies
- Bladder or electric submersible pump capable of achieving low-flow rates (i.e., 0.5 liters per minute or less)
- Teflon tubing
- Plastic sheeting
- Photoionization detector (PID)
- Clear tape, duct tape
- Coolers and ice
- Laboratory sample bottles
- Federal Express labels

Purging

- Prior to sampling, the static water level and will be measured to the nearest 0.01 foot from the surveyed well elevation mark on the top of the PVC casing with a decontaminated oil/water interface probe. The measurement will be recorded in the field book.
- The probe will be decontaminated between uses.
- Groundwater from the well will be purged until field parameters stabilize over three consecutive readings. Drawdown will be measured and limited to less than 0.3 ft. Readings will be collected at 5-minute intervals. The stabilization criteria are as follows: less than 50 nephelometric units (NTUs) for turbidity; +/- 3% for specific conductance; +/- 0.1 units for pH; +/- 10% DO > 0.5 mg/L, +/- 0.1 mg/L < 0.5 mg/L; and +/- 10 mV for ORP. Purging will be conducted using the low-flow sampling technique specified by USEPA Region 1 in its guidance document entitled "Low-Stress (low flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells".
- The flow rate measurement will be approximately 0.5 liter per minute or less.

- Purge water will be managed and disposed of properly.

Sampling

- Samples will be collected directly from the pump discharge line.
- Prior to filling the sample bottles, the temperature, pH, conductivity, and ORP and turbidity will be measured within a flow-through cell. All measurements will be recorded on the purging and sampling forms.
- If filtered metals samples are included in the sampling effort, the sample will be filtered in the field using dedicated, disposable 0.45 micron filters.
- Sample bottles will be supplied by the laboratory and will include preservatives as required.
- The sample containers will be labeled, placed in a laboratory-supplied cooler, and packed on ice (to maintain a temperature of 4 degrees C). The cooler will be shipped overnight or delivered to the laboratory for analysis.
- COC procedures will be followed.
- Well sampling data will be recorded on the Groundwater Sampling Record included in Appendix D.

All sampling and analyses will be performed in accordance with the requirements mentioned in this section:

- Sample containers will be properly washed, decontaminated, and appropriate preservative will be added (if applicable) prior to their use by the analytical laboratory. Containers with preservative will be tagged as such.
- Sample holding times will be in accordance with the NYSDEC ASP requirements.
- Field QC samples (e.g., trip blanks, coded field duplicates, and matrix spike/matrix spike duplicates) will be collected as necessary.
- Sample Tracking and Custody will be filled out and copied for record.
- Calibration Procedures
    - All field analytical equipment will be calibrated immediately prior to each day's use. Calibration procedures will conform to manufacturer's standard instructions.
    - The laboratory will follow all calibration procedures and schedules as specified in USEPA SW-846 and subsequent updates that apply to the instruments used for the analytical methods.

4.3.6 Monitoring Well repairs, Replacement and Decommissioning

The information collected on the Monitoring Well Field Inspection forms will be used to determine if the condition of each monitoring well is suitable for sampling. If a well has been damaged, a determination will be made as to whether to repair the well or replace it. Damaged wells that cannot be repaired will be decommissioned in accordance with the NYSDEC Groundwater Monitoring Well Decommissioning Policy (CP-43, dated November 2009 or most current update).

4.4 ILCTS Monitoring and Sampling

4.4.1 ILCTS Monitoring

Monitoring of the ILCTS will be performed on a routine basis, as identified in the table below, ILCTS Monitoring Requirements and Schedule. Modification to the frequency or sampling requirements will require approval from the NYSDEC. A visual inspection of the complete system will be conducted during each monitoring event. Unscheduled inspections and/or sampling may take place when a suspected failure of the ILCTS system has been reported or an emergency occurs that is deemed likely to affect the operation of the system. The ILCTS components to be monitored include, but are not limited to, the components included in the table below.

ILCTS Monitoring Requirements and Schedule

ILCTS Component	Monitoring Parameter	Operating Range/Setting	Monitoring Schedule
Sternpac Feed Pump	Delivery Rate	0.0690 GPM	Semi-weekly
*Redux Feed Pump	Delivery Rate (*Nominal Dosage Goal = 100 ppm)	*Stroke Length: 60% *Stroke Speed: 32%	Semi-weekly
Aeration Blower (#1 or #2)	Pressure	2.8 - 3.4 PSI	Semi-weekly
Polymer Mixer	Rotations per Minute (RPM)	40 RPM	Semi-weekly
Floc. Tank Agitator	Rotations per Minute (RPM)	20 RPM	Semi-weekly
Bag Filters (1-4)	Pressure (In/Out)	1-12 PSI	Semi-weekly
Carbon Vessels (1 and 2)	Pressure In Pressure Out	1-15 PSI 0-5 PSI	Semi-weekly
Backwash Tank	Reserve Quantity	0-800 Gal	Semi-weekly
*****Nominal Dosage = Stroke Speed% x Stroke Length% x Maximum pumping capacity of pump (0.13 gal/hr)			

The information obtained during the routine operation and maintenance site visits is recorded on two forms included in Appendix E. Form-1 (Summary of Daily Site Activities) is used to provide a narrative summary of the tasks completed during the twice weekly site visits. Form-2 (Daily Field Measurements) is used to provide specific data, such as flow rates, pH readings and pressures, of the various system components. Additionally, liquid level measurements at various locations along the leachate collection trenches are also recorded on a weekly basis and included on Form-3 (Water Level Measurements). Form-3 also includes depth to water measurements from 14 monitoring wells that are obtained on a weekly basis. These wells include: GMW-6; MW-90-11C; MW-90-3C; MW-90-2C; GMW-5; MW-90-4; MW-90-7C; MW-90-6C; MW-90-5; RW-1; GMW-3; MW-8; GMW-4 and MW-90-10C.

4.4.2 **General Equipment Monitoring**

A visual inspection of the system will be conducted during the routine maintenance site visits. This includes inspection of the following system components:

- tanks;
- transfer pumps;
- mixers;
- reagent vessels;
- metering pumps;
- filter housings;
- compressor, and;
- flow meters.

A list of components to be checked is provided in the Inspection Checklist (presented in Appendix D). If any equipment is found to be operating outside of its typical range, malfunctioning or, is not performing within specifications, operation of the treatment system will be temporarily suspended. The treatment system will be re-started as soon as repairs are completed.

5.0 Operation and Maintenance Plan

5.1 General

This Operation and Maintenance Plan provides a brief description of the measures necessary to operate, monitor, and maintain the mechanical components of the remedy selected for the site. This Operation and Maintenance Plan:

- Includes procedures necessary to allow individuals unfamiliar with the site to operate and maintain the ILCTS; and
- Will be updated periodically to reflect the changes in site conditions or the manner in which the ILCTS is operated and maintained.

Remediation of the landfill was completed by GE in 1989 as part of a settlement with the NYSDEC that involved construction of a leachate collection system; installation of a soil-bentonite groundwater cut-off wall; installation of a low permeability clay cap, and; installation of groundwater monitoring wells. These on-site remedial efforts reduced potential offsite exposure to various leachate-related compounds from the landfill. In 1988 and 1989, a wider drain system for leachate collection and an ILCTS were installed to pump and treat leachate from the landfill.

The ILCTS was designed for a maximum capacity of 30 gpm to reduce the groundwater elevation within the landfill. This was to help maintain the integrity of the cap at the southern end of the landfill. Leachate has historically been allowed to accumulate in the landfill until it approaches a maximum elevation of 200 feet above sea level. Once the leachate reached this action level, a pump was activated and the leachate is pumped to the ILCTS. In the ILCTS, leachate from the landfill is collected into two separate collection trenches. The first is a shallow collection trench; the second is a deep collection trench. Submersible pumps located within the deep and shallow collection trench manholes subsequently convey leachate through underground piping to the treatment system building located at the south east corner of the landfill (Figure 2). Once inside the treatment system building the collected leachate is first aerated to oxidize the ferrous iron, then chemically treated with polyaluminum chloride (Stern PAC50 - a polymerized aluminum coagulant) to facilitate removal of the precipitated iron. Removal of the precipitated iron is primarily realized in the clarifier tank and secondarily through four parallel bag filters equipped with 10 micron filter bags. The final step in the treatment process is polishing via activated carbon to remove the PCBs. A generalized layout of the treatment system is presented in Figure 7; a process flow diagram of the treatment system is included as Figure 8.

The various pumps and processes employed by the ILCTS are controlled by a PLC and level transmitters/flow sensors that are associated with various components of the system. The PLC, and related system controls, are located within a control panel (Figure 9 and Figure 10) that is positioned

on the wall between the primary and secondary rooms of the treatment building on the primary treatment room side (Figure 7). Processes can be activated and/or deactivated on-site (or, remotely) via the PLC or manually via a switch panel containing Hand-Off-Auto (HOA) switches (Figure 11). The HOA switch panel is also located on the wall within the treatment system building. The pump control settings for the manhole leachate supply pumps, filter feed tank level controls and recharge (floor) sump level controls are listed in Section 5.2 of this operations and maintenance plan.

5.2 ILCTS Performance Criteria

This section presents a detailed description of the design and operating parameters for each component of the ILCTS. The ILCTS is designed to operate continuously with a minimum of supervision and maintenance.

Leachate Collection & Pumping System

The leachate collection and pumping system consists of two sets of underground pipe drains, manholes, and submersible pumps with level controls. The purpose of these drains is to decrease hydrostatic pressure on the groundwater cutoff wall.

The first underground pipe drain, designated as “deep drain”, is located approximately 12 to 17 feet below the top of the landfill cutoff wall and flows into the deep drain manhole (MH-1). The second underground pipe drain, designated as “shallow drain”, is located approximately 4 to 11 feet below the top of the landfill cutoff wall and flows into the shallow drain manhole (MH-2). Leachate flows into each underground pipe drain and collects within the respective manholes and is pumped via submersible leachate supply pump to the treatment system. The leachate supply pumps are controlled by float-type level control systems located within the manholes. There are three floats associated with each pump. The “on” float turns the pumps on when the liquid level in the manholes reaches the designated pumping level. The “off” float turns the pumps off when the liquid level in the manhole reaches the designated pump-down level. The third float is a redundant “off” float (or safety) to protect the pump from pumping below the pump intake (which could result in pump failure).

Aeration System

At the time of system design, available analytical results indicated that the leachate contained up to 50 mg/L of biochemical oxygen demand (BOD), 30 mg/L of iron, and, trace concentrations of VOCs and PCBs. In order to protect the PCB removal function of the downstream carbon filters, and to reduce iron concentrations in the effluent from the treatment system, the leachate is aerated. Aeration accomplishes the following:

- Reduces BOD in the leachate before it enters the carbon system. This helps to reduce and avoid excessive biological growth in the carbon filters;
- Precipitates dissolved iron and brings iron concentrations into compliance with the temporary discharge permit limit. Iron precipitation also helps to control the growth of iron reducing bacteria in the carbon beds; and,

- Volatilizes the trace VOCs in the leachate stream.

The aeration system includes an 8-foot wide by 14-foot long by 10-foot deep (8,380 gallons) steel tank that is equipped with two rotary blowers capable of supplying up to 30 cubic feet per minute (CFM) of air to the system. The blowers operate in an alternating fashion on a 12 hour cycle. Air from the blowers is introduced into the leachate along a perforated manifold running along the centerline of the bottom of the aeration tank. Aeration at the bottom of the tank also helps to keep the contents mixed during the approximate 4.5 hour residence time of the leachate within the tank. The air is vented out of the top of the tank (and directed out of the building) by two 3-inch diameter vent pipes. The aeration tank access hatch is tied to a limit switch that activates a 1,000 CFM exhaust fan that evacuates the treatment building when the access hatch is opened.

Slow Mix Flocculation System

Once aerated, the leachate flows by gravity from a 3-inch diameter outlet near the top of the aeration tank through a 12-inch deep trap to seal the air exhaust from the aeration tank and then into a chemical rapid mix tank (U-Tube). The U-Tube is utilized as a mixing tank for the addition of Stern PAC to the leachate. Stern PAC (polyaluminum chloride) is a polymerized aluminum reagent that is used as a coagulant to remove the precipitated iron. It is injected into the leachate and agitated by means of a mechanical mixer within the U-tube assembly. The Stern PAC is fed to the U-Tube via a variable speed metering pump from a 55-gallon drum of reagent. The variable speed mixer agitates the mixture within the U-Tube at a rate of 40 RPM.

Following the addition of the Stern PAC, the leachate flows by gravity into the slow mix flocculation tank. The flocculation tank is a 4-foot diameter by 10-foot deep (940 gallon) flat bottom cylindrical tank equipped with a variable speed mechanical mixer. The flocculation tank provides 30 minutes of retention time at the design flow rate of 30 GPM. This allows for the flocculated solids in the leachate to coagulate into larger more easily settled solids. The mechanical mixer provides an approximate 20 RPM agitation to prevent solids accumulation in the bottom of the flocculation tank.

Solids Clarification System

The leachate flows from the flocculation tank by gravity into the solids clarifier. The solids clarifier is a 6-foot by 6-foot hopper-bottom tank that has an overall height of 9-foot 6-inches. The tank is equipped with clarifier media and an adjustable overflow baffle. The clarifier media is 6-foot wide by 5-foot long and has a depth of 1-foot. The media is removable through the top of the tank for periodic cleaning or replacement.

As water flows into the clarifier tank it passes under the clarifier tank inlet baffle and is directed up through the clarifier media. Particulates contact the clarifier media and flow by gravity into the hopper-bottom of the tank where it is collected. The hopper-bottom is designed to collect up to 50 cubic feet of settled solids before cleaning is required. The clarified leachate passes out through the top of the clarifier media, over the adjustable depth overflow baffle and out of the clarifier. Particulate and solids

that are collected in the hopper-bottom of the clarifier are periodically pumped from a nozzle at the bottom of the tank to the solids collection tanks.

Solids Collection System

Solids collected in the bottom of the clarifier are removed through a 2-inch line connected to a pneumatic solids pump. The solids pump transfers the solids from the clarifier to the first of two solids collection tanks and is allowed to settle. After settling, the leachate that is free of solids is decanted via siphoning to the building sump and ultimately pumped back to the treatment system via MH-1. After decanting, the remaining solids are transferred to the second solids collection tank via a second pneumatic solids pump.

The solids are allowed to accumulate in the second solids collection tank until such time that a sufficient amount has accumulated for disposal. The solids will be sampled and analyzed for the parameters necessary for disposal. Following analysis and approval from a licensed disposal facility, the solids will be drawn off of the bottom of the tank through the 3-inch drain piping via a vacuum truck and transported under proper chain-of-custody for disposal.

Filter Feed System

Overflow from the clarifier flows by gravity into the filter feed tank. The filter feed tank serves as a reservoir for the filter feed pumps which pump the leachate through the solids and carbon filters. The filter feed tank is a 5-foot diameter by 5-foot deep (735 gallons) steel tank equipped with a float style level control system that is tied into the PLC. The PLC controls the operation of the filter feed pumps and will shut off the submersible leachate supply pumps in the collection trench manholes (MH-1 and MH-2) in the event of a high system level. There are two filter feed pumps with one in the primary operation position at all times. The second acts as a backup unit.

Solids Filtration System

As the leachate is pumped from the filter feed tank to the solids filter system, Redux 390 is added via metering pump directly into the flow stream. The purpose of the Redux 390 is to eliminate fouling of the carbon and solids media by inhibiting microbial growth and controlling iron and/or hardness deposition. The Redux metering pump is located in the back room of the treatment building and, is controlled by the PLC. The Redux metering pump operates only when the filter feed pump is running.

After the addition of Redux, the leachate is pumped through the solids filtration system (consisting of four 10 micron solids bag filter units). The bag filters remove fine suspended solids which were not removed in the solids clarifier and help to minimize solids loading in the carbon filter system. The filter housings are plumbed in such a way that they can be operated in series or parallel (or some combination of both). Pressure gauges are installed at the inlet and outlet of each filter housing in order to provide information regarding the pressure drop across each housing.

Carbon Filtration System

Leachate flows from the solids filtration system to the carbon filtration system. The carbon filtration system consists of two 1,000 pound carbon vessels connected in series. The carbon vessels are piped such that leachate enters the top of the first vessel then flows in a downward direction. Upon exiting the first vessel, the leachate is subsequently piped to the top of the second vessel where it again flows in a downward direction. The contact of the leachate and granular activated carbon allows for the removal of PCBs and trace concentrations of VOCs from the leachate.

Each carbon vessel is equipped with pressure gauges at the inlet and outlet to monitor pressure drop across the vessel. A totalizing flow meter at the end of the carbon series is provided to record the total volume of leachate treated by the carbon filtration system. The treated leachate exiting the carbon filtration system is subsequently discharged to either the Glens Falls Feeder Canal or, if compliance testing is required, to the recharge (floor) sump.

Recharge (Floor Sump) System

If compliance testing is required prior to discharge to the Feeder Canal, the flow of leachate from the carbon filter system will be directed to the recharge (floor) sump. The recharge (floor) sump pump transfers the treated leachate back to the deep drain manhole (MH-1) until analysis verifies that the treated leachate is in compliance with the temporary discharge permit. After compliance is verified, the flow of treated leachate will be directed to the Glens Falls Feeder Canal and the recharge (floor) sump system will not be used. However, the recharge (floor) sump pump will function as the sump pump for the treatment system building.

For specific design and operation criteria for each component, refer to Appendix F – Equipment Manufacturers Information Sheets and Manuals.

5.3 Operation and Maintenance of the ILCTS

The following sections provide a description of the operations and maintenance of the ILCTS. Cut-sheets and as-built drawings for the ILCTS are provided in Appendix F – Equipment Manufacturers Information Sheets and Manuals.

5.3.1 System Start-Up and Testing

This section covers procedures to follow prior to activating the system after extended periods of system inactivity.

The following activities should be performed prior to start-up of the treatment system; a list of pre start-up system checks is included in Appendix E.

Aeration System Blowers (B-1 & B-2)

- Step-1: "Bump" each blower motor separately to verify proper blower rotation.

- Step-2: Once blower rotation is verified, turn one blower on and verify free flow of air to all spargers in the aeration tank (see Task I; Section 5.3.2).
- Step-3: Adjust blower pressure relief valves.
    - With one blower running, slowly close main air header valve on discharge of running blower until the pressure gauge on the blower discharge reads 4-½ psig.
    - Adjust the relief valve spring tension nut until the relief valve begins to open at the 4½ psig gauge pressure.
    - After adjustment of the relief valve is complete, fully close the main air header valve and verify that the relief valve opens.
    - Repeat sequence for second blower.

Manhole Leachate Supply Pumps (Deep-Well (P-1) & Shallow-Well (P-2))

The manhole level controls operate the manhole leachate supply pumps as follows:

Manhole Leachate Supply Pump Level Controls			
Manhole	**Float No.**	**Ground-Water Elevation**	**Function**
MH-1 (Deep-Well)	1	-	Available Contact
	2	190.00	Pump P-1 ON
	3	189.00	Pump P-1 OFF
	4	188.00	Pump P-1 Redundant OFF
MH-2 (Shallow-Well)	1	-	Available Contact
	2	198.00	Pump P-2 ON (if P-1 is OFF)
	3	197.00	Pump P-2 OFF
	4	196.00	Pump P-2 Redundant OFF

- Step-1: Momentarily apply power to the control panel to verify that the manhole leachate supply pumps are operable.
- Step-2: Verify operation of manhole level controls.
- Step-3: Observe piping for leaks.

- Filter Feed Pumps (P-3 & P-4)/Filter Systems

The filter feed tank level controls operate the filter feed pumps as follows:

Feed Tank Level Controls		
Float No.	**Depth**	**Function**
1	3’ 4”	Pumps P-1 and P-2 (from leachate manholes) OFF
2	3’ 0”	Pump P-4 ON (if P-3 is OFF)
3	2’ 9”	Pump P-3 ON (if P-4 is OFF)
4	1’ 0”	Pump P-3 and P-4 OFF
Note: Depth represents depth of liquid in Filter Feed Tank		

- Step-1: Install a 10 micron filter bag in each of the four solids filters.
- Step-2: Apply power to the filter feed pump control panel. Manually raise the level control floats to verify the level control functions described above.
- Step-3: Fill the filter feed tank to a depth of 4.0 feet with potable water.
- Step-4: With the filter feed pump discharge valves closed, apply power to the filter feed pump control panel. Slowly open the valve on the discharge of the pump which is running.
- Step-5: Slowly open the valves on the inlet and discharge of each solids filter so that the four (4) filters are operating in parallel. Observe the system piping for leaks.
- Step-6: Slowly open the valves on the inlet and discharge of each carbon filter along with the effluent discharge drain to the Glens Falls Feeder Canal. Observe the filters and interconnecting piping for leaks. Note: it will be necessary to add more water to the filter feed tank while performing this test.
- Step-7: After the inlet and discharge valves on all solids filters and carbon filters have been opened, allow the system to operate for one to two hours, observing all systems for leaks. Repeat Steps 2 through 6 with the second filter feed pump. The operation of the totalizing flow meter should also be checked.

Aeration Tank (T-1)

- Step-1: Fill the aeration tank with potable water to a depth approximately 1.0 foot above the air inlet header.
- Step-2: Following verification of the Aeration System Blowers (Task I; Section 5.3.2), start one of the blowers and observe the distribution of air in the aeration tank.

Flocculation Tank (T-4)

- Step-1: Fill the flocculation tank with potable water to a depth approximately 1.0 foot below the discharge pipe. Verify that the flocculation tank is free of leaks.
- Step-2: Verify that the variable speed slow mixer is operable.

Clarifier (T-2)

- Step-1: Verify that the clarifier bottom is free of solids.
- Step-2: Verify that the clarifier media is in place and clean.
- Step-3: Fill the clarifier with potable water to a level 1.0 foot below the media pack. Verify that the clarifier is free of leaks.

Solids Collection System

- Step-1: Open the inlet valve to the pneumatic solids pump.
- Step-2: Open the air valve to the pneumatic solids pump and slowly open discharge valve to one of the solids collection tanks (T-5).
- Step-3: Verify that the piping is free of leaks and that the liquid is being transferred from the clarifier to the solids collection tank.
- Step-4: Open the discharge valve to the second solids collection tank and close the discharge valve to the solids collection tank originally being filled.

- Step-5: Verify that the piping is free of leaks.
- Step-6: Shut off air to the pneumatic solids pump. Close inlet and discharge valves.
- Step-7: Drain the water in solids collection tanks to the recharge (floor) sump (after conducting Recharge Sump System check).

Chemical Feed System (i.e., Stern PAC and Redux)

- Step-1: Fill the U-shaped rapid mix tank with potable water. Verify that the rapid mix tank is free of leaks.
- Step-2: Verify that the variable speed rapid mixer is operable.
- Step-3: Verify that the Stern PAC suction line is in place in reagent drum and properly connected to metering pump.
- Step-4: Verify that the Stern PAC supply line is properly connected to metering pump and rapid mix tank.
- Step-5: Activate Stern PAC metering pump and verify that it is operable. Check all connections for leaks.
- Adjust speed and stroke controls for the required chemical dosage.

Stern Pac Pump Operating Settings		
ILCTS treatment rate (gpm)	Injection Rate (gph)	Stroke (%)
1.0 to 2.8	0.0460	100
2.8 to 3.4	0.0690	100
3.4 to 6.0	0.0920	100
6.0 to 8.0	0.1150	100
8.0 to 10.0	0.1380	100

Note: Current system configuration will not support adequate flocculant dropout above 10 gpm operation rate.

Redux injection setting: At an ILCTS operating rate of approximately 3 gpm the Redux Pump should be set to a Speed of 39 and a Stroke of 32. Operation of the ILCTS at a rate less than 2 gpm or greater than 4 gpm will require recalibration of Redux injection by the vendor.

- Step-6: Repeat Step-3 through Step-5 for Redux addition.

- Recharge (floor) Sump System

The recharge (floor) sump (S-1) level controls operate the recharge (floor) sump pump as follows:

Recharge (Floor) Sump Level Controls		
Float No.	**Depth**	**Function**
1	4’ 0”	Pump P-6 redundant ON
2	3’ 6”	Pump P-6 ON
3	1’ 6”	Pump P-6 OFF
4	1’ 0”	Pump P-6 redundant OFF
Note: Depth represents depth of liquid in Recharge (floor) Sump		

- Step-1: Apply power to the recharge (floor) sump pump control panel. Manually raise the level control floats to verify the level control functions at the elevations described above.
- Step-2: Fill the sump to a depth of 4.0 feet with potable water.
- Step-3: With the pump discharge valve closed, apply power to the recharge (floor) sump pump control panel and slowly open the discharge valve.
- Step-4: Observe the system piping for leaks and verify a flow back to the deep drain manhole (MH-1).

The system testing described above will be conducted if, in the course of the ILCTS lifetime, the system goes down or significant changes are made to the system and the system must be restarted.

5.3.2 Routine System Operation and Maintenance

Treatment System Start-Up

Following completion of the pre-startup system checks described in Section 5.3.1, the treatment system is ready for start-up. The following activities should be performed and logged on the start-up checklist (Appendix E):

- Step-1: Verify that all drain valves on all components are closed.
- Step-2: Open the discharge valves on the manhole leachate supply pumps and apply power to the manhole pumps via the main control panel. This should start the flow of leachate to the aeration tank.
- Step-3: Fill the aeration tank to a depth that is 6.0-inches below the aeration tank overflow. After the aeration tank is full, shut the power off to the manhole leachate supply pumps and close the discharge valve.
- Step-4: Turn the aeration system blower on and allow the aeration system to operate for a minimum of 4 hours.
- Step-5: After the aeration system has operated for a minimum of 4 hours, open the manhole leachate supply pump discharge valves and turn the power on to the desired manhole leachate supply pump via the main control panel. This will restore the flow of leachate to the aeration tank.

- Step-6: Allow the aeration tank to fill and overflow into the rapid mix tank.
- Step-7: Activate the rapid mixer and Stern PAC metering pump to begin chemical treatment of the leachate.
- Step-8: Allow the flocculation tank to fill and overflow into the clarifier. Start the variable speed slow mixer on the flocculation tank. Adjust the slow mixer to give only enough agitation to prevent solids accumulation in the bottom of the flocculation tank (approximately 20 rpm).
- Step-9: Allow the clarifier to fill and overflow into the filter feed tank.
- Step-10: Before starting the filter feed pumps, allow the filter feed tank to fill to a level of 3 feet 6 inches above the bottom of the tank. Verify that the filter feed tank level control will stop the manhole pump in the event of a tank overfill. Make adjustments to the level controls as necessary.
- Step-11: Following verification of the filter feed tank level controls, open the valves on filter feed pump discharge.
- Step-12: Activate the Redux metering pump and open the inlet and discharge valves on the solids filters.
- Step-13: Open the valves on the inlet and discharge of the carbon filters. Open the discharge valve to the recharge (floor) sump and close the discharge valve to the Glens Falls Feeder Canal. Open the valve to the deep drain manhole (MH-1) and close the valve to the shallow drain manhole (MH-2).
- Step-14: Record the total flow registered on the totalizing flow meter at the discharge of the carbon filter system.
- Step-15: Start the filter feed pump.
- Step-16: Start the recharge (floor) sump pump.
- Step-17: Allow the system to operate and stabilize for 4 hours before sampling. Observe the system for leaks or other problems.
- Step-18: After allowing the treatment system to stabilize for 4 hours, begin sampling the system in accordance with the temporary discharge permit requirements.
- Step-19: Following sampling, shut down the system until analytical results confirm compliance with the temporary discharge permit requirements.

When the system is restarted following compliance testing (or after routine maintenance), both manhole pumps will be operated as indicated in Step-5 and, discharge will be directed to the Glens Falls Feeder Canal as indicated in Step-13. Step-16 through Step-19 will not be required.

Treatment System Shutdown

The following activities should be performed to shut the treatment system down.

Temporary Shutdown (less than 72 hours)

- Step-1: Shut off circuit breakers to pumps P-1, P-2, P-3, P-4, and P-5; and the chemical metering pumps.

- Step-2: Leave blowers B-1 and B-2, and the Stern PAC rapid mixer and flocculation slow mixer operating.
- Step-3: Pump solids out of clarifier.
- Step-4: Verify that building heating system is in operation.

Extended Shutdown

- Step-1: Shut off circuit breakers to pumps P-1, P-2, P-3, P-4, P-5, and P-6; blowers B-1 and B-2; metering pumps; the Stern PAC rapid mixer and flocculation slow mixer. Unplug all mixers.
- Step-2: Empty water and sediment from all equipment and piping systems (see note below).
- Step-3: Remove carbon from all carbon filters and dispose in accordance with applicable regulations (see note below).
- Step-4: Follow manufacturers' instructions for storage of all equipment.

Note: It will be assumed that water, sediment, spent carbon and filter bags from the treatment system contain PCBs and will be handled as hazardous substances. Personal protective equipment will be required during handling of these materials.

Treatment System Operation and Maintenance

The treatment system is designed for continuous operation after start-up. The system precipitates and removes solids from the leachate, as well as PCBs and volatile organics.

The treatment system is designed to operate without continuous monitoring by a system operator. However, a system operator will be required to perform the following activities and complete the operation and maintenance (O&M) log sheets (**Form-1** and **Form-2;** Appendix E) at a minimum of twice a week. These activities include:

- Step-1: System Observation - Observe the operation of pumps, blowers, mixers, and controls to verify satisfactory system operation.
- Step-2: Clarifier Solids Level - Record the level of solids in the system clarifier. These solids should be transferred to the solids collection tanks at a minimum of once a week. The solids level in the clarifier should not exceed one foot below the bottom of the clarifier media pack.
- Step-3: Solids Collection Tank Sludge Removal - Record the level of solids in both solids collection tanks. The clear leachate should be decanted by gravity to the building sump and ultimately back to the collection trench manholes. The solids in the solids collection tank should be drawn off the bottom of the tank after liquid decanting is complete. The solids removed from the solids collection tanks should be disposed as directed by the NYSDEC.
- Step-4: Chemical Feed Drums (Stern PAC and Redux) - Observe and record the level of the reagents in each of the chemical feed drums. Supply additional reagents as necessary. Note: Proper Stern PAC dosing is verified based on the size of the particulate within the flocculation tank. Flocculant "particles" should be "fluffy" in appearance and, be no larger than 1/8-inch in diameter. If larger than 1/8-inch, then too much Stern PAC is being added; if smaller than 1/8-inch, then too little Stern PAC is being added. Redux dosing is established by the reagent supplier based on leachate chemistry and undiluted reagent concentration.

The volume of Redux used by the system should be evaluated on a quarterly basis by comparing the volume of reagent used to the total volume of leachate treated by the system. The reagents Stern PAC and Redux are both supplied and utilized in 55-gallon drums at the proper injection concentration. No pre-mixing is required.

- Step-5: Bag Filter Replacement - Whenever the outlet pressure reaches 10 psig below the inlet pressure the filters will be replaced. Additionally the system flow rates are monitored for reduced flow. If flow rates are reduced markedly bag filters are replaced at that time as well. Filter bags and solids must be disposed as a hazardous substance in accordance with applicable regulations.
- Step-6: Record Total Flow - Record the flow on the totalizing flow meter at the end of the carbon filter system.
- Step-7: Solids and Carbon Filters Operation - Record the pressure drop across the four (4) solids filters. Record the inlet and outlet pressures for the two (2) carbon filters.
- Step-8: Carbon Filter Sampling - Treated leachate samples should be collected from between the carbon vessels twice a month and analyzed for PCBs. This sampling should continue until 'breakthrough' of the primary carbon vessel is noted. 'Breakthrough' occurs when the carbon has reached its adsorptive capacity and is saturated with PCBs. When this happens, the carbon can no longer adsorb PCBs and, the PCBs begin to pass or 'break' through the carbon bed.

  When breakthrough of the carbon is noted (as evidenced by the presence of PCBs in the mid-carbon sample at concentrations greater than 1.0 ppb) the carbon in the primary carbon filter should be removed. The carbon removed from the primary carbon vessel should be disposed as a hazardous waste in accordance with applicable regulations. Personnel handling the spent carbon should, at a minimum, be equipped with respirators, face shields, and impervious gloves and clothing in accordance with the health and safety plan. After fresh carbon is added to the emptied carbon vessel, the system valves are adjusted such that the secondary carbon vessel now becomes the primary and the vessel containing the fresh carbon becomes the secondary. After sufficient data has been collected to predict carbon breakthrough frequency, it may be possible to reduce the frequency of treated leachate sampling from the carbon filters.
- Step-9: Discharge Permit Sampling - Monthly sampling of the treatment system effluent is required to monitor compliance with the temporary discharge permit limits as specified in Section 3.0 of the SMP.
- Step-10: Supplies Inventory - Record the inventory of the supplies (filter bags, activated carbon, Stern PAC, Redux, and empty drums) required to operate the treatment plant.
- Step-11: Clarifier Solids and Solid Waste Disposal - Record the date and volume/weight of any accumulated clarifier solids. Record the data and arrange for shipment and disposal of solid waste as necessary.

Liquid level measurements are also collected from the leachate collection trenches (and depth to water measurements from selected site monitoring wells) on a weekly basis. Liquid level and depth to water measurements are recorded on **Form-3** (Appendix E).

Equipment Maintenance

This section provides specific maintenance instructions for the treatment system process equipment. The information below summarizes the equipment manufacturer's operation and maintenance instructions. System operators should be familiar with all equipment manufacturers' operating and maintenance instructions and refer to these documents for detailed procedures. These instructions are separated into weekly and annual maintenance tasks. Replacement of carbon in the primary carbon vessels will also be a required maintenance task on an as-needed basis and is summarized below.

Weekly Maintenance Procedures

- Step-1: Leachate Supply Pumps (P-1 and P-2) - Verify that the submersible pumps in MH-1 and MH-2 are operable and that the level controls function as described in Section 5.3.1.
- Step-2: Aeration Tank (T-1) - Observe the exterior of the aeration tank for signs of leaking or excessive rusting. Observe the cover for any leakage.
- Step-3: Rapid Mix Tank (U-Tube) - Observe the exterior of the rapid mix tank for signs of leakage or excessive rusting. Observe the operation of the variable speed rapid mixer. Adjust the variable speed control to provide adequate mixing without causing vortexing in the rapid mix tank and subsequent air entrainment.
- Step-4: Flocculation Tank (T-4) - Observe the exterior of the flocculation tank for leaking or signs of excessive rusting. Observe the interior for evidence of solids build-up. If necessary, adjust the variable speed slow mixer to keep solids from settling to the bottom.
- Step-5: Solids Clarifier (T-2) - Observe the exterior of the solids clarifier for signs of leaking or excessive rusting. Observe the interior of the solids clarifier for evidence of excessive solids build-up (build-up of solids on the clarifier wall, baffle or media pack). If necessary, remove solids from Solids Clarifier (see Step 15).
- Step-6: Solids Collection Tanks (T-5) - Observe the exterior of the solids collection tanks for signs of leaking or excessive rusting.
- Step-7: Clarifier Pneumatic Solids Pump (P-5A) - Verify that the clarifier solids pump is operable.
- Step-8: Filter Feed Tank (T-3) - Observe the exterior of the filter feed tank for signs of leaking or excessive rusting. Observe the interior of the filter feed tank for the build-up of solids.
- Step-9: Filter Feed Pumps (P-3 and P-4) - Verify that both filter feed pumps are operable and that the control switches are in the automatic position. This can be accomplished by turning the operating filter feed pump switch to the off position. The other filter feed pump should start automatically if the filter feed tank is at a level that calls for a pump down. Return both switches to the automatic position.
- Step-10: Solids Filters - Observe the exterior of the solids filters for signs of leaking or excessive rusting. Observe the pressure gauges on the inlet and discharge of the four solids filters. Whenever the outlet pressure reaches 10 psig below the inlet pressure the filters will be replaced. Additionally the system flow rates are monitored for reduced flow. If flow rates are reduced markedly bag filters are replaced at that time as well. To change the filter bags, isolate the individual solids filter by closing valves on the inlet and discharge of the filter to be changed. Be sure that the pump discharge is flowing freely through the other filters. Open the

discharge sample point on the isolated filter to depressurize the filter. The filter bag and basket can be removed by releasing the four top ring bolts on the filter housing and lifting the top. A new filter bag can then be inserted into the filter basket and replaced in the filter housing. It should be noted that the water in the filter should be disposed in accordance with all applicable regulations.

- Step-11: Carbon Vessels (CF-1 & CF-2) - Observe the exterior of the carbon vessels for signs of leaking or excessive rusting. Observe the pressure gauges at the inlet and outlet of each carbon vessel and note any pressure drops in excess of 2.0 psig.
- Step-12: Aeration System Blowers (B-1 and B-2) - Verify that both blowers are operable. This is accomplished by turning off the operating blower at the blower control panel and turning the other blower on. Check the oil level in both blowers (See Step-16).
- Step-13: Metering Pumps - Verify the required flow of Stern PAC to the system rapid mix tank and Redux to the solids filter inlet line.
- Step-14: Recharge (Floor) Sump Pump (P-6) - Verify that the pump is operable and, the level control functions as described in Section 5.3.1.
- Step-15: Empty Solids Clarifier (T-2) - The bottom of the solids clarifier should be emptied on an as-needed basis. This is accomplished using the following procedures:
    - Decant the liquid in the solids collection tanks by gravity to the building sump.
    - Shut down the ILCTS.
    - Open valve to the suction of the pneumatic solids pump (P-5A). Open the discharge valve to the primary solids collection tanks.
    - Turn power on to the centrifugal solids pump and transfer all of the contents of the clarifier to the solids collection tank. Shut power off to centrifugal solids pump when complete.
    - When all water and solids have been transferred to the solids collection tank, spray the inside of the clarifier with a high pressure hose.
    - Close inlet and discharge valves.
    - Start up the ILCTS.
    - After a period of settling (second visit of the week), decant the liquid from the solids collection tank and transfer the remaining solids to the secondary solids collection tank via the pneumatic solids pump (P-5B).

Annual Maintenance Activities

In addition to the weekly maintenance activities described above, the following maintenance activities should be conducted on an annual basis:

- Drain all water from the aeration tank (T-1).
- Inspect the interior of the aeration tank for solids build-up, rust, and corrosion. Remove buildup as needed with heated power-washing and scrapers. Transfer residuals to the solids storage tanks.
- Inspect the aeration system headers and diffusers for signs of deterioration. Remove build up as needed with heated power-washing and scrapers. Transfer residuals to the solids storage tanks.

- Apply paint or protective coatings as required (both internal and external) to prevent rust and corrosion of the aeration system equipment.
- Drain the flocculation tank (T-4).
- Power wash interior of flocculation tank.
- Inspect the interior of the flocculation tank for solids build-up, rust, and corrosion. Remove remaining buildup as needed with heated power-washing and scrapers. Transfer residuals to the solids storage tanks.
- Apply protective coatings (both interior and exterior) of the flocculation tank as required.
- Drain the solids clarifier (T-2).
- Remove the clarifier media pack and inspect the media for cracking or plugging. Perform acid-wash of media as needed to remove build up.
- Power wash interior of solids clarifier.
- Inspect the interior of the clarifier for solids build-up, rust, and corrosion. Remove remaining build up as needed with heated power-washing and scrapers. Transfer residuals to the solids storage tanks.
- Apply protective coatings (both interior and exterior) to the solids clarifier as required.
- Drain the solids collection tanks (T-5).
- Power wash interior of solids collection tanks.
- Inspect the interior of the solids collection tanks for solids build-up, rust and corrosion. Remove remaining buildup as needed with heated power-washing and scrapers. Transfer residuals to the solids storage tanks.
- Apply protective coatings (both interior and exterior) to the solids collection tanks as required.
- Drain the filter feed tank (T-3).
- Manually manipulate the filter feed tank level control floats to simulate and verify the required pump actions.
- Power wash interior of filter feed tank.
- Inspect the interior of the filter feed tank for solids build-up, rust, and corrosion. Remove remaining buildup as needed with heated power-washing and scrapers. Transfer residuals to the solids storage tanks.
- Apply protective coatings (both interior and exterior) to the filter feed tank as required.
- Drain the rapid mix tank (U-Tube).
- Power wash interior of rapid mix tank.
- Inspect the interior of the rapid mix tank for solids build-up, rust, and corrosion. Remove remaining buildup as needed with heated power-washing and scrapers. Transfer residuals to the solids storage tanks.
- Apply protective coatings (both interior and exterior) to the rapid mix tank as required.
- Check the operation of the relief valve on both aeration system blowers.

- Manually manipulate the recharge (floor) sump level control floats to simulate and verify the required pump actions.
- Coordinate with Redux to verify strength and dosage of reagent added to leachate stream.
- Replace the oil in the aeration system blowers (B-1 & B-2).

Replacement of Carbon in Primary Carbon Filters

When PCB breakthrough or plugging of the primary carbon vessel with suspended solids occurs, all or part of the carbon in the primary carbon vessel will require replacement. This is accomplished by removing the top of the carbon vessel and manually removing the granular activated carbon with either a small shovel or, with a wet/dry vacuum. All carbon (and water) removed from the carbon vessel must be handled as hazardous substances. Protective clothing, impervious gloves, a respirator, and a face shield are required for handling these materials in accordance with the health and safety plan. After all spent carbon is removed, the vessel should be replenished with fresh carbon to within 10-inches of the top. The top of the vessel should be replaced securely and the vessel returned to operational status.

ILCTS Operation: Routine Equipment Maintenance

Collection of system readings and observations are the first steps to be conducted during routine operations and maintenance site visits. These readings and observations include:

- General system operation. Note any alarm conditions and proceed accordingly. A list of ILCTS Alarm Conditions is included in Appendix E.
- Treatment system flow rate (gpm).
- Treatment system totalizer (gal).
- Total iron concentration from the treatment system influent and effluent, and clarifier.
- Visual observation of the flocculant tank.
- Visual observation of the acid tank and clarifier media.
- pH readings of the treatment system influent and effluent, and clarifier tank.
- Influent and effluent pressure readings across the two (2) carbon vessels.
- Influent and effluent pressure readings across the four (4) bag filters.
- Proper metering of Stern PAC and Redux.
- Confirm operation and note pressure of aeration blower.
- Confirm operation and rpm of variable speed mixer (Stern PAC) and flocculation tank mixer.
- A general system/building inspection should take place to note any potential problems that exist.

Routine operation and maintenance site visits will be conducted twice weekly. Upon arrival for each visit, note the proper operation and cycling of treatment system. To eliminate a false alarm and fax warning as a result of the site visit, remove the flow relay from the PLC panel. The main influent pump from the influent trench manhole can then be shut off. The following tasks should be conducted during the routine site visit:

- Task-1: Aeration Tank – Note proper operation of aeration blower. Check for excessive vibration and/or noise; check blower temperature for overheated bearings. Under proper operating conditions a slight boiling effect will be noticed on the surface of the water within the aeration tank.
- Task-2: Stern PAC Injection – The Stern PAC coagulant is injected into and mixed within the rapid mix tank (U-Tube). Note the proper operation of the Stern PAC metering pump and mixer speed (40 rpm).
- Task-3: Flocculation Tank – Inspect the flocculation tank to verify flocculation of iron particulates. Note the proper operation and speed (20 rpm) of the flocculation tank mixer. The iron flocculate should appear small and tightly spaced and move freely throughout the water.
- Task-4: Clarifier – Pump off accumulated solids from the bottom of the clarifier to the first solids collection tank.
    - Shut off the main valve on the piping from the flocculation tank to the clarifier.
    - Shut off the main valve at the base of the clarifier that goes to the filter feed tank.
    - Open the valve that feeds the pneumatic solids transfer pump (P-5A).
    - Open the valve that feeds air to the pneumatic solids transfer pump (P-5B). This will pump off accumulated solids from the bottom of the clarifier to the first solids collection tank.
    - Monitor the discharge to the solids collection tank until the water runs mostly clear and no solids are present.
    - Shut off the pneumatic solids transfer pump (P-5B) and close the valve that feeds it. At this point the water level in the clarifier should be below the bottom of the clarifier media.
    - Using a squeegee, scrape down the inside of the clarifier through the inlet section of the tank. Then, using potable water, spray down the filter beds to help flush out any solids that have accumulated in the media.
    - Fill the clarifier with potable water until the water level reaches the fill line of the clarifier.
    - Once the water in the clarifier has reached the fill line, open the valve that feeds the filter feed tank and the valve from the flocculation tank to the clarifier.
- Task 5: Filter Feed Tank – Verify operation of the filter feed tank pumps (P-3 and P-4) that control the flow of leachate out of the filter feed tank and into the solids filtration assembly (see Step 2, Section 5.3.1)
- Task-6: Redux Injection – Verify Redux injection by inspection of metering pump located in the back room of the treatment building. The Redux metering pump is controlled by the PLC and is only operated when the filter feed pump is active.

- Task-7: Solids Filtration System – Inspect pressure gauges located on the four bag filters that are plumbed in parallel. When the pressure gauges on the filter housings indicate a pressure drop of approximately 5 psi or greater, the filter bags should be changed. To change the filter bags:
    - Isolate the respective housing.
    - Relieve the pressure on the housing.
    - Loosen the four ring bolts on the top of the housing and remove cover.
    - Remove filter bag and sleeve. Place used bag filter on sump cover to drain for future disposal as hazardous waste.
    - Install new 10 micron filter bag in sleeve and re-install into filter housing.
    - Replace cover and tighten bolts.
    - Return valves to operating positions.
- Task-8: Carbon Vessels – Backwash the two 1,000 pound carbon vessels that are plumbed in series once every week. When backwashing, the leachate flows through the carbon vessels in the opposite direction from normal operation and discharges to the floor sump. The contents of the floor sump is subsequently pumped back into the ILCTS via the collection trench manhole.
    - Make sure all valves are turned to the backwash position for each vessel respectively (all valves are labeled).
    - After positioning the valves, visually trace the path of the leachate to ensure correct valve alignment.
    - Backwash each carbon vessel separately.
    - Open the valve on the backwash reserve tank and turn on the backwash pump.
    - Pump half of the backwash reserve tank through the carbon vessel then, shut off the pump.
    - Reconfigure the valves to backwash the other vessel.
    - Turn the backwash pump back on and let run until the backwash reserve tank is emptied.
    - Return all valves to the operating position.
    - Refill the backwash reserve tank with potable water.
- Task-9: Solids Collection Tanks – Once a week, the primary solids collection tank needs decanting. When the solids are transferred to the collection tank it has time to settle out before decanting occurs. This is done via simple siphoning of the clear liquid on top of the solids.
    - Connect a hose to the standpipe fitting on the side of the tank.
    - Using a potable water hose, inject potable water into the standpipe hose (do this long enough for the standpipe to fill and, for water to enter the solids collection tank).
    - Remove the potable water hose from the standpipe hose and siphoning should occur.
    - Place the standpipe hose into the floor sump and siphon long enough to remove the clear liquid from the solids collection tank (the contents of the floor sump will subsequently pumped back into the ILCTS via the collection trench manhole).

- When siphoning is complete, transfer the remaining solids from the solids collection tank to the secondary solids collection tank via the pneumatic solids transfer pump (P-5B).

- Task-10: Vacuum Break – Check vacuum break (check valve) in collection manhole. This check valve is utilized as a vacuum break for the influent line to allow for complete drainage upon pump shut down. Upon turning the pump back on, it is necessary to make sure the ball in the valve resets.
- Task 11: Flow Relay - Replace flow relay in PLC and return influent pump to operating position.

5.3.3 Non-Routine Operation and Maintenance

Non-Routine Equipment Maintenance

Several non-routine maintenance tasks will also be conducted on a less frequent basis. This includes inspection and maintenance of transfer pumps, metering pumps and, other components of the ILCTS. These components should be inspected at variable frequencies based on their accessibility and historic performance. At a minimum, each component of the ILCTS should be inspected on an annual basis. The following additional tasks are recommended:

- Submersible Manhole Sump Pumps: Remove pumps from manhole annually. Inspect for signs of wear, corrosion, scaling. Perform maintenance as needed.
- Transfer Pumps: Inspect for signs of wear, corrosion, scaling quarterly. Perform maintenance as needed.
- Metering Pumps: Inspect for signs of wear, corrosion, scaling quarterly. Perform maintenance/cleaning as needed.
- Compressor: Check for proper operation monthly. Perform maintenance as needed. Change oil annually.
- Influent Water Meter: Inspect meter interior for signs of wear, corrosion and/or scaling quarterly. Clean/perform maintenance as needed.
- Clarifier Media: Remove the clarifier media pack and inspect the media for cracking or plugging annually. Replace as necessary.
- Sump Manhole Cleaning: Inspect sump manhole for buildup of precipitate, biomass and/or debris annually. Clean as needed.

ILCTS Operation - Miscellaneous Maintenance

- Solid Waste Removal and Disposal: Remove general trash on a weekly basis to minimize the presence of rodents and other vermin.
- Mowing/Weed-Wacking: Grass mowing/weed-wacking along the access road and within the area around the treatment system building should be conducted on an as-needed basis during the growing season.
- Fence Line Clearing: The fence line around the perimeter of the treatment building and landfill should be maintained free of vegetation during the growing season.

5.3.4 System Monitoring Devices and Alarms

The various pumps and processes employed by the ILCTS are controlled by a PLC that evaluates incoming information from level transmitters/flow sensors associated with various components of the system. The PLC evaluates this information following a certain pre-programmed logic that is input by the system operator. When that logic is not satisfied, the PLC identifies the problem, and enters into an alarm condition. During an alarm condition, the PLC notifies the operator by sending a fax report summarizing the status of the various components at the time the alarm condition was established. The PLC will often simultaneously initiate a shutdown procedure whereby operation of the various pumps and the aeration blowers is suspended until the cause of the alarm condition is addressed. A list of ILCTS alarm conditions (and, corresponding actions initiated by the PLC) is included in Appendix F.

6.0 Periodic Assessments/Evaluations

6.1 Climate Change Vulnerability Assessment

Increases in both the severity and frequency of storms/weather events, an increase in sea level elevations along with accompanying flooding impacts, shifting precipitation patterns and wide temperature fluctuation, resulting from global climate change and instability, have the potential to significantly impact the performance, effectiveness and protectiveness of a given site and associated remedial systems. Vulnerability assessments provide information as that the site and associated remedial systems are prepared for the impacts of the increasing frequency and intensity of severe storms/weather events and associated flooding.

This section provides a summary of vulnerability assessments that will be conducted for the site during periodic assessments, and briefly summarizes the vulnerability of the site and/or engineering controls to severe storms/weather events and associated flooding.

The Site is not in any flood plain. The Site is not prone to flash flooding due to severe rain events. As long as the grass cap is maintained, the Site is not susceptible to erosion during severe rain events. The ILCTS building is somewhat sheltered from high winds and its construction is capable of withstanding strong winds during storm events.

The ILCTS does require electricity to operate. The site is susceptible to power loss during storm events, but no more so that the surrounding areas of the Town of Hudson Falls. It does appear that the leachate extraction pumps in the manholes are susceptible to lightning strikes as evidenced by the pump failure in May 2015. As this is the first suspected lightning strike at the Site in over 20 years of operation, the probability of future lightning strikes is low.

The probability of spills at the Site due to storm related damage is low. If the ILCTS experiences a power loss, the system will shut down with no adverse effects. As the Site is not prone to flooding or erosion, the probability of spills caused by these events is low.

6.2 Green Remediation Evaluation

NYSDEC's DER-31 Green Remediation requires that green remediation concepts and techniques be considered during all stages of the remedial program including site management, with the goal of improving the sustainability of the cleanup and summarizing the net environmental benefit of any implemented green technology. This section of the SMP provides a summary of any green remediation evaluations to be completed for the site during site management, and as reported in the Periodic Review Report.

A green remediation/proposal was prepared in July 2011 at the request of NYSDEC. Green remedial options were also presented in the quarterly O&M Reports.

6.2.1 Timing of Green Remediation Evaluations

For major remedial system components, green remediation evaluations and corresponding modifications will be undertaken as part of a formal Remedial System Optimization (RSO), or at any time that the Project Manager feels appropriate, e.g., during significant maintenance events or in conjunction with storm recovery activities.

A remedial site optimization work plan was prepared in December 2011. A hydrogeologic investigation consisting of soil borings and piezometer installation was conducted in March 2013. The results of this investigation were presented in a Hydrogeologic Report dated August 2013. A water balance letter report was submitted in October 2014.

6.2.2 Remedial Systems

Remedial systems will be operated properly considering the current site conditions to conserve materials and resources to the greatest extent possible. Consideration will be given to operating rates and use of reagents and consumables. Spent material will be sent for recycling as appropriate.

6.2.3 Building Operations

Structures including buildings and sheds will be operated and maintained to provide for the most efficient operation of the remedy, while minimizing energy, waste generation and water consumption.

6.2.4 Frequency of System Checks, Sampling and Other Periodic Activities

Transportation to and from the site and use of consumables in relation to visiting the site in order to conduct system checks and or collect sampling and shipping samples to a laboratory for analysis have direct and/or inherent costs. The schedule and/or means of these periodic activities have been prepared so that these tasks can be accomplished in a manner that does not impact remedy protectiveness but reduces expenditure of energy or resources.

6.2.5 Metrics and Reporting

As discussed in Section 7.0 and as shown in Appendix D - Site Management Forms, information in energy usage, solid waste generation, transportation and shipping, water usage and land use and ecosystems will be recorded to facilitate and document consistent implementation of green remediation during site management and to identify corresponding benefits; a set of metrics has been developed.

6.3 Remedial System Optimization

A RSO Report was prepared and submitted to NYSDEC in November 2014. The report evaluated several options to replace the ILCTS with the goal of reducing or eliminating the need to pump and treat leachate.

Other recommendations for system upgrades include:

- Upgrade the remote alarm system;
- Repair/replace the four pan lysimeters on the landfill cap;
- Convert the ILCTS building to geothermal heating;
- Replace the gas vent carbon drums with turbine vents;
- Bollard Installation around the gas vents and the pan lysimeters;
- Install a new potable water line to the ILCTS building;
- Install gauging stations in the Feeder Canal and the pond east of the Site;
- Clear the sediment blockage from the landfill drain lines;
- Replace failed 48-inch fluorescent ceiling light fixtures with new units;
- Install a weather station; and
- Replace pressure gauges in the ILCTS treatment system.

7.0 Reporting Requirements

7.1 Site Management Reports

All inspections and monitoring events will be recorded on the appropriate forms. Examples of these forms are provided in Appendix D. These forms will be included in each Groundwater Sampling Report prepared for each sampling event and in the PRR.

The results of the inspections and site monitoring data will be evaluated as part of the IC/EC certification to confirm that the:

- IC/ECs are in place, performing properly, and remain effective;
- The Monitoring Plan is being properly implemented; and
- The Site remedy continues to be protective of human health and the environment.

7.2 Periodic Review Report

A Periodic Review Report will be submitted annually or as otherwise required by NYSDEC. The report will be submitted within 30 days of the end of each certification period. Other reports, such as validated groundwater data, site inspection reports, and OM&M data, will be submitted quarterly and as determined by NYSDEC. All data will be provided to the NYSDEC in electronic format using procedures or formats required by DEC at the time of submission. Details of the electronic reporting requirements can be found at: http://www.dec.ny.gov/regulations/2586.html and http://www.dec.ny.gov/chemical/62440.html.

The required reports and their respective deadlines are as follows:

Report Requirements		
Task	Reporting Frequency	Reporting Deadline
Groundwater Sampling Report	Five quarter basis	45 days after receipt of laboratory data packages
Site Inspection (Full)	Annually (Q1), reported in the QI OM&M Report	Included in the QI OM&M Report and the next PRR
OM&M Reports	Quarterly	45 Days after the end of the reporting period
Periodic Review Report	Every year or as required by NYSDEC.	30 Days after the end of the reporting period

Media sampling results will also incorporated into the Periodic Review Report. The report will include:

- IC/EC certification;
- All applicable inspection forms and other records generated for the site during the reporting period;
- A summary of any discharge monitoring data and/or information generated during the reporting period with comments and conclusions;
- Data summary tables and graphical representations of contaminants of concern by media, which include a listing of all compounds analyzed, along with the applicable standards, with all exceedances highlighted. These will include a presentation of past data sufficient for the Department to evaluate contaminant concentration trends; and
- Results of all analyses, copies of all laboratory data sheets, and the required laboratory data deliverables for all samples collected during the reporting period will be submitted electronically in a NYSDEC-approved format.

A performance summary for all treatment systems at the site during the calendar year, including information such as:

- The number of days the system was run for the reporting period;
- The average, high, and low flows per day;
- The contaminant mass removed;
- A description of breakdowns and/or repairs along with an explanation for any significant downtime;
- A description of the resolution of performance problems;
- A summary of the performance and/or effectiveness monitoring; and
- Comments, conclusions, and recommendations based on data evaluation.

A site evaluation, which includes the following:

- The operation and the effectiveness of all treatment units, including identification of any needed repairs or modifications;
- Any new conclusions or observations regarding site contamination based on inspections or data generated by the LTMP for the media being monitored;
- Recommendations regarding any necessary changes to the remedy and/or Monitoring Plan; and
- The overall performance and effectiveness of the remedy.

The PRR will be submitted to the NYSDEC Care of: Payson Long, Remedial Bureau E, Section D. NYSDEC DER, 625 Broadway, Albany, NY 12233.

7.2.1 Certification of Institutional and Engineering Controls

Inspection of the IC/ECs will occur at the frequency described in Section 3 (Monitoring Plan) and Section 4 (Operation and Maintenance Plan). After the last inspection of the reporting period, a qualified environmental professional or Professional Engineer licensed to practice in New York State will prepare a PRR which certifies that:

- On-site ECs/ICs are unchanged from the previous certification;
- They remain in-place and are effective;
- The systems are performing as designed;
- Nothing has occurred that would impair the ability of the controls to protect the public health and environment; and
- Nothing has occurred that would constitute a violation or failure to comply with any operation and maintenance plan for such controls.

7.3 Corrective Measures Plan

If any component of the remedy is found to have failed, or if the periodic certification cannot be provided due to the failure of an institutional or engineering control, a corrective measures plan will be prepared and submitted to NYSDEC for approval. This plan will explain the failure and provide the details and schedule for performing work necessary to correct the failure. Unless and emergency condition exists, no work will be performed without approval by NYSDEC.

7.4 Remedial Site Optimization Report

A RSO Report was submitted to NYSDEC in December 2014. Recommendations for system upgrades were also included in the Quarterly O&M Reports.

8.0 References

AECOM Technical Services Northeast, Inc., 2009. Site Specific Health and Safety Plan. Prepared for Superfund Standby Program, NYSDEC, December 2009.

AECOM Technical Services Northeast, Inc., 2010. Draft Site Management Plan. Prepared for Superfund Standby Program, NYSDEC, January 2010.

AECOM Technical Services Northeast, Inc., 2011. Final Groundwater Sampling Report, June 2011 Sampling Event. Prepared for Superfund Standby Program, NYSDEC, May 2012.

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AECOM Technical Services Northeast, Inc., 2014a. Final Remedial Systems Optimization Report. Prepared for Superfund Standby Program, NYSDEC, November 24, 2014.

Aztech Technologies, Inc., 2009. Health and Safety Program, Kingsbury Landfill, Hudson Falls, NY. Prepared for Superfund Standby Program, NYSDEC.

Earth Tech Northeast, Inc., 2002. Leachate Treatment System Operation and Monitoring Plan. Prepared for Superfund Standby Program, NYSDEC, 2002.

E.C. Jordan, 1991. Operations and Maintenance Manual Interim Leachate Treatment System. Prepared for Superfund Standby Program, NYSDEC 1991.

NYSDEC, 1980. Seven Sites Agreement Between General Electric and NYSDEC to Clean Up Seven PCB contaminated Sites in New York State. September 23, 1980.

NYSDEC, 1999. Technical Guidance for Screening Contaminated Sediments, Division of Fish and Wildlife and Marine Resources. January 1999.

NYSDEC, 2006. Rules and Regulations, 6 NYCRR Subpart 376-6, Remedial Program Soil Cleanup Objectives. December 14, 2006.

NYSDEC, 2008. Rules and Regulations, 6 NYCRR Subpart 703, Surface Water and groundwater Quality Standards and groundwater Effluent Limitations, January 17, 2008.

NYSDEC, 2010. DER-10 Technical Guidance for Site Investigation and Remediation. May 3, 2010.

USEPA Region I, 2010. Low Stress (Low Flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells. EQASOP-GW 001 (Revision 3). Dated July 30, 1996; revised January 19, 2010.

Tables

Table 1
Kingsbury Landfill (Site # 5-58-008)
Village of Hudson Falls, New York
Water Level Measurements, December 2013

Well ID	Ground Elevation (ft)	Top of Riser Elevation (ft)	Dec-13 Well Depth (ft)	December 2013 Readings	
				Depth to water	Elev.
GMW-2	196.76	198.24	31.94	10.41	187.83
GMW-3	179.01	181.26	36.15	4.51	176.75
GMW-4*	184.14	187.18	18.50	9.38	177.80
GMW-5	221.16	223.19	28.07	27.07	196.12
GMW-6*	226.05	228.85	79.15	33.19	195.66
MW-90-1	218.98	221.80	NM	NM	NM
MW-90-2A	213.77	216.53	NM	NM	NM
MW-90-2B	213.72	216.33	NM	NM	NM
MW-90-2C	213.75	216.34	45.15	5.49	210.85
MW-90-3A	219.52	222.60	NM	NM	NM
MW-90-3B	220.24	222.69	NM	NM	NM
MW-90-3C	220.14	223.10	53.80	25.00	198.10
MW-90-4	217.27	219.44	44.77	8.36	211.08
MW-90-5	209.73	212.61	NM	NM	NM
MW-90-6A	213.08	215.53	NM	NM	NM
MW-90-6B	212.29	215.35	NM	NM	NM
MW-90-6C	212.35	215.16	34.75	7.27	207.89
MW-90-7A	218.77	221.23	NM	NM	NM
MW-90-7B	218.41	221.46	NM	NM	NM
MW-90-7C	218.28	221.05	56.40	25.84	195.21
MW-90-8A	204.43	207.32	NM	NM	NM
MW-90-8B	203.67	206.49	NM	NM	NM
MW-90-9A	210.89	213.66	NM	NM	NM
MW-90-9B	210.79	213.74	NM	NM	NM
MW-90-10A*	203.36	206.06	NM	NM	NM
MW-90-10B*	203.44	205.84	NM	NM	NM
MW-90-10C*	203.03	205.98	55.35	16.16	189.82
MW-90-11A*	208.88	212.06	NM	NM	NM
MW-90-11B*	208.63	211.70	NM	NM	NM
MW-90-11C*	208.91	211.86	54.83	17.27	194.59
MW-90-12	213.22	216.21	NM	NM	NM
MW-90-13	209.53	212.35	NM	NM	NM
MW-90-14	185.32	187.64	36.74	11.80	175.84
GMW-1**	271.03	273.32	NM	NM	NM
MW-8	178.94	181.38	18.00	5.99	175.39
MW-8A	176.83	179.92	15.00	4.02	175.90
MW-15	182.43	185.34	15.03	7.71	177.63
MW-18	195.11	198.29	NM	NM	NM
PW-90-1	213.38	216.22	NM	NM	NM
PW-90-2	209.13	212.28	NM	NM	NM
MW-RW-1	213.27	215.41	76.60	21.21	194.20
MW-RW-2*	NM	NM	NM	NM	NM

NM = not measured, elevations unknown.

Elevation data surveyed by AECOM during May 2013

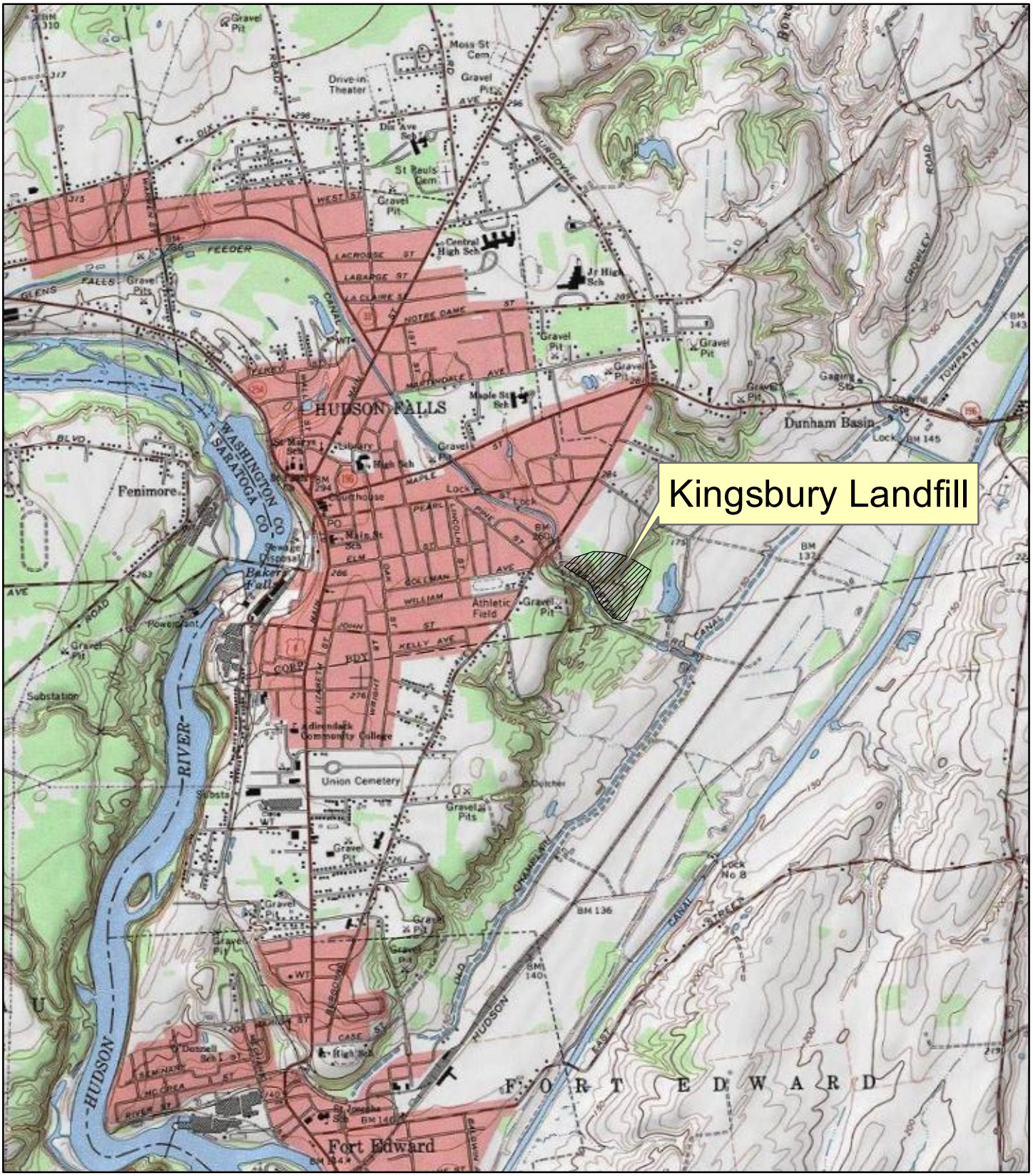
* = Survey data from E.C. Jordan Hydrogeologic Report, December 1991

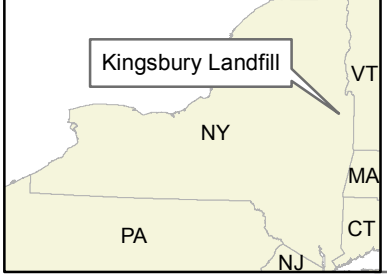
** = This data is from the W.J. Rourke Associates survey conducted in January 1991.

TABLE 2
KINGSBURY LANDFILL SITE (5-58-008)
SUMMARY OF MONITORING WELL SAMPLING DATES

	Well	Slurry Wall		Sampling Dates					
	ID	Inside	Outside	Jun-07	Sep-08	Mar-10	Jun-11	Nov-12	Dec-13
Upgradient Wells	MW-90-1		x						
	MW-90-12		x			x			
	PW-90-1		x			x			
	MW-90-2A		x			x			
	MW-90-2B		x			x			
	MW-90-2C		x	x	x	x	x	x	x
	MW-90-3A	x				x			
	MW-90-3B	x				x			
	MW-90-3C	x				x	x	x	x
	MW-90-4		x			x	x	x	x
	GMW-5	x				x	x	x	x
	GMW-1		x	x	x	x			
	MW-90-5		x			x			
	MW-90-13		x			x			
	PW-90-2		x			x			
	MW-90-6A		x			x			
	MW-90-6B		x			x			
	MW-90-6C		x	x	x	x	x	x	x
	MW-90-7A	x				x			
	MW-90-7B	x				x			
	MW-90-7C	x				x	x	x	x
Sidegradient Wells	GMW-2		x	x	x	x	x	x	x
	MW-18		x		x	x	x		
	MW-15		x		x	x	x	x	x
	MW-90-10A		x			x			
	MW-90-10B		x			x			
	MW-90-10C		x	x	x	x	x	x	x
	MW-90-11A	x				x			
	MW-90-11B	x				x			
	MW-90-11C	x				x	x	x	x
Downgradient Wells	MW-8A		x		x	x	x	x	x
	MW-90-14		x	x	x	x	x	x	x
	MW-90-8A		x			x			
	MW-90-8B		x			x			
	MW-90-9A	x				x			
	MW-90-9B	x				x			
	GMW-3		x	x	x	x	x	x	x
	MW-RW-1	x					x	x	x
	MW-8		x		x	x	x	x	x
	GMW-4		x	x	x	x	x	x	x
	GMW-6	x		x	x	x	x	x	x
	MW-RW-2	x					x		
	DD-East	x				x			
	DD-West	x				x			
	SD-East	x				x			
	SD-West	x				x			
	MH-1	x				x			
	MH-2	x				x			

Figures





USGS Hudson Falls Quadrangle

U.S.G.S. 1:24 000 SCALE TOPOGRAPHIC MAP

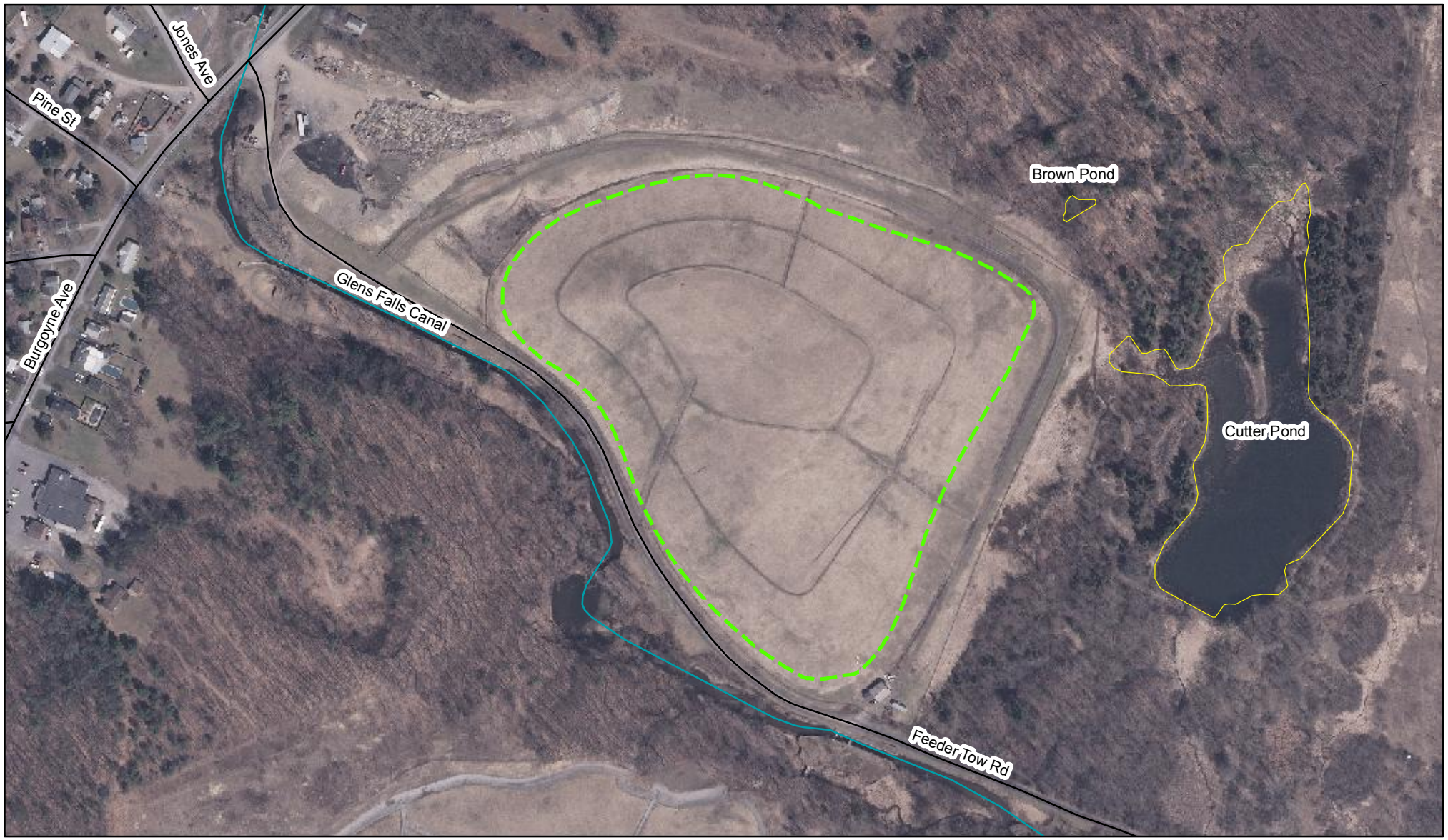
Prepared by: AECOM

Prepared for: NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Kingsbury Landfill
NYSDEC SIte #5-58-008
Village of Hudson Falls, Washington County

Site Location

Date:	Scale:	Figure No. :
August 2013	1 inch = 2,500 feet	1



Legend:

- Canal
- Pond
- Approx. Location of Slurry Wall

0 75 150 300 450 600 Feet

Reference:
2008 One Foot 4 Band East Zone Index
New York Statewide Digital Orthoimagery Program

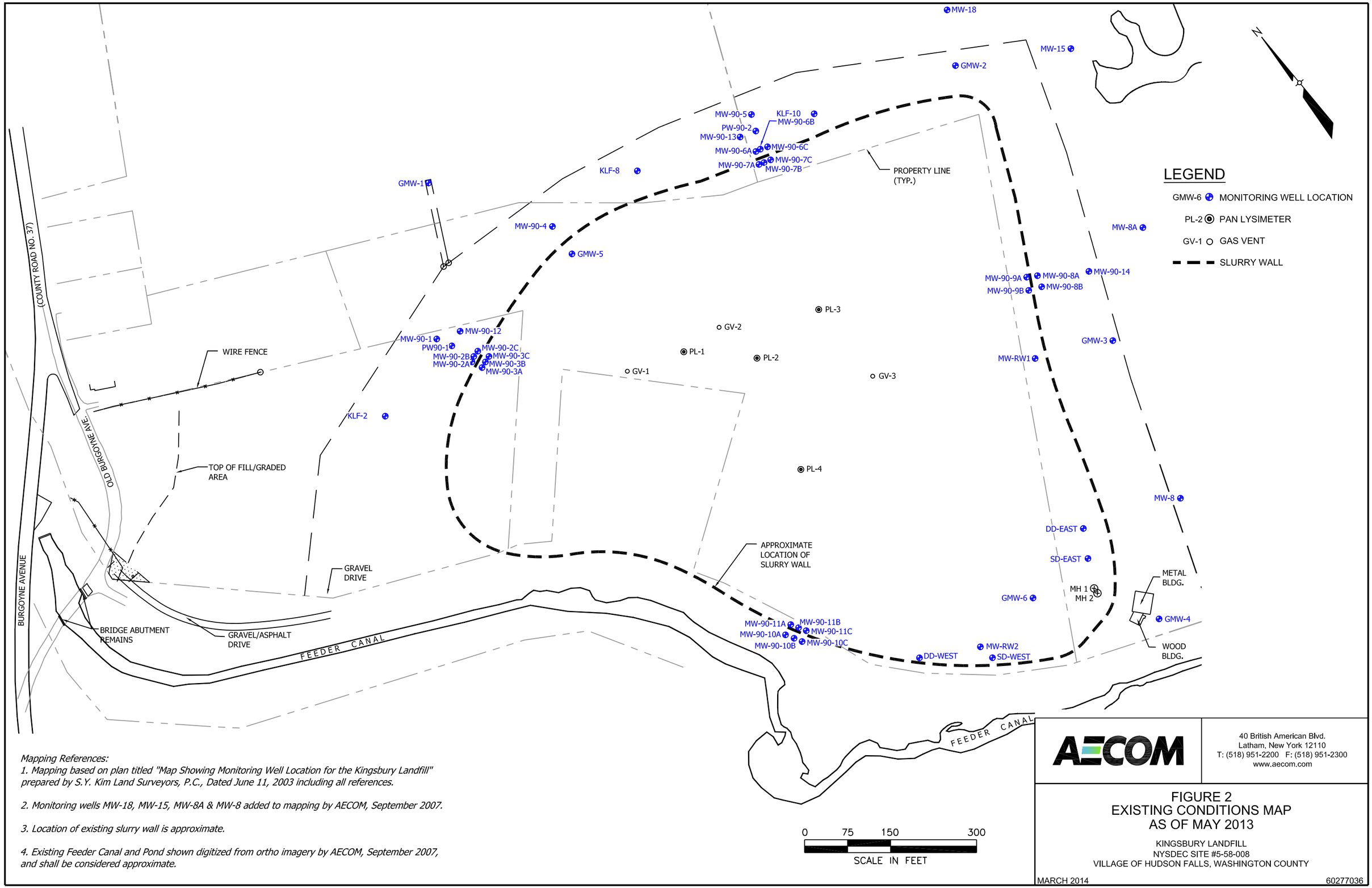
Prepared by: AECOM

Prepared for: NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Kingsbury Landfill
NYSDEC SIte #5-58-008
Village of Hudson Falls, Washington County

Kingsbury Landfill Site

Date:	Scale:	Figure No. :
September 2015	1 inch = 300 feet	1A



Mapping References:
1. Mapping based on plan titled "Map Showing Monitoring Well Location for the Kingsbury Landfill" prepared by S.Y. Kim Land Surveyors, P.C., Dated June 11, 2003 including all references.

2. Monitoring wells MW-18, MW-15, MW-8A & MW-8 added to mapping by AECOM, September 2007.

3. Location of existing slurry wall is approximate.

4. Existing Feeder Canal and Pond shown digitized from ortho imagery by AECOM, September 2007, and shall be considered approximate.

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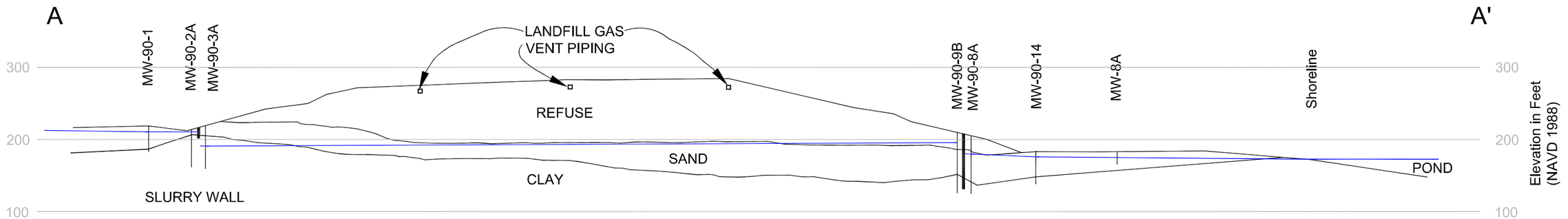
www.aecom.com

FIGURE 2
EXISTING CONDITIONS MAP
AS OF MAY 2013

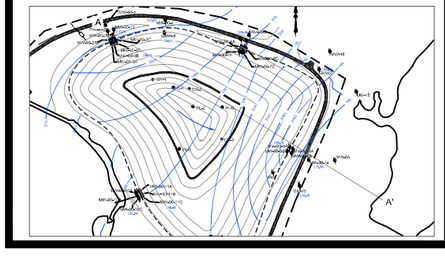
KINGSBURY LANDFILL
NYSDEC SITE #5-58-008
VILLAGE OF HUDSON FALLS, WASHINGTON COUNTY

MARCH 2014 60277036



LEGEND

GROUNDWATER ELEVATION



PLAN

150 0 75 150 300

(IN FEET)
1 inch = 150 ft.

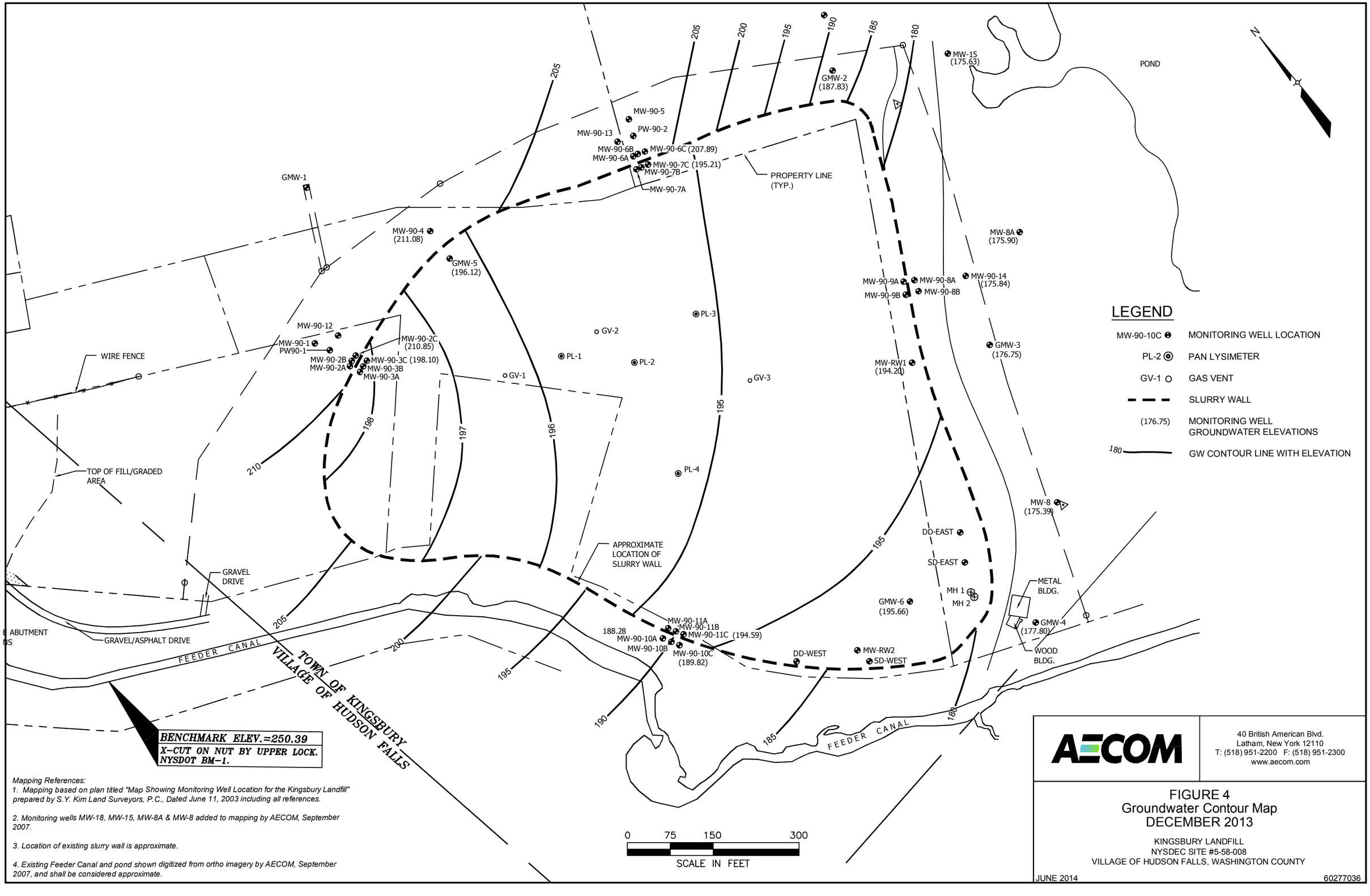
Map Reference:
Mapping shown based on a plan titled "Groundwater and Surface Water Monitoring Locations", Figure 2-1, by URS Consultants, Inc., including all references.

Monitoring wells labeled as "Unidentified MW" located by a Sub-meter GPS survey performed by Earth Tech, November 2007.

AECOM

FIGURE 3
CROSS SECTION
KINGSBURY LANDFILL
NYSDEC SITE #5-58-008
Town of Hudson Falls, Washington County

Date:May, 2010 Project No.: 99164



LEGEND

MW-90-10C	MONITORING WELL LOCATION
PL-2	PAN LYSIMETER
GV-1	GAS VENT
	SLURRY WALL
(176.75)	MONITORING WELL GROUNDWATER ELEVATIONS
180	GW CONTOUR LINE WITH ELEVATION

BENCHMARK ELEV.=250.39
X-CUT ON NUT BY UPPER LOCK. NYSDOT BM-1.

Mapping References:
1. Mapping based on plan titled "Map Showing Monitoring Well Location for the Kingsbury Landfill" prepared by S.Y. Kim Land Surveyors, P.C., Dated June 11, 2003 including all references.

2. Monitoring wells MW-18, MW-15, MW-8A & MW-8 added to mapping by AECOM, September 2007.

3. Location of existing slurry wall is approximate.

4. Existing Feeder Canal and pond shown digitized from ortho imagery by AECOM, September 2007, and shall be considered approximate.

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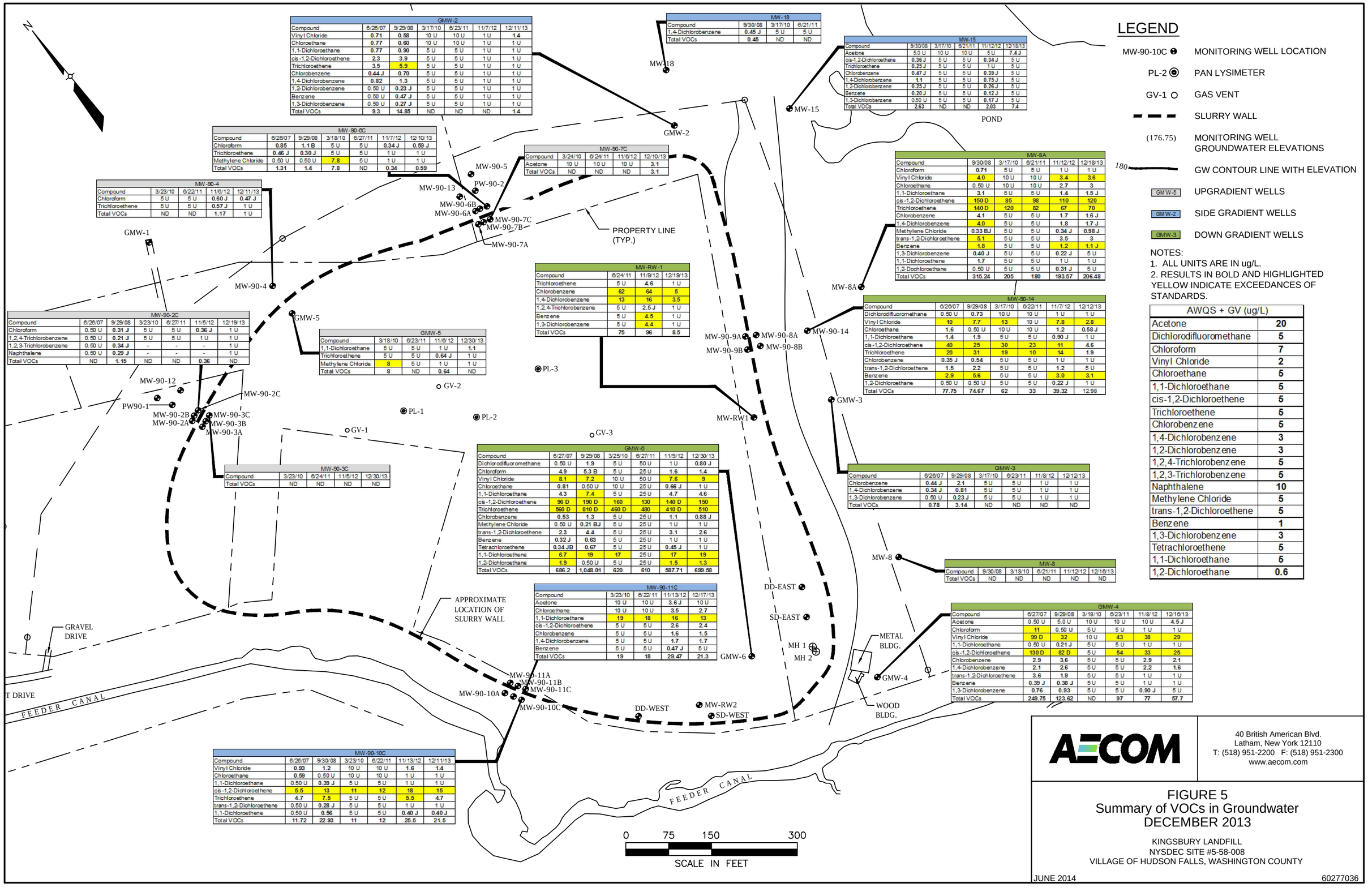
FIGURE 4
Groundwater Contour Map
DECEMBER 2013

KINGSBURY LANDFILL
NYSDEC SITE #5-58-008
VILLAGE OF HUDSON FALLS, WASHINGTON COUNTY

JUNE 2014 60277036



GMW-2						
Compound	6/26/07	9/29/08	3/17/10	6/23/11	11/7/12	12/11/13
Vinyl Chloride	0.71	0.58	10 U	10 U	1 U	1.4
Chloroethane	0.77	0.60	10 U	10 U	1 U	1 U
1,1-Dichloroethane	0.77	0.90	5 U	5 U	1 U	1 U
cis-1,2-Dichloroethene	2.3	3.9	5 U	5 U	1 U	1 U
Trichloroethene	3.5	5.9	5 U	5 U	1 U	1 U
Chlorobenzene	0.44 J	0.70	5 U	5 U	1 U	1 U
1,4-Dichlorobenzene	0.82	1.3	5 U	5 U	1 U	1 U
1,2-Dichlorobenzene	0.50 U	0.23 J	5 U	5 U	1 U	1 U
Benzene	0.50 U	0.47 J	5 U	5 U	1 U	1 U
1,3-Dichlorobenzene	0.50 U	0.27 J	5 U	5 U	1 U	1 U
Total VOCs	9.3	14.85	ND	ND	ND	1.4

MW-18			
Compound	9/30/08	3/17/10	6/21/11
1,4-Dichlorobenzene	0.45 J	5 U	5 U
Total VOCs	0.45	ND	ND

MW-15					
Compound	9/30/08	3/17/10	6/21/11	11/12/12	12/18/13
Acetone	5.0 U	10 U	10 U	5 U	7.4 J
cis-1,2-Dichloroethene	0.36 J	5 U	5 U	0.34 J	5 U
Trichloroethene	0.25 J	5 U	5 U	1 U	5 U
Chlorobenzene	0.47 J	5 U	5 U	0.39 J	5 U
1,4-Dichlorobenzene	1.1	5 U	5 U	0.75 J	5 U
1,2-Dichlorobenzene	0.25 J	5 U	5 U	0.26 J	5 U
Benzene	0.20 J	5 U	5 U	0.12 J	5 U
1,3-Dichlorobenzene	0.50 U	5 U	5 U	0.17 J	5 U
Total VOCs	2.63	ND	ND	2.03	7.4

MW-90-6C						
Compound	6/26/07	9/29/08	3/18/10	6/27/11	11/7/12	12/10/13
Chloroform	0.85	1.1 B	5 U	5 U	0.34 J	0.59 J
Trichloroethene	0.46 J	0.30 J	5 U	5 U	1 U	1 U
Methylene Chloride	0.50 U	0.50 U	7.8	5 U	1 U	1 U
Total VOCs	1.31	1.4	7.8	ND	0.34	0.59

MW-90-7C				
Compound	3/24/10	6/24/11	11/6/12	12/10/13
Acetone	10 U	10 U	10 U	3.1
Total VOCs	ND	ND	ND	3.1

MW-90-4				
Compound	3/23/10	6/22/11	11/6/12	12/11/13
Chloroform	5 U	5 U	0.60 J	0.47 J
Trichloroethene	5 U	5 U	0.57 J	1 U
Total VOCs	ND	ND	1.17	1 U

MW-RW-1			
Compound	6/24/11	11/9/12	12/19/13
Trichloroethene	5 U	4.6	1 U
Chlorobenzene	62	64	5
1,4-Dichlorobenzene	13	16	3.5
1,2,4-Trichlorobenzene	5 U	2.5 J	1 U
Benzene	5 U	4.5	1 U
1,3-Dichlorobenzene	5 U	4.4	1 U
Total VOCs	75	96	8.5

MW-8A					
Compound	9/30/08	3/17/10	6/21/11	11/12/12	12/18/13
Chloroform	0.71	5 U	5 U	1 U	1 U
Vinyl Chloride	4.0	10 U	10 U	3.4	3.6
Chloroethane	0.50 U	10 U	10 U	2.7	3
1,1-Dichloroethane	3.1	5 U	5 U	1.4	1.5 J
cis-1,2-Dichloroethene	150 D	85	98	110	120
Trichloroethene	140 D	120	82	67	70
Chlorobenzene	4.1	5 U	5 U	1.7	1.6 J
1,4-Dichlorobenzene	4.0	5 U	5 U	1.8	1.7 J
Methylene Chloride	0.33 BJ	5 U	5 U	0.34 J	0.98 J
trans-1,2-Dichloroethene	5.1	5 U	5 U	3.5	3
Benzene	1.8	5 U	5 U	1.2	1.1 J
1,3-Dichlorobenzene	0.40 J	5 U	5 U	0.22 J	5 U
1,1-Dichloroethene	1.7	5 U	5 U	1 U	1 U
1,2-Dochloroethane	0.50 U	5 U	5 U	0.31 J	5 U
Total VOCs	315.24	205	180	193.57	206.48

MW-90-2C						
Compound	6/26/07	9/29/08	3/23/10	6/27/11	11/5/12	12/19/13
Chloroform	0.50 U	0.31 J	5 U	5 U	0.36 J	1 U
1,2,4-Trichlorobenzene	0.50 U	0.21 J	5 U	5 U	1 U	1 U
1,2,3-Trichlorobenzene	0.50 U	0.34 J	-	-	-	1 U
Naphthalene	0.50 U	0.29 J	-	-	-	1 U
Total VOCs	ND	1.15	ND	ND	0.36	ND

GMW-5				
Compound	3/18/10	6/23/11	11/6/12	12/30/13
1,1-Dichloroethane	5 U	5 U	1 U	1.1
Trichloroethene	5 U	5 U	0.64 J	1 U
Methylene Chloride	8	5 U	1 U	1 U
Total VOCs	8	ND	0.64	ND

MW-90-14						
Compound	6/26/07	9/29/08	3/17/10	6/22/11	11/7/12	12/12/13
Dichlorodifluoromethane	0.50 U	0.73	10 U	10 U	1 U	1 U
Vinyl Chloride	10	7.7	13	10 U	7.8	2.8
Chloroethane	1.6	0.50 U	10 U	10 U	1.2	0.58 J
1,1-Dichloroethane	1.4	1.9	5 U	5 U	0.90 J	1 U
cis-1,2-Dichloroethene	40	25	30	23	11	4.6
Trichloroethene	20	31	19	10	14	1.9
Chlorobenzene	0.35 J	0.54	5 U	5 U	1 U	1 U
trans-1,2-Dichloroethene	1.5	2.2	5 U	5 U	1.2	5 U
Benzene	2.9	5.6	5 U	5 U	3.0	3.1
1,2-Dichloroethane	0.50 U	0.50 U	5 U	5 U	0.22 J	1 U
Total VOCs	77.75	74.67	62	33	39.32	12.98

MW-90-3C				
Compound	3/23/10	6/24/11	11/5/12	12/30/13
Total VOCs	ND	ND	ND	ND

GMW-6						
Compound	6/27/07	9/29/08	3/25/10	6/27/11	11/9/12	12/30/13
Dichlorodifluoromethane	0.50 U	1.9	5 U	50 U	1 U	0.80 J
Chloroform	4.9	5.3 B	5 U	25 U	1.6	1.4
Vinyl Chloride	8.1	7.2	10 U	50 U	7.6	9
Chloroethane	0.81	0.50 U	10 U	25 U	0.66 J	1 U
1,1-Dichloroethane	4.3	7.4	5 U	25 U	4.7	4.6
cis-1,2-Dichloroethene	96 D	190 D	160	130	140 D	150
Trichloroethene	560 D	810 D	460 D	480	410 D	510
Chlorobenzene	0.53	1.3	5 U	25 U	1.1	0.88 J
Methylene Chloride	0.50 U	0.21 BJ	5 U	25 U	1 U	1 U
trans-1,2-Dichloroethene	2.3	4.4	5 U	25 U	3.1	2.6
Benzene	0.32 J	0.63	5 U	25 U	1 U	1 U
Tetrachloroethene	0.34 JB	0.67	5 U	25 U	0.45 J	1 U
1,1-Dichloroethene	6.7	19	17	25 U	17	19
1,2-Dichloroethane	1.9	0.50 U	5 U	25 U	1.5	1.3
Total VOCs	686.2	1,048.01	620	610	587.71	699.58

GMW-3						
Compound	6/26/07	9/29/08	3/17/10	6/23/11	11/8/12	12/12/13
Chlorobenzene	0.44 J	2.1	5 U	5 U	1 U	1 U
1,4-Dichlorobenzene	0.34 J	0.81	5 U	5 U	1 U	1 U
1,3-Dichlorobenzene	0.50 U	0.23 J	5 U	5 U	1 U	1 U
Total VOCs	0.78	3.14	ND	ND	ND	ND

MW-8						
Compound	9/30/08	3/18/10	6/21/11	11/12/12	12/16/13	
Total VOCs	ND	ND	ND	ND	ND	

MW-90-11C				
Compound	3/23/10	6/22/11	11/13/12	12/17/13
Acetone	10 U	10 U	3.6 J	10 U
Chloroethane	10 U	10 U	3.5	2.7
1,1-Dichloroethane	19	18	16	13
cis-1,2-Dichloroethene	5 U	5 U	2.6	2.4
Chlorobenzene	5 U	5 U	1.6	1.5
1,4-Dichlorobenzene	5 U	5 U	1.7	1.7
Benzene	5 U	5 U	0.47 J	5 U
Total VOCs	19	18	29.47	21.3

GMW-4						
Compound	6/27/07	9/29/08	3/18/10	6/23/11	11/8/12	12/16/13
Acetone	0.50 U	5.0 U	10 U	10 U	10 U	4.5 J
Chloroform	11	0.50 U	5 U	5 U	1 U	1 U
Vinyl Chloride	99 D	32	10 U	43	38	29
1,1-Dichloroethane	0.50 U	0.21 J	5 U	5 U	1 U	1 U
cis-1,2-Dichloroethene	130 D	82 D	5 U	54	33	25
Chlorobenzene	2.9	3.6	5 U	5 U	2.9	2.1
1,4-Dichlorobenzene	2.1	2.6	5 U	5 U	2.2	1.6
trans-1,2-Dichloroethene	3.6	1.9	5 U	5 U	1 U	1 U
Benzene	0.39 J	0.38 J	5 U	5 U	1 U	1 U
1,3-Dichlorobenzene	0.76	0.93	5 U	5 U	0.90 J	5 U
Total VOCs	249.75	123.62	ND	97	77	57.7

MW-90-10C						
Compound	6/26/07	9/30/08	3/23/10	6/22/11	11/13/12	12/11/13
Vinyl Chloride	0.93	1.2	10 U	10 U	1.6	1.4
Chloroethane	0.59	0.50 U	10 U	10 U	1 U	1 U
1,1-Dichloroethane	0.50 U	0.39 J	5 U	5 U	1 U	1 U
cis-1,2-Dichloroethene	5.5	13	11	12	18	15
Trichloroethene	4.7	7.5	5 U	5 U	5.5	4.7
trans-1,2-Dichloroethene	0.50 U	0.28 J	5 U	5 U	1 U	1 U
1,1-Dichloroethene	0.50 U	0.56	5 U	5 U	0.40 J	0.40 J
Total VOCs	11.72	22.93	11	12	26.5	21.5

LEGEND

- MW-90-10C — MONITORING WELL LOCATION
- PL-2 — PAN LYSIMETER
- GV-1 — GAS VENT
- SLURRY WALL
- (176.75) — MONITORING WELL GROUNDWATER ELEVATIONS
- 180 — GW CONTOUR LINE WITH ELEVATION
- GMW-5 — UPGRADIENT WELLS
- GMW-2 — SIDE GRADIENT WELLS
- GMW-3 — DOWN GRADIENT WELLS

NOTES:
1. ALL UNITS ARE IN ug/L.
2. RESULTS IN BOLD AND HIGHLIGHTED YELLOW INDICATE EXCEEDANCES OF STANDARDS.

AWQS + GV (ug/L)	
Acetone	20
Dichlorodifluoromethane	5
Chloroform	7
Vinyl Chloride	2
Chloroethane	5
1,1-Dichloroethane	5
cis-1,2-Dichloroethene	5
Trichloroethene	5
Chlorobenzene	5
1,4-Dichlorobenzene	3
1,2-Dichlorobenzene	3
1,2,4-Trichlorobenzene	5
1,2,3-Trichlorobenzene	5
Naphthalene	10
Methylene Chloride	5
trans-1,2-Dichloroethene	5
Benzene	1
1,3-Dichlorobenzene	3
Tetrachloroethene	5
1,1-Dichloroethane	5
1,2-Dichloroethane	0.6

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FIGURE 5
Summary of VOCs in Groundwater
DECEMBER 2013

KINGSBURY LANDFILL
NYSDEC SITE #5-58-008
VILLAGE OF HUDSON FALLS, WASHINGTON COUNTY

JUNE 2014 60277036

GMW-2						
	6/26/07	9/29/08	3/17/10	6/23/11	11/7/12	12/11/2013
Total PCBs	ND	ND	ND	**0.699**	ND	ND

MW-18			
	9/30/08	3/17/10	6/21/11
Total PCBs	ND	**2**	**1.81**

MW-15					
	9/30/08	3/17/10	6/21/11	11/12/12	12/18/2013
Total PCBs	ND	ND	ND	ND	ND

MW-90-6C						
	6/26/07	9/29/08	3/18/10	6/27/11	11/7/12	12/10/2013
Total PCBs	ND	ND	ND	ND	ND	ND

MW-90-7C				
	3/24/10	6/24/11	11/6/12	12/10/2013
Total PCBs	ND	**1.292**	ND	ND

MW-90-4				
	3/23/10	6/22/11	11/6/12	12/11/2013
Total PCBs	ND	ND	ND	ND

MW-8A					
	9/30/08	3/17/10	6/21/11	11/12/12	12/18/2013
Total PCBs	ND	ND	ND	ND	ND

MW-RW-1			
	6/24/11	11/9/12	12/19/13
Total PCBs	**39.73**	**15**	ND

MW-90-14						
	6/26/07	9/29/08	3/17/10	6/22/11	11/7/12	12/12/2013
Total PCBs	ND	ND	ND	ND	ND	ND

GMW-5				
	3/18/10	6/22/11	11/6/12	12/30/2013
Total PCBs	**6.5**	**1.113**	**0.18**	**0.37**

GMW-3						
	6/26/07	9/29/08	3/17/10	6/23/11	11/8/12	12/12/2013
Total PCBs	ND	ND	ND	**0.094**	ND	ND

GMW-6						
	6/27/07	9/29/08	3/25/10	6/27/11	11/9/12	12/30/2013
Total PCBs	**0.67**	**7.3**	**1.5**	**0.974**	**1.1**	**2.5**

MW-8					
	9/30/08	3/18/10	6/21/11	11/12/12	12/16/2013
Total PCBs	ND	ND	ND	ND	ND

MW-90-3C				
	3/23/10	6/24/11	11/5/12	12/30/2013
Total PCBs	ND	ND	ND	ND

MW-90-2C						
	6/26/07	9/29/08	3/23/10	6/27/11	11/5/12	12/19/2013
Total PCBs	ND	ND	ND	ND	ND	ND

MW-90-11C				
	3/23/10	6/22/11	11/13/12	12/17/13
Total PCBs	**0.48**	**0.307**	ND	**3.9**

GMW-4						
	6/27/07	9/29/08	3/18/10	6/23/11	11/8/12	12/16/2013
Total PCBs	**9.4**	**8**	**4.7**	**23.46**	**18.8**	**4.7**

MW-90-10C						
	6/26/07	9/30/08	3/23/10	6/22/11	11/13/12	12/11/2013
Total PCBs	**1.1**	ND	**0.16**	**1.45**	**1.6**	ND

MW-18
GMW-2
MW-15
POND
MW-90-6C
MW-90-5
MW-90-2
MW-90-13
MW-90-6B
MW-90-6A
MW-90-7C
MW-90-7B
MW-90-7A
PROPERTY LINE (TYP.)
MW-90-4
GMW-1
GMW-5
MW-RW1
MW-8A
MW-90-14
MW-90-9A
MW-90-8A
MW-90-9B
MW-90-8B
GMW-3
MW-90-12
MW-90-2C
PW90-1
MW-90-2B
MW-90-2A
MW-90-3C
MW-90-3B
MW-90-3A
PL-3
GV-2
PL-1
PL-2
GV-1
GV-3
PL-4
MW-8
APPROXIMATE LOCATION OF SLURRY WALL
DD-EAST
SD-EAST
MH 1
MH 2
GMW-6
METAL BLDG.
GMW-4
WOOD BLDG.
GRAVEL DRIVE
T DRIVE
FEEDER CANAL
MW-90-11A
MW-90-11B
MW-90-11C
MW-90-10A
MW-90-10C
DD-WEST
MW-RW2
SD-WEST
FEEDER CANAL
0 75 150 300
SCALE IN FEET

LEGEND

- MW-90-10C — MONITORING WELL LOCATION
- PL-2 — PAN LYSIMETER
- GV-1 — GAS VENT
- SLURRY WALL
- (176.75) — MONITORING WELL GROUNDWATER ELEVATIONS
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NOTES:
1. ALL UNITS ARE IN ug/L
2. RESULTS IN BOLD AND HIGHLIGHTED YELLOW INDICATE EXCEEDANCES OF STANDARDS.

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FIGURE 6
Summary of PCBs in Groundwater
DECEMBER 2013

KINGSBURY LANDFILL
NYSDEC SITE #5-58-008
VILLAGE OF HUDSON FALLS, WASHINGTON COUNTY

JUNE 2014 60277036

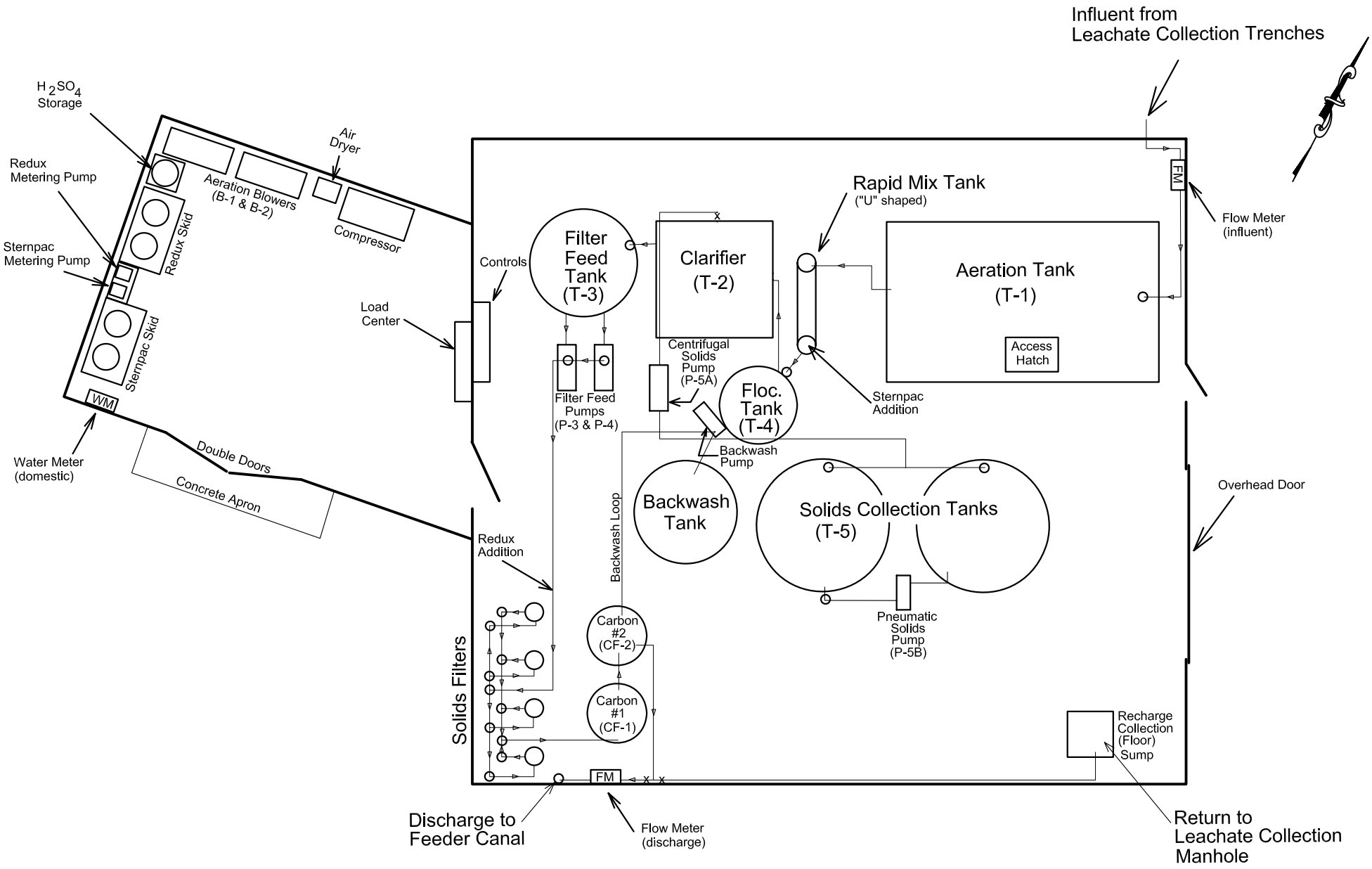


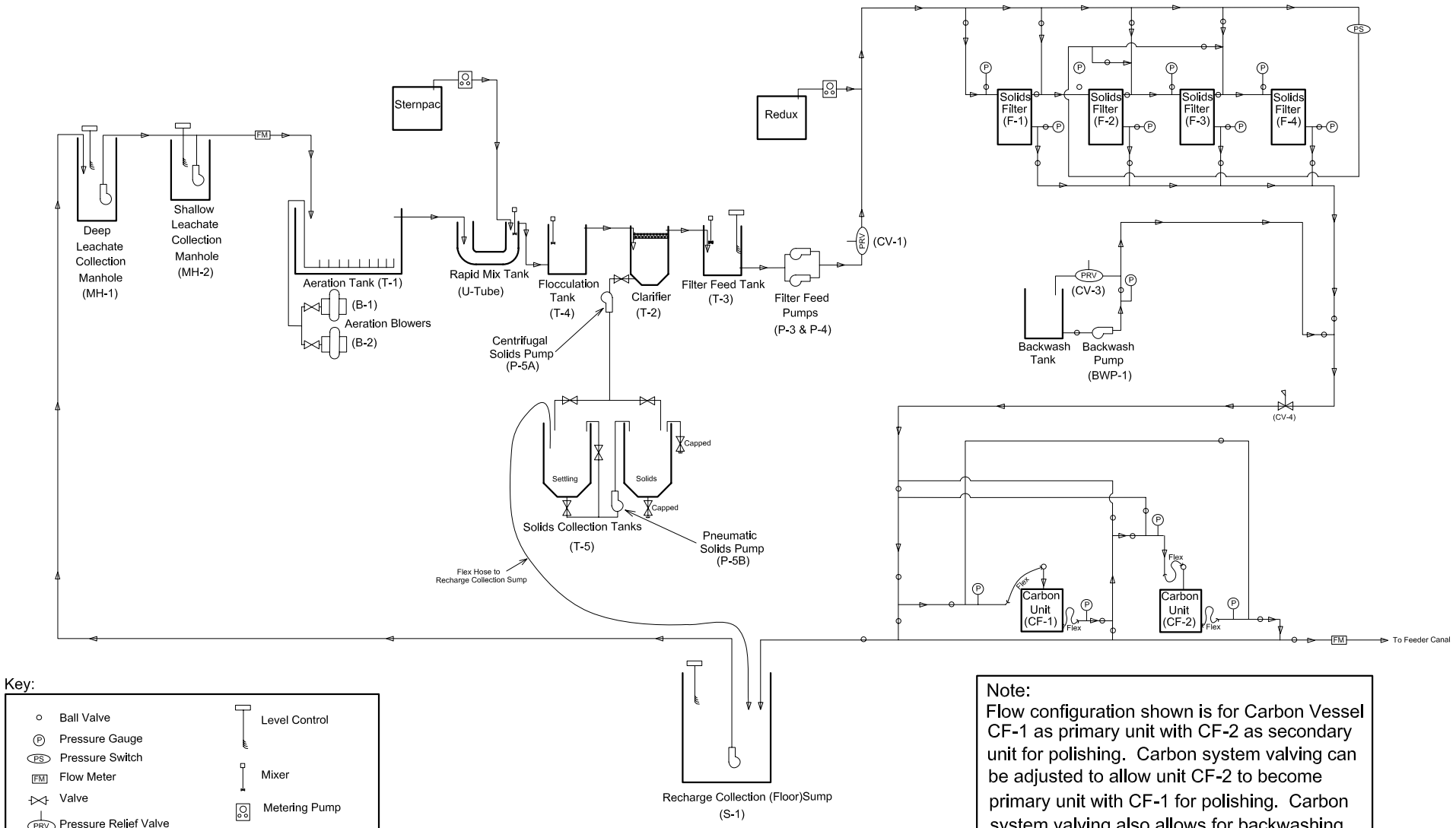
FIGURE 7

Treatment System Layout

Kingsbury Landfill

DATE: September, 2014 | Not to Scale

Note:
Configuration shown is for discharge to Feeder Canal



Key:

- Ball Valve
- Pressure Gauge (P)
- Pressure Switch (PS)
- Flow Meter (FM)
- Valve
- Pressure Relief Valve (PRV)
- Pump
- Level Control
- Mixer
- Metering Pump
- Pressure Reducing Valve

Note:
Flow configuration shown is for Carbon Vessel CF-1 as primary unit with CF-2 as secondary unit for polishing. Carbon system valving can be adjusted to allow unit CF-2 to become primary unit with CF-1 for polishing. Carbon system valving also allows for backwashing each vessel independantly with backwash discharge to Recharge Collection Sump.

FIGURE 8

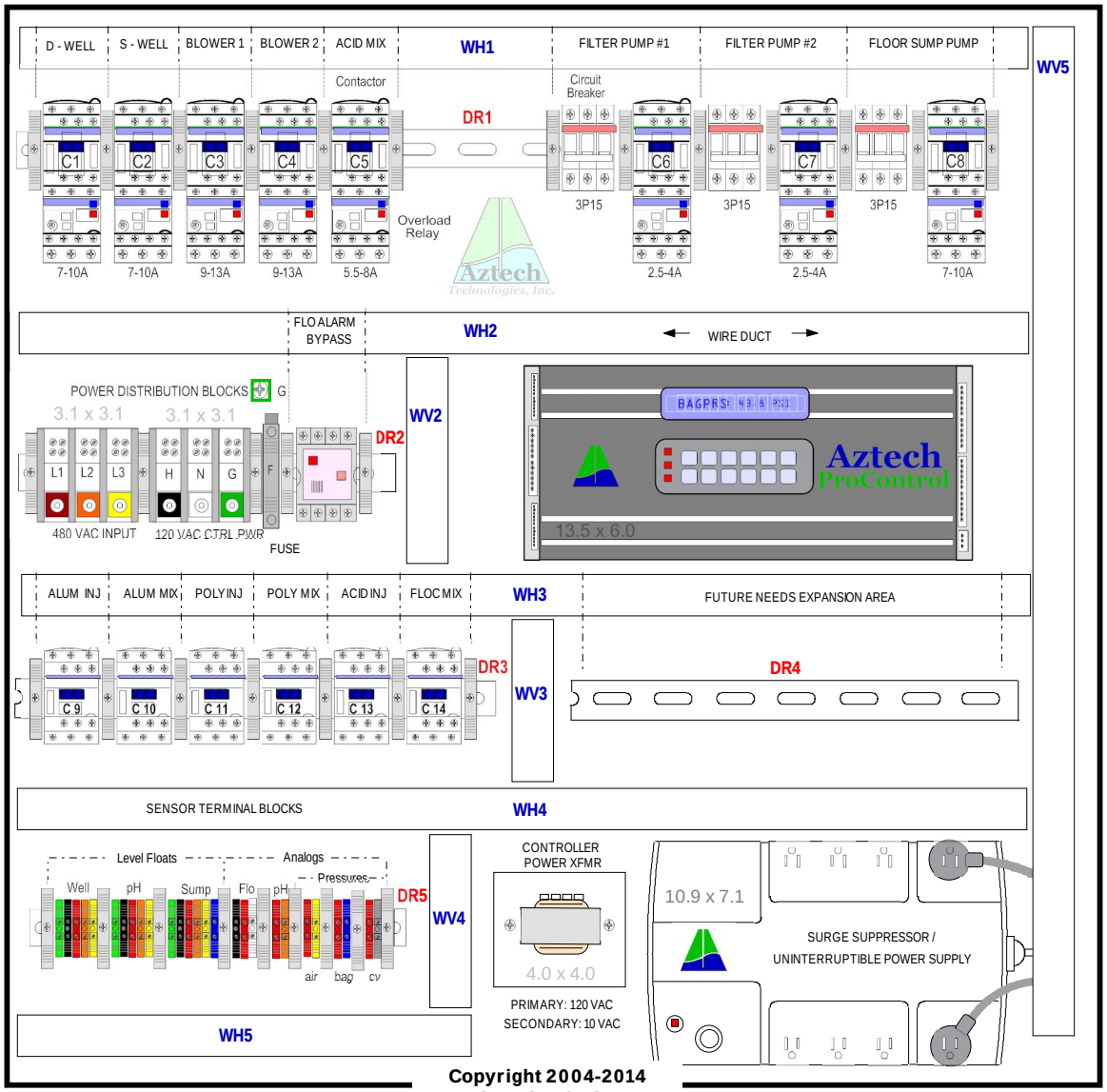
DATE: September, 2014

Not to Scale

Process Flow Diagram
Kingsbury Landfill

Fig. 9

NYSDEC/AECOM/AZTECH KINGSBURY LANDFILL
MAIN CONTROLPANEL LAYOUT



ENCLOSURE SPEC
36 x 36 x 12
NEMA 4/12
ANSI 61

EXPANSION AREA
INTERNAL: 8%
EXTERNAL/SW:30%

WIRE DUCT SCHEDULE

WH1 - 30.5"	WV1 - 31.5"
WH2-4 - 31.5"	WV-2 - 6.5"
WH5 - 15.5"	WV-3 - 5.0"
	WV4 - 5.2"
	WV5 - 32.5"

DIN RAIL SCHEDULE

DR1 - 31.5"	DR4 - 14.5"
DR2 - 11.0"	DR-5 - 13.5"
DR3 - 14.7"	

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Figure 9

Title:	NYSDEC Kingsbury Landfill Control Panel Layout	
Author:	Terrence Bohn	
Date:	13 May 2008	Sheet:
Revision:	IV	

NYSDEC /AECOM /AZTECH KINGSBURY LANDFILL
CONTROL PANEL SENSOR TERMINAL BLOCKS

Fig. 10

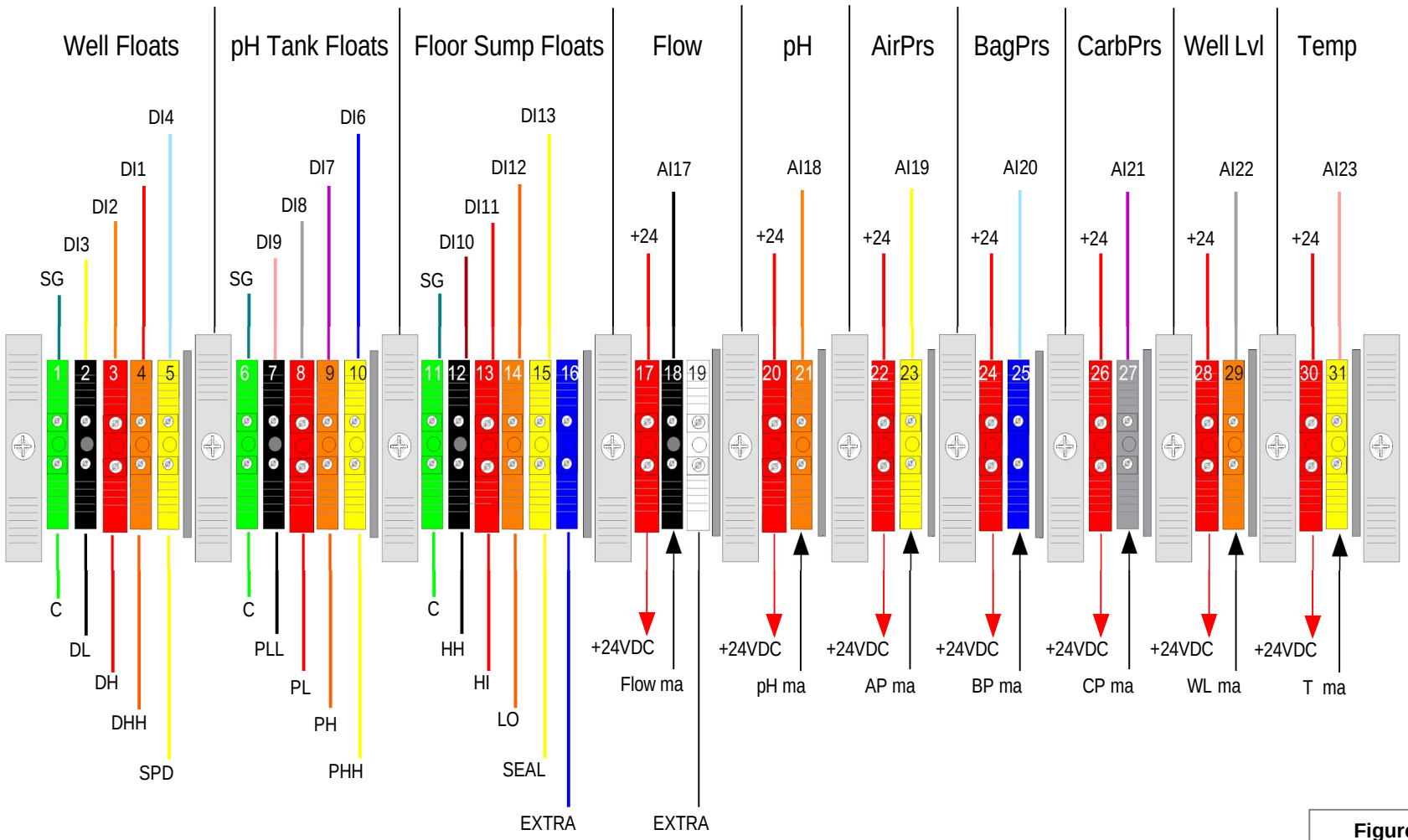

Figure 10

Title:	KINGSBURY LANDFILL CONTROL PANEL SENSOR TERMINAL BLOCKS	
Author:	Terrence Bohn	
Date:	12 June 2008	Sheet:
Revision:		

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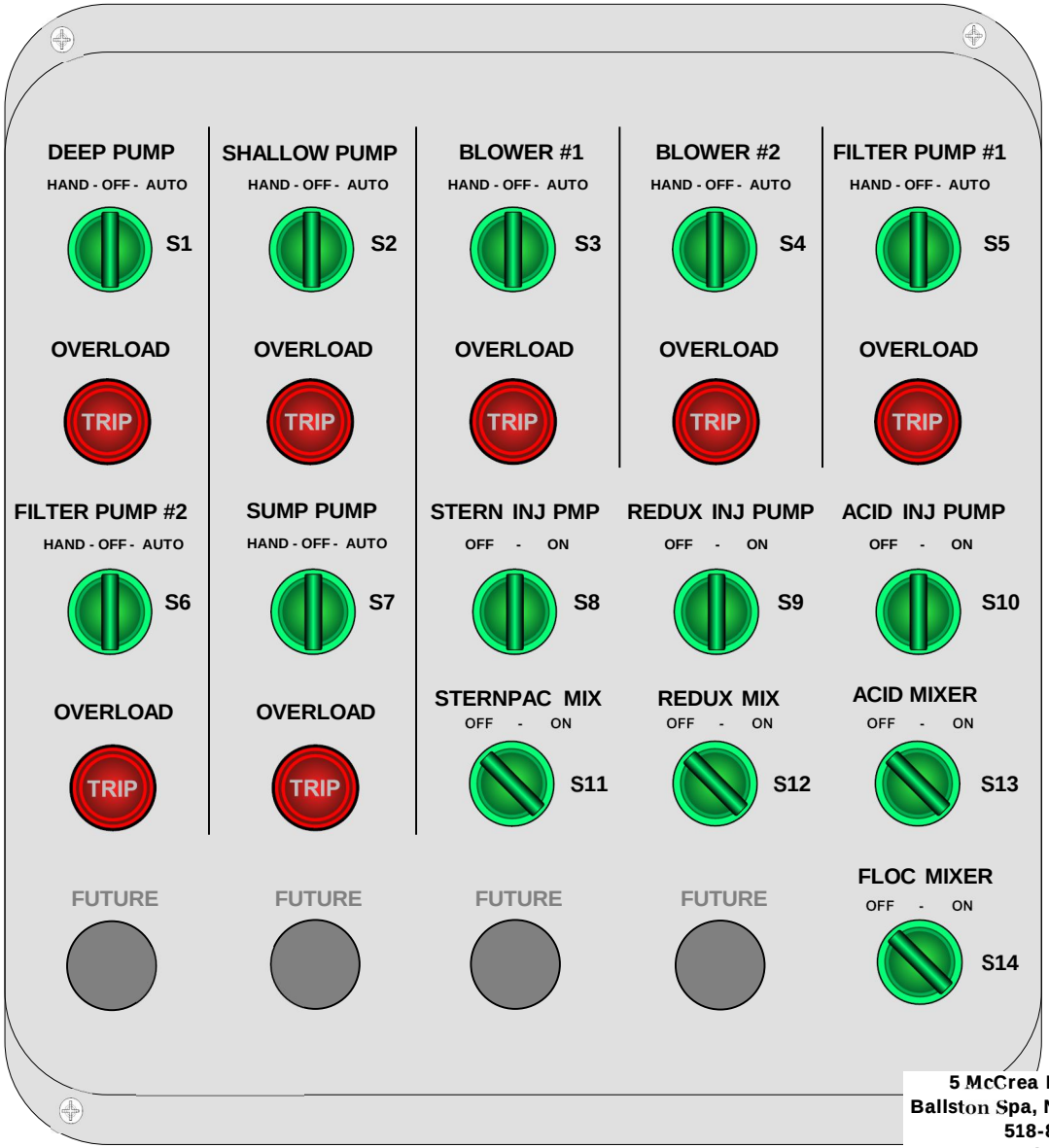
NYSDEC /AECOM /AZTECH KINGSBURY LANDFILL
SWITCH PANEL LAYOUT

Fig. 11



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Switch / Indicator Panel Detail
(7) Green illum. H-O-A Switches
(7) Green illum. Off-On Switches
Green lit switch = Controller / Switch CALL
(7) Red Indicators: Overload Relay TRIP
(4) Future Expansion Spaces

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Figure 11

Title:	NYSDEC Kingsbury Landfill Final Switch Panel Layout	
Author:	Terrence Bohn	
Date:	13 May 2008	Sheet:
Revision:	5c	

Appendix A

Excavation Work Plan

APPENDIX A – EXCAVATION WORK PLAN

A-1 NOTIFICATION

At least 15 days prior to the start of any activity that is anticipated to encounter remaining contamination, the site owner or their representative will notify the Department. Currently, this notification will be made to:

Payson Long
NYSDEC
Division of Environmental Remediation
625 Broadway
Albany, NY 12233
Office (518) 402-9813
Email: pdlong@gw.dec.state.ny.us

This notification will include:

- A detailed description of the work to be performed, including the location and areal extent, plans for site re-grading, intrusive elements or utilities to be installed below the soil cover, estimated volumes of contaminated soil to be excavated and any work that may impact an engineering control,
- A summary of environmental conditions anticipated in the work areas, including the nature and concentration levels of contaminants of concern, potential presence of grossly contaminated media, and plans for any pre-construction sampling;
- A schedule for the work, detailing the start and completion of all intrusive work,
- A summary of the applicable components of this EWP,
- A statement that the work will be performed in compliance with this EWP and 29 CFR 1910.120,
- A copy of the contractor's health and safety plan, in electronic format, if it differs from the HASP provided in Appendix F of this document,
- Identification of disposal facilities for potential waste streams,
- Identification of sources of any anticipated backfill, along with all required chemical testing results.

A-2 SOIL SCREENING METHODS

Visual, olfactory and instrument-based soil screening will be performed by a qualified environmental professional during all remedial and development excavations into known or potentially contaminated material (remaining contamination). Soil screening will be performed regardless of when the invasive work is done and will include all excavation and invasive work performed during development, such as excavations for foundations and utility work, after issuance of the COC.

Soils will be segregated based on previous environmental data and screening results into material that requires off-site disposal, material that requires testing, material that can be returned to the subsurface, and material that can be used as cover soil.

A-3 STOCKPILE METHODS

Soil stockpiles will be continuously encircled with a berm and/or silt fence. Hay bales will be used as needed near catch basins, surface waters and other discharge points.

Stockpiles will be kept covered at all times with appropriately anchored tarps. Stockpiles will be routinely inspected and damaged tarp covers will be promptly replaced.

Stockpiles will be inspected at a minimum once each week and after every storm event producing greater than ½ inches of rain within 24 hours. Results of inspections will be recorded in a logbook and maintained at the site and available for inspection by NYSDEC.

A-4 MATERIALS EXCAVATION AND LOAD OUT

A qualified environmental professional or person under their supervision will oversee all invasive work and the excavation and load-out of all excavated material.

The owner of the property and its contractors are solely responsible for safe execution of all invasive and other work performed under this Plan.

The presence of utilities and easements on the site will be investigated by the qualified environmental professional. It will be determined whether a risk or impediment to the planned work under this SMP is posed by utilities or easements on the site.

Loaded vehicles leaving the site will be appropriately lined, tarped, securely covered, manifested, and placarded in accordance with appropriate Federal, State, local, and NYSDOT requirements (and all other applicable transportation requirements).

A truck wash will be operated on-site. The qualified environmental professional will be responsible for ensuring that all outbound trucks will be washed at the truck wash before leaving the site until the activities performed under this section are complete.

Locations where vehicles enter or exit the site shall be inspected daily for evidence of off-site soil tracking.

The qualified environmental professional will be responsible for ensuring that all egress points for truck and equipment transport from the site are clean of dirt and other materials derived from the site during intrusive excavation activities. Cleaning of the adjacent streets will be performed as needed to maintain a clean condition with respect to site-derived materials.

A-5 MATERIALS TRANSPORT OFF-SITE

All transport of materials will be performed by licensed haulers in accordance with appropriate local, State, and Federal regulations, including 6 NYCRR Part 364. Haulers will be appropriately licensed and trucks properly placarded.

Material transported by trucks exiting the site will be secured with tight-fitting covers. Loose-fitting canvas-type truck covers will be prohibited. If loads contain wet material capable of producing free liquid, truck liners will be used.

All trucks will be washed prior to leaving the site. Truck wash waters will be collected and disposed of off-site in an appropriate manner.

Truck transport routes are as follows:

Exit the Site, turn right onto Suffolk Ave, proceed east to Washington Avenue, turn left, proceed north on Washington Avenue to the Long Island Expressway. Follow the Service Road to the nearest entrance (east or westbound).

All trucks loaded with site materials will exit the vicinity of the site using only these approved truck routes. This is the most appropriate route and takes into account: (a) limiting transport through residential areas and past sensitive sites; (b) use of city mapped truck routes; (c) prohibiting off-site queuing of trucks entering the facility; (d) limiting total distance to major highways; (e) promoting safety in access to highways; and (f) overall safety in transport.

Trucks will be prohibited from stopping and idling in the neighborhood outside the project site.

Egress points for truck and equipment transport from the site will be kept clean of dirt and other materials during site remediation and development.

Appendix B

Health & Safety Plans

Appendix B1

AECOM Health & Safety Plan

New York State Department of Environmental Conservation
Contract No. D007626
Task/Delivery Order No. WA 21.1

S3NA-209-TP2 HEALTH AND SAFETY PLAN

Leachate Treatment System OM&M Engineering Oversight
Kingsbury Landfill
1580 Burgoyne Avenue
Kingsbury, New York

Prepared for:

New York State Department of Environmental Conservation (NYSDEC)
232 Golf Course Road
Warrensburg, NY 12885

Prepared by:

AECOM
100 Red Schoolhouse Road, Suite B-1
Chestnut Ridge, New York

Health and Safety Plan Expiration Date: September 2016

Project No: 60277036 task 2

Project Health and Safety Plan

approval page

This project Health and Safety Plan (HASP) was prepared for employees performing a specific, limited scope of work. It was prepared based on the best available information regarding the physical and chemical hazards known or suspected to be present on the project site. While it is not possible to discover, evaluate, and protect in advance against all possible hazards, which may be encountered during the completion of this project, adherence to the requirements of the HASP will significantly reduce the potential for occupational injury.

By signing below, I acknowledge that I have reviewed and hereby approve the HASP for the Kingsbury Landfill site. This HASP has been written for the exclusive use of AECOM, its employees, and subcontractors. The plan is written for specified site conditions, dates, and personnel, and must be amended if these conditions change.

Prepared by:

Jennifer E. Pfeiffer
Safety, Health, and Environment Representative
212-377-8706

September 2, 2015
Date

Concurrence by:

Peter Gregory, MPH, CSP, STS
New York Area Safety Manager
973-883-8683

September 25, 2015
Date

Approved by:

Paul Kareth
Project Manager
845-425-4980

September 30, 2015
Date

Executive Summary

The purpose of this Health and Safety Plan (HASP) is to address health and safety concerns related to AECOM managed activities at the Kingsbury Landfill site, located at 1580 Burgoyne Avenue in Kingsbury, New York. The specific roles, responsibilities, authority, and requirements as they pertain to the safety of employees and the scope of services are discussed herein. The document is intended to identify known potential hazards and facilitate communication and control measures to prevent injury or harm. Additionally, provisions to control the potential for environmental impact from these activities are included where applicable.

AECOM will be performing oversight of the OM&M sub for the operation of the leachate treatment system, treatment system upgrades and periodic monitoring well sampling. AECOM will also perform a site survey.

Subcontractors will be utilized for OM&M operation of the leachate treatment system and a state licensed surveyor.

The primary physical hazards which may be encountered include:

- Slip, Trip, Falls
- Biological Hazards
- Ergonomics (Overexertion)
- Hand Safety
- Noise
- Heat Stress
- Cold Stress

The chemical hazards which may be encountered include:

- 1-1 dichloroethane
- Acetone
- Antimony
- Arsenic
- Chlorobenzene
- Iron metal
- Magnesium
- Manganese
- PCBs
- Sodium
- Toluene
- Xylenes

All staff are bound by the provisions of this HASP and are required to participate in a preliminary project safety meeting to familiarize them with the anticipated hazards and respective onsite controls. The discussion will cover the entire HASP subject matter, putting emphasis on critical elements of the plan; such as the emergency response procedures, personal protective equipment, site control strategies, and monitoring requirements. In addition, daily tailgate safety meetings will be held to discuss: the anticipated scope of work, required controls, identify new hazards and controls, incident reporting, review the results of inspections, any lessons learned or concerns from the previous day.

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ATTACHMENTS

1.0 Introduction

This Health and Safety Plan (HASP) (including Attachments A-C) provides a general description of the levels of personal protection and safe operating guidelines expected of each employee or subcontractor associated with the environmental services being conducted at the Kingsbury Landfill site, located at 1580 Burgoyne Avenue in Kingsbury, New York. This HASP also identifies chemical and physical hazards known to be associated with the AECOM-managed activities addressed in this document.

HASP Supplements will be generated as necessary to address any additional activities or changes in site conditions, which may occur during field operations.

1.1 General

1.1.1 The provisions of this HASP are mandatory for all AECOM personnel engaged in fieldwork associated with the environmental services being conducted at the subject site. A copy of this HASP, any applicable HASP Supplements and the AECOM's North America Safety, Health, and Environmental (SH&E) Procedures and Manual shall be accessible on site and available for review at all times. Record keeping will be maintained in accordance with this HASP and the applicable Standard Operating Procedures (SOPs). In the event of a conflict between this HASP, the SOPs and federal, provincial, state, and local regulations, workers shall follow the most stringent/protective requirements. Concurrence with the provisions of this HASP is mandatory for all personnel at the site covered by this HASP and must be signed on the acknowledgement page.

1.2 Project Policy Statement

AECOM is committed to protecting the safety and health of our employees and meeting our obligations with respect to the protection of others affected by our activities. We are also committed to protecting and preserving the natural environment in which we operate. The safety of persons and property is of vital importance to the success of this project and accident prevention measures shall be taken toward the avoidance of needless waste and loss. It shall be the policy of this project that all operations be conducted safely. Onsite supervisors are responsible for those they supervise by maintaining a safe and healthy working environment in their areas of responsibility, and by fairly and uniformly enforcing safety and health rules and requirements for all project personnel. Subcontractors shall comply with the requirements of this HASP, provisions contained within the contract document and all applicable rules, requirements and health, safety and environmental regulations. All practical measures shall be taken to promote safety and maintain a safe place to work. Contractors are wholly responsible for the prevention of accidents on work under their direction and shall be responsible for thorough safety and loss control programs and the execution of their own safety plans for the protection of workers.

1.3 References

This HASP conforms to the regulatory requirements and guidelines established in the following documents:

- Title 29, Part 1910 of the Code of Federal Regulations (29 CFR 1910), Occupational Safety and Health Standards (with special attention to Section 120, Hazardous Waste Operations and Emergency Response).
- Title 29, Part 1926 of the Code of Federal Regulations (29 CFR 1926), Safety and Health Regulations for Construction.
- National Institute for Occupational Safety and Health (NIOSH)/OSHA/U.S. Coast Guard (USCG)/EPA, Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, Publication No. 85-115, 1985.

2.0 Site Information and Scope of Work

AECOM will conduct environmental services at the Kingsbury Landfill site. Work will be performed in accordance with the applicable Statement of Work (SOW) and associated Project Work Plan developed for project site. Deviations from the listed SOW will require that a Safety Professional review and changes made to this HASP, to ensure adequate protection of personnel and other property.

The following is a summary of relevant data concerning the project site, and the work procedures to be performed. The Project Work Plan prepared by AECOM as a companion document to this HASP provides more detail concerning both site history and planned work operations.

2.1 Site Information

This section provides a general description and historical information associated with the site.

2.1.1 General Description

The Kingsbury Landfill is an 18-acre, inactive landfill that operated as a municipal dump from 1930 to 1985. Located in the Town of Kingsbury (see Figure 1), next to the Towns of Fort Edward and Hudson Falls. It is bordered by Burgoyne Avenue to the west and Feedertow Road to the south. The adjacent Canal serves as the receiving stream for treated leachate from the landfill. Access to the landfill is through a fenced gate on Feedertow Road, which also serves as part of the park.

2.1.2 Site Background/History

Approximately 1,900 tons of hazardous waste was discarded by the General Electric Company (GE) at this landfill in the past, and represented approximately 87% of the total amount of hazardous waste that had been disposed of in this landfill. Other hazardous wastes included PCB-laden and oil impregnated rolls of paper. Prior to remediation, leachate generated at this site reached several surface water bodies southwest of the site including the feeder/tow canal, Cutter Pond and a swamp. Off-site investigations revealed contamination of the sediments in these areas with PCBs, trichloroethene, cis-1, 2-dichloroethene and vinyl chloride.

Remediation of the landfill was completed by GE in 1989 in a settlement with the NYSDEC, and involved the construction of a leachate collection system, a soil-bentonite groundwater cut-off wall, a low permeability clay cap and the installation of groundwater monitoring wells. The on-site remediation eliminated exposure to contaminants from the landfill. In 1988 and 1989, a wider drain system for leachate collection and an Interim Leachate Treatment System (ILTS) were installed to pump and treat leachate from the landfill. This system was designed to reduce the groundwater elevation within the landfill and to maintain the integrity of the cap at the southern end of the landfill.

Leachate is allowed to accumulate (i.e., stored) in the landfill until it reaches an action level of 202 feet elevation. In the treatment system, leachate from the landfill is first aerated to oxidize the iron, then chemically treated with sodium aluminate and a polymer to remove the precipitated iron, and finally polished by activated carbon to remove PCBs. The ILTS was last operated in 1991 removing and treating almost two million gallons of leachate. Due to the many operational problems encountered, the treatment system was renovated in 1995. After the renovation, the plant was mothballed due to the fact that water levels in the landfill did not rise as quickly as anticipated. Since 1991, the groundwater elevation within the landfill has been closely monitored, and water table was found to reach the 200' action level in 1999.

The level fluctuated but now continues to rise and stay above 202 ft. As a result, the NYSDEC restarted the leachate treatment system and placed it back in operation. Operational problems include the rapid plugging of the in-line bag filters before the carbon vessels and winter-time freezing.

2.2 Scope of Work

This work assignment is for AECOM to provide engineering oversight of the operations and maintenance of the leachate treatment system. Specific tasks to be performed on site during the course of this work assignment include:

- Routine inspection of the leachate treatment system.
- Routine observation of work performed by AECOM subcontractor responsible for the operations and maintenance of treatment system, and environmental monitoring, including groundwater sampling and treatment system performance monitoring.
- A handheld global positioning system (GPS) unit (WAAS enabled) will be used to locate each well during sampling and the coordinates will be recorded in the field notes.
-

2.2.1 Additional Work Operations

Operations at the site may require additional tasks not identified in this section or addressed in Attachment A THAs. Before performing any task not covered in this HASP a THA must be prepared, and approved by the Safety Professional.)

3.0 Hazard Assessment (Safety)

3.1 Physical Hazards

Physical hazards anticipated to be encountered include the following;

- Slip, Trip, Falls
- Biological Hazards
- Ergonomics (Overexertion)
- Hand Safety
- Noise
- Heat Stress
- Cold Stress
- Driving Hazards

3.2 Falls on Same Level

Falls from slips and trips are common workplace occurrences that can result in serious injuries and disabilities. The most common types of falls are falls at the same level. Fall hazards exist in most workplaces including offices, manufacturing and construction. Slips and trips can be prevented by following these guidelines:

- Personnel shall be vigilant in providing clear footing, clearly identifying obstructions, holes, protruding objects, or other tripping hazards and maintaining an awareness of uneven terrain and slippery surfaces.
- Walking and working surfaces shall be kept free of materials, obstructions, and substances that could cause a surface to become slick or otherwise hazardous.
- Makeshift substitute ladders such as toolboxes, buckets, and coolers shall not be used.
- The use of cellular telephones (testing, making or receiving calls) for personal use is prohibited in the work area.
- Walk around, not over or on, debris or equipment that might have been stored in the work area.
- Don't jump from platforms or truck beds.
- When carrying equipment, identify a path that is clear of any obstructions. It might be necessary to remove obstacles to create a smooth, unobstructed access point to the work areas on site.

3.3 Manual Lifting

Most materials associated with investigation and remedial activities are moved by hand. The human body is subject to severe damage in the forms of back injury, muscle strains, and hernia if caution is not observed in the handling process. Whenever possible, use mechanical assistance to lift or move materials and at a minimum, use at least two people to lift, or roll/lift with your arms as close to the body as possible. For additional requirements, refer to S3NA 308 PR, Manual Lifting. The following precautions should be implemented when lifting or moving heavy objects:

- Bend at the knees, not the waist. Let your legs do the lifting;
- Do not twist while lifting;
- Bring the load as close to you as possible before lifting;
- Be sure the path you are taking while carrying a heavy object is free of obstructions and slip, trip and fall hazards;
- Use mechanical devices to move objects that are too heavy to be moved manually; and,
- If mechanical devices are not available, ask another person to assist you.

3.4 Driving Hazards

Drivers must be licensed to drive the class of vehicle they are operating and trained in defensive driving. Only AECOM personnel may drive AECOM vehicles or vehicles rented for AECOM business; client, subcontractor, or other work-related personnel may ride. Drivers and passengers must comply with all traffic laws and posted signs, and will not operate a

vehicle if under the influence of impairing medication, alcohol, or any other substance. Specific requirements for driving safety can be found in S3NA-005-PR Vehicle and Driver Safety Program.

Make sure that the following basic safe driving practices are followed at all times while working on this project:

- Always wear a seat belt while operating a motor vehicle or while traveling as a passenger.
- Obey speed limits and local traffic laws at all times.
- Obtain proper directions to the site in advance and take the route that is most likely to be free of known traffic hazards (e.g., congestion, construction, etc.) and that avoids travel through potentially dangerous neighborhoods.
- The use of all mobile communication devices (MCDs) while driving is strictly prohibited. MCDs include all hand-held or hands-free devices, including all mobile phones and other portable electronic devices that cause driver distraction such as tablets (e.g., iPads), PDAs, pagers, iPods, MP3s, GPS, DVD players, laptops, etc. Employees shall not use a personal or company MCD while driving a company vehicle; use a company MCD while driving a personal vehicle; or use a personal MCD while driving a personal vehicle on company business. Driving includes the time spent in traffic or while stopped at red lights or stop signs.
- GPS units and GPS units on smart phones may only be used if factory installed or secured to the vehicle with a bracket that allows the driver to view the image without having to take their eyes off the road. Electronic devices shall be setup for operation prior to commencing driving activities.
- Do not operate a motor vehicle if you are tired and/or have not had sufficient rest. Additional information on vehicle safety can be found in S3NA-005-PR Driver and Vehicle Safety Program.

3.5 Wildlife, Plant and Insect Hazards

Employees are encouraged to review AECOM SHE SOP 509 – Biological Hazards Injury & Illness Prevention, for detailed discussion on working around insects within the workplace and procedures that can be used to minimize and prevent exposure.

Ticks

Ticks are bloodsuckers, attaching themselves to warm-blooded vertebrates to feed. Deer ticks are the most common carriers of Lyme disease, a bacterial infection that is transmitted to humans through the bite of the tick.

Personnel should carefully inspect themselves each day for the presence of ticks or any rashes. This is important since prompt removal of the tick can prevent disease transmission. Female deer ticks are about one-quarter inch in length and are black and brick red in color. Males are smaller and all black.

Removal of the tick is important in that the tick should not be crushed and care must be taken so that the head is also removed. If the head is not completely removed or if the tick is allowed to remain for days feeding on human blood, a condition known as tick paralysis can develop, this is due to a neurotoxin that the tick apparently injects while engorging. This neurotoxin acts upon the spinal cord causing loss of coordination, weakness and paralysis.

One characteristic symptom of Lyme disease is a bulls-eye rash that develops around the bite site. The rash appears in about 60-80% of all Lyme disease cases. Contact your OHSC immediately if you develop such a rash.

Tick season typically lasts from April through October; peak season is May through July; seasons can very depending on climate. Wear light-colored clothing (easier to spot ticks) with long sleeves and make sure that shirts are tucked into pants and pants are tucked into socks or boots. Ticks have a tendency to crawl upwards. These procedures will make it more difficult for a tick to reach your skin.

Studies have determined that repellants containing DEET as a main ingredient are most effective against mosquitoes and ticks. DEET can be directly applied to the exposed skin of adults and/or clothing. Products containing DEET can't be used with Fire Resistant Clothing (FRC) as it diminishes the garments' capacity to resist ignition in a fire. Permethrin is another repellent; however, it can only be directly applied to clothing.

Mosquitoes

Mosquitoes, carriers of the West Nile Virus, Yellow Fever and other diseases, are indigenous to the area. As mentioned above, DEET is an effective mosquito repellent and is recommended. Although concentrated DEET formulations protect longer than those that are more dilute, little improvement is offered by concentrations of the active ingredient higher than 50 percent. Adverse effects, though documented, are infrequent and are generally associated with gross overuse of the product. Users should avoid the temptation to apply the most concentrated product available. The transient protection offered by more dilute preparations can be extended by reapplication. When using DEET care should be taken to reapply the repellant when its effectiveness wears off.

Spiders

Spiders and wasps may be found in derelict buildings, sheltered areas, and even on open ground. Exercise care when collecting samples and avoid reaching into areas where visibility is limited. If bitten by a spider, notify a co-worker or someone who can help if you should you have an allergic reaction or develop other symptoms related to spider venom. Stay calm and treat the area with ice or cold water. Seek medical attention if you have any reactions to the bite such as developing a rash, excessive swelling or pain at the site of the bite or sting or any swelling or numbness beyond the site of the bite.

Wasps and Bees

Wasps (hornets and yellow-jackets) and bees (honeybees and bumblebees) are common insects that may pose a potential hazard to the field team if work is performed during spring, summer or fall. Bees normally build their nests in the soil. However, they use other natural holes such as abandoned rodent nests or tree hollows. Wasps make a football-shaped, paper-like nest either below or above the ground. Yellow-jackets tend to build their nests in the ground but hornets tend to build their nests in trees and shrubbery. Bees are generally more mild-mannered than wasps and are less likely to sting. Bees can only sting once while wasps sting multiple times because their stinger is barbless. Wasps sting when they feel threatened. By remaining calm and not annoying wasps by swatting, you lessen the chance of being stung.

Wasps and bees inject a venomous fluid under the skin when they sting. The venom causes a painful swelling that may last for several days. If the stinger is still present, carefully remove it with tweezers or y scraping a credit card or other blunt object against the sting site in the opposite direction in which the stinger is embedded. Some people may develop an allergic reaction, i.e. anaphylaxis, to a wasp or bee sting. If such a reaction develops, seek medical attention at once. Persons who are allergic to bee and wasp stings should carry an epinephrine pen, e.g., epi-pen, with them that is prescribed by a doctor and used to help abate swelling that occurs due to their allergy. Even if an employee utilizes their epi-pen, they still need to seek medical attention for follow-up care and observation.

3.6 Radiological Hazards

No known radiological hazards are present.

3.7 NOISE HAZARDS

Wear approved hearing protection when working around equipment that produces sound levels in excess of 85 decibels, whenever signs indicate that hearing protection is required, and whenever voices must be raised to be heard at a distance of three feet or less.

3.8 Ultraviolet Hazards

No known ultraviolet hazards are present.

3.9 Weather Hazards

Severe Weather

Prior to mobilization the project manager or field team personnel should be cognizant of the long range and short range weather forecast for the region in which they will be working in. If severe weather is forecasted work should be temporarily postponed until the weather is more favorable. Daily, field team members should check the weather forecast for inclement or severe weather. A weather radio or radio set on an AM channel is the best sources for weather information and weather alerts. On the internet the Storm Prediction Center's web page can be check for alerts and warnings. http://www.spc.noaa.gov/products/wwa/.

All four seasons can bring about severe weather to the region, ranging from extremely cold temperatures to high winds and thunder and lightning storms. Hurricanes have been known to hit the northeast and while rare, tornados do occur in the northeast.

In the event that severe weather is forecasted, the following steps should be taken:

- Temporarily stop work and secure the site.
- Seek shelter in a vehicle or safe indoor location.
- Stop all work and seek a safe area when lightning is within range of the site (by the time you hear thunder, you are ALREADY within lightning range). Safe areas include low areas (NOT subject to flash floods), grounded metal structures or vehicles. Follow the 30/30 rule: If you see lightning and cannot count to 30 before hearing thunder, stay indoors for 30 minutes after hearing the last clap of thunder.
- Shut down generators and electrical equipment in an orderly manner to protect the equipment from electrical surges and abrupt power loss.
- Move all personnel off crawler-type equipment and boom equipment. Lower booms.

When working in low areas, be alert for the potential of flash flooding and plan a route to reach higher ground.

Cold and Heat Stress

AECOMs Heat Stress Prevention Plan can be found in S3NA-511-PR and Cold Stress Prevention Plan can be found in S3NA-505-PR. Procedures found in these plans must be implemented as necessary to prevent thermal stress.

Heat and cold stress may vary based upon work activities, PPE/clothing selection, geographical locations, and weather conditions. To reduce the potential of developing heat/cold stress, be aware of the signs and symptoms of heat/cold stress and watch fellow employees for signs of heat/cold stress.

Heat stress can be a significant field site hazard, particularly for non-acclimated personnel operating in a hot, humid setting. Site personnel will be instructed in the identification of a heat stress victim, the first-aid treatment procedures for the victim and the prevention of heat stress casualties.

Responding to Heat-Related Illnesses

The guidance below will be used in identifying and treating heat-related illness.

Identification and Treatment of Heat-Related Illness

Type of Heat-Related Illness	Description	First Aid
Mild Heat Strain	The mildest form of heat-related illness. Victims exhibit irritability, lethargy, and significant sweating. The victim may complain of headache or nausea. This is the initial stage of overheating, and prompt action at this point may prevent more severe heat-related illness from occurring.	• Provide the victim with a work break during which he/she may relax, remove any excess protective clothing, and drink cool fluids. • If an air-conditioned spot is available, this is an ideal break location. • Once the victim shows improvement, he/she may resume working; however, the work place should be moderated to prevent recurrence of the symptoms.
Heat Exhaustion	Usually begins with muscular weakness and cramping, dizziness, staggering gait, and nausea. The victim will have pale, clammy moist skin and may perspire profusely. The pulse is weak and fast and the victim may faint unless they lie down. The bowels may move involuntarily.	• Immediately remove the victim from the work area to a shady or cool area with good air circulation (*avoid drafts or sudden chilling*). • Remove all protective outerwear. • Call a physician. • Treat the victim for shock. (*Make the victim lie down, raise his or her feet 6–12 inches, and keep him/her cool by loosening all clothing*). • If the victim is conscious, it may be helpful to give him/ her sips of water. • Transport victim to a medical facility ASAP.

Responding to Cold-Related Illnesses

The guidance below will be used in identifying and treating cold-related illness.

Identification and Treatment of Cold-Related Illness

Type of Cold-Related Illness	Description	First Aid
Frostbite	• Lack of feeling in the affected area; skin that appears waxy, is cold to the touch, or is discolored (flushed, white or gray, yellow or blue).	• Move the person to a warm place. • Handle the area gently; never rub the affected area. • Warm gently by soaking the affected area in warm water (100–105 °F) until it appears red and feels warm. • Loosely bandage the area with dry, sterile dressings. • If the person's fingers or toes are frostbitten, place dry, sterile gauze between them to keep them separated. • Avoid breaking any blisters. • Do not allow the affected area to refreeze. • Seek professional medical care as soon as possible
Hypothermia	• Signs and symptoms of hypothermia include— shivering, numbness, glassy stare; apathy, weakness, impaired judgment; loss of consciousness. • A person with hypothermia usually isn't aware of his or her condition,	• CALL 9-1-1 or the local emergency number. • Gently move the person to a warm place. • Monitor breathing and circulation. • Give rescue breathing and CPR if needed. • Remove any wet clothing and dry the person. • Warm the person slowly by wrapping in blankets or by putting dry clothing on the person. Hot water bottles and chemical hot packs may be used when first wrapped in a towel or blanket before applying. Do not warm the person too quickly, such as by immersing him or her in warm water. Rapid warming may cause dangerous heart arrhythmias. Warm the core first (trunk, abdomen), not the extremities (hands, feet). This is important to mention because most people will try to warm hands and feet first and that can cause shock.

3.10 Hand Tool Hazards

Use the proper tool for the job; maintain tools in good condition. Inspect tools before use and remove defective tools from service. Wear gloves appropriate for the task

3.11 Hazard Analysis

Task Hazard Analyses (THAs) have been completed for all tasks identified in the Scope of Work (Attachment A):

- Mobilization/Demobilization
- Site Inspections

3.11.1 Unanticipated Work Activities/Conditions

As a result of unanticipated work activities or changing conditions, additional THAs may be required. All additional THAs will be reviewed and approved by the SH&E Professional.

3.12 **Task Specific SH&E Procedures**

As discussed in Section5.0, personnel may be exposed to a variety of chemical, physical, and radiological hazards resulting from task or equipment-specific activities. The controls for many of these hazards are discussed in SOPs found in the **Series 300 to 500** North America SH&E SOPs.

	SOP#	TITLE		SOP#	TITLE
S3NA 300 Series Field(Common)			**S3NA 500 Series Industrial Hygiene**		
☐	S3NA-301-PR	Confined Spaces	☐	S3NA-501-PR	Asbestos
☐	S3NA-302-PR	Electrical, General	☐	S3NA-502-PR	Benzene
☐	S3NA-303-PR	Excavation and Trenching	☐	S3NA-503-PR	Blood borne Pathogen Program
☐	S3NA-304-PR	Fall Protection	☐	S3NA-504-PR	Cadmium
☐	S3NA-305-PR	Hand and Power Tools	☒	S3NA-505-PR	Cold Stress Prevention
☐	S3NA-306-PR	Highway and Road Work	☐	S3NA-506-PR	Compressed Gases
☒	S3NA-307-PR	Housekeeping, Worksite	☐ ☒	S3NA-507-PR	Hazardous Materials Communication / WHMIS
☒	S3NA-308-PR	Manual Lifting, Field		S3NA-508-PR	Hazardous Materials Handling and Shipping
☒	S3NA-309-PR	Mobile or Heavy Equipment	☒	S3NA-509-PR	Hazardous Waste Operations and Emergency Response Activities
☐	S3NA-310-PR	Rigging, Hoisting, Cranes and Lifting Devises	☒	S3NA-510-PR	Hearing Conservation Program
☐	S3NA-311-PR	Scaffolding	☒	S3NA-511-PR	Heat Stress Prevention
☐	S3NA-312-PR	Ladders and Stairways	☐	S3NA-512-PR	Laboratory Safety
☒	S3NA-313-PR	Wildlife, Plants and Insects	☐	S3NA-513-PR	Lead
☐	S3NA-314-PR	Working Alone & Remote Travel	☐	S3NA-514-PR	Munitions and Explosives of Concern / Unexploded Ordnance (MEC-UXO)
☐	S3NA-315-PR	Water, Working Around	☐	S3NA-515-PR	Nanotechnology
			☐	S3NA-516-PR	Radiation Safety Programs
S3NA 400 Series Field (Uncommon)			☐	S3NA-517-PR	Radiation, Non-Ionizing
☐	S3NA-401-PR	Aircraft Charters	☐	S3NA-518-PR	Radiation, Gauge Source program
☐	S3NA-402-PR	All Terrain Vehicles (ATVs)	☐	S3NA-519-PR	Respiratory Protection Program
☐	S3NA-403-PR	Avalanches	☐	S3NA-520-PR	Spill Response, Incidental
☐	S4NA(US)-404-PR	Commercial Motor Vehicles			
☐	S3NA-405-PR	Drilling and Boring			
☐	S3NA-406-PR	Electrical Lines, Overhead			
☐	S3NA-407-PR	Electro-fishing			
☐	S3NA-408-PR	Elevated Work Platforms and Aerial Lifts			
☐	S3NA-409-PR	Forklifts (operation of)			
☐	S3NA-410-PR	Hazardous Energy Control			
☒	S3NA-411-PR	Machine Guarding			
☐	S3NA-412-PR	Powder-Actuated Tools			
☐	S4NA(US)-413-PR1	Process Safety Management			
☐	S4NA(US)-414-PR	Railway Sites			
☐	S4NA(US)-415-PR	RCRA Regulated Facilities			
☐	S3NA-416-PR	Tunnel and Underground Work			
☐	S3NA-417-PR	Utilities, Underground			
☐	S3NA-418-PR	Welding, Cutting and Other Hot Work			
☐	S3NA-419-PR	Water, Marine Operations, Boating			
☐	S3-NA420-PR	Water, Underwater Diving			

4.0 SH&E Requirements (Safety)

4.1 HAZWOPER Qualifications

Personnel performing work at the job site must be qualified as HAZWOPER workers (unless otherwise noted in specific THAs or by the SSO), and must meet the medical monitoring and training requirements specified in the AECOM's North America SH&E Standard Operating Procedures.

If site monitoring procedures indicate that a possible exposure has occurred above the OSHA permissible exposure limit (PEL), employees may be required to receive supplemental medical testing to document any symptoms that may be specific to the particular materials present.

4.2 Site-Specific Safety Training

All AECOM personnel performing activities at the site will be trained in accordance with *S3NA-003-PR SH&E Training*. All personnel are required to remain current in all of their required training and evaluate their need for additional training when there is a change in work. In addition to the general health and safety training programs, personnel will be required to complete any supplemental task specific training developed for the tasks to be performed. Administration and compliance with the requirements for additional task-specific training will be the responsibility of the project or lead manager. Any additional required training that is completed will be documented and tracked in the project files.

4.2.1 Competent Person Training Requirements

In order to complete the planned scope of work, an (OSHA conformance) competent person must be designated to perform the required daily onsite inspections of operations and/or equipment. The competent person may be an AECOM (if responsible for supervising that activity) or the subcontractor's employee. Designated competent person(s) for this project are shown in Table 4-2:

Table 4.2.1-2: Task-Specific Competent Persons

Employee Name	Organization	Area of Competency

Note: The training requirements for competent persons are specified in the indicated SOPs and/or *S3NA-202-PR Competent Person Designation*. By identifying an employee as a "competent person", that person has now been authorized to take prompt corrective measures to eliminate hazards.

4.3 Tailgate Meetings

Prior to the commencement of daily project activities, a tailgate meeting will be conducted by the SSO to review the specific requirements of this HASP, applicable THA. Attendance at the daily tailgate meeting is mandatory for all employees at the site covered by this HASP and must be documented on the attendance form. All safety training documentation is to be maintained in the project file by the SSO.

4.4 Hazard Communication

Hazardous materials that may be encountered as existing on-site environmental or physical/health contaminants during the work activities are addressed in this HASP and their properties, hazards and associated required controls will be communicated to all affected staff and subcontractors.

In addition, any employee or organization (contractor or subcontractor) intending to bring any hazardous material onto this AECOM-controlled work site must first provide a copy of the item's Safety Data Sheet (MSDS) to the SSO for review and filing (the SSO will maintain copies of all MSDS on site). SDS may not be available for locally-obtained products, in which case some alternate form of product hazard documentation will be acceptable in accordance with the requirements of *S3NA-507-PR Hazardous Materials Communication/WHMIS*.

All personnel shall be briefed on the hazards of any chemical product they use, and shall be aware of and have access to all SDS.

All containers on site shall be properly labeled to indicate their contents. Labeling on any containers not intended for single-day, individual use shall contain additional information indicating potential health and safety hazards (flammability, reactivity, etc.).

Attachment B provides copies of SDS for those items planned to be brought on site at the time this HASP is prepared. This information will be updated as required during site operations.

4.5 Confined Space Entry

The SSO/site supervisor shall identify all potential confined spaces in accordance with S3NA-*301-PR Confined Spaces*. In addition; the SSO/site supervisor will inform all employees of the location of onsite confined spaces, and their associated security controls and procedures. AECOM personnel are not permitted to access confined spaces. AECOM employees shall contact the AHSEM for authorization prior to entering any confined spaces. AECOMs confined space entry procedures and training requirements are listed in S3NA-301-PR Confined Spaces.

4.6 Hazardous, Solid, or Municipal Waste

If hazardous, solid, and/or municipal wastes are generated during any phase of the project, the waste shall be accumulated, labeled, and disposed of in accordance with applicable Federal, State, Provincial, Territorial and/or local regulations. Consult the Regional SH&E Manager for further guidance.

4.7 General Safety Rules

All site personnel shall conduct themselves in a safe manner and maintain a working environment that is free of additional hazards, in adherence to *S3NA-001-PR Safe Work Standards and Rules* and *S3NA-103-PR General Housekeeping*.

4.7.1 Housekeeping

During site activities, work areas will be continuously policed for identification of excess trash and unnecessary debris. Excess debris and trash will be collected and stored in an appropriate container (e.g., plastic trash bags, garbage can, roll-off bin) prior to disposal. At no time will debris or trash be intermingled with waste PPE or contaminated materials.

4.7.2 Smoking, Eating, or Drinking

Smoking, eating and drinking will not be permitted inside any controlled work area at any time. Field workers will first wash hands and face immediately after leaving controlled work areas (and always prior to eating or drinking). Consumption of alcoholic beverages is prohibited at any AECOM site. Smoking, eating or drinking must be in an approved area.

4.7.3 Personal Hygiene

The following personal hygiene requirements will be observed:

Water Supply: A water supply meeting the following requirements will be utilized:

> *Potable Water* - An adequate supply of potable water will be available for field personnel consumption. Potable water can be provided in the form of water bottles, canteens, water coolers, or drinking fountains. Where drinking fountains are not available, individual-use cups will be provided as well as adequate disposal containers. Potable water containers will be properly identified in order to distinguish them from non-potable water sources.
>
> *Non-Potable Water* - Non-potable water may be used for hand washing and cleaning activities. Non-potable water will not be used for drinking purposes. All containers of non-potable water will be marked with a label stating:
>
> ***Non-Potable Water***
> ***Not Intended for Drinking Water Consumption***

Toilet Facilities: A minimum of one toilet will be provided for every 20 personnel on site, with separate toilets maintained for each sex except where there are less than 5 total personnel on site. For mobile crews where work activities and locations permit transportation to nearby toilet facilities on-site facilities are not required.

Washing Facilities: Employees will be provided washing facilities (e.g., buckets with water and Alconox) at each work location. The use of water and hand soap (or similar substance) will be required by all employees following exit from the Exclusion Zone, prior to breaks, and at the end of daily work activities.

4.7.4 Buddy System

All field personnel will use the buddy system when working within any controlled work area. Personnel belonging to another organization on site can serve as "buddies" for AECOM personnel. Under no circumstances will any employee be present alone in a controlled work area. For areas not in controlled work areas, the procedures outlined in *S3NA-314-PR Working Alone Remote Travel* will be followed at all times.

4.8 Stop Work Authority

All employees have the right and duty to stop work when conditions are unsafe and to assist in correcting these conditions as outlined in *S3NA-002-PR Stop Work Authority.* Whenever the SSO determines that workplace conditions present an uncontrolled risk of injury or illness to employees, immediate resolution with the appropriate supervisor shall be sought. Should the supervisor be unable or unwilling to correct the unsafe conditions, the SSO is authorized and required to stop work, which shall be immediately binding on all affected AECOM employees and subcontractors.

Upon issuing the stop work order, the SSO shall implement corrective actions so that operations may be safely resumed. Resumption of safe operations is the primary objective; however, operations shall not resume until the Safety Professional has concurred that workplace conditions meet acceptable safety standards.

4.9 Client Specific Safety Requirements

The client has specified no additional health and safety requirements.

5.0 Exposure Monitoring Procedures (Health)

5.1 Contaminant Exposure Hazards

The following is a discussion of the hazards presented to worker personnel during this project from on-site chemical and radiological hazards known, suspected or anticipated to be present on site.

Exposure symptoms and applicable first aid information for each suspected site contaminant identified in the Scope of Work are located in the following subsections.

- 1-1 dichloroethane
- Acetone
- Antimony
- Arsenic
- Chlorobenzene
- Iron metal
- Magnesium
- Manganese
- PCBs
- Sodium
- Toluene
- Xylenes

5.1.1 1,1-Dichloroethane (1,1-DCA)

1,1-Dichloroethane is a colorless, oily, man-made liquid. It evaporates quickly at room temperature and has an odor like ether. 1,1-Dichloroethane burns easily. When 1,1-dichloroethane is released to the environment, it usually exists as a vapor rather than a liquid. It is used primarily to make 1,1,1-trichloroethane and a number of other chemicals. It is also used to dissolve other substances such as paint, varnish and finish removers, and to remove grease. 1,1-Dichloroethane was used as a surgical anesthetic. 1,1-Dichloroethane can be found in the environment as a breakdown product of 1,1,1-trichloroethane in landfills where no air comes in contact with the 1,1,1-trichloroethane.

5.1.2 Acetone

Acetone is a very flammable liquid that evaporates rapidly forming vapor clouds that can be easily ignited. The vapors have a mild (fingernail polish remover) odor. Symptoms of over exposure include nausea and dizziness.

5.1.3 Antimony

Antimony ores are mined and then mixed with other metals to form antimony alloys or combined with oxygen to form antimony oxide.

Little antimony is currently mined in the United States. It is brought into this country from other countries for processing. However, there are companies in the United States that produce antimony as a by-product of smelting lead and other metals.

Antimony isn't used alone because it breaks easily, but when mixed into alloys, it is used in lead storage batteries, solder, sheet and pipe metal, bearings, castings, and pewter. Antimony oxide is added to textiles and plastics to prevent them from catching fire. It is also used in paints, ceramics, and fireworks, and as enamels for plastics, metal, and glass.

Exposure can occur:

Because antimony is found naturally in the environment, the general population is exposed to low levels of it every day, primarily in food, drinking water, and air.

It may be found in air near industries that process or release it, such as smelters, coal-fired plants, and refuse incinerators.

In polluted areas containing high levels of antimony, it may be found in the air, water, and soil.

Workers in industries that process it or use antimony ore may be exposed to higher levels.

Exposure to antimony at high levels can result in a variety of adverse health effects. Breathing high levels for a long time can irritate your eyes and lungs and can cause heart and lung problems, stomach pain, diarrhea, vomiting, and stomach ulcers.

In short-term studies, animals that breathed very high levels of antimony died. Animals that breathed high levels had lung, heart, liver, and kidney damage. In long-term studies, animals that breathed very low levels of antimony had eye irritation, hair loss, lung damage, and heart problems. Problems with fertility were also noted. In animal studies, problems with fertility have been seen when rats breathed very high levels of antimony for a few months.

Ingesting large doses of antimony can cause vomiting. Long-term animal studies have reported liver damage and blood changes when animals ingested antimony. Antimony can irritate the skin if it is left on it.

The Occupational Safety and Health Administration (OSHA) has set an occupational exposure limit of 0.5 milligrams of antimony per cubic meter of air (0.5 mg/m^3) for an 8-hour workday, 40-hour workweek.

5.1.4 Inorganic Arsenic

Arsenic enters the body principally through the mouth, either in food or in water. Most ingested arsenic is quickly absorbed through the stomach and intestines and enters the bloodstream, although this varies somewhat for different chemical forms of arsenic. Arsenic, which is inhaled, is also well absorbed through the lungs into the blood stream. Small amounts of arsenic may enter the body through the skin, but this is not usually an important consideration.

Most arsenic that is absorbed into the body is converted by the liver to a less-toxic form that is efficiently excreted in the urine. Consequently, arsenic does not have a strong tendency to accumulate in the body except at high exposure levels.

Inorganic arsenic has been recognized as a human poison since ancient times, and large doses can produce death. Lower levels of exposure may produce injury in a number of different body tissues or systems: these are called "systemic" effects. When taken by mouth, a common effect is irritation of the digestive tract, leading to pain, nausea, vomiting, and diarrhea. Other effects typical of exposure by mouth include decreased production of red and white blood cells, abnormal heart function, blood vessel damage, liver and/or kidney injury, and impaired nerve function causing a "pins-and-needles" feeling in the feet and hands. There is evidence from animal studies that high oral doses during pregnancy may be damaging to the fetus, but this has not been well studied in humans.

Inhalation exposure to inorganic arsenic dusts or fumes sometimes produces the same types of systemic health effects produced by oral exposure. However, this is not common, and the effects are usually mild.

Direct dermal contact with arsenic compounds, frequently from inorganic arsenic dusts in air, may result in mild to severe irritation of the skin, eyes, or throat.

5.1.5 Manganese Compounds

Manganese is an essential trace element. In excess, it is of medium toxicity to humans. Manganese poisoning is rare and is limited to those exposed occupationally, in the manufacture of manganese compounds and in the pottery manufacturing. It is a respiratory irritant when inhaled, and long-term exposure produces symptoms similar to those of Parkinson’s disease

Manganese can exist as compounds in up to eight different valence states, which may be cations or anions. It appears that cationic manganese compounds are more toxic than anionic compounds, and that Mn2+ is more toxic

than Mn3+. Manganese and its compounds are usually absorbed into the body by oral and respiratory routes, in the form of dust.

In excess amounts, manganese can cause irreversible nervous system damage . Studies have shown that the effects of manganese in the brain are due to the presence of lesions and degeneration in the basal ganglia. The metal is also known to block calcium channels, and with chronic intoxication the levels of dopamine in the CNS are depleted, which causes the Parkinson's-like symptoms.

5.1.6 Polychlorinated Biphenyls

Polychlorinated Biphenyls are a series of technical mixtures consisting of many isomers and compounds that vary from mobile oily liquids to white crystalline solids to hard non-crystalline resins. PCB oils are typically used in heat transfer applications, hydraulic fluids and lubricants. Technical products vary in composition and in the degree of chlorination. Toxicity increases with the degree of chlorination.

Dermal contact with liquid PCBs may produce skin irritation or a rash. Prolonged or repeated skin contact may cause dermatitis or "chloracne."

5.1.7 Sulfuric Acid

Sulfuric acid is commonly used in water treatment, food and beverage production, metal finishing, cleaning, and in wet cell batteries. Upon contact, sulfuric acid can destroy body tissues, metals, plastics, and other materials. Sulfuric acid reacts with water to produce heat, steam and sulfuric acid splatter or mist. Skin irritation and burns are typical results when the body contacts sulfuric acid. Sulfuric acid reacts with common metals to form sulfur dioxide, a toxic and corrosive vapor.

5.1.8 Toluene

Toluene (also called methyl benzene) is a colorless, flammable liquid. It occurs naturally in petroleum crude oil and a component of gasoline. Toluene enters the body when breathed in with contaminated air or when consumed with contaminated food or water. It can also be absorbed through skin contact. Toluene does not remain in the body due to its breakdown and removal. Toluene is a very flammable liquid that evaporates rapidly forming vapor clouds that can be easily ignited. The vapors have a mild (aromatic) odor. Symptoms of over exposure include nausea and dizziness.

Exposure to the vapors of toluene may produce irritation of the mucous membranes of the upper respiratory tract, nose and mouth. Overexposure may also result in the depression of the central nervous system. Symptoms of such exposure include drowsiness, headache, fatigue and drunken-like behaviors. The OSHA permissible exposure limit (PEL) for toluene is 200 ppm. However, the American Conference of Governmental Industrial Hygienists (ACGIH) recommends a threshold limit value (TLV) of 50 ppm for toluene.

5.1.9 Xylene

Xylene (also called methyl toluene) is a colorless, flammable liquid. It occurs naturally in petroleum crude oil and a component of gasoline. Xylene enters the body when breathed in with contaminated air or when consumed with contaminated food or water. It can also be absorbed through skin contact. Xylene does not remain in the body due

to its breakdown and removal. Xylene is a very flammable liquid that evaporates rapidly forming vapor clouds that can be easily ignited. The vapors have a mild (aromatic) odor. Symptoms of over exposure include nausea and dizziness.

Chemical Name	PEL[1]	TLV[2]	VP[3]	VD[4]	SG[5]	SOL[6]	FP[7]	LEL[8]	UEL[9]
1,1-DCA (dichloroethane)	1	1	230	3.3	1.2	<1	**-5.6**	5.6	NE
Acetone	1000	250	4	2.2	1.1	100	120	2.7	10.3
Antimony	0.5 mg/m³	0.5 mg/m³	NA	NA	NA	NA	NA	NA	NA
Inorganic Arsenic	0.01 mg/m³	0.002 mg/m³	NA	NA	?	?	NA	NA	NA
Manganese Compounds	5 (C) mg/M³	0.2 mg/M³	NA	NA	NA	<1	NA	NA	NA
PCB	0.1	0.1	50	9.3	1.38	<1	356	?	?
Toluene	200	50	21	4	0.87	<1	40	1.1	7.1
Xylene	100	100	9	4	0.86	<1	81	1.1	7.0
Sulfuric Acid	1 mg/m³	1 mg/m³	<1	4	1.84	100	NA	NA	NA

[1] Permissible Exposure Limit in mg/m³
[2] Threshold Limit Value in mg/m³
[3] Vapor Pressure in mm Hg
[4] Vapor Density (air = 1)
[5] Specific Gravity (water = 1)
[6] Solubility in Water in %
[7] Flash Point in □F
[8] Lower Explosive Limit in % by volume
[9] Upper Explosive Limit in % by volume
NA = Not Applicable
? = Not known
C = Ceiling limit not to be exceeded

5.2 Route of Entry Assessment of Exposure Hazards

Based on the proposed scope of work, work zone air monitoring will not be required for the engineering oversight activities or the groundwater sampling activities.

There is minimal potential for contact and exposure to site contaminants. In addition, the low concentration of site contaminants identified in the environmental media in combination with the chemical properties of low vapor pressures for these contaminants would not create an airborne concentration at or above its published exposure levels.

The need for personal air sampling is also not anticipated by AECOM during the activities covered by this HASP. The AECOM Project Manager, or the AECOM DSHEM can prescribe personal air sampling based on observations or concerns recognized during the project

5.3 Heat and Cold Stress

Heat and cold stress may vary based upon work activities, PPE/clothing selection, geographical locations, and weather conditions. To reduce the potential of developing heat/cold stress, be aware of the signs and symptoms of heat/cold stress and watch fellow employees for signs of heat/cold stress.

Heat stress can be a significant field site hazard, particularly for non-acclimated personnel operating in a hot, humid setting. Site personnel will be instructed in the identification of a heat stress victim, the first-aid treatment procedures for the victim and the prevention of heat stress casualties. Work-rest cycles will be determined and the appropriate measures taken to prevent heat stress as outlined in *S3NA-511-PR Heat Stress Prevention Program*.

5.3.1 Responding to Heat-Related Illness

The guidance below will be used in identifying and treating heat-related illness.

Table 5.3.1: Identification and Treatment of Heat-Related Illness

Type of Heat-Related Illness	Description	First Aid
Mild Heat Strain	The mildest form of heat-related illness. Victims exhibit irritability, lethargy, and significant sweating. The victim may complain of headache or nausea. This is the initial stage of overheating, and prompt action at this point may prevent more severe heat-related illness from occurring.	• Provide the victim with a work break during which he/she may relax, remove any excess protective clothing, and drink cool fluids. • If an air-conditioned spot is available, this is an ideal break location. • Once the victim shows improvement, he/she may resume working; however, the work pace should be moderated to prevent recurrence of the symptoms.
Heat Exhaustion	Usually begins with muscular weakness and cramping, dizziness, staggering gait, and nausea. The victim will have pale, clammy moist skin and may perspire profusely. The pulse is weak and fast and the victim may faint unless they lie down. The bowels may move involuntarily.	• Immediately remove the victim from the work area to a shady or cool area with good air circulation (*avoid drafts or sudden chilling*). • Remove all protective outerwear. • Call a physician. • Treat the victim for shock. (*Make the victim lie down, raise his or her feet 6–12 inches, and keep him/her cool by loosening all clothing*). • If the victim is conscious, it may be helpful to give him/her sips of water. • Transport victim to a medical facility ASAP.
Heat Stroke	The most serious of heat illness, heat stroke represents the collapse of the body's cooling mechanisms. As a result, body temperature may rise to 104 degrees Fahrenheit or higher. As the victim progresses toward heat stroke, symptoms such as headache, dizziness, nausea can be noted, and the skin is observed to be dry, red, and hot. Sudden collapse and loss of consciousness follows quickly and death is imminent if exposure continues. Heat stroke can occur suddenly.	• Immediately evacuate the victim to a cool/shady area. • Remove all protective outerwear and as much personal clothing as decency permits. • Lay the victim on his/her back w/the feet slightly elevated. • Apply cold wet towels or ice bags to the head, armpits, and thighs. • Sponge off the bare skin with cool water. • The main objective is to cool without chilling the victim. • Give no stimulants or hot drinks. • Since heat stroke is a severe medical condition requiring professional medical attention, emergency medical help should be summoned immediately to provide onsite treatment of the victim and proper transport to a medical facility.

6.0 Environmental Program (Environment)

6.1 **Environmental Compliance and Management**

This project and the individual tasks will comply with all federal, state, provincial, and local environmental requirements.

6.1.1 Air Emissions

Air emissions will not negatively impact the surrounding area.

6.1.2 Hazardous Waste Management

Hazardous waste management is not anticipated.

6.1.3 Storm Water Pollution Prevention

Storm water pollution prevention is not anticipated.

6.1.4 Wetlands Protection

Wetland protection is not anticipated (due to no wetlands at or adjacent to the site).

6.1.5 Critical Habitat Protection

Critical habitat protection is not anticipated (due to no critical habitat protection at or adjacent to the site).

6.1.6 Environmental Protection

No additional environmental protection controls will need to be implemented.

7.0 Personal Protective Equipment

7.1 Personal Protective Equipment

The purpose of personal protective equipment (PPE) is to provide a barrier, which will shield or isolate individuals from the chemical and/or physical hazards that may be encountered during work activities. *S3NA-208-PR Personal Protective Equipment Program* lists the general requirements for selection and usage of PPE. Table 7-1 lists the minimum PPE required during site operations and additional PPE that may be necessary. The specific PPE requirements for each work task are specified in the individual THAs.

By signing this HASP the employee agree shaving been trained in the use, limitations, care and maintenance of the protective equipment to be used by the employee at this project. If training has not been provided, request same of the PM/SSO for the proper training before signing.

Table 7-1: Personal Protective Equipment

TYPE	MATERIAL	ADDITIONAL INFORMATION
Minimum PPE		
Safety Vest	ANSI Type II high-visibility	Must have reflective tape/be visible from all sides.
Boots	Leather	ANSI approved safety toe.
Safety Glasses		ANSI Approved; ≥98% UV protection.
Safety goggles		If potential exposure to grout
Hard Hat		ANSI Approved; recommended wide-brim.
Work Uniform		
Additional PPE	Ear plugs and/ or muffs	In hazardous noise areas.
Hearing Protection	Ear plugs and/ or muffs	In hazardous noise areas.
Leather Gloves		If working with sharp objects or powered equipment.
Protective Chemical Gloves	Inner: Nitrile Outer:	
Protective Coveralls	Inner: Tyvek © Outer:	
Protective Chemical Boots		
Level C Respiratory Protection		
Level B Respiratory Protection		
Face Shield		Safety glasses or goggles must be worn concurrently if working around vacuum truck opertions.
Sunscreen	SPF 30 or higher	
Cooling Vest		
Cold Weather Gear	Hard hat liner, hand warmers, insulated gloves	
Cold Weather Gear	Hard hat liner, hand warmers, insulated gloves	
Fall Protection		

7.2 PPE Doffing and Donning (UTILIZATION) Information

The following information is to provide field personnel with helpful hints that, when applied, make donning and doffing of PPE a more safe and manageable task:

- Never cut disposable booties or any other PPE from your body with basic utility knives. This has resulted in workers cutting through the booty and the underlying sturdy leather work boot, resulting in significant cuts to the legs/ankles. Recommend using a pair of scissors or a package/letter opener (cut above and parallel with the work boot) to start a cut in the edge of the booty, then proceed by manually tearing the material down to the sole of the booty for easy removal.
- When applying duct tape to PPE interfaces (wrist, lower leg, around respirator, etc.) and zippers, leave approximately one inch at the end of the tape to fold over onto itself. This will make it much easier to remove the tape by providing a small handle to grab while still wearing gloves. Without this fold, trying to pull up the tape end with multiple gloves on may be difficult and result in premature tearing of the PPE.
- Have a "buddy" check your ensemble to ensure proper donning before entering controlled work areas. Without mirrors, the most obvious discrepancies can go unnoticed and may result in a potential exposure situation.
- Never perform personal decontamination with a pressure washer.

7.3 **Decontamination**

7.3.1 General Requirements

All possible and necessary steps shall be taken to reduce or minimize contact with chemicals and contaminated/impacted materials while performing field activities (e.g., avoid sitting or leaning on, walking through, dragging equipment through or over, tracking, or splashing potential or known contaminated/impacted materials, etc).

All personal decontamination activities shall be performed with an attendant (buddy) to provide assistance to personnel that are performing decontamination activities. Depending on specific site hazards, attendants may be required to wear a level of protection that is equal to the required level in the Exclusion Zone (EZ).

All persons and equipment entering the EZ shall be considered contaminated, and thus, must be properly decontaminated prior to entering the SZ.

Decontamination procedures may vary based on site conditions and nature of the contaminant(s). If chemicals or decontamination solutions are used, care should be taken to minimize reactions between the solutions and contaminated materials. In addition, personnel must assess the potential exposures created by the decontamination chemical(s) or solutions. The applicable Material Safety Data Sheet (MSDS) must be reviewed, implemented, and filed by personnel contacting the chemicals/solutions.

All contaminated PPE and decontamination materials shall be contained, stored and disposed of in accordance with site-specific requirements determined by site management.

7.3.2 Decontamination Equipment

The equipment required to perform decontamination may vary based on site-specific conditions and the nature of the contaminant(s). The following equipment is commonly used for decontamination purposes:

- Soft-bristle scrub brushes or long-handled brushes to remove contaminants;
- Hoses, buckets of water or garden sprayers for rinsing;
- Large plastic/galvanized wash tubs or children's wading pools for washing and rinsing solutions;
- Large plastic garbage cans or similar containers lined with plastic bags for the storage of contaminated clothing and equipment;
- Metal or plastic cans or drums for the temporary storage of contaminated liquids; and
- Paper or cloth towels for drying protective clothing and equipment.

7.3.3 Personal/Equipment Decontamination

All equipment leaving the EZ shall be considered contaminated and must be properly decontaminated to minimize the potential for exposure and off-site migration of impacted materials. Such equipment may include, but is not limited to: sampling tools, heavy equipment, vehicles, PPE, support devices (e.g., hoses, cylinders, etc.), and various handheld tools.

All employees performing equipment decontamination shall wear the appropriate PPE to protect against exposure to contaminated materials. The level of PPE may be equivalent to the level of PPE required in the EZ. Other PPE may include

splash protection, such as face-shields and splash suits, and knee protectors. Following equipment decontamination, employees may be required to follow the proper personal decontamination procedures above.

For larger equipment, a high-pressure washer may need to be used. Some contaminants require the use of a detergent or chemical solution and scrub brushes to ensure proper decontamination.

For smaller equipment, use the following steps for decontamination:

- Remove majority of visible gross contamination in EZ.
- Wash equipment in decontamination solution with a scrub brush and/or power wash heavy equipment.
- Rinse equipment.
- Visually inspect for remaining contamination.
- Follow appropriate personal decontamination steps outlined above.

All decontaminated equipment shall be visually inspected for contamination prior to leaving the Contaminant Reduction Zone (CRZ). Signs of visible contamination may include an oily sheen, residue or contaminated soils left on the equipment. All equipment with visible signs of contamination shall be discarded or re-decontaminated until clean. Depending on the nature of the contaminant, equipment may have to be analyzed using a wipe method or other means.

8.0 Project Health and Safety Organization

8.1 Project Manager

The Project Manager (PM) has overall management authority and responsibility for all site operations, including safety. The PM will provide the site supervisor with work plans, staff, and budgetary resources, which are appropriate to meet the safety needs of the project operations.

8.2 Site Supervisor

The site supervisor has the overall responsibility and authority to direct work operations at the job site according to the provided work plans. The PM may act as the site supervisor while on site.

8.2.1 Responsibilities

The site supervisor is responsible to:

- Discuss deviations from the work plan with the SSO and PM.
- Discuss safety issues with the PM, SSO, and field personnel.
- Assist the SSO with the development and implementation of corrective actions for site safety deficiencies.
- Assist the SSO with the implementation of this HASP and ensuring compliance.
- Assist the SSO with inspections of the site for compliance with this HASP and applicable SOPs.

8.2.2 Authority

The site supervisor has authority to:

- Verify that all operations are in compliance with the requirements of this HASP, and halt any activity that poses a potential hazard to personnel, property, or the environment.
- Temporarily suspend individuals from field activities for infractions against the HASP pending consideration by the SSO, the Safety Professional, and the PM.

8.2.3 Qualifications

In addition to being Hazardous Waste Operations and Emergency Response (HAZWOPER)-qualified (see Section 4.1), the Site Supervisor is required to have completed the 8-hour HAZWOPER Supervisor Training Course in accordance with 29 CFR 1910.120 (e)(4).

8.3 Site Safety Officer

8.3.1 Responsibilities

The SSO is responsible to:

- Update the site-specific HASP to reflect changes in site conditions or the scope of work. HASP updates must be reviewed and approved by the Safety Professional.
- Be aware of changes in AECOM Safety Policy.
- Monitor the lost time incidence rate for this project and work toward improving it.
- Inspect the site for compliance with this HASP and the SOPs using the appropriate audit inspection checklist provided by an AECOM Safety Professional.
- Work with the site supervisor and PM to develop and implement corrective action plans to correct deficiencies discovered during site inspections. Deficiencies will be discussed with project management to determine appropriate corrective action(s).
- Contact the Safety Professional for technical advice regarding safety issues.

- Provide a means for employees to communicate safety issues to management in a discreet manner (i.e., suggestion box, etc.).
- Determine emergency evacuation routes, establishing and posting local emergency telephone numbers, and arranging emergency transportation.
- Check that all site personnel and visitors have received the proper training and medical clearance prior to entering the site.
- Establish any necessary controlled work areas (as designated in this HASP or other safety documentation).
- Present tailgate safety meetings and maintain attendance logs and records.
- Discuss potential health and safety hazards with the Site Supervisor, the Safety Professional, and the PM.
- Select an alternate SSO by name and inform him/her of their duties, in the event that the SSO must leave or is absent from the site.

8.3.2 Authority

The SSO has authority to:

- Verify that all operations are in compliance with the requirements of this HASP.
- Issue a “Stop Work Order” under the conditions set forth in this HASP.
- Temporarily suspend individuals from field activities for infractions against the HASP pending consideration by the Safety Professional and the PM.

8.3.3 Qualifications

In addition to being HAZWOPER-qualified, the SSO is required to have completed the 8-hour HAZWOPER Supervisor Training Course in accordance with 29 CFR 1910.120 (e)(4).

8.4 **Employees**

8.4.1 Employee Responsibilities

Responsibilities of employees associated with this project include, but are not limited to:

- Understanding and abiding by the policies and procedures specified in the HASP and other applicable safety policies, and clarifying those areas where understanding is incomplete.
- Providing feedback to health and safety management relating to omissions and modifications in the HASP or other safety policies.
- Notifying the SSO, in writing, of unsafe conditions and acts.

8.4.2 Employee Authority

The health and safety authority of each employee assigned to the site includes the following:

- The right to refuse to work and/or stop work authority when the employee feels that the work is unsafe (including subcontractors or team contractors), or where specified safety precautions are not adequate or fully understood.
- The right to refuse to work on any site or operation where the safety procedures specified in this HASP or other safety policies are not being followed.
- The right to contact the SSO or the Safety Professional at any time to discuss potential concerns.
- The right and duty to stop work when conditions are unsafe, and to assist in correcting these conditions.

8.5 Safety Professional

8.5.1 The Safety Professional is the member of the AECOM Safety, Health and Environmental Department assigned to provide guidance and technical support for the project. Duties include the following:

- Approving this HASP and any required changes.
- Approving the designated Site Safety Officer (SSO).
- Reviewing all personal exposure monitoring results.
- Investigating any reported unsafe acts or conditions.

8.6 Subcontractors

The requirements for subcontractor selection and subcontractor safety responsibilities are outlined in *S3NA-213-PR Subcontractors*. Each AECOM subcontractor is responsible for assigning specific work tasks to their employees. Each subcontractor's management will provide qualified employees and allocate sufficient time, materials, and equipment to safely complete assigned tasks. In particular, each subcontractor is responsible for equipping its personnel with any required personnel protective equipment (PPE and all required training). The subcontractor (Aztech) will also provide their own site-specific HASP for the work to be completed on this project.

AECOM considers each subcontractor to be an expert in all aspects of the work operations for which they are tasked to provide, and each subcontractor is responsible for compliance with the regulatory requirements that pertain to those services. Each subcontractor is expected to perform its operations in accordance with its own unique safety policies and procedures, in order to ensure that hazards associated with the performance of the work activities are properly controlled. Copies of any required safety documentation for a subcontractor's work activities will be provided to AECOM for review prior to the start of onsite activities, if required.

Hazards not listed in this HASP but known to any subcontractor, or known to be associated with a subcontractor's services, must be identified and addressed to the AECOM PM or the Site Supervisor prior to beginning work operations. The Site Supervisor or authorized representative has the authority to halt any subcontractor operations, and to remove any subcontractor or subcontractor employee from the site for failure to comply with established health and safety procedures or for operating in an unsafe manner.

8.7 Visitors

Authorized visitors (e.g., client representatives, regulators, AECOM management staff, etc.) requiring entry to any work location on the site will be briefed by the PM on the hazards present at that location. Visitors will be escorted at all times at the work location and will be responsible for compliance with their employer's health and safety policies. In addition, this HASP specifies the minimum acceptable qualifications, training and personal protective equipment which are required for entry to any controlled work area; visitors must comply with these requirements at all times.

8.7.1 Visitor Access

Visitors to any HAZWOPER controlled-work area must comply with the health and safety requirements of this HASP, and demonstrate an acceptable need for entry into the work area. All visitors desiring to enter any controlled work area must observe the following procedures:

- A written confirmation must be received by AECOM documenting that each of the visitors has received the proper training and medical monitoring required by this HASP. Verbal confirmation can be considered acceptable provided such confirmation is made by an officer or other authorized representative of the visitor's organization.
- Each visitor will be briefed on the hazards associated with the site activities being performed and acknowledge receipt of this briefing by signing the appropriate tailgate safety briefing form.
- All visitors must be escorted by an AECOM employee.

If the site visitor requires entry to any EZ, but does not comply with the above requirements, all work activities within the EZ must be suspended. Until these requirements have been met, entry will not be permitted.

Unauthorized visitors, and visitors not meeting the specified qualifications, will not be permitted within established controlled work areas.

9.0 Site Control

9.1 General

The purpose of site control is to minimize potential contamination of workers, protect the public from site hazards, and prevent vandalism. The degree of site control necessary depends on the site characteristics, site size, and the surrounding community.

Controlled work areas will be established at each work location, and if required, will be established directly prior to the work being conducted. Diagrams designating specific controlled work areas will be drawn on site maps, posted in the support vehicle or trailer and discussed during the daily safety meetings. If the site layout changes, the new areas and their potential hazards will be discussed immediately after the changes are made. General examples of zone layouts have been developed for drilling and earth moving activities [(e.g., excavating, trenching, etc.) and are attached to this section.

9.2 Controlled Work Areas

Each HAZWOPER controlled work area will consist of the following three zones:

- Exclusion Zone: Contaminated work area.
- Contamination Reduction Zone: Decontamination area.
- Support Zone: Uncontaminated or “clean area” where personnel should not be exposed to hazardous conditions.

Each zone will be periodically monitored in accordance with the air monitoring requirements established in this HASP. The Exclusion Zone and the Contamination Reduction Zone are considered work areas. The Support Zone is accessible to the public (e.g., vendors, inspectors).

9.2.1 Exclusion Zone

The Exclusion Zone is the area where primary activities occur, such as sampling, remediation operations, installation of wells, cleanup work, etc. This area must be clearly marked with hazard tape, barricades or cones, or enclosed by fences or ropes. Only personnel involved in work activities, and meeting the requirements specified in the applicable THA and this HASP will be allowed in an Exclusion Zone.

The extent of each area will be sufficient to ensure that personnel located at/beyond its boundaries will not be affected in any substantial way by hazards associated with sample collection activities.

All personnel should be alert to prevent unauthorized, accidental entrance into controlled-access areas (the EZ and CRZ). If such an entry should occur, the trespasser should be immediately escorted outside the area, or all HAZWOPER-related work must cease. All personnel, equipment, and supplies that enter controlled-access areas must be decontaminated or containerized as waste prior to leaving (through the CRZ only).

9.2.2 Contamination Reduction Zone

The Contamination Reduction Zone is the transition area between the contaminated area and the clean area. Decontamination is the main focus in this area. The decontamination of workers and equipment limits the physical transfer of hazardous substances into the clean area. This area must also be clearly marked with hazard tape and access limited to personnel involved in decontamination.

9.2.3 Support Zone

The Support Zone is an uncontaminated zone where administrative and other support functions, such as first aid, equipment supply, emergency information, etc., are located. The Support Zone shall have minimal potential for significant exposure to contaminants (i.e., background levels).

Employees will establish a Support Zone (if necessary) at the site before the commencement of site activities. The Support Zone would also serve as the entry point for controlling site access.

9.3 Site Access Documentation

If implemented by the PM, all personnel entering the site shall complete the “Site Entry/Exit Log” located at the site trailer or primary site support vehicle.

9.4 Site Security

9.4.1 Site security is necessary to:

- Prevent the exposure of unauthorized, unprotected people to site hazards.
- Avoid the increased hazards from vandals or persons seeking to abandon other wastes on the site.
- Prevent theft.
- Avoid interference with safe working procedures.

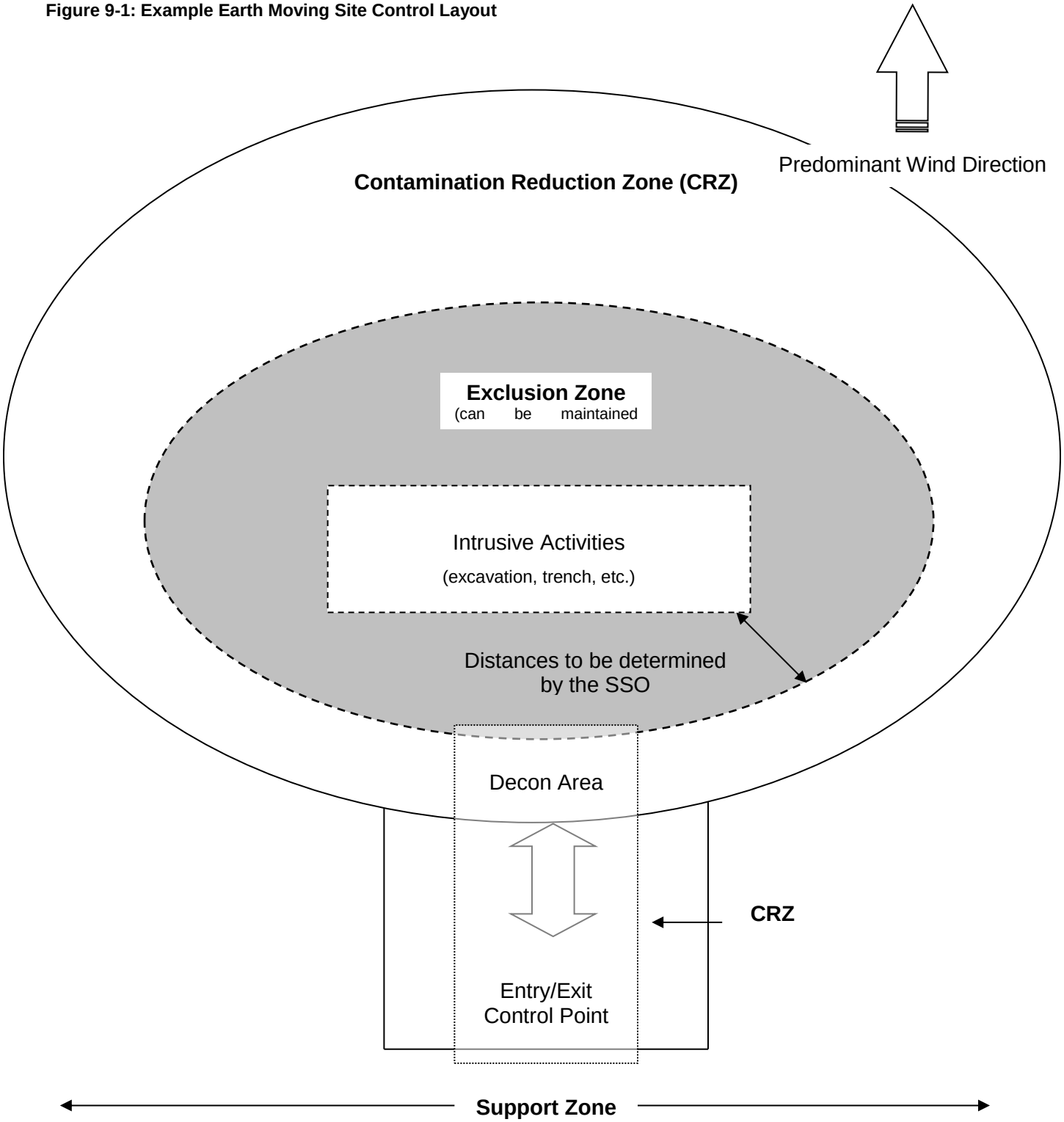
9.4.2 To maintain site security during working hours:

- Maintain security in the Support Zone and at access control points.
- Establish an identification system to identify authorized persons and limitations to their approved activities.
- Assign responsibility for enforcing authority for entry and exit requirements.
- When feasible, install fencing or other physical barrier around the site.
- If the site is not fenced, post signs around the perimeter and whenever possible, use guards to patrol the perimeter. Guards must be fully apprised of the hazards involved and trained in emergency procedures.
- Have the PM approve all visitors to the site. Make sure they have valid purpose for entering the site. Have trained site personnel accompany visitors at all times and provide them with the appropriate protective equipment.

9.4.3 To maintain site security during off-duty hours:

- If possible, assign trained, in-house technicians for site surveillance. They will be familiar with the site, the nature of the work, the site’s hazards, and respiratory protection techniques.
- If necessary, use security guards to patrol the site boundary. Such personnel may be less expensive than trained technicians, but will be more difficult to train in safety procedures and will be less confident in reacting to problems around hazardous substances.
- Enlist public enforcement agencies, such as the local police department, if the site presents a significant risk to local health and safety.
- Secure the equipment.

Figure 9-1: Example Earth Moving Site Control Layout



10.0 Emergency Response Planning

10.1 Emergency Action Plan

Although the potential for an emergency to occur is remote, an emergency action plan has been prepared for this project should such critical situations arise. The only significant type of onsite emergency that may occur is physical injury or illness to a member of the AECOM team. The Emergency Action Plan (EAP) will be reviewed by all personnel prior to the start of field activities. A test of the EAP will be performed within the first three (3) days of the project field operations. This test will be evaluated and documented in the project records.

10.1.1 Three major categories of emergencies could occur during site operations:

- Illnesses and physical injuries (including injury-causing chemical exposure)
- Catastrophic events (fire, explosion, earthquake, or chemical)
- Workplace Violence, Bomb Threat
- Safety equipment problems

10.1.2 Emergency Coordinator

The duties of the Emergency Coordinator (EC) include:

- Implement the EAP based on the identified emergency condition.
- Notify the appropriate project and SH&E Department personnel of the emergency (Table 9-3).
- Verify emergency evacuation routes and muster points are accessible.
- Conduct routine EAP drills and evaluate compliance with the EAP.

10.1.3 Site-Specific Emergency Procedures

Prior to the start of site operations, the EC will complete Table 9-1 with any site-specific information regarding evacuations, muster points, communication, and other site-specific emergency procedures.

Table 10-1: Emergency Planning

Emergency	Muster Location	Evacuation Route
Chemical Spill	Burgoyne Avenue just outside of the site limits	Upwind
Fire/Explosion	Burgoyne Avenue just outside of the site limits	Burgoyne Avenue just outside of the site limits
Tornado	Nearest building	Nearest building
Lightning	Nearest building,Vehicle	Nearest building, vehicle
Communication Procedures	All site personnel to have mobile phone or two way radio contact at all times. Project contacts provided on Page 33 of this document.	All site personnel to have mobile phone or two way radio contact at all times. Project contacts provided on Page 33 of this document.
CPR/First Aid Trained Personnel	TBD	TBD
Site-Specific Spill Response Procedures	Follow NYSDEC protocol	Follow NYSDEC protocol

10.1.4 Spill Containment Procedure

Work activities may involve the use of hazardous materials (i.e. fuels, solvents) or work involving drums or other containers. Where these activities exist, a site-specific Spill Reporting Card [project team must develop the spill reporting card] will be developed (Attachment C). Procedures outlined below will be used to prevent or contain spills:

- All hazardous material will be stored in appropriate containers
- Tops/lids will be placed back on containers after use.
- Containers of hazardous materials will be stored appropriately away from moving equipment.

At least one spill response kit, to include an appropriate empty container, materials to allow for booming or diking the area to minimize the size of the spill, and appropriate clean-up material (i.e. speedy dri) shall be available at each work site (more as needed).

- All hazardous commodities in use (i.e. fuels) shall be properly labeled.
- Containers shall only be lifted using equipment specifically manufactured for that purpose.
- Drums/containers will be secured and handled in a manner which minimizes spillage and reduces the risk of musculoskeletal injuries.

10.1.5 Safety Accident/Incident Reporting

All incidents and near miss events that occur on-site during any field activity will be promptly reported to the SSO and the immediate supervisor.

If any AECOM employee is injured and requires medical treatment, the Site Supervisor will report the incident in accordance with AECOM's incident reporting procedures. A copy of the final Supervisor's Report of Incident will be provided to the SH&E Professional before the end of the following shift.

If any employee of a subcontractor is injured, documentation of the incident will be accomplished in accordance with the subcontractor's procedures; however, copies of all documentation (which at a minimum must include the OSHA Form 301 or equivalent) must be provided to the SSO within 24 hours after the accident has occurred.

All incidents will be investigated. Copies of all subcontractor accident investigations will be provided to the SSO within five (5) days of the accident/incident.

10.1.6 Environmental Spill/Release Reporting

All environmental spills or releases of hazardous materials (e.g., fuels, solvents, etc.), whether in excess of the Reportable Quantity or not, will be reported according to the sequence identified in the *Site-Specific Spill Reporting Card*. In determining whether a spill or release must be reported to a regulatory agency, the Site Supervisor will assess the quantity of the spill or release and evaluate the reporting criteria against the state-specific reporting requirements, your applicable regulatory permit, and/or client-specific reporting procedures. In order to support the Site Supervisor and expedite the decision to report to a state regulatory agency, a site-specific Spill Reporting Card will be developed (Attachment C). **If reporting to a US state or Federal regulatory agency is required, AECOM has 15 minutes from the time of the spill/release to officially report it.**

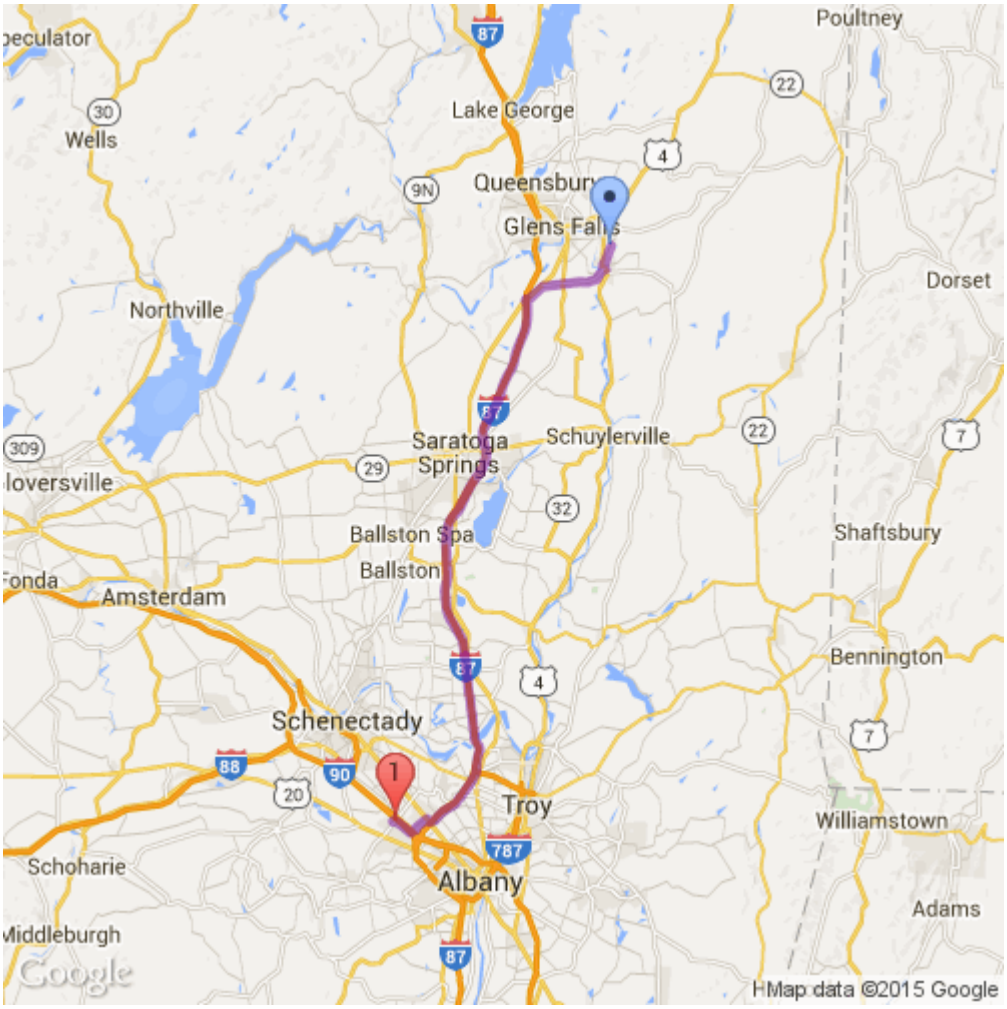
Chemical-specific Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Reportable Quantities for the known chemicals onsite are shown in Table 10.1.

Table 10.1: CERCLA Reportable Quantities

Project Personnel Contact Information			
Name	**Title/Workstation**	**Telephone Number**	**Cellular Phone**
Payson Long	NYSDEC Project Manager	518-402-9813	
Paul Kareth	AECOM Project Manager	1-845-425-4980	
Ben Bertolotti	Regional SH&E Manager	1-973-777-3003	1-973-572-3916
Peter Gregory	NYC Metro SH&E Manager	1-973-883-8683	1-201-602-3511
Incident Reporting	**Incident Reporting Line**	**(800) 348-5046**	

Organization / Agency	
Name	**Telephone Number**
Police Department	911
Glens Falls Police Department (non-emergency)	518-761-3840
Fire Department	911
Glens Falls Fire Department (non-emergency)	518-761-3822
Emergency Ambulance Service ***(EMS will determine appropriate hospital for treatment)***	911
(Closest Hospital to Site - Use by site personnel for non-emergency cases) **Concentra Medical Center** 10b Madison Avenue Ext Albany, NY 12203 Urgent Care Clinic	518-452-7030 866-944-6046 888-997-2669
WorkCare	(877) 878-9525
Poison Control Center	(800) 222-1222
Pollution Emergency	(800) 292-4706
National Response Center	(800) 424-8802
INFOTRAC(insert account number)	(800) 355-5053
Title 3 Hotline	(800) 424-9346
WorkCare	(877) 878-9525
Call Before You Dig	811

Figure 10.1: Emergency Occupational Hospital Route/Detail Map



From: 1580 Burgoyne Avenue
kingsbury, NY

To: 10b Madison Avenue Ext
Albany, NY 12203

1. 1.2 mi

Head **south** on **Burgoyne Ave** toward **Dennis Ave**

2. 335 ft

Slight **right** onto **Maple Ave**

3. 0.6 mi

Turn **left** onto **Broadway**

4. 4.7 mi

Turn **right** onto **NY-197 W/Bridge St**

Continue to follow NY-197 W

5. 1.5 mi

Turn **left** onto **U.S. 9 S**

6. 0.3 mi

Take the **Interstate 87 S** ramp

7. 39.1 mi

Merge onto **I-87 S**

8. 0.7 mi

Take exit **2W** to merge onto **NY-5 W/Central Ave** toward **Schenectady**

9. 1.6 mi

Turn **left** onto **Lincoln Ave**

10. 1.2 mi

Turn **right** onto **Washington Ave Ext**

11. 0.2 mi

Continue onto **Madison Avenue Extension**

12. 348 ft

Turn **left** onto **Point of Woods Dr**

13. 0.2 mi

Turn **left** to stay on **Point of Woods Dr**

14. 344 ft

Turn **right** to stay on **Point of Woods Dr**

15. 348 ft

Turn **left** to stay on **Point of Woods Dr**

16. 0.1 mi

Turn **right** onto **Madison Avenue Extension**

Destination will be on the right

51.8 mi

Estimated driving time: 60 minutes

11.0 Personnel Acknowledgement

By signing below, the undersigned acknowledges that he/she has read and reviewed the AECOM Health and Safety Plan for the Kingsbury Landfill site. The undersigned also acknowledges that he/she has been instructed in the contents of this document and understands the information pertaining to the specified work, and will comply with the provisions contained therein.

PRINT NAME	SIGNATURE	ORGANIZATION	DATE

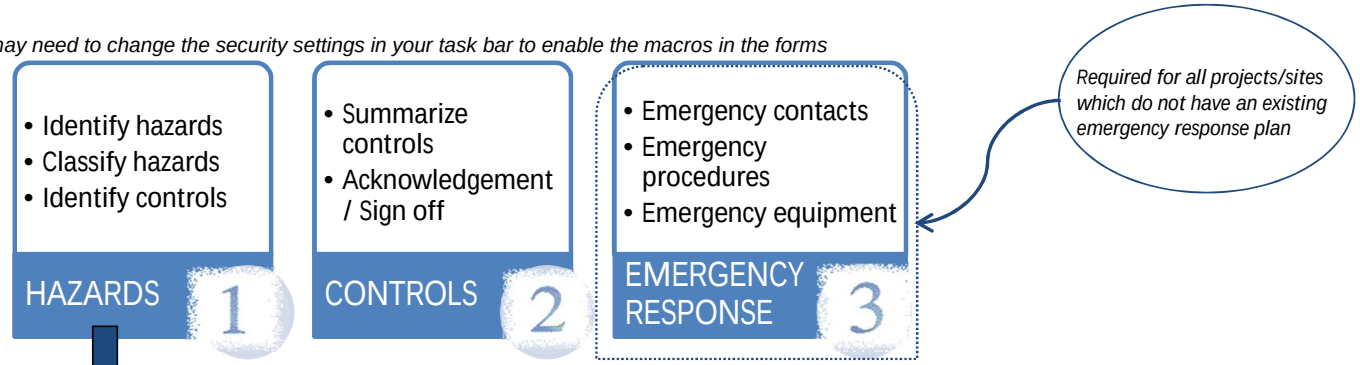
Attachment A

Task Hazard Analyses

S3NA-209-FM TASK HAZARD ANALYSIS

This THA (worksheets 1 & 2) must be completed for all field work.

***you may need to change the security settings in your task bar to enable the macros in the forms*



Hazard Identification

- Natural (biological) – bacteria, viruses, insects, plants, birds, and animals
- Chemical – exposure to chemical toxins, acute or chronic, by way of inhalation, injection, ingestion or absorption
- Physical – slipping/tripping, being struck by moving objects, repetitive movement, strains from lifting
- Environmental – extreme heat or cold, noise, vibrations, magnetic fields, pressure extremes and air quality
- Psychosocial – stress, violence

Hazard Classification

- Considers the potential severity of the outcome
- Considers the likelihood of the occurrence
- Used to prioritize and determine extent of required controls

Controls

- Elimination (first) – choose a different process; modify an existing process; substitute with less hazardous substance
- Engineering Controls (second) – physically alter the plant or equipment design in order to circumvent possible hazards; place guards on machinery
- Administrative Controls (third) – change the job procedure and/or process; limit the amount of time an individual is in a hazardous environment through job rotation
- Personal Protective Equipment (last option) – provide employees with direct physical protection while working in a hazardous environment

S3NA-209-FM TASK HAZARD ANALYSIS

AECOM	Project Name: Kingsbury	Project Number:	Client:
	Supervisor:	Project Manager: Paul Kareth	Location: 100 Red School House Road, Chestnut Ridge, NY
	THA Developed By: Jennifer Pfeiffer		Date: September 24, 2015
TASK HAZARD ANALYSIS	Task Name:	Regularity of Task: One-time ☐ Routine ☑	

Job Event Sequence (List the major steps of the individual task)	Hazards (List primary hazards)	Hazard Classification (before controls) Severity	Likelihood	Risk Level	Hazard Classification	Controls (List controls that AECOM will implement)
driving to and from the site	traffic accident, distracted driving	4	2	8	Medium	follow state DOT rules and regulations, do not use phone while driving.
mobilization/demobilization, work area, drilling, well decommissioning, sampling	slips trips falls	2	3	6	Medium	maintain good houskeeping, no running on-site, waer proper ppe including leather/kevlar gloves when working on-site and handling equipment/materials
	biological hazards	2	2	4	Low	wear proper PPE, remove brush if possible
	heat and cold stress	3	2	6	Medium	wear proper PPE, take breaks, pay attention to EVERYONE on-site for signs and symptoms of heat/cold stress.
	elevated noise	2	3	6	Medium	wear proper PPE, hearing protection.
	manual lifting	2	3	6	Medium	use mechanical equipment, use buddy system, don't carry a load where you cannot see the space in front of your feet when walking.
	field ergonomics	2	2	4	Low	stretch and flex, take breaks
	cuts, pinch points - hands	2	3	6	Medium	machine guarding, were required.
	fire hazards	3	2	6	Medium	remove combustables from fuel source areas, maintain proper fire extinguisher near work area, inpect fire extinguisher, understand protocol for fire emergency
	exposure to contaminants	2	2	4	Low	wear proper ppe, nitrile gloves, eye and face protection.

Hazard Classification Guidelines

Severity

1 Remote potential for injury, property damage/$ loss, or env damage

2 Potential for minor first aid injury, property damage/$ loss, or environmental damage

3 Potential for moderate personnel injuries, including medical treatment, property damage/$ loss, environmental damage, or negative public impact

4 Potential for a serious injury, major property damage/$ loss, serious impact to the environment, and public health

5 Catastrophic damage to people, property/equipment, environment, or public health

Likelihood of Occurrence

1 Very unlikely

2 Unlikely

3 Likely

4 Very likely

5 Certain

Hazard Classification Matrix

Likelihood \ Severity	1	2	3	4	5
1	1	2	3	4	5
2	2	4	6	8	10
3	3	6	9	12	15
4	4	8	12	16	20
5	5	10	15	20	25

Risk Level
Low
Medium
High

Risk Level = Likelihood x Severity

S3NA-209-FM TASK HAZARD ANALYSIS

AECOM	Project Name: Kingsbury	Project Number:	Client:
	Supervisor:	Project Manager: Paul Kareth	Location: 100 Red School House Road, Chestnut Ridge, NY
	THA Developed By: Jennifer Pfeiffer		Date: September 24, 2015
SUMMARY OF CONTROLS	Task Name:		Regularity of Task: One-time ☐ Routine ☐

Personal Protective Equipment (*check all that apply*)	Air Monitoring (reference HASP monitoring plan)			
☐ CSA/ANSI Safety-Toed Boots (Leather or Rubber)	☐ No air monitoring required		☐ Air monitoring required (*see procedures below*)	
☐ CSA/ANSI Safety Glasses or Goggles	Parameter	Location/Monitoring Interval	Response/Action Levels	Response Activity
☐ CSA/ANSI-approved Hard Hat				
☐ CSA/ANSI Type II/III Reflective Traffic Safety Vest				
☐				
☐				
☐				
☐				
☐				
☐				

Required Training (associated with this THA)	Key SOPs (associated with this THA)		Client & Other Requirements
1			
2			
3			
4			
5			
6			

Acknowledgement / Signatures

Project Manager / Supervisor (signature): Date:

Name	Signature	Company	Date	Name	Signature	Company	Date

S3NA-209-FM TASK HAZARD ANALYSIS

AECOM	Project Name: Kingsbury	Project Number:	Client:
	Supervisor:	Project Manager: Paul Kareth	Location: 100 Red School House Road, Chestnut Ridge, NY
	THA Developed By: Jennifer Pfeiffer		Date: September 24, 2015
EMERGENCY RESPONSE PLAN	Task Name:	Regularity of Task: One-time ☐ Routine ☐	

Check-in Procedures

Check-in Times	Check-in Person	Phone Number	Cell Phone Number
Alternate:			

Emergency Coordinators / Key Personnel

Name	Title	Phone Number	Cell Phone Number
	On-site First Aid Attendant		
	Project Manager		
	Site Supervisor		
	Regional SH&E Manager		
	Incident Reporting Line (BY THE END OF THE SHIFT)		
	Client Contact		

Emergency Agencies / Public Utilities

Name	Type	Details	Phone Number
	Police		
	Fire		
	Ambulance		
	Nearest Hospital / Clinic		
	Poison Control Center		
	Pollution / Environmental		

Emergency Equipment & Supplies

- ☐ First Aid Kit - Type:
- ☐ Blankets / Survival:
- ☐ Fire Extinguishers Type:
- ☐ Communication Device
- ☐ Vehicle Safety Equipment
- ☐ Eye Wash
- ☐ Spill Kit
- ☐ Other:

Other Emergency Plan Details

Attachment B

Safety Data Sheets

[attach MSDSs]

Attachment C
Applicable SH&E SOPs

Americas

Housekeeping, Worksite

S3NA-307-PR1

1.0 Purpose and Scope

1.1 This procedure provides AECOM's work practices as well as personal hygiene and work site sanitation standards for housekeeping.

1.2 Applies to all AECOM Americas-based staff and field worksites.

2.0 Terms and Definitions

2.1 None

3.0 References

3.1 S3NA-103-PR1 Housekeeping, Office

3.2 S3NA-208-PR1 Personal Protective Equipment Program

4.0 Procedure

4.1 Roles and Responsibilities

4.1.1 **Supervisor (or Project Manager)**

Responsible for the procedure's implementation and the details of addressing housekeeping policy within the worksite.

4.1.2 **SH&E Department**

Monitor, assess, and report on project housekeeping when visiting worksites.

4.1.3 **Employees**

Responsible for reporting any areas of concern to the **Supervisor** for prompt resolution as well as for maintaining worksites that are free from debris, clutter, and slipping or tripping hazards.

4.2 Smoking, Eating, and Drinking

4.2.1 Eating and drinking will be permitted in designated areas at AECOM project sites and as specified on client sites.

4.2.2 Smoking will be permitted only in areas:

- designated in compliance with applicable local laws, regulations, legislation, and ordinances, by the Supervisior
- situated in locations that are not in the immediate vicinity of activities associated with work site activities
- Free of fire hazard
- That will not contaminate indoor areas and HVAC systems. Specifically, there shall be no smoking within 16 feet (5 meters) around doorways, windows, air vents, and HVAC intakes and equipment.

Additionally, **Supervisiors** will designate each smoking area giving primary consideration to those employees who do not smoke.

4.2.3 **Employees** involved in the performance of certain activities will not be permitted to smoke, eat, drink, or use smokeless tobacco, except during breaks (e.g., HAZWOPER-controlled work areas).

4.2.4 Site **employees** will first wash hands and face after completing work activities and prior to eating or drinking.

4.3 Water Supply

Water supplies will be available for use on site and will comply with the following requirements:

- Potable Water: An adequate supply of drinking water will be available for site staff consumption. Potable water can be provided in the form of approved well or city water, bottled water, or drinking fountains. Where drinking fountains are not available, individual use cups will be provided as well as adequate disposal containers. Potable water containers will be properly identified in order to distinguish them from nonpotable water sources.
- Nonpotable Water: Nonpotable water will not be used for drinking purposes. Nonpotable water may not be used for hand washing or other personal hygiene activities but may be used for other types of cleaning activities. All containers/supplies of nonpotable water used will be properly identified and labeled as such.

4.4 Toilet Facilities

4.4.1 Toilet facilities will be available for site staff and visitors. Should subcontractor staff be located on-site for extended periods, it may become necessary to obtain temporary toilet facilities. Exceptions to this requirement will apply to mobile crews where work activities and locations permit transportation to nearby toilet facilities.

4.4.2 A minimum of one toilet will be provided for every 20 site staff, with separate toilets maintained for each sex, except where there are less than five total staff on site. For mobile crews where work activities and locations permit use of nearby toilet facilities (e.g., gas station, or rest stop), on-site facilities are not required.

4.5 Washing Facilities

4.5.1 Hand and Face: Site staff will wash hands and face after completing work activities and prior to breaks, lunch, or completion of workday.

4.5.2 Personal Cleaning Supplies: Cleaning supplies at AECOM project sites will consist of soap, water, and disposable paper towels or items of equal use/application (e.g., anti-bacterial gels, wipes, etc.).

4.6 Clothing and Personal Protective Equipment (PPE)

4.6.1 All PPE will be kept clean at all times and maintained in accordance with the manufacturer's, AECOM's. and applicable regulatory, legislative, or provincial requirements. Refer to the *S3NA--208-PR1 Personal Protective Equipment Program*.

4.6.2 General Work Areas - At all times work areas will be kept free of dirt and debris that may impact the safety of site staff and visitors. All trash receptacles will be emptied regularly.

4.6.3 Break Areas and Lunchrooms - Site staff will observe the following requirements when using break areas and lunchrooms at AECOM project sites:

4.6.4 All food and drink items will be properly stored when not in use.

4.6.5 Food items will not be stored in personal lockers for extended periods in order to prevent the potential for vermin infestation.

4.6.6 Perishable foods will be refrigerated whenever possible.

4.6.7 All waste food containers will be discarded in trash receptacles.

4.6.8 All tables, chairs, counters, sinks, and similar surfaces will be kept clean and free of dirt, waste food, and food containers at all times.

4.6.9 Refrigerators used to store food items will be maintained at 45 degrees Fahrenheit and emptied of all unclaimed food items weekly. Refrigerators used to store food will be labeled as such so that only food and drinks are stored within the refrigerator.

4.6.10 Routine cleaning of refrigerators will also be performed on a regular basis.

4.7 Vermin Control

4.7.1 Every enclosed workplace shall be constructed, equipped, and maintained, so far as reasonably practicable, to prevent the entrance or harborage of rodents, insects, and other vermin.

4.7.2 A continuing and effective extermination program shall be instituted where the presence of rodents, insects, or other vermin is detected.

4.8 General Housekeeping

4.8.1 All work areas shall be kept clean to the extent that the nature of the work allows.

4.8.2 Every work area shall be maintained, so far as practicable, in a dry condition. Where wet processes are used, drainage shall be maintained and platforms, mats, or other dry standing places shall be provided, where practicable, or appropriate waterproof footgear shall be provided.

4.8.3 Protruding objects or placement of materials on paths or foot traffic areas present a problem with regard to slips, trips, falls, and puncture wounds. Employees will use a reasonable amount of effort to keep slip, trip, and fall hazards to a minimum.

4.8.4 Excess debris and trash will be collected and stored in an appropriate container (e.g., plastic trash bags, garbage can, roll-off bin) prior to disposal.

4.8.5 At no time will debris or trash be intermingled with waste PPE or contaminated materials.

4.8.6 Material and equipment must be placed, stacked, or stored in a stable and secure manner. Stacked material or containers must be stabilized as necessary by interlocking, strapping, or other effective means of restraint to protect the safety of workers.

4.8.7 An area in which material may be dropped, dumped, or spilled must be guarded to prevent inadvertent entry by workers or protected by adequate covers and guarding.

4.8.8 Floors, platforms, ramps, stairs, and walkways available for use by workers must be maintained in a state of good repair and kept free of slipping and tripping hazards. If such areas are taken out of service, the employer must take reasonable means for preventing entry or use.

4.8.9 Site ice / snow conditions shall be assessed prior to the start of work each day and controls for removal of ice or slip risk mitigation shall be implemented as necessary.

4.8.10 Hazardous areas not intended to be accessible to workers must be secured by locked doors or equivalent means of security and must not be entered unless safe work procedures are developed and followed.

4.8.11 Worksite Offices and Trailers - Worksite offices and trailers will be maintained in accordance with *S3NA-103-PR1 Housekeeping, Office.*

5.0 Records

5.1 None

6.0 Attachments

6.1 None

Americas

Manual Lifting, Field

S3NA-308-PR1

1.0 Purpose and Scope

1.1 This procedure provides the requirements for use when performing manual materials handling activities (e.g., lifting/handling of items or materials).

1.2 This procedure applies to all field staff for AECOM Americas-based operations.

2.0 Terms and Definitions

2.1 **Manual Materials Handling** – Moving or handling things by lifting, lowering, pushing, pulling, carrying, holding, or restraining.

2.2 **Team Handling** – Team handling occurs when more than one person is involved during the lift.

3.0 References

3.1 OSHA Technical Manual

3.2 National Safety Council

3.3 Canadian Centre for Occupational Health and Safety

4.0 Procedure

4.1 Roles and Responsibilities

4.1.1 **Project Manager**

Responsible for administering the procedure and providing resources and direction on proper lifting/handling techniques.

4.1.2 **District SH&E Manager**

Assist in identifying activities with a high potential for lifting/handling strains/injuries as well as the associated mitigation strategies and training on proper lifting/manual materials handling techniques.

4.1.3 **Employees**

Responsible for reviewing and following *S3NA-308-WI1 Manual Lifting Safe Work Practices*.

4.2 Mechanical Controls

4.2.1 Mechanical equipment or assistance such as dollies, carts, come-alongs, or rollers are preferable to be used whenever possible rather than the employee physically moving materials.

4.2.2 Mechanical assistance will be of proper size, have wheels sized for the terrain, and be designed to prevent pinching or undue stress on wrists.

4.2.3 Objects to be moved will be secured to prevent falling and properly balanced to prevent tipping.

4.3 Administrative Controls

4.4 When significant, sustained lifting work is required, it is desirable to rotate **employees** to spread the work load among several people and thereby avoid fatigue.

4.5 Rotation is not simply performing a different job but instead is performing a job that utilizes a completely different muscle group from the ones that have been overexerted.

4.6 All **employees** exposed to manual handling hazards shall be trained on safe lifting and handling of loads.

5.0 Records

5.1 None

6.0 Attachments

6.1 S3NA-308-WI1 Manual Lifting Safe Work Practices

Americas

Manual Lifting Safe Work Practices

S3NA-308-WI1

1.0 General

1.1 Before Performing a Lift:

1.1.1 Check to see if mechanical aids such as hoists, lift trucks/dollies, or wheelbarrows are available.

1.1.2 Do not lift if you are not sure that you can handle the load safely.

1.1.3 Confirm that, based on your own physical capabilities and medical limitations, you can lift the load without overexertion. Get help with heavy or awkward loads.

1.1.4 Confirm that the load is “free” to move.

1.1.5 Check that the planned destination of the load is free of obstacles and debris.

1.1.6 Confirm that the path to the planned destination of the load is clear. Grease, oil, water, litter, and debris can cause slips and falls.

1.1.7 Particular handling and lifting techniques are needed for different kinds of loads or materials being handled (for example, compact loads, small bags, large sacks, drums, barrels, cylinders, and sheet materials like metal or glass). See Section 2.0 for additional guidance.

1.2 General Tips for Lifting

1.2.1 Prepare for the lift by warming up your muscles.

1.2.2 Make certain that your balance is good. Feet should be shoulder width apart, with one foot beside and the other foot behind the object that is to be lifted.

1.2.3 Bend the knees; do not stoop. Keep the back straight, but not vertical. There is a difference. Tucking in the chin straightens the back.

1.2.4 Grip the load with the palms of your hands and your fingers. The palm grip is much more secure. Tuck in the chin again to make certain your back is straight before starting to lift.

1.2.5 Use your body weight to start the load moving, then lift by pushing up with the legs. This makes full use of the strongest set of muscles.

1.2.6 Keep the arms and elbows close to the body while lifting.

1.2.7 Carry the load close to the body. Do not twist your body while carrying the load. To change direction, shift your foot position and turn your whole body.

1.2.8 Watch where you are going!

1.2.9 To lower the object, bend the knees. Do not stoop. To deposit the load on a bench or shelf, place it on the edge and push it into position. Confirm that your hands and feet are clear when placing the load.

1.3 Engineering Controls

1.3.1 Material handling tasks should be designed to minimize the weight, range of motion, and frequency of the activity.

1.3.2 Alter the task to eliminate the hazardous motion and/or change the position of the object in relation to the employee's body—such as adjusting the height of a pallet or shelf.

1.3.3 Work methods and stations should be designed to minimize the distance between the person and the object being handled.

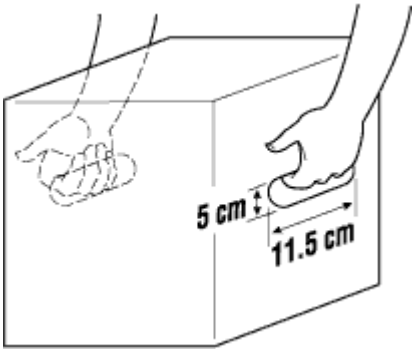
1.3.4 High-strength push-pull requirements are undesirable, but pushing is better than pulling. Material handling equipment should be easy to move, with handles that can be easily grasped in an upright posture.

1.3.5 Workbench or workstation configurations can force people to bend over. Corrections should emphasize adjustments necessary for the employee to remain in a relaxed upright stance or fully supported seated posture. Bending the upper body and spine to reach into a bin or container is highly undesirable. The bins should be elevated, tilted, or equipped with collapsible sides to improve access.

1.3.6 Repetitive or sustained twisting, stretching, or leaning to one side are undesirable. Corrections could include repositioning bins and moving employees closer to parts and conveyors.

1.3.7 Store heavy objects at waist level.

1.4 Whenever possible, utilize hand holds or other lifting attachments on objects being handled.



1.4.1 Use the “hook grip” on loads with cut-out handholds.

1.4.2 Curl your fingers around the edge.

1.4.3 Do not hold the load with your fingertips.

1.4.4 Use containers with handles located more than halfway up the side of the container.

1.4.5 Use the “ledge grip” to handle regularly shaped objects without handles.

1.4.6 Use vacuum lifters to handle sheet materials or plates.

1.4.7 Hold the object with hands placed diagonally.

1.4.8 Wear gloves where practical.

2.0 Specific Handling Techniques

The following guidance will be used when performing manual materials handling of various types.

2.1 Square or Rectangular Objects

2.1.1 Place one foot slightly in front of the other.

2.1.2 Squat as close to the object as possible.

2.1.3 Grasp one of the top corners away from the body and the opposite bottom corner closest to the body.

2.1.4 Tilt the object slightly away from the body, tilt forward at the hips, keep the back straight, and tuck in the chin.

2.1.5 Test to confirm that the object is loose from floor and will lift without snagging.

2.1.6 Straighten the legs, keeping the backbone straight, pull the object into the body, and stand up slowly and evenly without jerking or twisting.

2.1.7 If turning or change of direction is required, turn with feet without twisting the torso and step in the direction of travel.

2.1.8 To set an object down, reverse the sequence, being sure not to trap the bottom hand between the object and the surface on which the object is set.

2.2 Cylindrical Objects

2.2.1 When lifting/moving round or cylindrical objects, the objects should be rolled wherever possible. Rolling must be controlled by chute, tagline, or other means of limiting acceleration. Workers must not be positioned downhill from rolled objects. Use of the legs for pushing and tagline control of rolled objects must be stressed.

2.2.2 Cylindrical objects, such as drums that must remain upright, are to be handled manually by slightly tilting the object, using the legs for control, and balancing the object on the bottom edge. The handler then walks besides the object, with the object tilted toward the body, positioning the hands on the top edge away from the body and moving so they do not cross, thus maintaining balance and a steady, controlled, forward motion. Motion must be controlled so that ceasing to walk and moving the hands will stop forward motion.

2.2.3 **Use carts or tracks to transport cylinders. Make sure that two people transport a cylinder if carts cannot be used, use lifting straps to improve grip.** Technique for one person lifting a cylinder onto a platform:

- Roll the cylinder to within 3 feet (1 meter) of the platform.
- Position the forward foot around the cylinder, the back foot about 1 foot (30 centimeters) behind the cylinder.
- Bend knees slightly.
- Place one hand on the valve protective cap, the other hand underneath the cylinder about 1 foot (30 centimeter) from the ground.
- Tilt the cylinder onto the thigh of the back leg.
- Balance the cylinder on the thigh by pressing down with the back hand while lifting the cylinder with the forward hand.
- Extend both knees to initiate forward movement of the cylinder and continue by pushing up and forward with the arms until the cylinder is located on the platform.
- Climb on the platform.
- Straddle the cylinder at the valve end.
- Grasp the valve protective cap of the cylinder with both hands between the thighs.
- Lean forward and straighten the knees to set the cylinder upright.

2.3 Bags and Sacks

2.3.1 The best way to handle a bag depends on its size, weight, and how far it is to be carried. When lifting, remember to:

- Straddle the end of the bag.
- Bend the hips and knees.
- Keep the back straight.
- Grasp the bag with both hands under the closer end. Keep elbows inside the thighs.
- Lean forward, straightening the knees to set the bag upright.
- Readjust the straddle position moving feet closer to the bag.
- Readjust the grasp, with one hand clasping the bag against the body and the other under it.
- Stand up by thrusting off with the back leg and continuing in an upward and forward direction.
- Thrust the bag up with the knee while straightening the body.
- Put the bag on the shoulder opposite the knee used to thrust the bag up.
- Stabilize the bag on the shoulder.
- Move off without bending sideways.

2.3.2 Avoid unloading a bag from the shoulder directly to floor level. Use an intermediate platform or get help from a co-worker, remember to:

- Stand close to the platform.
- Place one foot in front of the platform.
- Bend hips and knees.
- Keep the back straight.
- Ease the bag off the shoulder and put it upright on the platform.
- Pull the bag slightly over the edge of the platform.
- Stand close to the platform with the bag touching the chest.
- Clasp the bag against the body with one hand, the other hand holding bottom of the bag.
- Step back.
- Bend hips and knees, keeping back straight.
- Ease the bag onto the floor.

2.3.3 Bulkier sacks are easier to carry on your back. Lift the sack onto your back from a platform:

- Move the sack to the edge of the platform.
- Put your back against the sack.
- Grasp with both hands on the upper corners of the sack.
- Ease the sack onto the back, bending hips and knees before taking the weight.
- Keep the back straight.
- Stand up and straighten the hips and knees.
- Stabilize the sack.
- Move away without bending sideways.

2.3.4 Two-person handling of a sack:

- Position one person on either side of the sack.
- Squat with one foot balancing behind the sack.

- Keep back straight.
- Grasp with the outer hand on the upper corner, the other hand holding the bottom of the sack.
- On one person's command:
    - Stand up and straighten the hips and knees.
    - Move toward the stack.
    - Put the sack on the stack.

2.4 Sheet Materials

2.4.1 When lifting sheet materials:

- Stand close to the pile of sheets in a walking stance.
- Grasp sheet firmly at the midpoint of its long side with the closer hand.
- Pull sheet up and toward the body.
- Change grip using your other hand and put your fingers on top of the sheet.
- Pull sheet up to the vertical position and to the side until one half is off the pile.
- Grasp the lower edge of the sheet with the free hand and support the hand by placing it on your knee.
- Stand up without bending or twisting body.
- Whenever moving sheet materials, be cognizant of wind conditions.

2.4.2 To carry sheets:

- Use drywall carts to carry sheet materials.
- Get help from another person where carts are not available.
- Apply carrying handles for manual carrying.
- Always use gloves and carrying handle for glass and other materials with sharp edges.

2.4.3 Use team lifting and carrying where other solutions are inappropriate.

- Remember that the combined strength of the team is less than the sum of individual strength.
- Select team members of similar height and strength.
- Assign a leader to the team.
- Determine a set of commands to be used such as "lift," "walk," "stop," and "down." Make sure that everyone knows what to do when they hear the command.
- Follow the commands given by the team leader.
- Practice team lifting and carrying together before attempting the task.

2.5 Material Storage

2.5.1 When storing materials on site:

- Store materials at a convenient height.
- Leave the lowest shelf unused if necessary.
- Use vertically mobile shelves to avoid bending and overhead reaching.
- Use bin racks for storing small items.
- Store heavy and frequently used materials at waist height.
- Do not store materials at floor level.

- Use hand trucks with elevating devices in storage and loading areas.
- Use trucks with a tilting device to avoid bending.
- Use elevating platforms to avoid overhead reaching.

Americas

Mobile or Heavy Equipment

S3NA-309-PR1

1.0 Purpose and Scope

1.1 Outline the safe working requirements for working with and near mobile or heavy equipment and heavy equipment operation.

1.2 This procedure applies to all AECOM Americas-based employees and operations.

2.0 Terms and Definitions

2.1 **Heavy equipment** – All excavating equipment include scrapers, loaders, crawler or wheel tractors, excavators, backhoes, bulldozers, off-highway trucks, graders, agricultural and industrial tractors, and similar equipment.

2.2 **Operator** – Any person who operates the controls while the heavy equipment is in motion or the engine is running.

2.3 **Ground personnel/workers** – Personnel performing work on the ground around heavy equipment (note: operators are considered ground personnel when outside of the equipment cab).

3.0 References

3.1 S3NA-202-PR1 Competent Person Designation

3.2 S3NA-205-PR1 Equipment Inspections & Maintenance

3.3 S3NA-406-PR1 Electrical Lines, Overhead

4.0 Procedure

4.1 Roles and Responsibilities

4.1.1 **Project Managers/Site Supervisor**

Responsible for ensuring all equipment is in good working order and all equipment operators are qualified on the piece of machinery they are assigned. Ensure that subcontractor machinery and mechanized equipment is certified in accordance with the requirements of *S3NA-309-FM1 Certification of Machinery and Mechanized Equipment*.

4.1.2 **Employees**

Confirm that all rented equipment arrives in proper working order with the manufacturer's operating manual before acceptance from the supplier.

4.1.3 **Operators** (of mobile equipment)

Operate the equipment safely, maintain full control of the equipment, and comply with the laws governing the operation of the equipment. Immediately report defects and conditions affecting the safe operation of the equipment to the site Supervisor.

4.2 Communication

4.2.1 Communication between site supervisors/managers, heavy equipment operators, and other site personnel is a key method of preventing serious injury or death during heavy equipment operations.

4.2.2 The following points outline the communication requirements during heavy equipment operations:

- **Site Supervisors/Project Managers** shall confirm that all operators are notified/informed of when, where, and how many ground personnel will be working on site.

- **Site Supervisors/ Project Managers** shall inform all ground personnel before changes are made in the locations of designated work areas.
- Prior to work initiating on site, the **Site Supervisor/Project Manager** is to confirm all operators and ground personnel are trained on the hand signals that will be used to communicate between operators and ground personnel.
- **Ground Personnel** working around heavy equipment operations are to maintain eye contact with operators to the greatest extent possible (always face equipment). Never approach equipment from a blind spot or angle.
- All heavy equipment whose backup view can be obstructed shall be equipped with reverse warning devices (i.e., backup alarms) that can be significantly heard over equipment and other background noise. Reverse signaling lights shall be in working order.
- When feasible, two-way radios shall be used to verify the location of nearby ground personnel.
- When an operator cannot adequately survey the working or traveling zone, a **signlal person** shall use a standard set of hand signals to provide directions. Flags or other high visibility devices may be used to highlight these signals.

4.3 Ground Personnel

4.3.1 Ground clearance around heavy equipment may significantly reduce hazards posed during heavy equipment operations.

4.3.2 The following points outline the clearance requirements during heavy equipment operations:

- **Ground Personnel** shall always yield to heavy equipment.
- **Ground Personnel** shall maintain a suitable “buffer” area of clearance from all active heavy equipment.
- A job-specific hazard analysis that identifies any special precautions shall be completed and communicated to all AECOM personnel.
- **Site Supervisors/Project Managers** shall designate areas of heavy equipment operation and confirm that all ground personnel are aware of designated areas. Designated areas shall include boundaries and travel routes for heavy equipment. Travel routes shall be set up to reduce crossing of heavy equipment paths and to keep heavy equipment away from ground personnel.
- When feasible, **Site Supervisors/Project Managers** shall set up physical barriers (e.g., caution tape, orange cones, concrete jersey barriers) around designated areas and confirm that unauthorized ground personnel do not enter such areas.
- **Operators** shall stop work whenever unauthorized personnel or equipment enter the designated area and only resume when the area has been cleared.
- **Operators** shall only move equipment when aware of the location of all workers and when the travel path is clear.
- **Ground Personnel** shall never stand between two pieces of heavy equipment or other objects (i.e., steel support beams, trees, buildings, etc.).
- **Ground Personnel** shall never stand directly below heavy equipment located on higher ground.
- If working near heavy equipment, **Ground Personnel** shall stay out of the travel and swing areas (excavators, all-terrain forklifts, hoists, etc.) of all heavy equipment.
- **Ground Personnel** shall never work near heavy equipment.
- **Employees** shall keep all extremities, hair, tools, and loose clothing away from pinch points and other moving parts on heavy equipment.
- **Employees** shall not talk on a cell phone while standing or walking on a roadway or other mobile equipment path.

4.3.3 At a minimum, all **Ground Personnel** and **Operators** outside of heavy equipment shall wear the following:

- High visibility, reflective (Class 2) safety vest that is visible from all angles and made of fluorescent material and orange, white, or yellow reflective material (confirm that vest is not faded or covered with outer garments, dirt, etc.)
- Retro-reflective striping for arms and legs (night work)
- American National Standards Institute/Canadian Standards Association- (ANSI/CSA-) approved hard hat
- ANSI/CSA-approved safety glasses with side shields
- ANSI/CSA-approved work boots (unless project requirements are more stringent)
- ANSI/CSA-approved hearing protection as needed
- Appropriate work clothes (i.e., full-length jeans/trousers and a sleeved shirt; no tank, crew tops or other loose clothing permitted).

4.4 Prior to work commencing

4.4.1 All mobile equipment will be inspected pre-shift and then regularly as required with the details of the inspection recorded in a log book.

4.4.2 The **Operator** will report defects and conditions affecting the safe operation of the equipment to the Site Supervisor or employer. Any repair or adjustment necessary for the safe operation of the equipment will be made before the equipment is used.

4.4.3 Exposed moving parts on mobile equipment which are a hazard to the operator or to other workers will be guarded and if a part will be exposed for proper function it will be guarded as much as is practicable consistent with the intended function of the component.

4.4.4 An approved 4A40BC fire extinguisher shall be present on all mobile equipment.

4.4.5 Inform the operators of the equipment that AECOM employees are in the area and inquire if there are any restricted areas or specific rules or requirements. In some industrial facilities, mobile equipment has the ‘right of way’.

4.4.6 Where the **Operator** will not have a full view of the path of travel, a signal person will be used on the ground that has a full view of the load, the operator, and the path.

4.4.7 Mobile equipment in which the operator cannot directly or by mirror or other effective device see immediately behind the machine will have an automatic audible warning device which activates whenever the equipment controls are positioned to move the equipment in reverse, and if practicable, is audible above the ambient noise level.

4.5 Operation

4.5.1 The **Operator** of mobile equipment is the only worker permitted to ride the equipment unless the equipment is a worker transportation vehicle.

4.5.2 A person will not operate mobile equipment unless the person has received adequate instruction and training in the safe use of the equipment, and has demonstrated to a qualified supervisor or instructor competency in operating the equipment.

4.5.3 The **Operator** of mobile equipment will operate the equipment safely, maintain full control of the equipment, and comply with the laws governing the operation of the equipment.

4.5.4 A site **Supervisor** will not knowingly operate or permit a worker to operate mobile equipment which is, or could create, an undue hazard to the health or safety of any person.

4.5.5 The **Operator** of mobile equipment will not leave the controls unattended unless the equipment has been secured against inadvertent movement such as by setting the parking brake, placing the transmission in the manufacturer's specified park position, and by chocking wheels where necessary.

4.5.6 The **Operator** will maintain the cab, floor and deck of mobile equipment free of material, tools or other objects which could create a tripping hazard, interfere with the operation of controls, or be a hazard to the operator or other occupants in the event of an accident.

4.5.7 If mobile equipment has seat belts required by law or manufacturer's specifications, the **Operator** and passengers will use the belts whenever the equipment is in motion, or engaged in an operation which could cause the equipment to become unstable.

4.5.8 When approaching or crossing the intended path of travel of mobile equipment, **Field Staff** shall establish eye contact with the operator of the mobile equipment and confirm that it is safe to proceed.

4.5.9 Have vehicle headlights on at all times when driving in the area.

4.5.10 Park motor vehicles off the haul roads, or away from the work areas.

4.5.11 Do not wear loose clothing or jewelry where there is a danger of entanglement in rotating equipment.

4.5.12 Do not enter the swing area of machines such as cranes, mobile drill rigs, or excavators, without first making eye contact with the operator, and receiving permission to do so.

4.5.13 Stay out of the blind areas around mobile equipment and never assume that the equipment operators have seen you or are aware of your presence.

4.5.14 Maintain a distance of 2 feet (60 centimeters) between the counterweight of swing machines and the nearest obstacle. If this distance cannot be maintained, the area will be barricaded or guarded to prevent access.

4.5.15 Vibration from moving traffic or mobile equipment can cause excavations or spoil piles to become unstable. Be aware of the risk and keep clear.

4.5.16 All heavy equipment shall be operated in a safe manner that will not endanger persons or property. When operating an electric-powered, remote controlled, hydraulic device used for demolishing concrete structures and refractory linings as well as excavating, refer to the *S3NA-309-WI1 Brokk 180 Safety Card* for more specifics.

4.5.17 All heavy equipment shall be operated at safe speeds.

4.5.18 Always move heavy equipment up and down the face of a slope. Never move equipment across the face of a slope.

4.5.19 Slow down and stay as far away as possible while operating near steep slopes, shoulders, ditches, cuts, or excavations.

4.5.20 When feasible, **Operators** shall travel with the "load trailing", if the load obstructs the forward view of the operator.

4.5.21 Slow down and sound horn when approaching a blind curve or intersection. Signal people equipped with 2-way radio communications may be required to adequately control traffic.

4.5.22 **Operators** shall remain in cab while heavy equipment is being loaded.

4.5.23 Equipment shall be shut down prior to and during fueling. Do not smoke or use electrical devices while fueling. Fuel shall not be carried in or on heavy equipment, except in permanent fuel tanks or approved safety cans.

4.5.24 Turn off heavy equipment, place gear in neutral and set parking brake prior to leaving vehicle unattended. Buckets and blades are to be placed on the ground and with hydraulic gears in neutral. Heavy equipment parked on slopes shall have the wheels chocked.

4.5.25 Never jump on to or off of a piece of heavy equipment, always maintain 3-points of contact at a minimum.

4.5.26 Never exit heavy equipment while it is in motion.

4.5.27 Passengers shall only ride in heavy equipment designed for occupancy of passengers.

4.5.28 Never ride on the outside of a piece of heavy equipment (e.g., tailgates, buckets, steps, etc.).

4.5.29 Site vehicles will be parked in a designated parking location away from heavy equipment.

4.5.30 **Operators** shall never push/pull "stuck" or "broken-down" equipment unless a spotter determines that the area is cleared of all personnel around and underneath the equipment.

4.5.31 If designated for work in contaminated areas/zones, equipment shall be kept in the exclusion zone until work or the shift has been completed. Equipment will be decontaminated within designated decontamination areas.

4.5.32 Equipment left unattended at night adjacent to traveled roadways shall have appropriate lights or reflectors, or barricades equipped with appropriate lights or reflectors, to identify the location of that equipment, and shall not be closer than 6 feet (or the regulatory requirement for the work location) to the active roadway.

4.5.33 Pneumatic-tired earthmoving haulage equipment, with a maximum speed exceeding 15 miles per hour, shall be equipped with fenders on all wheels.

4.5.34 Lift trucks shall have the rated capacity clearly posted on the vehicle, and the ratings are not to be exceeded.

4.5.35 Steering or spinner knobs shall not be attached to steering wheels.

4.5.36 High-lift rider industrial trucks shall be equipped with overhead guards.

4.5.37 When ascending or descending grades in excess of 5 percent, loaded trucks shall be driven with the load upgrade.

4.5.38 All belts, gears, shafts, pulleys, sprockets, spindles, drums, flywheels, chains, or other reciprocating, rotating or moving parts of equipment shall be guarded when exposed to contact by persons or when they otherwise create a hazard.

4.5.39 All hot surfaces of equipment, including exhaust pipes or other lines, shall be guarded or insulated to prevent injury and fire.

4.5.40 All equipment having a charging skip shall be provided with guards on both sides and open end of the skip area to prevent persons from walking under the skip while it is elevated.

4.5.41 Platforms, foot walks, steps, handholds, guardrails, and toeboards shall be designed, constructed, and installed on machinery and equipment to provide safe footing and access ways.

4.5.42 Substantial overhead protection shall be provided for the operators of fork lifts and similar equipment.

4.6 Utilities

4.6.1 When contacted by heavy equipment, aboveground and underground utilities may cause severe injuries or death as a result of electrocution, explosion, etc. Refer to the *S3NA-406-PR1 Electrical Lines, Overhead* procedure for more specifics.

4.6.2 The following outline the requirements while performing heavy equipment operations that may lead to contact with aboveground or underground utilities:

- Always be aware of surrounding utilities.
- Confirm all equipment (i.e., dump trailers, loaders, excavators, etc.) is lowered prior to moving underneath of aboveground utilities.
- Confirm utilities are cleared and identified prior to beginning any earthmoving operation. Contact the local utility service providers for clearance prior to performing work. Confirm documentation of the contact is made; date, number; contact name, organization, etc.

4.7 Training

4.7.1 The **Operator** or other qualified supervisor will provide all on-site personnel with an orientation to the mobile equipment and its associated hazards and controls.

4.7.2 Only designated, qualified personnel shall operate heavy equipment.

4.7.3 **Operators** shall have all appropriate local, State, or Federal licenses or training to operate a designated piece of heavy equipment.

4.7.4 **Operators** shall be evaluated through documented experience and routine monitoring of activities unless the equipment is operated by an AECOM operator in which case a practical evaluation is needed. **Operators** shall be knowledgeable and competent in the operation of a designated piece of heavy equipment.

4.8 Inspection and Maintenance

4.8.1 Maintenance records for any service, repair or modification which affects the safe performance of the equipment will be maintained and be reasonably available to the operator and maintenance personnel during work hours. Refer to the *S3NA-205-PR1 Equipment Inspections & Maintenance* program.

4.8.2 Maintenance records will be maintained on the site or project for mobile equipment.

4.8.3 Servicing, maintenance and repair of mobile equipment will not be done when the equipment is operating, unless continued operation is essential to the process and a safe means is provided.

4.8.4 All heavy equipment shall have a documented inspection and if necessary, repaired prior to use. **Operators** shall not operate heavy equipment that has not been cleared for use. All machinery and mechanized equipment will be certified to be in safe operating condition (refer to *S3NA-309-FM1 Certification of Machinery and Mechanized Equipment*) by a competent person (refer to *S3NA-202-PR1 Competent Person Designation*) seven days prior to on-site operation, and is valid for one year.

4.8.5 All heavy equipment shall be inspected at a minimum to the manufacturer's recommendations prior to each work shift. All defects shall be reported to the **Supervisor/Project Manager** immediately. Inspection records shall be maintained at the site. If a manufacturer's or company-specific inspection checklist is not provided, use the Heavy Equipment Pre-Operation Inspection Checklist (*S3NA-309-FM2 Heavy Machinery Pre-Operation Checklist*).

4.8.6 Defective heavy equipment shall be immediately taken out of service until repaired.

4.9 Fueling and batteries

4.9.1 A well-ventilated area shall be used for refueling.

4.9.2 Only the type and quality of fuel recommended by the engine manufacturer shall be used.

4.9.3 Fuel tanks shall not be filled while the engine is running. All electrical switches shall be turned off.

4.9.4 No one shall spill fuel on hot surfaces. Any spillage should be cleaned before starting an engine.

4.9.5 Spilled fuel shall be cleaned with cotton rags or cloths; do not use wool or metallic cloth.

4.9.6 Open flames, lighted smoking materials, or sparking equipment shall remain well away from the fueling area.

4.9.7 Heaters in carrier cabs shall be turned off when refueling the carrier or the drill rig.

4.9.8 Portable fuel containers shall not be filled completely to allow expansion of the fuel during temperature changes.

4.9.9 The fuel nozzle shall be kept in contact with the tank being filled to prevent static sparks from igniting the fuel.

4.9.10 Portable fuel containers shall not travel in the vehicle or carrier cab with personnel.

4.9.11 Fuel containers and transfer hoses shall be kept in contact with a metal surface during travel to prevent buildup of a static charge.

4.9.12 Batteries shall be serviced in a ventilated area while wearing appropriate Personal Protective Equipment.

4.9.13 When a battery is removed from a vehicle or service unit, the battery shall be disconnected ground post first.

4.9.14 When installing a battery, the battery shall be connected ground post last.

4.9.15 When charging a battery, cell caps shall be loosened prior to charging to permit gas to escape.

4.9.16 When charging a battery, the power source shall be turned off to the battery before either connecting or disconnecting charger loads to the battery posts.

4.9.17 Spilled battery acid shall be immediately flushed off the skin with a continuous supply of water.

4.9.18 Should battery acid get into the eyes, the eyes shall be flushed immediately with copious amounts of water and medical attention shall be sought immediately.

4.9.19 To avoid battery explosions, the cells shall be filled with electrolytes. A flashlight (not an open flame) shall be used to check water electrolyte levels. Avoid creating sparks around batteries by shorting across a battery terminal. Lighted smoking materials and flames shall be kept at least 25 feet (7.6 meters) away from battery-charging stations.

5.0 Records

5.1 Inspection records shall be maintained with the equipment.

6.0 Attachments

6.1 S3NA-309-WI1 Brokk180 Safety Card

6.2 S3NA-309-FM1 Certification of Machinery and Mechanized Equipment

6.3 S3NA-309-FM2 Heavy Machinery Pre-Operation Checklist

Americas

Certification of Machinery and Mechanized Equipment S3NA-309-FM1

1.0 General Guidelines

1.1 Subcontractor equipment shall comply with all applicable legislative requirements, local, State, Federal, Provincial, Territorial for motor vehicles and material handling heavy equipment.

1.2 Certification shall be obtained for all subcontractor machinery and mechanized equipment prior to but within seven calendar days in advance of use on the project site.

1.3 Heavy equipment includes, but is not limited to, drill rigs, front-end loaders, backhoes, trackhoes, bulldozers, forklifts, and similar equipment used for the implementation of the project Statement of Work.

2.0 Equipment Safety Inspections

2.1 The following presents general guidelines for certifying equipment is in safe operating condition before activities commence at the site and during site operations. The following guidelines are not meant to be all-inclusive.

2.1.1 All machinery and mechanized equipment will be certified to be in safe operating condition (using the attached form) by a competent individual seven days prior to on-site operation. This certification is valid for one year.

2.1.2 Equipment will be inspected on a daily basis by the owner/operator and daily logs will be maintained. All discrepancies shall be corrected prior to placing the equipment in service.

2.1.3 Inspections shall include, but are not limited to, all hydraulic lines and fittings for wear and damage, all cable systems and pull ropes for damage and proper installation, exhaust systems, brake systems, and drill controls, etc.

2.1.4 Drill rigs and related support equipment and vehicles shall be inspected by the driller in charge on a daily basis. These inspections shall be recorded on the Daily Drill Rig Checklist or on equivalent subcontractor forms.

2.1.5 Exhaustive preventive maintenance shall be conducted for all equipment according to manufacturer recommendations and/or the subcontractor's internal policies, schedules, and equipment Standard Operating Procedures.

2.1.6 Only designated qualified persons shall operate machinery and mechanized equipment.

2.1.7 The contractor shall maintain records of tests and inspections at the site and shall make the records available upon request of the designated authority; the records shall become part of the official project file.

2.1.8 Equipment found to not be in safe operating condition or to have a deficiency that affects the safe operation of the equipment shall immediately be taken out of service and its use shall be prohibited until safe conditions have been corrected.

2.1.9 All equipment shall be kept in the exclusion zone until work or the shift has been completed. Equipment will be decontaminated within designated decontamination areas.

2.1.10 Equipment with an obstructed rear view must have an audible alarm that sounds when equipment is moving in reverse.

TO: AECOM

DATE:

FROM:

Project Name:

Project Location:

1. This form provides certification of machinery and mechanized equipment to be used on the referenced project for the following work:

Description of equipment work:	
Project site:	
Subcontractor providing equipment: Address:	
Dates (duration) of equipment work:	

2. Inspection and certification of machinery and mechanized equipment, as required by AECOM, has been made prior to but within seven calendar days in advance of use on the project site. Recertification will be required for equipment that is used on the project site for more than one year.

Identification of equipment (make, model, serial no.)		Date of Certification
1		
2		
3		

3. The above listed equipment has been inspected and tested as indicated above, and is CERTIFIED TO BE IN SAFE OPERATING CONDITION BY THE FOLLOWING COMPETENT INDIVIDUAL:

Name		Title
Company		
Signature		Date

4. If there are any questions regarding this certification, please contact the following AECOM representative:

Americas

Heavy Equipment Pre-Operation Checklist

S3NA-309-FM2

Project Name/Location:															
Equipment Number/Name:					Equipment Make/Model:										
Hour meter reading:															
Check the following as appropriate	Operator Name/Date			Operator Name/Date			Operator Name/Date			Operator Name/Date			Operator Name/Date		
	SAT	UNSAT	N/A	SAT	UNSAT	N/A	SAT	UNSAT	N/A	SAT	UNSAT	N/A	SAT	UNSAT	N/A
1. Operator qualified	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
2. Overhead guard (ROPS)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
3. Horn	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
4. Lights	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
5. Parking brake	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
6. Service brakes	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
7. Steering	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
8. Oil level	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
9. Hydraulic oil level	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
10. Radiator fluid level	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
11. Major fluid leaks	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
12. Windows	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
13. Backup alarm	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
14. Tires (visual)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
15. Seat belts	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Project Name/Location:															
Equipment Number/Name:						**Equipment Make/Model:**									
Hour meter reading:															
Check the following as appropriate	**Operator Name/Date**			**Operator Name/Date**			**Operator Name/Date**			**Operator Name/Date**			**Operator Name/Date**		
	SAT	**UNSAT**	**N/A**	**SAT**	**UNSAT**	**N/A**	**SAT**	**UNSAT**	**N/A**	**SAT**	**UNSAT**	**N/A**	**SAT**	**UNSAT**	**N/A**
16. Fuel leaks	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
17. Fire extinguisher	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
18. Fuel lines secure	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
19. Electrical lines	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
20. Exhaust components	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Comments:															

Definitions:

SAT = Satisfactory; in working order

UNSAT = Unsatisfactory; not in working order/damaged

N/A = Not Applicable

Americas

Wildlife, Plants and Insects

S3NA-313-PR1

1.0 Purpose and Scope

1.1 Communicates the requirements and precautions to be taken by AECOM employees to protect against the biological hazards associated with insects, arachnids, snakes, poisonous plants, and other animals referred to herein collectively as “biological hazards”.

1.2 This procedure applies to all AECOM Americas-based employees and operations.

2.0 Terms and Definitions

2.1 **Field Work –** Any activity conducted at a site that contains brush, overgrown grass, leaf litter, poisonous plants, or is located near mosquito breeding areas and includes work in structures where animals might exist that harbor fleas or ticks or where spiders and mites could be present. Field work includes, but is not limited to, Phase I, Phase II, Operations Monitoring & Maintenance, biological surveys, and other work that meets the definition of field work.

2.2 **Poisonous** – Capable of harming or killing by or as if by poison; toxic or venomous.

2.3 **Phase I Environmental Site Assessment –** Investigation of real property to determine the possibility of contamination, based on visual observation and property history, but no physical testing. Under new Environmental Protection Agency regulations that went into effect on November 1, 2006, a Phase I, as it is called for short, will be mandatory for all investors who wish to take advantage of Comprehensive Environmental Response, Compensation, and Liability Act defenses that will shield them from liability for future cleanup, should that prove necessary. The new Phase I rules, called “All Appropriate Inquiry” or AAI, also require more investigation than previously mandated. Investors can expect to see dramatic price increases over prior experiences.

2.4 **Phase II Environmental Site Assessment** – Investigation of real property through physical samplings and analyses to determine the nature and extent of contamination and, if indicated, a description of the recommended remediation method.

3.0 References

3.1 WP-001-PR Firearms Standard

3.2 S2-032-PR1 Weapons Safety

3.3 S3NA-004-PR1 Incident Report

3.4 S3NA-208-PR1 Personal Protective Equipment Program

3.5 S3NA-209-PR1 Project Hazard Assessment and Planning

3.6 S3NA-511-PR1 Heat Stress

3.7 Public Health Agency of Canada on Ticks and Lyme Disease in Canada

3.8 Public Health Agency of Canada on West Nile Virus

3.9 United States Center for Disease Control (CDC) on Lyme Disease

3.10 New York State Department of Health, 2007. Health Advisory, Tick and Insect Repellents.

3.11 Spectrum Brands, 2007. Personal Insect Repellent Products.

3.12 U.S. Centers for Disease Control and Prevention, 2004. Tick Management Handbook

3.13 U.S. Environmental Protection Agency, 2006. Permethrin Facts: Preregistration Eligibility Decision Fact Sheet

3.14 U.S. National Pesticide Information Center, 1997, National Pesticide Telecommunications Network Fact Sheet for Permethrin

3.15 U.S. Environmental Protection Agency, 2005. New Pesticide Fact Sheet, Picaridin

4.0 Procedure

4.1 Roles and Responsibilities

4.1.1 Project Managers / Supervisors

- Responsible for managing field work.
- Work with employees to see that a Task Hazard Analysis (THA) for the work to be conducted has been performed prior to the beginning of the field work and that it includes an assessment of potential biological hazards.
- If biological hazards are identified as an exposure risk in the workplace, control measures that may be applied at the project site will be implemented to reduce the potential for employees to be exposed to injuries and illnesses while working.
- If the exposures cannot be eliminated or managed with engineering controls, the **Project Manager** or **Supervisor** will approve the use of Personal Protective Equipment (PPE) and protective repellents and lotions and ensure that exposed employees have and use these products.
- Approve the costs associated with the PPE and materials necessary to protect employees from the biological hazards covered by this procedure.

4.1.2 Region Safety, Health and Environment (SH&E) Manager

- Participate in incident reporting and investigations when appropriate.
- Work with Office Manager (Operations), SH&E Department and project Safety Professionals provide training and guidance to employees consistent with this procedure.
- During the performance of project site visits, assess the precautions being taken against the requirements of this procedure.
- Assist project teams in identifying hazards and selecting appropriate control measures.

4.1.3 Office Managers (Operations)

- Assure implementation of this procedure in their regions and offices.
- Participate in incident reporting and investigations when appropriate.

4.1.4 Field Staff / Employees

- Participate in required training on this procedure.
- Participate in the development of THAs for the project, identify control measures to limit exposure and request PPE, repellents, and protective lotions required by this Procedure.
- Obtain approval from Project Managers and/or Supervisors to purchase selected PPE prior to purchasing.
- Implement the precautions appropriate to prevent exposure to the hazardous wildlife, insects and plants.
- Observe requirements for reporting as detailed within the Procedure.
- Participate in incident reporting and investigations when appropriate.

4.2 Overview

4.2.1 The procedures discussed below are detailed because these hazards have historically posed the most significant risk to AECOM employees. Note that this discussion is not a fully encompassing list of hazards and as part of the THA, in accordance with the *S3NA-209-PR1 Project Hazard Assessment and Planning,* conducted by the project team, additional consideration must be given to other biological hazards.

4.2.2 Departments of Public Health local to the worksite, as well as the Centers for Disease Control (CDC) can serve as a resource for identifying biological hazards not discussed in this procedure.

4.2.3 If additional biological hazards are identified, the project team should contact the Region SH&E Manager to discuss the hazards and identify effective control measures that can be implemented at the project site.

4.3 Employee Sensitivity

4.3.1 Sensitivity to toxins generated by plants, insects and animals varies according to dosage and the ability of the victim to process the toxin; therefore, it is difficult to predict whether a reaction will occur, or how severe the reaction will be. Staff should be aware that there are a large number of organisms capable of causing serious irritations and allergic reactions. Some reactions will only erupt if a secondary exposure to sunlight occurs. Depending on the severity of the reaction, the result can be severe scarring, blindness or even death.

4.3.2 Employees / Field Staff also need to consider whether they are sensitive to the use of insect repellents.

4.4 Planning and Hazard Assessment

4.4.1 The AECOM project team shall ensure that the potential for exposure to specific biological hazards are assessed prior to the commencement of work and that the procedures specified by this procedure are integrated into the task hazard analysis (THA) planning process and conveyed to AECOM employees conducting the field work (also referred to as field staff). This information shall be communicated in the site-specific Safe Work Plan (SWP), Health and Safety Plan (HASP), the THA, pre-project kickoff meetings, and tailgate meetings at the project site.

4.4.2 It is important to note that the precautions to be taken by AECOM employees to decrease the risk of exposure to biological hazards can directly increase the risk of heat-related illness due to thermal stresses. Therefore, heat stress monitoring and precautions shall be included as a critical component of the project-specific hazard assessments in accordance with *S3NA-511-PR1 Heat Stress.*

4.4.3 During the preparation of the project-specific SWP, HASP and project specific THA, Project Managers, Supervisors, and the project staff will determine what biological hazards might be encountered during the project and will prescribe the precautions to be taken to reduce the potential for exposure and the severity of resulting illnesses. Consideration will be given to conditions such as weather, proximity to breeding areas, host animals, and published information discussing the presence of the hazards.

4.4.4 It should be assumed that at least one of the biological hazards exists whenever working on undeveloped property. This can include insect activity any time that local temperatures exceed 40 degrees Fahrenheit (4.5 degrees Celsius) for a period of more than 24 hours. The stubble and roots of poisonous plants can be a hazard any time of year, including when some plants are dormant or mown.

4.4.5 The hazard assessments must also consider the additional hazards posed by vegetative clearing such as the increased risk of coming in contact with poison ivy, oak or sumac and hazards associated with the use of tools and equipment to remove vegetation.

4.4.6 Employees in the field where biological hazards exist will not enter the hazard areas unless they are wearing the appropriate protective clothing, repellents, and barrier creams specified below. If the hazard is recognized in the field but was not adequately assessed during the THA, the field

staff shall stop work and not proceed until the THA has been amended and protective measures implemented.

4.4.7 A decision flow chart and table for determining the potential for biological hazards in the U.S. has been provided in *S3NA-313-WI1 Biological Hazard Assessment Decision Flow Chart Hazard Assessment (U.S.)*.

4.4.8 Restrictions:

- In accordance with the Global Safety Department standards, no firearms or weapons are allowed to be used without express permission by the Region Executive and chief Security Officer, refer to the *WP-001-PR Global Firearms Standard*.
- No weapons related work shall occur without an assessment that includes appropriate hazard control measures and training, refer to the *S2-032-PR1 Weapons Safety*.
- Staff with life-threatening reactions shall not undertake work in areas infested with the allergen (e.g., wasps, poison ivy), unless precautions are met which satisfy a medical practitioner's requirements.

4.5 Habitat Avoidance, Elimination, and/or Control

4.5.1 Ticks, Spiders and other Insects

- The most effective method to manage worker safety and health is to eliminate, avoid and/or control hazards. Clearing the project site of brush, high grass and foliage reduces the potential for exposure to biological hazards. Clearing will not eliminate the exposure to flying insects and there might be an increased exposure to ticks, spiders, and poisonous plants during the clearing process.
- Projects such as subsurface environmental assessment or remediation are often candidates for brush and overgrown grass to be cleared. In these instances, the **Project Manager** shall either request that the client eliminate vegetation, or request approval from the client to have vegetation clearing added to the scope of work.
- When projects must be conducted in areas that cannot or may not be cleared of foliage, personal precautions and protective measures shall be prescribed.
- Mosquitoes breed in stagnant water and typically only travel a quarter mile (less than half a kilometer) from their breeding site. Whenever possible, stagnant water should be drained to eliminate breeding areas. **Project Managers** and client site managers should be contacted to determine whether water can be drained and the most appropriate method for draining containers, containment areas, and other objects of standing water.
- If water cannot be drained, products similar to Mosquito Dunks® can be placed in the water to control mosquitoes. Once wet, the Mosquito Dunks® kill the immature, aquatic stage of the mosquito. The active ingredient is a beneficial organism that is lethal to mosquito larvae, but harmless to fish, humans, and other animals. Mosquito Dunks® provide long-term protection for 30 days or more.

4.5.2 Poisonous Plants

- If poisonous plants are identified in the work area, **field staff** will mark the plants using either flags or marking paint, and discuss what the specific indicator will be to signal to other **field staff** to avoid the designated area. If **field staff** decide to use ground-marking paint to identify poisonous plants, they should discuss this tactic with the **Project Manager** (and Client as appropriate) to gain approval.
- If removal of the plants is considered, it should be subcontracted to a professional landscaping service that is capable and experienced in removing the plant. If herbicides are considered for use, a discussion will need to occur with the **Project Manager** (and Client as appropriate) to determine whether it is acceptable to apply herbicides at the work site. Application of herbicides may require a license.

- **Field staff** shall not attempt to physically remove poisonous plants from the work area unless a clearing procedure including PPE is prepared in advance and approved by the **Region SH&E Manager**. If a SWP or HASP is prepared for the project, the clearing procedure should be included and the required PPE specified.

4.5.3 Wildlife Hazards (Wild Animals, Reptiles and Birds)

Staff must not work alone in areas where the risk of an encounter with dangerous wildlife is high. Wildlife handling must only be completed under direct supervision of an experienced individual. Refer to the following work instructions for more specifics on prevention:

- *S3NA-313-WI11 Large Carnivores*
- *S3NA-313-WI12 Bear Safety*
- *S3NA-313-WI13 Small Mammals*
- *S3NA-313-WI14 Snakes*
- *S3NA-313-WI15 Alligators*

4.5.4 Bird Droppings

Work in any area where pigeons or other flying animals may nest, a written statement from the client shall be obtained in regards to the potential for, and extent of, accumulation of excrement on/in the structure from pigeons and other winged animals.

4.6 Insects

4.6.1 Insects for which precautionary measures should be taken include but are not limited to: mosquitoes (potential carriers of disease aside from dermatitis), black flies, wasps, bees, ticks, fire ants and European fire ants.

4.6.2 Employees with known allergies to insect stings should consult their personal physician for advice on any immediate medications that they should carry with them. AECOM highly recommends that employees with known allergies inform their co-workers of the allergy and the location of the medications they might carry for the allergy.

4.6.3 Ticks

- Ticks can be encountered when walking in tall grass or shrubs. They crawl up clothing searching for exposed skin where they will insert mouthparts to drink blood. The most serious concern is a possibility of contracting a disease.
- Data from the CDC indicates that tick-borne diseases have become increasingly prevalent. At the same time, tick repellents have become both safe and effective so it is possible to prevent the vast majority of bites and, therefore, most related illnesses. The use of permethrin is strongly advised.
- The most common and severe tick-borne illnesses in the U.S. are Lyme disease, Ehrlichiosis, and Rocky Mountain spotted fever. A summary table listing CDC informational resources for these diseases is provided in *S3NA-313-WI2 Ticks* along with a listing of CDC information resources and maps showing the distribution of common tick-borne diseases in the U.S.
- When working in areas where ticks may occur, it is recommended that clothes are turned inside out and shaken at the end of day; do not wear the same clothes two days in a row.
- To remove ticks that are embedded in skin, utilize a tick key. Alternatively use tweezers or fingers to carefully grasp the tick as close to the skin as possible and pull slowly upward, avoiding twisting or crushing the tick. Do not try to burn or smother the tick. Cleanse the bite area with soap and water, alcohol, or household antiseptic. Note the date and location of the bite and save the tick in a secure container such as an empty pill vial or film canister. A bit of moistened paper towel placed inside the container will keep ticks from drying out.

- Familiarize yourself with the characteristic bulls-eye pattern of Lyme disease infection surrounding the bite. If you notice this type of pattern or rash resulting from a tick bite, contact AECOM reporting line 1 (800) 348-5046 and asked to be connected to WorkCare for medical support. If this service is unavailable, contact your personal physician or a local medical clinic.
    - Canada – National Microbiology Laboratory (NML) (Phone: (204) 789-2000; email: ticks@phac-aspc.gc.ca). The NML will conduct diagnostic testing for the Lyme disease agent as well as several other disease-causing agents. The NML results will not only benefit anyone bit by the tick, but will also assist the NML in their goal to accurately map the distribution of the tick species and associated diseases in Canada.
    - U.S. – IGeneX, Inc. (Phone: (800) 832-3200; www.igenex.com). IGeneX will test the tick for the presence of the Lyme bacteria. They also test ticks for *Babesia microti* and/or *Babesia duncani* (formerly WA-1), Ehrlichia, Bartonella henselae and Rickettsia (Rocky Mountain Spotted Fever). All tick testing should be coordinated through WorkCare, AECOM's Corporate medical provider using the *S3NA-313-FM1 Tick Test Request Form*.
- If you experience symptoms such as fever, headache, fatigue, and a skin rash, you should immediately visit a medical practitioner as Lyme disease is treated easily with antibiotics in the early stages, but can spread to the heart, joints, and nervous system if left untreated.

4.6.4 Chiggers

- Chiggers are mite larvae, approximately ½ millimeter in size, and typically invisible to the naked eye. While chiggers are not known to carry infectious diseases, their bites and resulting rashes and itching can lead to dermatitis and a secondary infection.
- Chiggers are typically active from the last hard freeze in the winter or spring to the first hard freeze. They are active all year in the Gulf Coast and tropical areas.

4.6.5 Spiders

- Spiders can be found in derelict buildings, sheltered areas, basements, storage areas, well heads and even on open ground. Spiders can be found year round in sheltered areas and are often present in well heads and valve boxes.
- Most spider bites produce wounds with localized inflammation and swelling. The Black Widow and Brown Recluse spiders in the U.S. and others outside the U.S. inject a toxin that causes extensive tissue damage and intense pain.
- Additional information on spider identification can be found in attachment *S3NA-313-WI3 Poisonous Spider Identification*.

4.6.6 Mosquitoes

4.6.6.1 When a mosquito bites, it injects an enzyme that breaks down blood capillaries and acts as an anticoagulant. The enzymes induce an immune response in the host that results in itching and local inflammation. The tendency to scratch the bite sites can lead to secondary infections.

4.6.6.2 CDC data indicates that mosquito-borne illnesses, including the strains of encephalitis, are a health risk to field staff. At least one of the Encephalitis strains listed below is known to exist in every area of the U.S. and in many other countries as well:

- Eastern Equine encephalitis
- Western Equine encephalitis
- West Nile Virus
- St. Louis encephalitis
- La Crosse encephalitis

4.6.6.3 Mosquitoes can transmit the West Nile Virus and other forms of encephalitis after becoming infected by feeding on the blood of birds which carry the virus. Positive cases of West Nile Virus have been confirmed throughout North America since 2007.

4.6.6.4 Most people infected with the virus experience no symptoms or they have flu-like symptoms. Sometimes though, the virus can cause severe illness, resulting in hospitalization and even death, so proper precautions should be taken. Consult a medical practitioner if you suspect you have West Nile Virus. Other diseases including Dengue Fever and Malaria are spread by mosquitoes in the sub-tropic and tropical parts of the world. See *S3NA-313-WI4 Mosquito Borne Diseases* for information on the locations where mosquito borne diseases are known to be present.

4.6.7 Bees and Hornets

- Wasps and bees will cause a painful sting to anyone if they are harassed. They are of most concern for individuals with allergic reactions who can go into anaphylactic shock. Also, instances where an individual is exposed to multiple stings can cause a serious health concern for anyone. These insects are most likely to sting when their hive or nest is threatened.
- Bees, hornets, and wasps may be found in derelict buildings, sheltered areas, behind covers or lids and even on open ground. Other protective measures are not normally effective against aggressive, flying insects. Be aware of the potential areas for these types of insects, approach these locations cautiously and if you locate insect back away without disturbing. Avoid reaching into areas where visibility is limited".
- If stung by a wasp, bees, or hornet, notify a co-worker or someone who can help should you have an allergic reaction. Stay calm and treat the area with ice or cold water. Seek medical attention if you have any reactions to the sting such as developing a rash, excessive swelling or pain at the site of the bite or sting, or any swelling or numbness beyond the site of the bite or sting.

4.6.8 Fire Ants

- The fire ant (southern and western U.S.) and the European fire ant (northeastern U.S. and eastern Canada) is often very abundant where it is established. It is very aggressive and commonly climbs up clothing and stings unprovoked when it comes into contact with skin. Painful irritations will persist for an hour or more.

4.6.9 Poisonous Plants

4.6.10 Plants that field staff should recognize and take precautions to avoid include: poison sumac, poison ivy (terrestrial and climbing), poison oak, giant hogweed[1] (or giant cow parsnip), wild parsnip, devil's club and stinging nettle. Many others are extremely poisonous to eat (e.g., poison hemlock; water parsnip) – do not eat anything that has not been identified. Refer to *S3NA-313-WI5 Plants of Concern* for information on locations where some of these poisonous plants are found in the U.S.

- Poisonous plants including poison ivy, oak and sumac, which contain the oil urushiol that produces a rash, can lead to dermatitis and infections. Exposure to urushiol produces a rash that can be irritating and cause the exposed employee to scratch the affected area, increasing susceptibility for an infection. It should be noted that each time an employee is exposed to urushiol the severity of the reaction increases. In cases that involve severe rashes, medical treatment may be necessary to control the rash.
- Wild parsnip is found throughout the U.S. and contains a poison that produces a rash similar to poison oak and ivy. Unlike poison oak and ivy, the active oil will not be present on unbroken leaves. See *S3NA-313-WI6 Wild Parsnip Identification* for additional information and photos of wild parsnip.

[1] Phytodermatisi producer: keep skin covered and wash well after exposure

- Of the toxic plants in the cashew family, poison ivy (*Rhus radicans*) is most widespread. It grows as ina a variety of forms from a low sprawling shrub, dense ground cover, and or a thick woody vine that grows high into the tree canopy. Poison oak (*Rhus diversiloba*) is typically a low shrub in drier soils. Both of these plants have leaves of three and white berries. Poison sumac (*Rhus vernix*) is a tall shrub that is less prolific in distribution. It grows in wet areas, has a compound leaf with a red leaf stem (rachis), and white berries. All of these plants possess urushiol oils in nearly all parts of the plant. Touching the plant causes an itchy skin rash that shows up several days following contact. People have a wide range of reactions which in severe cases can lead to oozing blisters on large parts of the body. Some people apparently never react and others who have never had a reaction may develop an allergy after years of frequent contact.
- Several plants in the carrot family contain toxic sap that causes severe dermatitis if it comes into contact with skin that is then exposed to sunlight. The most serious reaction is caused by the giant hogweed (*Heracleum mantegazzianum*), a plant that is spreading in southern Ontario and is also present in southwestern British Columbia. The plant is enormous, attaining up to 16 feet (5 meters) in height, which it does in one growing season. Contact causes painful blistering that can cause permanent disfigurement. It is to be avoided. Similar but less serious reactions can be caused by meadow parsnip (*Pastinaca sativa*) and cow parsnip (*Heracleum lanatum*). Meadow parsnip can be very abundant on disturbed sites.
- Nettles, particularly stinging nettle (*Urtica dioica*) and wood nettle (*Laportea canadensis*) contain urticating hairs on the leaves and stems that cause sharp pain or itchiness on contact with skin. The irritation is immediate and normally lasts no more than an hour and there are no lasting consequences.
- Some plants contain abundant stiff spines that can present a safety hazard, particularly if one is to fall into them. These include the cactus (*Opuntia spp.*), devils club (*Oplopanax horridum*), and prickly-ash (*Zanthoxylon americanum*).

4.6.11 A large number of plants are not harmful to touch but may contain poisonous berries or foliage that could cause serious complications or death if they are ingested. It goes without saying to not eat any berries or plants if you are unsure of their identity.

4.6.12 Giant hogweed presents the most serious health risk. Field staff should learn to recognize and avoid it if encountered.

4.6.13 Employees / Field Staff who develop a rash as a result of exposure to poisonous plants shall report the exposure immediately to their Supervisor or Project Manager who will then forward the report to the Region SH&E Manager.

4.7 Additional Wildlife Hazards (Wild Animals, Reptiles and Birds)

4.7.1 Refer to following for protection and prevention:

- *S3NA-313-WI11 Large Carnivores*
- *S3NA-313-WI12 Bear Safety*
- *S3NA-313-WI13 Small Mammals*
- *S3NA-313-WI14 Snakes*
- *S3NA-313-WI15 Alligators*

4.7.2 Bird Droppings

Bird excrement may be encountered due to the nesting of pigeons and other birds and winged animals (e.g., bats) on or in structures. Substantial accumulations of droppings can pose physical and health risks as slippery surfaces (if wet) and if the material is disturbed and becomes airborne, it can be inhaled or ingested if personal hygiene practices are not implemented. Inhalation of airborne droppings can cause diseases such as histoplasmosis. Exposure to surfaces with bird

droppings shall be safeguarded by implementing proper work practices, training employees for awareness and using PPE. See *S3NA-313-WI10 Bird Droppings Safe Work Practices*.

4.8 Personal Protective Equipment (PPE)

4.8.1 The selection of PPE is dependent on the hazard present and a Task Hazard Analysis (THA) should be conducted to determine situation-specific PPE required refer to *S3NA-208-PR1 Personal Protective Equipment Program*.

4.8.2 At a minimum, in addition to any project-specific PPE, long sleeves and pants should be worn on field projects where the risk of biological encounter exists.

4.8.3 PPE for insects should include insect repellent, bug nets, bug jackets, or similar deterrents. Socks should be pulled over pant legs where the threat of exposure is anticipated.

4.8.4 Epi-pens[2] or other personal medication should be carried by those staff that is aware that anaphylactic shock is a possibility for them.

4.9 Personal Precautions and Personal Protective Measures

4.9.1 Precautions

- Be aware of the potential irritants in your area and know how to recognize them.
- Modify activities to avoid encounters (diurnal rhythms, seasonal rhythms).
- Wear protective clothing.
- When working in areas where there may be small insects that "hitchhike" (e.g., ticks, spiders, scorpions), it is recommended that clothes are turned inside out and shaken at the end of day; do not wear same clothes two days in a row.
- Staff should always be aware of where they are placing their hands, or where they are sitting in order to avoid contact with potential toxins.

4.9.2 Insects, Spiders, and Ticks

- Chemically-treated field clothing, full-length clothing, or Tyvek® coveralls.
- Use of Permethrin to treat field clothing.
- Application of insect repellent to clothing and/or exposed skin.
- Routine personal checks.
- Exercise care when collecting samples and avoid reaching into areas where visibility is limited. If stung by an insect or bitten by a spider or tick, attempt to identify the attacker and notify a co-worker or someone who can help should the bite site become painful, discolored, or swollen. Stay calm and treat the area with ice or cold water. Seek medical attention if you have any reactions to the sting such as developing a rash, excessive swelling or pain at the site of the bite, or any swelling or numbness beyond the site of the bite.
- Oil of lemon eucalyptus, DEET, and Permethrin have been recommended by the CDC for effective protection against mosquitoes that may carry the West Nile virus and related diseases.
- Note that DEET will reduce the effectiveness of Fire Resistance Clothing (FRC) and should not be applied to this clothing. If working in FRC, **field staff** can apply DEET to their skin and let dry prior to putting FRC on, or use Permethrin as it has been shown not to reduce the effectiveness of FRC. Permethrin will need to be applied to FRC well in advance of the planned work.

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[1] *Epi-pens must be prescribed by a personal physician. Renew epi-pens on a regular schedule to ensure effectiveness and make sure your field companions know where it is and how to use it if you cannot self administer the dose.*

4.9.3 Poisonous Plants

- **Field staff** conducting clearing, grubbing, or similarly disturbing work activities in areas where poisonous plants exist shall wear either long-sleeve clothing or Tyvek® coveralls, and disposable cotton, leather or synthetic gloves. **Field Staff** must not touch exposed skin (neck and face) with potentially contaminated gloves. Tyvek® and gloves worn to protect from exposure to poisonous plants will be treated as contaminated, removed from the body in a manner that the contamination is not spread, and placed in plastic bags for disposal.
- Personal clothing that has been exposed to poisonous plants shall be decontaminated with a poisonous plant cleanser such as Tecnu® or removed in a careful manner, bagged and washed separately from other clothing to remove urushiol.
- For dermatitis caused by poison ivy, poison oak, or poison sumac, calamine lotion is effective.
- Work boots will be decontaminated with either soap and water or a cleansing agent such as Tecnu® cleanser.
- Remember that in the fall and winter the hazard still exists in the form of stubble and roots.
- **Employees / Field Staff** who develop a rash as a result of exposure to poisonous plants shall report the exposure immediately to their **Supervisor** or **Project Manager** who will forward the report to the **Region SH&E Manager**.

4.9.4 PPE Recommendations

The following recommendations may be considered by the project team to determine if the use of PPE is necessary for the type of work planned:

- Disposable gloves may be cotton, leather, or synthetic materials and must not be reused after removing.
- Clearing activities present the greatest risk to **field staff** exposure but reduce the risks once completed. Recommendation – Use full protection from ticks and insects during the clearing activities including insect repellents, Tyvek® coveralls, and gloves.
- If the foliage being cleared includes poisonous plants, exposed skin will be treated with a dermal barrier cream such as Tecnu®'s Oak 'n Ivy Armor or Enviroderm's Ivy Block and either a full-face respirator or a half-face respirator (with goggles) fitted with a P-100 (HEPA) dust filter.
- Work in habitats with direct exposure to ticks, mosquitoes, and poisonous plants is likely and the scope of work does not allow for worksite control measures like vegetative clearing: Recommendation – Full protection from biological hazards including insect repellents, Tyvek® coveralls or full-length clothing, poisonous plant barrier creams and wipes, and gloves.
- Work in habitats with direct exposure to ticks and mosquitoes and no exposure to poisonous plants is likely and the scope of work typically does allow for worksite control measures like vegetative clearing: Recommendation – Protection including insect repellents and Tyvek® coveralls or full-length clothing.
- Work in habitats with direct exposure to poisonous plants and no exposure to ticks or insects is likely and the scope of work does not allow for worksite control measures like vegetative clearing: Recommendation – Full protection from poisonous plants including insect repellents, Tyvek® coveralls or full-length clothing, poisonous plant barrier creams and wipes, and gloves.
- Industrial/Commercial/Office Facilities – Direct contact with biological hazards is considered unlikely or low risk: Recommendation – PPE for biological hazards are not required; however, Tyvek coveralls and insect repellentrepellent should be available if exposure to spiders, flying insects, or other biological hazards is encountered.
- Work in areas where no biological hazards are expected because of the local environment, winter weather, or property development: Recommendation – PPE for biological hazards is not

required; however, Tyvek® coveralls and insect repellentrepellent should be available if exposures to spiders, flying insects, or other biological hazards are encountered.

4.9.5 Selection and Configuration of Field Clothing

4.9.5.1 See *S3NA-313-WI7 Configuration Clothing for Protection* against ticks and insects for illustrations and instructions for configuring, taping, and tucking clothing.

4.9.5.2 At a minimum, field staff will wear long-legged pants and long-sleeve shirts or Tyvek® coveralls to reduce the amount of exposed skin when biological hazards are identified at the work site. Gloves will also be worn consistent with the recommendations of the site-specific SWP, HASP and/or THA to minimize hand exposure.

4.9.5.3 Where ticks, chiggers, and spiders are presumed to exist, the Tyvek® or chemically treated clothing will be taped to the work boots.

4.9.5.4 Chemical Treatment of Field Clothing

Oil of lemon eucalyptus, DEET, and Permethrin have been recommended by the CDC for effective protection against mosquitoes that may carry the West Nile virus and related diseases.

4.9.5.4.1 Lemon Eucalyptus

Lemon Eucalyptus is a plant-based insect repellent on the market as Repel Lemon Eucalyptus. The products have been proven to be effective against mosquitoes, deer ticks, and no-see-ums for up to six hours. Derived from Oil of Lemon Eucalyptus, this non-greasy lotion or spray has a pleasant scent and is not known to be toxic to humans. The spray or lotions will be effective for approximately two to six hours and should be reapplied every two hours to sustain protection. Lemon Eucalyptus products cannot be applied to fire retardant clothing.

4.9.5.4.2 DEET

Note that DEET will reduce the effectiveness of FRC and should not be applied to this clothing. If working in FRC, field staff can apply DEET to their skin prior to putting FRC on, or use Permethrin as it has been shown not to reduce the effectiveness of FRC. Permethrin will need to be applied to FRC well in advance of the planned work.

4.9.5.4.3 Permethrin

- When selected as part of a project's PPE requirements, the **AECOM Project Manager** shall ensure that field teams wear clothing treated with the chemical Permethrin, which is an insecticide with repellent properties registered with the Environmental Protection Agency and recommended by the CDC. Information regarding the toxicity and product safety of Permethrin is provided in *S3NA-313-WI8 Insect Repellent Active Ingredient Product Information*. Permethrin is highly effective in preventing tick bites when applied to clothing, but is not effective when applied directly to the skin. Two options are available for Permethrin treatment of clothing worn during field work: 1) pre-treatment of fabric by the clothing manufacturer; or 2) persons treatment of their personal clothing using 0.5 percent Permethrin spray. AECOM strongly recommends the first option (**field staff** obtaining pre-treated clothing) to avoid the time required, potential risk, and housekeeping issues involved with manually treating the clothing with spray. Purchase pre-treated clothing in accordance with *S3NA-208-PR1 Personal Protective Equipment Program* and with the approval of your **Supervisor** or **Project Manager**. For more information visit the AECOM Americas SH&E website.

- The Permethrin pre-treatment is odorless and retains its effectiveness for approximately 25 washings. After 25 washings, the pre-treated clothing will be considered no longer effective and removed from service. Clothing that has been manually treated **field staff** will be considered effective for five wash cycles.
- Also, use of clothing that has been pre-treated with Permethrin offers a reduction in the use and application of other insect repellents that must be applied directly to the skin. Costs for clothing shall be charged to projects as a consumable item. If charging to the project is not possible, the charges should be managed as an operational expense. **Supervisor** or **Project Manager** approval is required prior to purchase.
- If the **employee / field staff** opts not to utilize chemically pre-treated clothing while potentially exposed to insects, spiders and/or ticks, they must either: 1) wear Tyvek® coveralls taped to the boots, or 2) wear full-length clothing consisting of long-legged pants and long-sleeved shirts treated with an insect repellent containing Permethrin, DEET, or an organic alternative to their work clothing.

4.9.5.5 Manual Treatment of Field Clothing

- If clothing pre-treated with Permethrin is not available or not purchased prior to field work, field staff may manually treat their clothing with Permethrin spray. The outer surfaces of all external clothing to be worn during field work should be treated with 0.5 percent Permethrin spray a minimum of 2 to 4 hours prior to field work (boots, trousers, shirt, jackets, rain gear) in accordance with recommendations provided by the New York State Department of Health presented in *S3NA-313-WI9 New York Department of Health Recommendations for Permethrin Application*. This will likely require treatment at home or the office prior to field mobilization. Caution should be used when applying Permethrin as it is highly toxic to fish and house cats. Clothing treatment will last for approximately five wash cycles (check the specific instructions for the product used.) Purchase of PPE and Repellents and Lotions
- Costs for clothing, repellents, lotions, and other PPE shall be charged to projects as a consumable item. If charging to the project is not possible, the charges should be managed as an operational expense. **Supervisor** or **Project Manager** approval is required prior to purchase.
- Material Safety Data Sheets (MSDS) for the repellents, lotions, and cleansers discussed in this Procedure are not required because the repellents, lotion, and clothing are consumer products used in the manner intended for the general public. Although not required, a MSDS should be obtained for the products used and placed into the office MSDS library and site-specific health and safety plans. Selected MSDSs are available on the AECOM Americas SH&E website.

4.10 Personal Hygiene and Body Checks

4.10.1 Tick-borne diseases typically require that the tick be imbedded for four hours to begin disease transfer. The oils from poisonous plants can take up to 4 hours after exposure to penetrate the skin and react with the live proteins under the skin.

4.10.2 It is recommended that exposed skin be checked frequently for the presence of ticks, insects, rashes, or discolorations. External clothing should also be checked for the presence of ticks and insects; these should be retained for identification and to determine if medical treatment is needed.

4.10.3 Field Staff will shower as soon as practical after working in the field and examine their bodies for the presence of ticks, insect bites, rashes, or swollen areas. If imbedded ticks are found, they should be removed using the technique described in *S3NA-313-WI2 Ticks*, the tick should be preserved with the date and location of the bite noted, and retained for identification if medical treatment is needed as described in Section 4.10 of this Procedure.

4.10.4 The presence of an imbedded tick, rash, or abnormal reactions will be reported as an SH&E Incident to the Project Manager or Supervisor who will forward the report to the Region SH&E Manager for follow up.

4.11 Training

4.11.1 Field staff must learn to recognize organisms that represent a threat in the regions in which they work – experienced field staff must provide on the job training to assist staff with hazard recognition.

4.11.2 Field staff who have severe allergic reactions are strongly recommended to notify their Project Manager, field Supervisor and Employees of the potential for a reaction and demonstrate what medication they might need and how it is administered.

4.12 Remedies / Exposure

4.12.1 If you suspect exposure to an irritant, identify the cause including obtaining a specimen if possible. Document the occurrence as a safety precaution if the exposure should lead to complications. There is a host of over the counter treatment options available for exposures to various biological hazards.

4.12.2 Report the incident, call WorkCare for advice, or consult a private doctor if necessary, refer to the *S3NA-004-PR1 Incident Report* procedure for more specifics.

5.0 Records

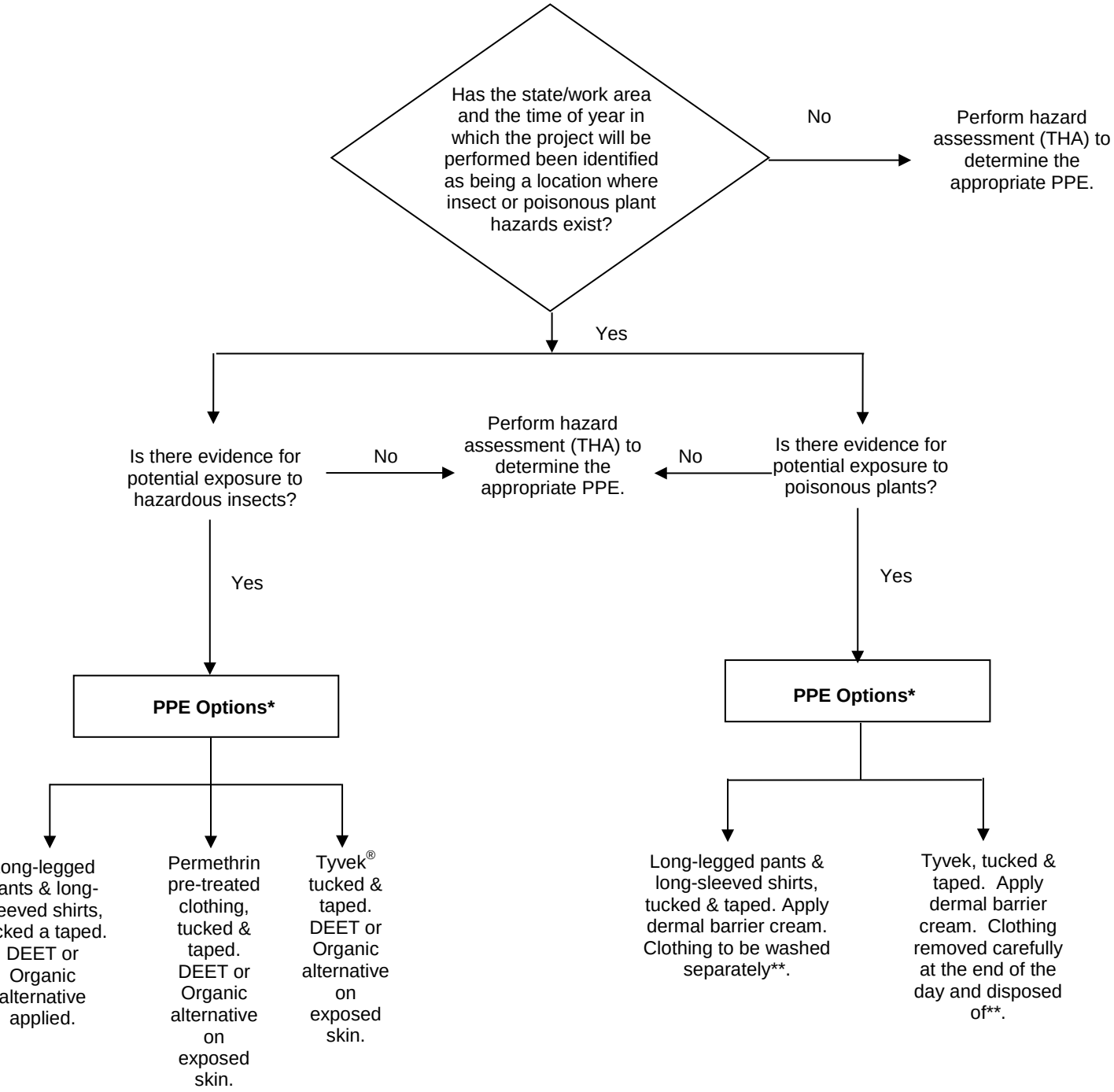
None

6.0 Attachments

6.1	S3NA-313-WI1	Biological Hazard Assessment Decision Flow Chart
6.2	S3NA-313-WI2	Ticks
6.3	S3NA-313-WI3	Poisonous Spider Identification
6.4	S3NA-313-WI4	Mosquito Borne Diseases
6.5	S3NA-313-WI5	Plants of Concern
6.6	S3NA-313-WI6	Wild Parsnip Identification
6.7	S3NA-313-WI7	Configuration Clothing for Protection against ticks and insects
6.8	S3NA-313-WI8	Insect Repellent Active Ingredient Product Information
6.9	S3NA-313-WI9	New York Department of Health Recommendations for Permethrin Application
6.10	S3NA-313-WI10	Bird Droppings Safe Work Practices
6.11	S3NA-313-WI11	Large Carnivores
6.12	S3NA-313-WI12	Bear Safety
6.13	S3NA-313-WI13	Small Mammals
6.14	S3NA-313-WI14	Snakes
6.15	S3NA-313-WI15	Alligators
6.16	S3NA-313-FM1	Tick Test Request Form

Americas

Biological Hazard Assessment Decision Flow Chart (U.S.) S3NA-313-WI1



* indicates that when both insect and poisonous plant hazards are recognized hazards at a project site, the most conservative combination of the available PPE choices will be selected.

** indicates that clothing that has been known or suspected to have come in contact with poisonous plants must be washed before it can be worn again. Similarly, Tyvek® that has been known or suspected to have come in contact with poisonous plants will be disposed of rather than reused during a subsequent day or project.

State by State Guideline for Exposure

States	Tick-Borne Diseases	Mosquito-Borne Diseases	Poisonous Plants
Alabama	Year Round Low Risk	Year Round	Year Round
Alaska	No Risk	No Risk	No Risk
Arizona	No Risk	March - July	March - November
Arkansas	March - November	March - November	March - November
California	Low Risk	March - November	Year Round
Colorado	Low Risk	March - November	No Risk
Connecticut	March - November	Low Risk March - November	March - November
Delaware	March - November	Low Risk March - November	March - November
Florida	Year Round Low Risk	Year Round	Year Round
Georgia	Year Round Low Risk	Year Round	Year Round
Hawaii	No Risk	No Risk	No Risk
Idaho	No Risk	Low Risk March - November	No Risk
Illinois	March - November	March - November	March - November
Indiana	March - November	March - November	March - November
Iowa	March - November	March - November	March - November
Kansas	Low Risk	March - November	March - November
Kentucky	March - November	March - November	March - November
Louisiana	Year Round Low Risk	Year Round	Year Round
Maine	March - November	March - November	March - November
Maryland	March - November	Low Risk	March - November
Massachusetts	March - November	March - November	March - November
Michigan	March - November	March - November	March - November
Minnesota	March - November	March - November	March - November
Mississippi	Year Round	Year Round	Year Round
Missouri	March - November	March - November	March - November
Montana	Low Risk March - July	Low Risk March - July	No Risk
Nebraska	Low Risk	Low Risk	Low Risk
Nevada	Low Risk March - July	Low Risk March - July	Low Risk March - November
New Hampshire	March - November	March - November	March - November
New Jersey	March - November	March - November	March - November
New Mexico	No Risk	Low Risk March - July	No Risk
New York	March - November	March - November	March - November
North Carolina	March - November	March - November	March - November
North Dakota	No Risk	March - November	No Risk
Ohio	Low Risk March - November	March - November	March - November
Oklahoma	March - November	Low Risk March - November	March - November
Oregon	Low Risk March - November	Low Risk March - November	March - November
Pennsylvania	March - November	March - November	March - November

States	Tick-Borne Diseases	Mosquito-Borne Diseases	Poisonous Plants
Puerto Rico	???	Low Risk March - November	Year Round
Rhode Island	March - November	Low Risk March - November	March - November
South Carolina	March - November	Low Risk March - November	March - November
South Dakota	Low Risk March - November	March - November	March - November
Tennessee	March - November	March - November	March - November
Texas	Year Round Low Risk	Year Round	Year Round
Utah	Low Risk March - July	Low Risk March - July	No Risk
Vermont	March - November	Low Risk March - November	March - November
Virginia	Low Risk March - November	March - November	March - November
Washington	Low Risk March - November	Low Risk March - November	March - November
West Virginia	Low Risk March - November	March - November	March - November
Wisconsin	March - November	March - November	March – November
Wyoming	No Risk March - July	Low Risk March - July	No Risk

Americas

Ticks

S3NA-313-WI2

1.0 Background

1.1 The Public Health Agency of Canada works with the Provinces, health authorities and other experts on research to define and monitor the occurrence of the ticks that carry *Borrelia burgdorferi*, the bacterium that causes Lyme disease. In Canada, the black-legged tick (*Ixodes scapularis*; often referred to as a deer tick) and the western black-legged tick (*Ixodes pacificus*) are the species known to transmit this disease-causing agent, as well as other less common agents.

1.2 In Quebec, black-legged tick populations are becoming established in parts of the Monteregie and Estrie regions in the southeast of the province. In Ontario, populations can be found in Long Point; Point Pelee National Park; Rondeau Provincial Park; Turkey Point; Prince Edward Point National Wildlife Area and St. Lawrence Islands National Park in the Thousand Islands region of eastern Ontario. In Nova Scotia, black-legged tick populations are found in the Lunenburg, Bedford and Shelburne areas. An established population has also been found in the southeastern corner of Manitoba. Western black-legged ticks, on the other hand, are found in British Columbia; they are fairly widely distributed but populations are largest in the lower mainland, on Vancouver Island, and in the Fraser Valley.

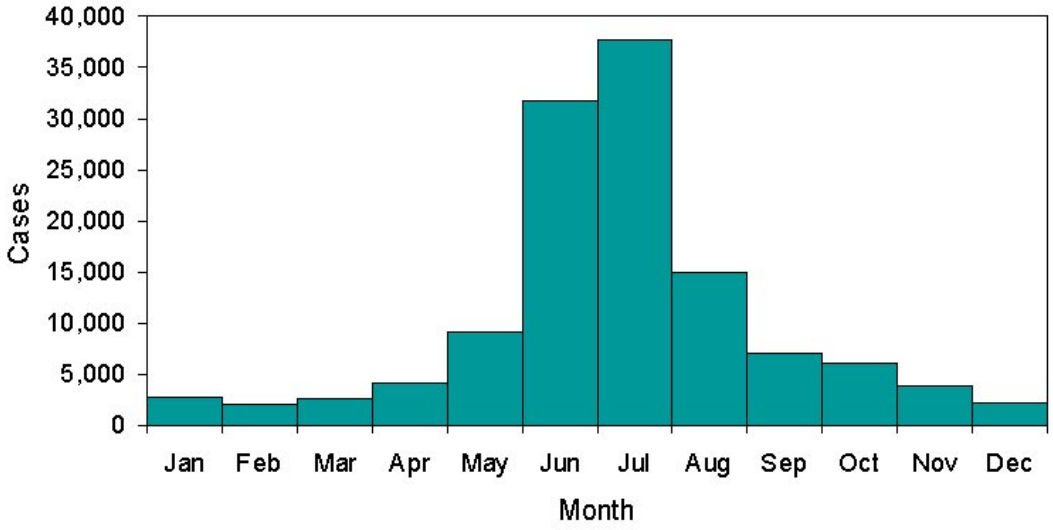
1.3 Although the distribution of black-legged ticks in Canada appears to be limited, surveillance indicates that some of the established populations are spreading within certain areas of southern Canada. The potential expansion of localized tick populations makes it difficult to precisely define the geographic limits of any given population; however, people living in or visiting areas adjacent to established tick populations may have a greater chance of contact with blacklegged ticks. Although current evidence does not suggest a widespread distribution of blacklegged tick populations in Canada, the establishment of new populations appears to be an ongoing process. Hence, it is desirable to continue surveillance and to take precautions to reduce tick contact.

1.4 The rate of infection of ticks with the bacterium that causes Lyme disease varies. Infection rates are typically higher in adult ticks compared to the other stages (nymphs and larvae). Despite the lower rates of infection, people are most likely to acquire Lyme disease from a nymph because this stage is so small and thus more likely to go unnoticed and feed for a sufficient amount of time for the Lyme disease bacterium to be transmitted (24-36 hours). Infection rates are often greater in tick populations that have been established for long periods of time (such as Long Point) compared to newly established ones. As many as 60 percent of the adult ticks at Long Point are infected; however, infection rates in adults are more often between 10 and 25 percent at the other localities where ticks are established. Partly because of differences in the types of hosts that they feed upon, infection rates of the Lyme disease agent in *Ixodes pacificus* are much lower (1-3 percent) than *Ixodes scapularis*.

1.5 While there is a higher risk of coming in contact with infected black-legged ticks in areas where populations are established, there is also a low risk of Lyme disease being contracted almost anywhere in Canada because migratory birds transport infected ticks over large geographic distances. Surveillance data indicates that about 12 percent of the ticks detected outside of areas where tick populations are established, and likely transported there on migratory birds, are infected with the agent of Lyme disease.

1.6 Source: http://www.phac-aspc.gc.ca/id-mi/tickinfo-eng.php

Figure 1 Reported Cases of Lyme Disease by Month of Illness Onset United States, 1992-2004



Lyme disease patients are most likely to have illness onset in April through November with onset peaking in June, July, or August and less likely to have illness onset from December through March.

http://www.cdc.gov/ncidod/dvbid/lyme/ld_rptmthofill.htm

2.0 Tick Removal Tips from CDC

http://www.cdc.gov/ncidod/dvrd/ehrlichia/Q&A/Q&A.htm

3.0 To Remove Attached Ticks

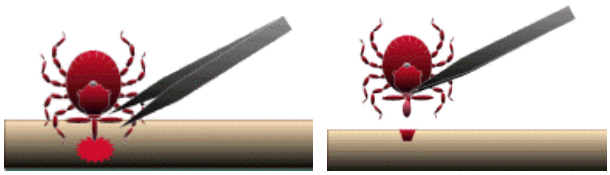
3.1 Use fine-tipped tweezers or notched tick extractor, and protect your fingers with a tissue, paper towel, or latex gloves (see figure). Persons should avoid removing ticks with bare hands.

3.2 Grasp the tick as close to the skin surface as possible and pull upward with steady, even pressure. Do not twist or jerk the tick; this may cause the mouthparts to break off and remain in the skin. (If this happens, remove mouthparts with tweezers. Consult your health care provider if illness occurs.)

3.3 After removing the tick, thoroughly disinfect the bite site and wash your hands with soap and water.

3.4 Do not squeeze, crush, or puncture the body of the tick because its fluids may contain infectious organisms. Skin accidentally exposed to tick fluids can be disinfected with iodine scrub, rubbing alcohol, or water containing detergents.

3.5 Save the tick for identification in case you become ill. This may help your doctor make an accurate diagnosis of potential diseases by determining what type of tick it is. Place the tick in a sealable plastic bag and put it in your freezer. Write the date of the bite on a piece of paper with a pencil and place it in the bag.



4.0 Devices Designed for Removing Ticks

4.1 http://www.tickkey.com/

4.2 The Tick Tool - http://www.ticktool.com/index.html

5.0 Folklore Remedies Don't Work

5.1 Folklore remedies, such as the use of petroleum jelly or hot matches, do little to encourage a tick to detach from skin. In fact, they may make matters worse by irritating the tick and stimulating it to release additional saliva or regurgitate gut contents, increasing the chances of transmitting the pathogen. These methods of tick removal should be avoided.

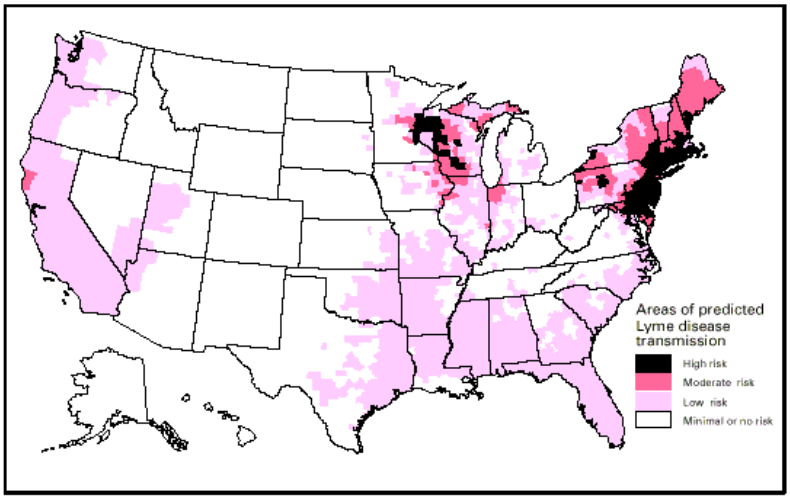
6.0 Information Regarding Common Tick-Borne Diseases

Table 1 Common Tick-Borne Diseases in the U.S. and Information Resources

Disease	Tick Species	CDC Informational Web Pages
Lyme disease	• Black-legged or deer tick • Western black legged tick	http://www.cdc.gov/ncidod/dvbid/lyme/
Ehrlichiosis	• Lone star tick • Black-legged or deer tick • Western black legged tick	http://www.cdc.gov/Ncidod/dvrd/ehrlichia/Index.htm
Rocky Mountain spotted fever	• American dog tick • Rocky Mountain wood tick • Brown dog tick	http://www.cdc.gov/ncidod/dvrd/rmsf/index.htm

7.0 Distribution

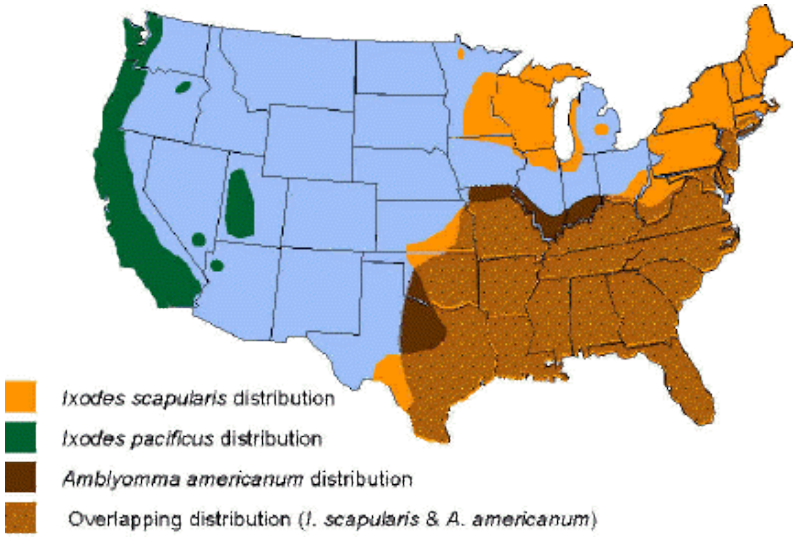
Figure 2 Distribution Map for Lyme Disease Risk, U.S.



Note: This map demonstrates an approximate distribution of predicted Lyme disease risk in the United States. The true relative risk in any given county compared with other counties might differ from that shown here and might change from year to year. Risk categories are defined in the accompanying text. Information on risk distribution within states and counties is best obtained from state and local public health authorities.

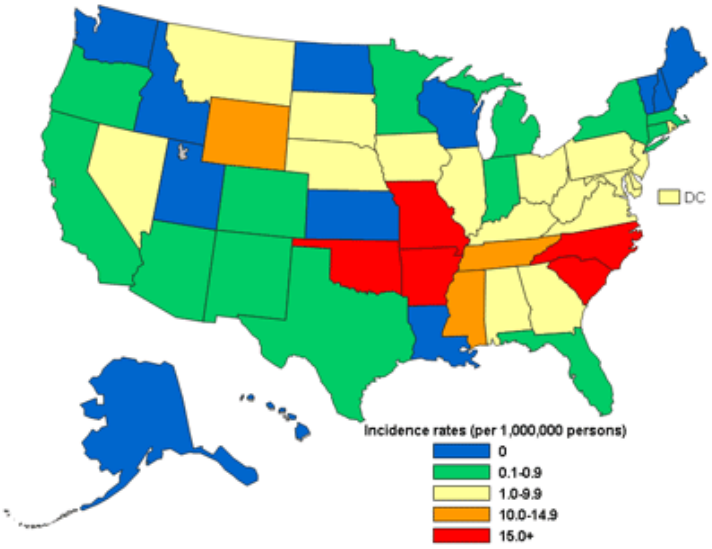
Source: CDC, http://www.cdc.gov/ncidod/dvbid/lyme/riskmap.htm

Figure 3 Distribution Map of Vector Tick Species for Human Ehrlichiosis, U.S.



Source: CDC, http://www.cdc.gov/ncidod/dvrd/ehrlichia/Q&A/Q&A.htm

Figure 4 Distribution Map of Annual Incidence of Rocky Mountain Spotted Fever, U.S



Data for calendar year 2002

Source: CDC, http://www.cdc.gov/ncidod/dvrd/rmsf/Epidemiology.htm

Americas

Poisonous Spider Identification

S3NA-313-WI3

Black Widow Spider

- Abdomen usually shows hourglass marking.
- The female is 1 to 1.5 inches (3-4 centimeters) in diameter.
- Have been found in well casings and flush-mount covers.
- Not aggressive, but more likely to bite if guarding eggs.
- Light, local swelling and reddening of the bite are early signs of a bite, followed by intense muscular pain, rigidity of the abdomen and legs, difficulty breathing, and nausea.
- If bitten, see physician as soon as possible.

Brown Spiders (Recluse)

- Central and South U.S., although in some other areas, as well.
- 0.25-to 0.5-inch (0.6 to 1.3 centimeters)-long body and the size of silver dollar.
- Hides in decaying wood, baseboards, ceilings, cracks, and undisturbed piles of material.
- Bite either may go unnoticed or may be followed by a severe localized reaction, including scabbing, necrosis of affected tissue, and very slow healing.
- If bitten, see physician as soon as possible.

Exercise care when collecting samples and avoid reaching into areas where visibility is limited. If bitten by a spider, attempt to identify the spider, notify a co-worker or someone who can help should the bite site become painful, discolored, or swollen. Stay calm and treat the area with ice or cold water. Seek medical attention if you have any reactions to the sting such as developing a rash, excessive swelling or pain at the site of the bite or any swelling or numbness beyond the site of the bite.

Additional U.S. Spider Identification charts are available at http://www.termite.com/spider-identification.html

Americas

Mosquito-Borne Diseases

S3NA-313-WI4

1.0 Background

1.1 CDC data indicates that mosquito-borne illnesses, including encephalitis, are a health risk to employees working in outdoor environments.

1.2 Mosquitoes pose a risk of causing infection with various forms of encephalitis and other diseases in AECOM employees. This section will focus on the transmission of encephalitis. West Nile encephalitis is an infection of the brain that is caused by a virus known as the West Nile virus.

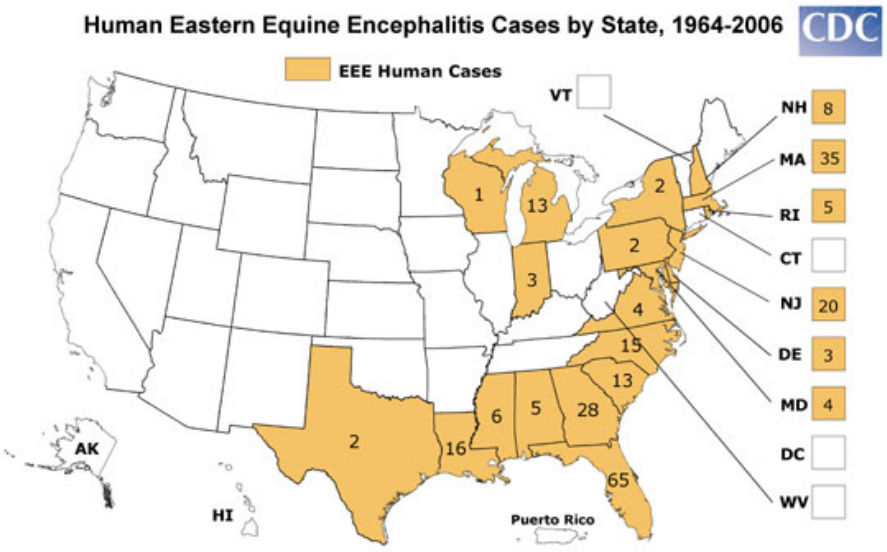
1.3 If other mosquito-borne diseases are identified in the project area, the local Public Health Department and Center for Disease Control and Prevention (CDC) should be consulted to determine what diseases are present and exposure prevention recommendation.

1.4 According to the CDC, arboviral encephalitis is a virus that is "maintained in nature through biological transmission between susceptible vertebrate hosts by blood feeding arthropods", e.g., mosquitoes. It exists in various forms in global distribution, and in four primary forms in the U.S.: 1) eastern equine encephalitis (EEE), 2) western equine encephalitis (WEE), 3) St. Louis encephalitis (SLE), and 4) La Crosse (LAC) encephalitis; all of which are transmitted by mosquitoes.

1.5 Mosquitoes are known to breed in standing water; therefore, when standing water is found at a job site, actions should be taken to drain the water. Typically, mosquitoes will fly only a quarter of a mile (400 meters) from their breeding location.

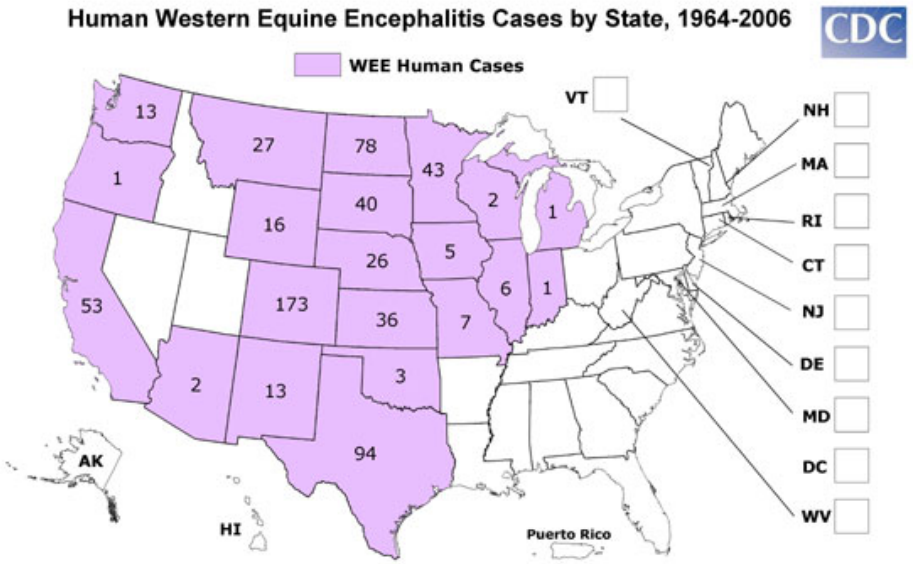
2.0 Distribution

Figure 1 Distribution Map for EEE Cases



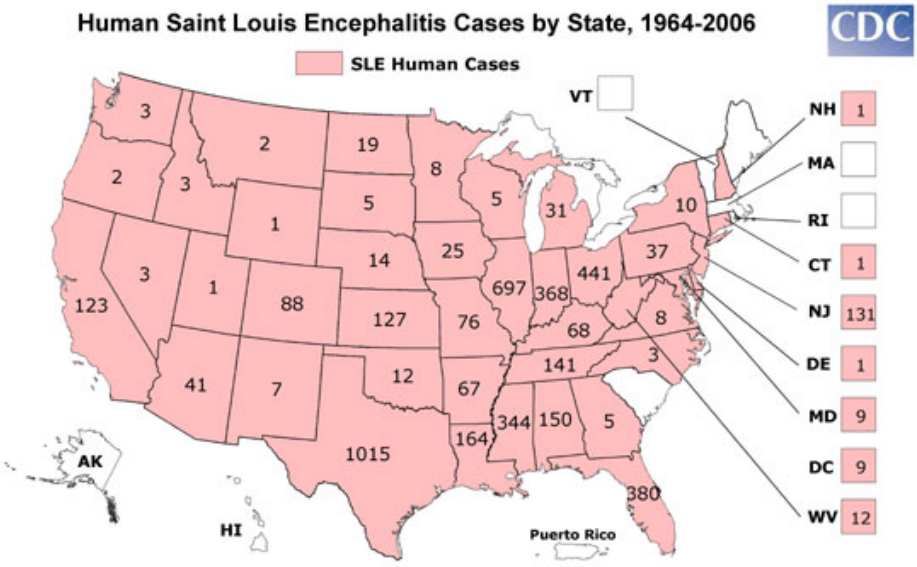
Source: http://www.cdc.gov/ncidod/dvbid/arbor/images/EEE_Map.jpg

Figure 2 Distribution Map for WEE Cases



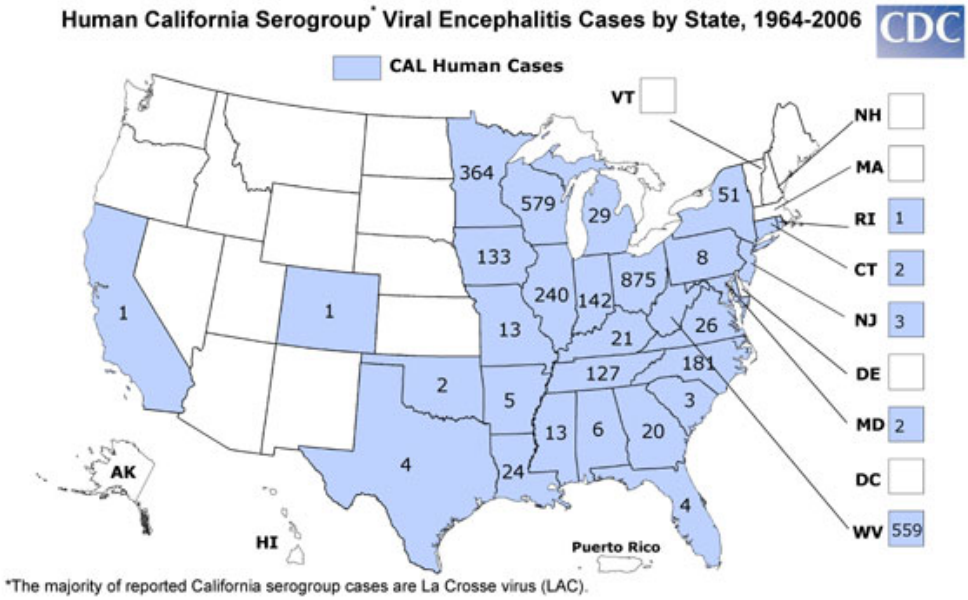
Source: http://www.cdc.gov/ncidod/dvbid/arbor/images/WEE_Map.jpg

Figure 3 Distribution Map for SLE Cases



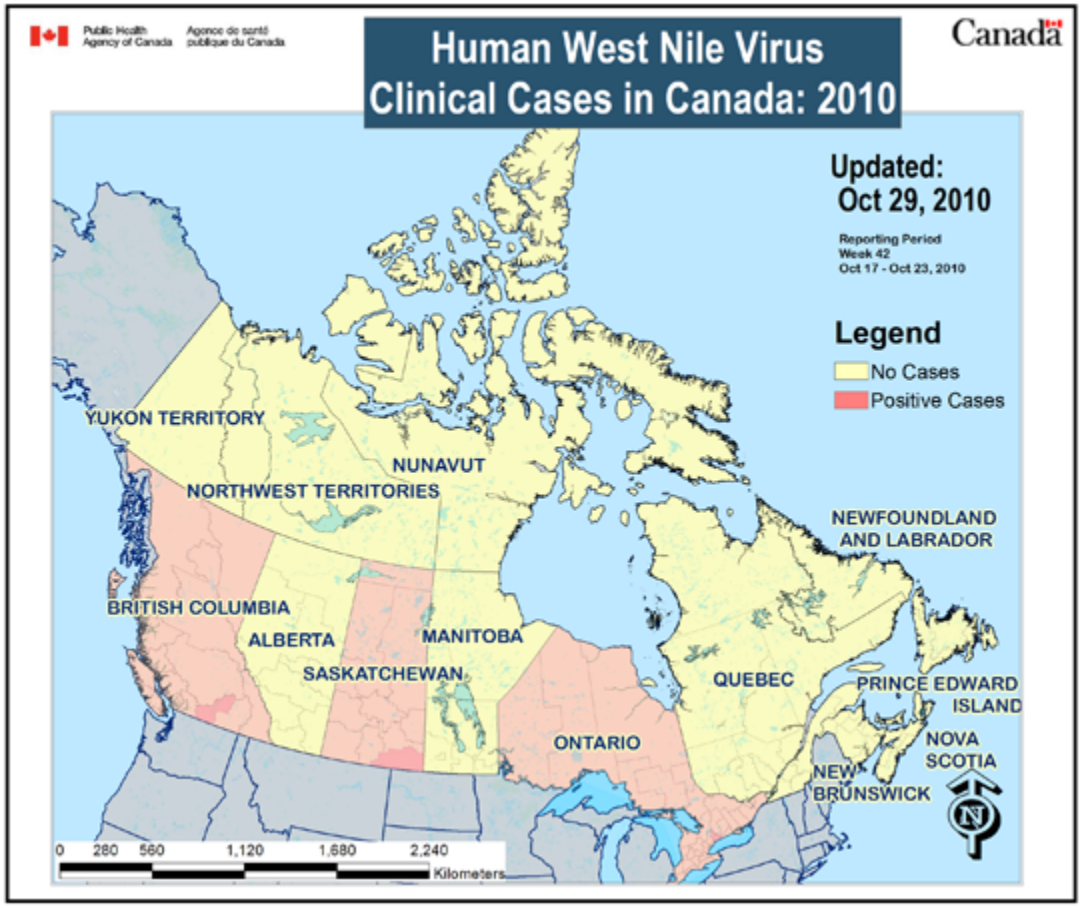
Source: http://www.cdc.gov/ncidod/dvbid/arbor/images/SLE_Map.jpg

Figure 4 Distribution Map for LAC Encephalitis Cases



Source: http://www.cdc.gov/ncidod/dvbid/arbor/images/LAC_Map.jpg

Canadian Mosquito Borne Diseases



Source: http://www.eidgis.com/wnvmonitorca/

Disease	Distribution
California encephalitis	Canada-wide
Western equine encephalitis	Western Canada
Eastern equine encephalitis	Quebec, Ontario
St Louis encephalitis	Ontario, Quebec, Manitoba, Saskatchewan
Cache Valley	Ontario, Manitoba, Saskatchewan, Alberta

Source: Paediatr Child Health. 2000 May–Jun; 5(4): 206–212.

Americas

Plants of Concern

S3NA-313-WI5

1.0 Background

1.1 Poison ivy, oak and sumac (poisonous plants) pose a significant threat to AECOM employees due to the dermatitis that results from exposure to the oil on these plants, called urushiol.

1.2 Exposure to urushiol produces a rash that can be irritating and cause the exposed employee to scratch the infected area, increasing susceptibility for an infection to result from the rash.

1.3 It should be noted that each time an employee is exposed to urushiol, it increases the severity of the reaction they will have in subsequent exposures.

2.0 Treatment

2.1 In cases that involve severe rashes, medical treatment may be necessary to control the rash.

2.2 Employees that develop a rash as a result of exposure to poison ivy, oak or sumac should report the exposure immediately to their Supervisor, Project Manager and Region Safety, Health and Environment Manager.

Figure 1 Distribution Map for Poison Ivy

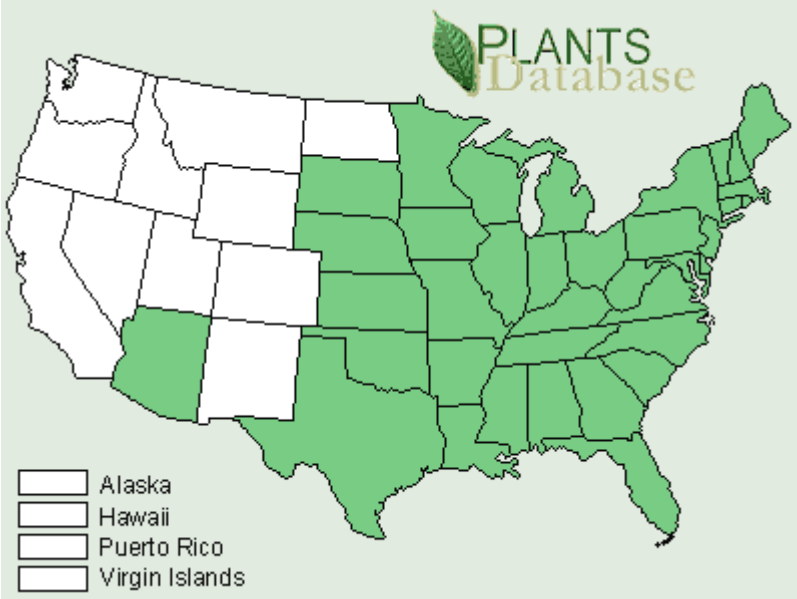


Figure 2 Distribution Map for Poison Oak

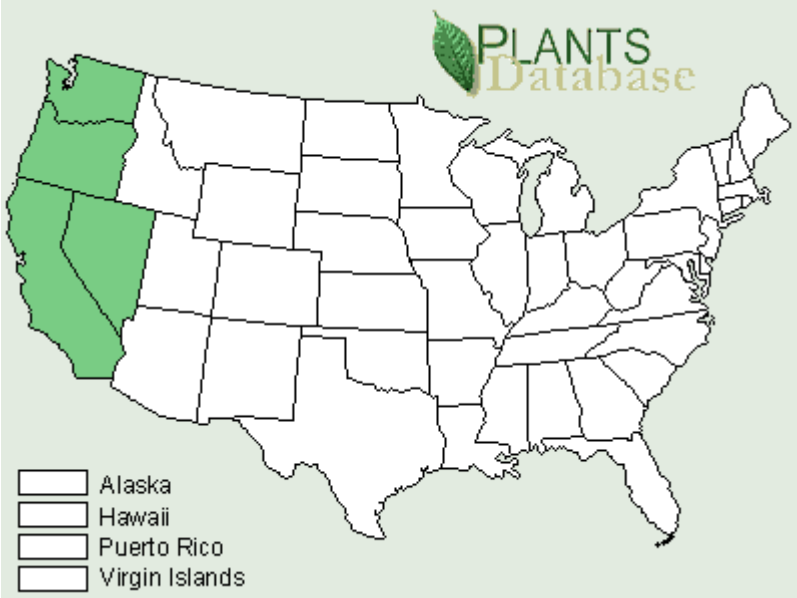
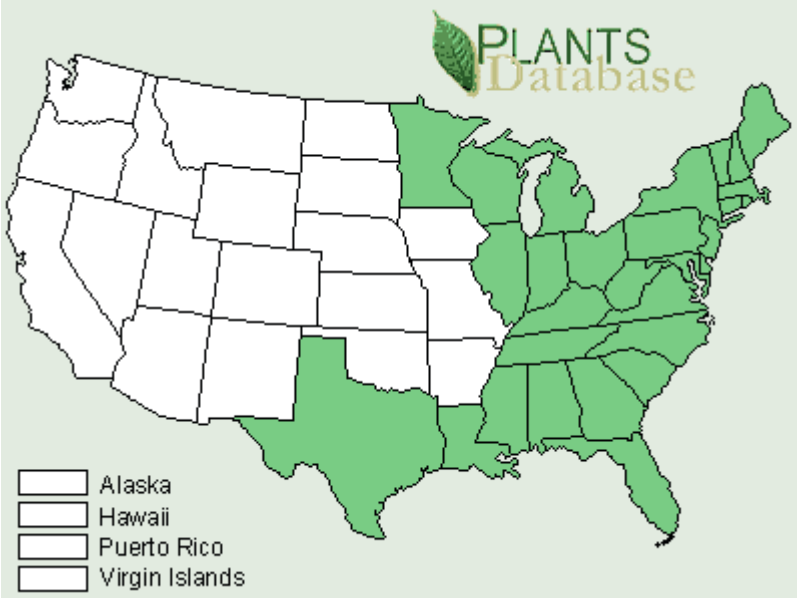


Figure 3 Distribution Map for Poison Sumac



Source for Figures 1, 2, and 3: http://www.tecnuextreme.com/plant-map.htm

Americas

Wild Parsnip Identification

S3NA-313-WI6

1.0 Background

1.1 Wild parsnip (also known as poison parsnip) looks similar to a large carrot plant and is found in open places along roadsides and in waste places throughout the United States and Canada.

1.2 This plant produces a compound that causes severe blistering and discoloration after being exposed to sunlight—a condition known as photodermatitis. That is, when the skin comes in contact with this plant's juice and then is exposed to UV light, a severe burn develops.

2.0 Hazard

2.1 Everyone can get burned by wild parsnip. Unlike poison ivy, you don't need to be sensitized by a prior exposure. However, wild parsnip is only dangerous when the juice from broken leaves or stems gets on your skin—therefore, you can touch and brush against the undamaged plant without any danger.

2.2 If one gets some of the sap of hogweed (or meadow parsnip or cow parsnip) in contact with skin, it is critical that they stay out of the sun for 8 hours. If one needs to remove the plant they should be completely covered with overalls, gloves, hat and safety glasses.

More information can be found at www.co.becker.mn.us/dept/soil_water/wild_parsnip.aspx

Configuration Clothing for Protection Against Ticks and Insects

1.0 Configuration of Clothing

1.1 Loose-cuff trousers must be tucked into socks, wrapped with duct tape (or equivalent) completely around the cuff of the sock up on to the surface of the pant leg to prevent entry of insects between the sock and pants, and preferably reverse-wrapped with “sticky” side out (see figure below).

Americas

Insect Repellent Active Ingredient Product Information S3NA-313-WI8

1.0 Application of Insect Repellent

1.1 Immediately prior to the commencement of work in the field, an AECOM-approved insect repellent shall be applied to exposed skin, and to the outer surface of pant leg cuffs tucked into socks, shirt tails tucked into pants at the waist, and shirt cuffs.

1.2 Table 1 provides a list of AECOM-approved insect repellent active ingredients; employees may utilize any brand containing the minimum concentration of active ingredients as listed.

1.3 All products are registered with the U.S. Environmental Protection Agency and recommended by the Centers for Disease Control and Prevention.

1.4 Employees should select the AECOM-approved repellent which is best for them based on skin sensitivity/allergies, and personal preference, but be aware that reapplication frequency will be greater for Picaridin and lemon eucalyptus products.

1.5 Employees shall carefully read and comply with manufacturer recommendations and instructions on product labels prior to application. Repellent shall not be applied beneath clothing to minimize the potential for irritation and/or allergic reaction.

1.6 The chemical N,N-diethyl-*m*-toluamide (DEET) shall not be applied to Nomex™ fire retardant clothing as it reduces the effectiveness of the fabric.

Table 1 Approved Insect Repellents

Active ingredient and minimum concentration	Products Available	Approximate Duration of Effectiveness	Notes and Web Link to Product Safety Information
Permethrin (0.5%)	-Repel® Permanone -Coulston's Duranon™	2 weeks[1]	-Application to clothing and equipment only
DEET (23.8%)	-Deep Woods Off! ® -Repel® Sportsmen Formula®	5 hours[2]	-Cannot be applied to Nomex™ fabric
Picaridin (7%)	-Cutter Advanced™	4 hours[3]	-Protection equivalent to approximately 10% DEET
Oil of Lemon Eucalyptus (30%)	-Repel® Lemon Eucalyptus	2 hours[2]	-Protection equivalent to approximately 7% DEET -Natural, plant based product

[1] – New York State Department of Health, 2007
[2] – Fradin and Day, 2002
[3] – Spectrum Brands, 2007

1.7 Repellent shall be reapplied multiple times daily over the course of the day at a frequency identified during the hazard assessment based on manufacturers' recommendations, the approximate effective period provided in Table 1, and other factors such as perspiration, precipitation, etc.

1.8 All approved repellents are available at most department or sporting goods stores.

Product Safety Information

Facts about the repellants recommended by AECOM are available by clicking on the embedded link.

National Pesticide Telecommunications Network Fact Sheet: Permethrin and Picaridin

Picaridin

Picaridin Fact Sheet.pdf

Permethrin

Permethrin Fact Sheet.pdf

DEET

DEET Fact Sheet.pdf

Lemon Eucalyptus

Lemon Eucalyptus fact sheet.pdf

Americas

Permethrin Application

S3NA-313-WI9

1.0 Application Recommendations

1.1 Source: New York State Department of Health, 2007. Health Advisory, Tick and Insect Repellents. **http://www.health.state.ny.us/nysdoh/westnile/pdf/2737.pdf**

1.2 Products containing permethrin are for use on clothing only—not on skin. Permethrin kills ticks and insects that come in contact with treated clothes. It is effective for two weeks or more if the clothing is not laundered.

2.0 Treat Clothing Only– DO NOT APPLY TO SKIN.

2.1 Read carefully and follow manufacturer's recommendations for application.

2.2 If you accidentally get the product on your skin, immediately wash with soap and water.

2.3 Apply to clothing in a well-ventilated outdoor area, protected from wind.

2.4 Only spray Permethrin products on the outer surface of clothing and shoes before you put them on - do not apply to clothing while it is being worn. Only spray enough product to lightly moisten the outer surface of the fabric causing a slight color change or darkening; do not saturate clothing. Do not exceed recommended spraying times. Pay special attention while treating socks, trouser cuffs and shirt cuffs to ensure proper coverage. Hang the treated clothing outdoors and allow clothing to dry for at least two hours (four hours under humid conditions) before wearing.

2.5 Do not treat clothing more than once every two weeks. Launder treated clothing separately from other clothing at least once before retreating.

2.6 Keep treated clothes in a separate bag. Those who frequent tick or mosquito habitats should consider having a set of clothes, preferably long-sleeved shirt, pants and socks that are used only in such settings. These clothes can be treated with a Permethrin-containing product according to the label directions, worn only when needed, and then placed in a separate bag when not in use. In hot weather, when long-sleeved shirt and pants may be uncomfortable, pants and jackets made of insect netting (either untreated or treated with repellent) can be worn. Such clothes are available in some sporting good stores and through outdoor equipment catalogs.

1. U. S. Environmental Protection Agency. 1999. Office of Pesticide Programs List of Chemicals Evaluated for Carcinogenic Potential-August 25, 1999. Office of Pesticide Programs. Washington, DC.

Americas

Bird Droppings Safe Work Practices

S3NA-313-WI10

1.0 Background

1.1 According to the National Institute for Occupational Safety and Health (NIOSH), histoplasmosis is an infectious disease caused by inhaling spores of a fungus called *Histoplasma capsulatum (*abbreviated *H. capsulatum)* that may inhabit accumulated masses of pigeon droppings and excrement of other birds and flying animals. Its symptoms vary greatly, but the disease primarily affects the lungs. Occasionally, other organs are affected. This form of the disease is called disseminated histoplasmosis, and it can be fatal if untreated. The acute respiratory disease form of histoplasmosisis is characterized by respiratory symptoms, a general ill feeling, fever, chest pains, and a dry or non-productive cough. Distinct patterns may be seen on a chest x-ray. Chronic lung disease resembles tuberculosis and can worsen over months or years. If symptoms occur, they may start within 3 to 17 days of exposure, with an average of 10 days. On a positive note, histoplasmosis is not contagious.

1.2 Psittacosis, although primarily a respiratory disease, can cause a wide variety of clinical manifestations. Generally, about 10 days after infection occurs, the clinical illness begins abruptly with fever, chills, weakness, fatigue, muscle pain, anorexia, nausea, vomiting, excessive sweating and difficulty with breathing, headache, backache, and sensitivity to light.

1.3 Hypersensitivity pneumonitis is also known as pigeon breeder's disease.

2.0 Symptoms

2.1 The acute form of hypersensitivity pneumonitis is clinically characterized by chills, fever, cough, breathlessness without wheezing, and malaise 4-10 hours after exposure. In general, an acute attack subsides after 18 to 24 hours.

3.0 Treatment

3.1 If a person should develop any of the symptoms as noted above, or others, it is important to see a physician and inform him of an exposure to pigeon/bird or bat excrement. A failure to diagnose the preceding conditions could occur if a treating physician is unaware of a patient's exposure to pigeon/bird or bat excrement.

4.0 Prevention

4.1 Prior to work in any area where pigeons or other flying animals may nest, a written statement from the client shall be obtained in regards to the potential for, and extent of, accumulation of excrement on/in the structure from pigeons and other winged animals.

4.2 The client shall be asked to provide appropriate details as to the basis for their statement (e.g., date of last visual survey for pigeon/bird or bat excrement accumulation, date of last excrement removal effort, etc.).

4.3 In no case will an AECOM employee or contract employee be permitted to commence structure inspection procedures without the Project Manager having received and evaluated the aforementioned written statement from the client.

4.4 According to NIOSH, the best way to prevent exposure to *H. capsulatum* spores during survey and inspection work is to avoid situations where excrement and other potentially contaminated material can become airborne and inhaled. Therefore, it is preferable that the efforts to determine if, and to what extent, there is an accumulation of pigeon/bird or bat excrement on/in structures, or the efforts to clean-up/remove/dispose of such contaminated material, be left to the client or subcontracted out.

5.0 Safe Work Practices

5.1 In those cases where AECOM employees or contract employees are contracted by the client to determine the extent of accumulation of animal excrement in/on structures, the following minimum safety and health precautions shall be taken. (NOTE: precautionary measures are based on recommendations and best practices prescribed in the NIOSH 2004 public document titled *Histoplasmosis – Protecting Workers at Risk*).

5.2 All workers shall wear disposable protective clothing (Tyvek® coveralls). Disposable overalls with hoods shall be donned when working in areas where *H. capsulatum* spore-contaminated material is likely to fall from overhead.

5.3 All workers shall wear disposable shoe coverings fitted with ridged soles made of slip-resistant material to reduce the likelihood of slipping on wet or dusty surfaces. Gloves shall be worn.

5.4 All workers shall wear a full facepiece air purifying respirator fitted with P100 (HEPA) cartridges. If entering an enclosed area in which the extent of excrement contamination is unknown, additional protective measures shall be taken such that workers shall wear a powered air-purifying respirator (APR) with full facepiece fitted with P100 (HEPA) cartridges. Any variance from these requirements must be approved by the Region Safety, Health an Environment Manager. Workers donning APRs shall be medically screened, cleared, and trained in their proper use in accordance with AECOM safety program standards.

5.5 If contaminated material must be disturbed for purposes of removal/disposal or during the structure inspect process, it shall be wetted down prior to all work and will be rewetted as necessary to minimize airborne dusting.

5.6 After working in *H. capsulatum* spore-contaminated areas and before removing any respiratory protective equipment, workers shall remove all protective clothing and shoe coverings and seal them in a heavy-duty plastic bag for disposal.

5.7 Workers shall observe a high degree of personal hygiene, even if the exposure is casual. Special care shall be taken to wash hands, face, and other areas of exposed skin thoroughly before eating, drinking or smoking.

Americas

Large Carnivores

S3NA-313-WI11

1.0 Hazard

1.1 Most wild carnivores in the feline family (cougars, lynx, and bobcat) or the canine family (wolves and coyotes) are more predictable than bears and are not predatory towards humans; however, all wild animals can be dangerous if they feel threatened or if they are sick or starving.

1.2 Most ungulates (deer, moose, elk, and caribou) will avoid humans and will flee as soon as a human is sighted; however, females with young (during May and June) and males during the mating season (September to November) can be very aggressive, especially if provoked.

2.0 Personal Protective Equipment

2.1 Noise makers such as bear bangers, whistles and bells can be used as deterrents for an approaching animal.

2.2 Pepper (bear) spray can be used to ward off an imminent attack.

3.0 Safe Work Practice

3.1 Most negative encounters with ungulates or carnivores can be avoided with a few key preventative measures:

3.1.1 When working in wilderness isolation, always travel in pairs and make lots of noise.

3.1.2 Always store food in air-tight containers away from sleeping areas (if camping) and never carry strong smelling foods which could attract animals.

3.1.3 Keep your eyes open for fresh animal signs which may indicate a dangerous situation:

- Extensive fresh rubbing on branches in the fall might indicate the presence of a rutting male ungulate that may become aggressive to defend a potential mate.
- A fresh kill or carcass which might indicate the presence of a carnivore that may become aggressive to defend its food.

3.2 Maintaining a distance of at least 100 feet (30 meters) allows large animals an escape route. If you notice any signs of aggression or behavioral changes, you should move away to a safe location. Wildlife should not be enticed by reaching out or simulating calls.

3.3 Pets should be kept secure and away from wildlife as their actions can provoke an attack. Moose, deer and other wildlife may appear quite docile; however, if a dog makes them feel threatened, their behavior can become unpredictable.

3.4 **If you are approached by a carnivore (wolf, coyote, or cougar):**

3.4.1 Pick up small children immediately.

3.4.2 Try to appear bigger, hold your arms or an object over your head.

3.4.3 Face the animal and retreat slowly. Do not run or play dead.

3.4.4 Maintain steady eye contact with the animal.

3.4.5 If the animal continues to approach, deter an attack by yelling, waving a stick or throwing rocks.

3.4.6 If you are attacked, fight back. Hit the animal with a heavy stick or rock.

3.5 **If you are approached by an ungulate (moose, elk, deer, bison or caribou):**

3.5.1 An angry moose, elk or deer will face you with its head and ears lowered.

3.5.2 Back away slowly.

3.5.3 Look for something to get behind like a tree or a car. You can go faster around an obstacle than the ungulate can.

3.5.4 An ungulate is more likely to bluff charge but if it continues the charge and you are attacked in the open, curl up in a ball on the ground. Always protect your head with your arms and lie still.

3.5.5 Stay still after the attack until the ungulate moves away.

Americas

Bear Safety

S3NA-313-WI12

1.0 Hazard

1.1 An encounter with a bear of any species can have a wide variety of outcomes, ranging from a simple sighting, to a false charge, to a serious mauling or even death. Consequently, the risk of a bear encounter must be taken very seriously.

1.2 The hazard or risk associated with a bear encounter varies significantly depending on the location. It is important to research the project area before field work commences to determine the expected probability of encountering a bear. Remoteness from urbanized areas should not be a criterion, as bears have been encountered within city limits, especially near landfills.

1.3 The risk associated with a bear encounter also varies with the species of bear, the season, and the circumstances under which the bear is encountered.

1.4 Preparing staff for any type of encounter is key to managing the risk.

2.0 Personal Protective Equipment

2.1 The best deterrent of a “bad bear encounter” is knowledge: a good understanding of the ecology and the behavior of the bears that will likely be encountered.

2.2 Bear Spray and Bear Bangers

2.2.1 Staff must have hands-on training for the safe use of bear spray (a pre-season practice run is a good use of expired bear spray).

2.2.2 Prior to work commencing, staff must ensure that the bear spray they are carrying is still valid and not past its expiration date.

2.2.3 During travel, bear spray must be sealed in an airtight container or bag and must not travel in the cab of a vehicle, aircraft, or helicopter.

2.3 Firearms

2.3.1 Environments and conditions which pose a high risk of bear encounters, may warrant the use of an armed wildlife monitor. Project managers, in consultation with appropriate project staff and Safety, Health and Environment Management, are responsible for determining the level of risk for their projects and whether or not such measures are required.

2.3.2 A person hired as an armed bear monitor must be properly trained in wildlife monitoring as well as certified in the expert usage of firearms.

2.3.3 The usage of an armed bear monitor is intended only as an additional precautionary measure to be used in specific environments to ensure the protection of field staff; staff should still be equipped and trained appropriately for the risk.

3.0 Restrictions

3.1 Staff must not work alone in areas where there is a medium or high risk of a bear encounter.

3.2 AECOM personnel shall not carry firearms or attempt to function as a wildlife monitor and/or perform their professional duties. For possible exceptions contact the Regional SH&E Manager who will evaluate the potential hazards with Regional Manager and Legal and provide written response. This can only be over-ridden with expressed permission of Region Executive and AECOM Chief Security Officer, refer to *WP-001-PR Firearms Standard*.

4.0 Training

4.1 In-house Bear Awareness training must be taken by all field staff who work in bear country every three years at a minimum, or more often as required.

4.2 The Bear Awareness training involves testing and improving the employee's knowledge about bear encounters, watching videos regarding bear awareness and behavior, and participating in group discussions about how to avoid and how to respond to bear encounters.

4.3 Specific considerations are given to black bear, grizzly bear, and polar bear encounters.

5.0 Safe Work Practice

5.1 Staff must be aware of wildlife signs and avoid wildlife encounters.

5.2 Bear Signs

5.2.1 Fresh tracks – It is often better to see the bear's tracks than to see the actual bear. If you can tell the direction that the bear is travelling in, it is prudent to change your course of direction. Bears will travel down the same pathways people or other large animals use. If you have a clear track you can determine which type of bear has passed through the area. If you see more than one track, you can tell that it is possibly a female with cubs. Avoid females with cubs!

5.2.2 Scat – Bear scat will look different depending upon the bear's diet. Close examination of bear scat can sometimes give you an indication of what the bears have been eating at that time of year. If the scat contains remnants of human garbage, there is a human food conditioned bear in the area. These bears associate people with food and can be the most dangerous type of bear to encounter.

5.2.3 Animal carcasses – IF YOU COME ACROSS A CARCASS, LEAVE THE AREA IMMEDIATELY. Grizzly bears will often cover their kills for a few days and let it rot, then come back and eat it. THE BEAR WILL STAY CLOSE BY. Grizzly bears will defend their kill and this is a situation that could prompt a defensive attack by a bear.

5.2.4 Torn-up logs and stumps – Bears will forage for insects in dead logs and rotting trees. You will often see torn up logs and stumps, evidence of their foraging.

5.2.5 Evidence of digging – Holes dug into the ground are often made by grizzly bears digging for roots or ground squirrels. In particular, grizzlies will dig for food in the early spring soon after they leave their dens.

5.2.6 Claw marks on trees – Claw marks can be left on trees by black bears when they have climbed up a tree. Grizzly bears will also leave claw marks on trees and on the ground. Bears will often chew a small tree or a sign-post, so watch for signs of chew marks along the trail.

5.2.7 Hair on trees – Bears will rub against trees, usually trees with rough bark, to scratch themselves. You can find evidence of bears by the hair left in the tree's bark. The higher the hair left on the tree, the bigger the bear. Remember that the bear will often stand on its back legs to scratch its back on the tree.

5.2.8 Daybeds – Bears will be most active in the early morning and in the evening. It would be prudent for field staff to restrict their field activities during the bear's most active foraging times as much as possible. During the heat of the day, bears will rest in daybeds. These can be shallow depressions of piled up leaves in the forest, trampled vegetation, a shallow scrape or a hole. Daybeds are usually located in cool places. Bears will make daybeds along streams and rivers. Daybeds are often associated with feeding places and therefore should be avoided.

5.3 Prevention

5.3.1 Your best defense against bears is to actively practice bear avoidance techniques when working in the field. You can prevent chance encounters by taking the following precautions:

- Know the areas and habitats bears use at different times of the year, and attempt to avoid such areas or be extremely cautious if you have to travel through them.
- Contact the local Fish & Wildlife Office to get current information on the bears in the area. Ask what other camps are in the area and if they are following good bear avoidance practices. (i.e., do they keep a clean camp?) If there are nearby human food sources available, e.g., an open dumpsite, the local bears may not be afraid to approach your camp.
- Always be aware of your surroundings. Stay alert. Watch for signs of bears along your route.
- Use binoculars to look around for bears when you are in open terrain.
- Never approach a bear if you see one feeding in the distance.
- Note the behavior of other wildlife in the area. Flocks of ravens can alert you to a possible animal carcass, and perhaps a bear. The area should be avoided. Bird or squirrel alarm calls might be telling you that a bear is near.
- Whenever possible, travel in daylight and try to avoid areas with restricted visibility, e.g., dense brush.
- Make lots of noise, especially when travelling in dense vegetation. Sing, shout, or talk loudly. You can carry portable air horns or cans of rocks. (Please note that bear bells are not effective – they do not make enough noise to warn a bear that you are approaching. You need to be loud so the bear can hear you coming.) Remember that the noise you make can be masked by loud natural sounds such as the wind or water. Therefore it is possible that the noise you make can go unnoticed by a bear whose attention is focused on feeding. You must make every attempt not to surprise a bear. In areas of loud natural noise, be louder!
- Stay together and travel in groups. Bears are less likely to attack groups of people. When travelling in groups, stay close together. Being in a group doesn't help if the individuals have spread apart along the trail.
- Pets should not accompany you when you are travelling in bear country. If you must take your pet, keep the animal on a short leash at all times. Unleashed dogs will harass bears and once scared, run back to their owner with an angry bear in pursuit.
- Do not wear perfumes or cosmetic products when you are travelling in bear country. Do not mask your human scent.
- Women should use internal sanitary protection, (i.e. tampons) when menstruating and burn all used sanitary products after usage. Keep all used sanitary supplies in sealed bags until you have a chance to burn them.
- Children should be kept very close by in bear country.
- Carry bear deterrents and know their limitations. Be familiar with how to use the deterrents, how to transport the deterrent safely and under what conditions it is most effective. Carry the deterrent in a belt, out in front and ready to grab at a moment's notice, never in your backpack.

5.4 Field Worker Precautions in Bear Country

5.4.1 Field workers should take extra precautions when working in bear country:

- Make every effort to go out into the field with another person; you should not be working alone in the field. One person can act as a lookout for the other. Keep watch for bear signs.
- Never approach a bear.

- Report where you are going and when you will return every time you leave camp. Have a plan of action if someone does not report back to camp at a specified time.
- Bears do get used to a camp's schedule and you will have fewer surprise encounters if everyone in the camp comes and goes at the same time every day.
- Take a two-way radio with you when you go out into the field.
- Always carry bear deterrents with you in the field and understand each deterrent's limitations. Carry your deterrents on a belt, out in front and ready to use instantly. Do not carry your deterrents in your backpack.
- Keep any food that you take with you sealed in odor-proof/bear-proof containers. Make every attempt to take odorless food with you, not something with a heavy scent.
- Pack out any garbage in odor-proof containers and burn once you return to camp.
- The noise of an ATV or skidoo can scare off a bear. Starting the machine and revving it up can scare off a curious bear. DO NOT CHASE A BEAR WITH AN ATV OR SKIDOO. You may need to drive the ATV around in circles to scare off the bear, but do not chase the bear.
- Take extra precautions when travelling along lakes or stream beds; bears use streams and river beds as travel routes. Be sure to carry noise makers.
- Limit your workday so you are not out in the early morning or evening when bears are most likely to be foraging.
- All **Field Workers** should be proficient in First Aid. Do not go out into the field without first aid training.
- All field camps should have a First Aid Kit.
- All field camps should have means of communication with local ambulance or air ambulance personnel.
- A person's best defense against bears is to avoid them. If this is not possible, then being heard, smelled, or seen may lessen your chances of surprising a bear and/or provoking an attack.
- All wildlife should be respected, avoided, and not harassed at any time.
- Cooking in remote areas should be avoided. Any food should be stored in airtight containers and all garbage should be managed appropriately: "pack it in, pack it out".
- A bear in camp or within human structures is not a chance encounter. If this bear challenges you, you must fight, scream, and do whatever is necessary to live, no matter what species the bear is!
- In general, there are two types of bear encounters: Defensive and Non-defensive for grizzly bears and black bears. Your response will vary based on your assessment of the situation (your training will help you in identifying these situations and the appropriate response).

6.0 Encounters

6.1 General Recommendations When Encountering a Bear

- Consider your surroundings and assess the situation before you act.
- Remain calm. Do not turn your back to a bear.
- DO NOT RUN – You will trigger the bear's natural response to chase you. Bears are extremely fast and you cannot outrun a bear. (They are as fast as an Olympic sprinter, so if you are not faster than an Olympic sprinter, don't run! They can run 25 miles per hour [40 kilometers per hour] and you can't!) You cannot outswim a bear either.

6.2 Bear Encounters in the Field

6.2.1 Your response will depend upon the type of encounter.

6.2.2 Bears are more predictable than once believed and you can determine your best course of action in a confrontation by understanding the bear's characteristics and motivation. There are two pieces of information you should be aware of in any bear encounter:

- The type of bear you are dealing with, and
- The reason for the encounter.

6.2.3 Some people believe that when you stand your ground against a predatory black bear attack, the bear will feel threatened and leave. This has been effective in some cases. HOWEVER, it is not effective against a grizzly bear predatory attack and it is very difficult to know when it will be effective against black bears. Polar bears do not follow the same behavioral patterns as grizzly and black bears; polar bears are almost always aggressive and will not back down. Special considerations must be given to projects where polar bear encounters are anticipated.

6.3 If you can leave undetected:

6.3.1 Leave the area quietly in the same direction that you came from.

6.3.2 Move while the bear's head is down. Stop moving when the bear lifts its head to check its surroundings.

6.3.3 Stay downwind so the bear will not pick up your scent.

6.3.4 When you have moved a safe distance away, you can either watch and wait until the bear leaves or make a wide detour around the bear.

6.3.5 If the bear is unaware of you and approaching, allow the bear the right of way.

6.4 If you cannot leave undetected:

6.4.1 Let the bear know that you are present by smell first; therefore move upwind so they can pick up your scent.

6.4.2 If it is possible, try to keep the bear in your sight. Watch to see if the bear leaves when it smells that a person is nearby.

6.4.3 Attempt to move out of the way without being noticed by the bear. If you cannot do this, talk loudly to let the bear know where you are.

6.5 If the bear is aware of you but in the distance:

- Remain calm.
- Continue walking slowly in the same general direction, but head away from the bear.
- DO NOT RUN. The bear can quickly outrun you if it is so inclined.
- If the bear begins to follow you, drop your pack or some article, (not food) to distract the bear. This may distract the bear long enough for you to escape. If you drop food for the bear – you will help the bear associate food with humans and teach it that aggressive behaviour will be rewarded with food.
- If it is a grizzly following you, climb a tree if there is a large tree around. Although grizzlies can climb trees, they are often not motivated enough to try. Very large grizzlies are not able to climb trees well. If grizzlies climb, they can go 9 to 13 feet (3 to 4 meters). Grizzlies will try and push trees over so do not climb a small tree.

6.6 If the bear is aware of you and close:

- A bear will feel threatened in a close confrontation. The bear's natural tendency will be to reduce or to remove the threat. Assist the bear by acting as non-threatening as possible.
- Do not make direct eye contact with the bear.

- Do not make any sudden moves.
- Do not run!
- The bear needs to identify you as a person, so talk in low tones and slowly wave your arms over your head.
- Attempt to give the bear an opportunity to leave. Be sure the bear has an open escape route. Do not corner a wild animal.
- Try to back away slowly and/or climb a tree if appropriate.
- Attempt to deter the bear if you are in a safe position.

6.7 If the bear is close and threatening:

- If you have a deterrent such as a bear banger or bear spray, be prepared to use it depending on how close the bear is. Try to scare the bear off.
- If you do not have a deterrent, or if using the deterrent is not successful, act as non-threatening as possible.
- Talk to the bear in a calm authoritative tone of voice.
- Do not startle or provoke the bear by making sudden moves.
- Never imitate the bear's aggressive sounds, signals or posture. The bear is attempting to establish dominance and imitating its moves is a challenge to its dominance.
- Back slowly away from the bear and drop a pack or some other article in order to distract the bear momentarily.
- Remember that the bear may be defending cubs that you have not yet seen or they have a food cache nearby. Attempt to look as non-threatening as possible.

6.8 If the bear is very close and approaching:

- A distance of less than 164 feet (50 meters) in an open area and closer in a forested area.
- If the bear continues to approach, use your deterrent.
- If the bear does not respond to the deterrent you must now STAND YOUR GROUND!
- If the bear continues to approach and is acting aggressive, YOU MAY HAVE TO SHOOT if you are carrying a firearm.

6.9 If the Bear Charges:

- A bear will charge you at high speed down on all four legs and often crouched low to the ground.
- Bears do not charge when standing up on the hind legs.
- Many charges are bluffs and the bear will often stop or veer off just at the last minute. It is difficult to know if the bear is bluff charging or not until it gets very close.
- When faced with a charging bear you have two options:
    - Use your bear deterrent; or
    - Roll into a ball and cover your neck and head with your arms if you are unarmed and have no other choice.

6.10 Playing Dead

6.10.1 Note: Playing dead is a very controversial topic among seasoned field personnel. Some will tell you to never play dead in any situation, others will swear that it is the only thing you should do. Playing dead is a personal choice that you will have to make.

6.10.2 If you play dead it is possible that you can prevent serious injuries if a chance encounter with a bear results in an attack. Playing dead may reduce the threat that you represent to the bear.

6.10.3 If you decide to play dead, it is important to protect your vital areas. The older information that is still found online states that the person should roll into a ball to protect their vital organs. This has been replaced and you are now advised to lie in the prone position. Lie flat on your stomach and lace your fingers behind your neck (to protect it), Spread your legs apart to provide stability if the bear tries to turn you over. Stay in this position. If the bear manages to roll you over, immediately roll back onto your stomach to protect your face, neck and vital areas. Do not try to resist or struggle as this will intensify or prolong the attack. Once the attack is over, DO NOT MOVE until the bear has left the area. Look around and be very sure that the bear is gone before moving. (If the bear is a female with cubs, she will leave and move her cubs to safety.) If the bear covers you with leaves and vegetation, it probably thinks you are dead. Grizzlies will often cover their prey with vegetation and leave the carcass to ripen for a few days.

6.10.4 It is important to note that if the bear attack is prolonged or if the bear begins to eat you, the attack has changed from what you may have first believed to be a defensive attack to a predatory attack. Fight back in a predatory attack. Concentrate your efforts on the face, eyes and nose of the bear.

Americas

Small Mammals

S3NA-313-WI13

1.0 Hazard

1.1 Working in the field either directly or indirectly with small mammals has inherent risks of injury or exposure to zoonotic diseases (infectious diseases that can be transmitted from animals to humans) that all field staff need to protect themselves against.

1.2 The risks are usually higher when there is direct contact with a wild animal, either through a break in the skin (blood), saliva, or excrement; however, there are also risks through air-borne diseases (e.g., Hantavirus).

1.3 Obviously, wildlife biologists directly handling wildlife, dead or alive, or working with wildlife feces or in enclosed habitats (such as caves), have an increased risk of exposure to a wider range of zoonotic diseases and should take extra precautions.

2.0 Personal Protective Equipment

2.1 Full-length clothing (long sleeves and pants)

2.2 Insect repellent

2.3 Respiratory equipment (when directly handling wildlife)

2.4 Gloves (when directly handling wildlife)

3.0 References

3.1 Trapping and Tagging Small Mammals. A RIC Standard for British Columbia. 1993. Dr. Todd Zimmerling.

4.0 Restrictions

4.1 Wildlife handling must only be completed under direct supervision of an experienced individual.

5.0 Training

5.1 Any staff that will be handling wildlife must be adequately trained and/or supervised by a wildlife biologist experienced in the job task.

6.0 Safe Work Practice

6.1 Wild animals can carry a variety of diseases that humans can contract: viral, parasitic, bacterial, and protozoal. Basic Personal Protective Equipment such as full-length clothing, gloves and a respiratory mask will greatly reduce the risk of exposure.

6.2 Whenever a wild animal must be handled, the procedure must be accomplished as safely and quickly as possible.

6.3 Proper techniques must be employed to avoid or minimize the risk of personal injury while, at the same time, avoiding or minimizing injury to the animal.

6.4 Gloves, catch sticks, caging, and other appropriate equipment may be necessary when handling a wild animal. Most of these animals will be extremely stressed, resisting every restraint attempt.

6.5 In the unfortunate circumstance that a person is bitten or scratched, he or she should cleanse the wound thoroughly with soap and flush with water immediately, providing for a mechanical removal of potentially infective organisms. This should be followed by cleansing under medical supervision and consultation with a physician to consider the potential exposure to the rabies virus.

7.0 Rabies

7.1 You will not be able to accurately determine if an animal has rabies simply by observation as traditional symptoms of rabies (foaming at the mouth, biting, etc.) do not occur in all animals nor at all stages. There are some mammals that are at a higher risk than others for the rabies virus, such as raccoons, skunks, stray cats and dogs, foxes, coyotes, rodents. and bats; however, any mammal can contract the virus.

7.2 Rabies is contracted by contact of an infected animal's saliva with an open wound – a bite or a scratch.

7.3 Symptoms of rabies in humans usually do not present themselves for a minimum of 10 days to a year or longer (the average is 30 to 50 days). Symptoms are typical of a flu, including malaise, loss of appetite, fatigue, headache, and fever. Over half of all patients have pain (sometimes itching) or numbness at the site of exposure. They may complain of insomnia or depression. Two to ten days later, signs of nervous system damage appear; these include hyperactivity and hypersensitivity, disorientation, hallucinations, seizures, and paralysis.

7.4 Because rabies is so difficult to detect and positively identify, it is very important to consult a physician immediately. If rabies is a possibility, begin treatment with the rabies vaccine as soon as possible (unlike other vaccines, rabies vaccination begins after exposure because the virus takes a comparatively long time to induce disease).

8.0 Hantavirus

8.1 Rodents can carry a variety of diseases; of notable concern is the North American hantavirus which can cause Hantavirus Pulmonary Syndrome (HPS).

8.2 A common host of the hantavirus is deer mouse and related species (*Peromyscus* spp.), which are common throughout much of North America.

8.3 Although infection is rare, it can be fatal and, therefore, it is necessary that risk of exposure be minimized. Infection can be spread to humans when they:

8.3.1 Breathe air contaminated by deer mouse saliva, urine or feces containing infectious hantaviruses; or

8.3.2 Accidentally rub eyes, mouth or broken skin with hantavirus-infected deer mouse saliva, urine or feces.

8.4 The following precautions will be taken for all field operations:

8.4.1 Limit exposure to soils handling and use gloves where appropriate.

8.4.2 Wash or sanitize hands often throughout the day and before meals.

8.4.3 Equipment bags, storage areas, and vehicles will be inspected daily for signs of deer mouse infestation.

8.4.4 Rodent-proof storage containers will be used when practical.

8.4.5 Do not enter buildings infested with deer mice without adequate respiratory protection.

8.4.6 Droppings should never be removed by vacuuming or sweeping. Wetting down an area with a mixture of 1:9 household bleach and water solution will reduce risk of airborne exposure.

8.5 If flu-like symptoms develop three days to six weeks after exposure to rodents, a doctor should be contacted immediately (mechanical ventilation is the primary method of treatment).

Americas

Snakes

S3NA-313-WI14

1.0 Hazard

1.1 Snakes have the ability to inject venom. A bite from a venomous snake, which may inject varying degrees of toxic venom, is rarely fatal but should always be considered a medical emergency.

2.0 Personal Protective Equipment

2.1 Long pants and shirts

2.2 Heavy gloves if staff will be handling debris or be close to the ground

2.3 Rubber boots, or boots that fully cover the foot (not sandals!) and preferably are at least 10 inches (25 centimeters) high

2.4 Snake Chaps that cover at least the shin

2.5 Personal first aid kit

3.0 References

3.1 The Eastern Massasauga Rattlesnake Stewardship Guide. A resource and field guide for living with rattlesnakes in Ontario. Sponsored by the Government of Canada, and distributed on behalf of the Toronto Zoo and the Eastern Massasauga Rattlesnake Recover Team.

3.2 http://www.rattlesnakes.us/

3.3 http://drdavidson.ucsd.edu/Portals/0/snake/Crotalus.htm

4.0 Restrictions

4.1 Staff must not work alone in areas where the risk of a snake encounter is high.

5.0 Training

5.1 Staff must be notified of the hazard before work commences.

6.0 Safe Work Practice

6.1 Staff working in areas known to be inhabited by venomous snakes should take extra precautions, be able to identify the local snake species, and understand the best practices for administering first aid.

6.2 Most snakes in Canada are non-venomous; and most snake bites are not fatal, only painful. Learning to identify snake species will assist you in responding appropriately to an encounter, and will assist medical professionals in determining if antivenin needs to be administered if anyone is bit.

6.3 Most snakes are non-aggressive and will only attack if immediately threatened.

6.4 Prevention

6.4.1 Before venturing out into the wilderness, familiarize yourself with the snakes in your area, both venomous and non-venomous species.

6.4.2 Learn which habitats the venomous species in your region are likely to be encountered in, and use caution when in those habitats.

6.4.3 Try as much as possible not to take a snake by surprise.

6.4.4 Stay on trails where possible, and watch where you place your hands and feet, especially when climbing or stepping over fences, large rocks, and logs, or when collecting firewood. Take care when overturning any objects on the ground when in snake country.

6.4.5 If you see a snake, give it as much room as possible. Most snakes have a strike distance that is only half the length of their body.

6.4.6 If you get very close to a rattlesnake, hold very still until it calms down and starts to move away. Then slowly move backwards until you are at least one snake-body length away.

6.5 Treatment

6.5.1 Venomous snakebites are rare, and they are rarely fatal to humans. Of the 8,000 snakebite victims in the United States each year, only about 10 to 15 die. In Canada, the number of snake bites each year is very small. However, for any snakebite the best course of action is to get medical care as soon as possible.

6.5.2 Try to keep the snakebite victim still, as movement helps the venom spread through the body.

6.5.3 Keep the injured body part motionless and just below heart level.

6.5.4 Keep the victim warm, calm, and at rest, and transport him or her immediately to medical care.

6.5.5 Do not allow him to eat or drink anything.

6.5.6 If medical care is more than half an hour away, wrap a bandage a few inches above the bite, keeping it loose enough to enable blood flow (you should be able to fit a finger beneath it). Do not cut off blood flow with a tight tourniquet. Leave the bandage in place until reaching medical care.

6.5.7 If you have a snakebite kit, wash the bite, and place the kit's suction device over the bite. (Do not suck the poison out with your mouth.) Do not remove the suction device until you reach a medical facility.

6.5.8 Identify the snake that caused the bite to determine if it is venomous, and if antivenin needs to be administered. Do not waste time or endanger yourself trying to capture or kill it. Note the shape and color of the snake's head.

6.5.9 If you are alone and on foot, start walking slowly toward help, exerting the injured area as little as possible.

- Note that there are several species of snakes that superficially resemble rattlesnakes. Several species, including Bull, Milk, Fox, and Rat Snakes will even rattle their tails when startled.
- Massasauga Rattlesnake is recognized as a Threatened Species in Ontario and it is an offence to harass, , or destroy the habitat of this species.
- One scorpion species, the Northern Scorpion (*Paruroctonus boreus*) occurs in semi-arid areas of southern British Columbia, Alberta, and Saskatchewan. It carries a stinger on the end of its tail. The sting is painful but not life threatening unless there is an allergic reaction.

7.0 Species

7.1 Venomous Snakes in Canada

Eastern Massasauga Rattlesnake (*Sistrurus catenatus*) found around Wainfleet, Windsor, Bruce Penninsula and eastern Georgian Bay in Ontario.	 Eastern Massasauga Rattlesnake picture by Michael Redmer/Courtesy Lincoln Park Zoo
Northern Pacific Rattlesnake (*Crotalus viridis*) found primarily in Okanagan and Thompson River valleys of southern British Columbia.	
Prairie Rattlesnake (*Crotalus viridis*) found in south eastern Alberta, and south western Saskatchewan.	

7.2 Venomous snakes in the United States

Rattlesnake(*Crotalus cerastes)* found mostly concentrated in the southwestern United States, they extend north, east and south in diminishing numbers and varieties. Every contiguous state has one or more varieties of rattlesnake.	 Western Rattlesnake

The rattlesnake is found in many different biomes ranging from along the coast at sea level, the inland prairies and desert areas to the mountains at elevations of more than 10,000 feet. Species include: Sidewinder, Santa Catalina, Western, Mojave, Red Diamond, Western Diamond, Ridge Nosed, Eastern Diamondback, and Pigmy.	 Eastern Diamondback
Copperhead (*Agkistrodon contortrix*) is the most common venomous snake found in the eastern United States. It can be found in the states of Texas, Oklahoma, Kansas, Missouri, Arkansas, Louisiana, Mississippi, Alabama, Georgia, Florida, South Carolina, North Carolina, Tennessee, Kentucky, Virginia, Illinois, Indiana, Ohio, Iowa, Pennsylvania, Maryland, New Jersey, Delaware, New York, Connecticut, and Massachusetts.	
Cottonmouths (water moccasins) (*Agkistrodon piscivorus)* found in the eastern United States from Virginia, south through the Florida peninsula and west to Arkansas, eastern and southern Oklahoma, and east and central Texas.	
Coral Snake (*Micrurus sp.)* found in the southern range of many temperate United States including North Carolina, Georgia, Alabama, Mississippi, Louisiana, Texas, Arkansas, Kentucky, Arizona, and New Mexico.	 Eastern Coral Snake, *Micrurus fulvius*

Americas

Machine Guarding

S3NA-411-PR1

1.0 Purpose and Scope

1.1 Provides the AECOM requirements for machine guarding practices for all equipment located within 7 feet (2.14 metres) or less from grade level or the floor.

1.2 This procedure applies to all AECOM Americas-based employees and operations.

2.0 Terms and Definitions

2.1 None

3.0 References

3.1 None

4.0 Procedure

4.1 Roles & Responsibilities

4.1.1 **Project Manager**

- Confirm that all equipment used or worked on by AECOM personnel is properly guarded and that employees are instructed not to remove any guards in the absence of controlling all sources of hazardous energy.

4.1.2 **Employee**

- Shall not remove any machine guarding in the absence of controls for all sources of hazardous energy. Under no circumstances shall Employees remove manufacturer-installed guards (except during maintenance procedures) or use guards in a manner not consistent with the manufacturer's directions. Guards must be inspected prior to use, refer to *S3NA-411-FM1 Machine Guarding Inspection Checklist*, and used in accordance with *S3NA-411-WI1 Machine Guarding Safe Work Practice* guidelines.

4.2 Restrictions

4.2.1 Typically, moving parts (e.g., rotating parts) require machine guards to prevent employee injury.

4.2.2 Guards will be firmly fixed or secured, with no more than ½-inch (1.27 centimeters) diameter openings. If work equipment does not have the proper machine guards installed, it shall be removed from service and locked out/tagged out until the proper guard is installed.

4.2.3 Guards will conform to the following requirements:

- When guarding is provided by two hand-control devices, the devices shall be constructed to prevent tie-down of either of the two or to prevent bridging (i.e., using something else such as a pipe to hold down both control devices simultaneously with one hand).
- Under no circumstances shall equipment control interlocks or "deadman" switches be bypassed (e.g., spring trigger taped down on an abrasive blast guns or other powered tools) and will be located within reach of the operator's working position.
- Sufficient clearance will be provided around and between machines to allow for safe operations, set up and servicing, material handling, and waste removal.

4.3 Auto-Starting Equipment

Some process equipment starts automatically in response to control system inputs of system sensors. Since inadvertent startup can present special worker hazards, all auto-starting equipment will be identified, and a label affixed to each reading:

CAUTION
EQUIPMENT MAY START WITHOUT WARNING
DE-ENERGIZE BEFORE SERVICING

5.0 Records

5.1 None

6.0 Attachments

6.1 S3NA-411-WI1 Machine Guarding Safe Work Practice

6.2 S3NA-411-FM1 Machine Guarding Inspection Checklist

Americas

Machine Guarding Safe Work Practice

S3NA-411-WI1

1.0 Why Is Guarding Needed?

1.1 There are as many hazards created by moving machine parts as there are types of machines. Safeguards are an essential requirement for protecting workers from needless and preventable injuries.

1.2 A good rule to remember is: Any machine part, function, or process that may cause injury must be safeguarded. When the operation of a machine or accidental contact with it can injure the operator or others in the vicinity, the hazards must be either controlled or eliminated.

2.0 Where Mechanical Hazards Occur

2.1 Dangerous moving parts in three basic areas require safeguarding:

2.1.1 The **point of operation –** That point where work is performed on the material, such as cutting, shaping, boring, or forming of stock.

2.1.2 **Power transmission apparatus –** All components of the mechanical system that transmit energy to the part of the machine performing the work. These components include flywheels, pulleys, belts, connecting rods, couplings, cams, spindles, chains, cranks, and gears.

2.1.3 **Other moving parts –** All parts of the machine that move while the machine is working. These can include reciprocating, rotating, and transverse moving parts, as well as feed mechanisms and auxiliary parts of the machine.

2.2 Hazardous Mechanical Motions and Actions

A wide variety of mechanical motions and actions may present hazards to the worker. These can include the movement of rotating members, reciprocating arms, moving belts, meshing gears, cutting teeth, and any parts that impact or shear. These different types of hazardous mechanical motions and actions are basic in varying combinations to nearly all machines, and recognizing them is the first step toward protecting workers from the danger they present.

The basic types of hazardous mechanical motions and actions are:

2.2.1 Motions

- **Rotating motion** can be dangerous; even smooth, slowly rotating shafts can grip clothing and through mere skin contact force an arm or hand into a dangerous position. Injuries due to contact with rotating parts can be severe.
  - Parts can rotate in opposite directions while their axes are parallel to each other. These parts may be in contact (producing a nip point) or in close proximity. In the latter case the stock fed between the rolls produces the nip points. This danger is common on machines with intermeshing gears, rolling mills, and calendars.
  - Collars, couplings, cams, clutches, flywheels, shaft ends, spindles, meshing gears, and horizontal or vertical shafting are some examples of common rotating mechanisms that may be hazardous. The danger increases when projections such as set screws, bolts, nicks, abrasions, and projecting keys or set screws are exposed on rotating parts.
  - In-running nip point hazards are caused by the rotating parts on machinery. There are three main types of in-running nips:
  - Nip points are also created between rotating and tangentially moving parts. Some examples would be: the point of contact between a power transmission belt and its pulley, a chain and a sprocket, and a rack and pinion.

- Nip points can occur between rotating and fixed parts which create a shearing, crushing, or abrading action. Examples are spoked handwheels or flywheels, screw conveyors, or the periphery of an abrasive wheel and an incorrectly adjusted work rest.

- **Reciprocating motions** may be hazardous because during the back-and-forth or up-and-down motion, a worker may be struck by or caught between a moving and a stationary part.
- **Traverse motion** (movement in a straight, continuous line) creates a hazard because a worker may be struck or caught in a pinch or shear point by the moving part.

2.2.2 Actions

- **Cutting action** may involve rotating, reciprocating, or traverse motions. The danger of cutting action exists at the point of operation where finger, arm and body injuries can occur and where flying chips or scrap material can strike the head, particularly in the area of the eyes or face. Such hazards are present at the point of operation in cutting wood, metal, or other materials.
  - Examples of mechanisms involving cutting hazards include band saws, circular saws, boring or drilling machines, turning machines (lathes), or milling machines.
- **Punching action** results when power is applied to a slide (ram) for the purpose of blanking, drawing, or stamping metal or other materials. The danger of this type of action occurs at the point of operation where stock is inserted, held, and withdrawn by hand.
  - Typical machines used for punching operations are power presses and iron workers.
- **Shearing action** involves applying power to a slide or knife in order to trim or shear metal or other materials. A hazard occurs at the point of operation where stock is actually inserted, held, and withdrawn.
  - Examples of machines used for shearing operations are mechanically, hydraulically, or pneumatically powered shears.
- **Bending action** results when power is applied to a slide in order to draw or stamp metal or other materials. A hazard occurs at the point of operation where stock is inserted, held, and withdrawn.
  - Equipment that uses bending action includes power presses, press brakes, and tubing benders.

2.2.3 Requirements for Safeguards – Safeguards must meet these minimum general requirements:

- **Prevent contact** – The safeguard must prevent hands, arms, and any other part of a worker's body or clothing from making contact with dangerous moving parts. A good safeguarding system eliminates the possibility of the operator or another worker placing parts of their bodies near hazardous moving parts.
- **Positioning of fixed machines –** Sufficient clearance will be provided around and between machines to allow for safe operations, set up and servicing, material handling and waste removal.
- **Secure** – Workers should not be able to easily remove or tamper with the safeguard. Guards and safety devices should be made of durable material that will withstand the conditions of normal use. They must be firmly secured to the machine.
- **Protect from falling objects** – The safeguard should ensure that no objects can fall into moving parts. A small tool which is dropped into a cycling machine could easily become a projectile that could strike and injure someone.
- **Create no new hazards** – A safeguard defeats its own purpose if it creates a hazard of its own such as a shear point, a jagged edge, or an unfinished surface which can cause a laceration. The edges of guards, for instance, should be rolled or bolted in such a way that they eliminate sharp edges.
- **Create no interference** – Any safeguard which impedes a worker from performing the job quickly and comfortably might soon be overridden or disregarded. Proper safeguarding can actually enhance efficiency since it can relieve the worker's apprehensions about injury.

- **Allow safe lubrication** – If possible, one should be able to lubricate the machine without removing the safeguards. Locating oil reservoirs outside the guard, with a line leading to the lubrication point, will reduce the need for the operator or maintenance worker to enter the hazardous area.

2.2.4 Training

Even the most elaborate safeguarding system cannot offer effective protection unless the worker knows how to use it and why. Specific and detailed training is therefore a crucial part of any effort to provide safeguarding against machine-related hazards. Thorough operator training with the use of manufacturers' instructions, should involve instruction or hands-on training in the following:

- A description and identification of the hazards associated with particular machines;
- The safeguards themselves, how they provide protection, and the hazards for which they are intended;
- How to use the safeguards and why;
- How and under what circumstances safeguards can be removed, and by whom (in most cases, repair or maintenance personnel only); and
- What to do (e.g., contact the supervisor) if a safeguard is damaged, missing, or unable to provide adequate protection and take the affect machine out of service until the guard is repaired or replaced.

This kind of safety training is necessary for new operators and maintenance or setup personnel, when any new or altered safeguards are put in service, or when workers are assigned to a new machine or operation.

3.0 Guards

Method	Safeguarding Action	Advantages	Limitations
Fixed	Provides a barrier.	Can be constructed to suit many specific applications In-plant construction is often possible. Can provide maximum protection. Usually requires minimum maintenance. Can be suitable to high-production, repetitive operations.	May interfere with visibility. Can be limited to specific operations. Machine adjustment and repair often require its removal, thereby necessitating other means of protection for maintenance personnel.
Interlocked	Shuts off or disengages power and prevents starting of machine when guard is open; should require the machine to be stopped before the worker can reach into the danger area.	Can provide maximum protection. Allows access to machine for removing jams without time-consuming removal of fixed guards.	Requires careful adjustment and maintenance may be easy to disengage jams.
Adjustable	Provides a barrier that may be adjusted to facilitate a variety of production operations.	Can be constructed to suit many specific applications. Can be adjusted to admit varying sizes of stock.	Hands may enter danger area; protection may not be complete at all times. May require frequent maintenance and/or adjustment. The guard may be made ineffective by the operator may interfere with visibility.
Self-adjusting	Provides a barrier that moves according to the size of the stock entering the danger area.	Off-the-shelf guards are often commercially available.	Does not always provide maximum protection may interfere with visibility may require frequent maintenance and adjustment.

Americas

Cold Stress Prevention

S3NA-505-PR1

1.0 Purpose and Scope

1.1 To protect employees from the severest effects of cold stress (hypothermia) and cold injury and to identify exposures to cold working conditions under which it is believed nearly all employees can be repeatedly exposed without adverse health effects.

1.2 This procedure applies to all AECOM Americas based employees and operations.

2.0 Terms and Definitions

2.1 **Cold Stress** – The production of physiological effects due to cold temperatures and\or wind chill.

2.2 **Equivalent Chill Temperature (ECT)** – Also known as Wind Chill (see below).

2.3 **Frostnip** – Superficial cooling of tissues without cellular destruction.

2.4 **Frostbite –** Freezing of tissue, resulting in tissue destruction.

2.5 **Hypothermia –** Condition of reduced core body temperature to 95^{o}F (35^{o}C) resulting in loss of dexterity, loss of mental alertness, collapse, and possible death.

2.6 **Wind Chill –** The combined effect of air temperature and wind. Also expressed as "equivalent chill temperature" (ECT), wind chill is defined as heat loss resulting from the effects of air temperature and wind velocity upon exposed skin.

3.0 References

3.1 S3NA-003-PR1 SH&E Training

3.2 S3NA-208-PR1 Personal Protective Equipment

3.3 S3NA-605-PR1 Medical Surveillance Program

4.0 Procedure

4.1 Roles and Responsibilities

4.1.1 **Project Manager**

- Ensuring the safety of employees on their project sites, consistent with *S3NA-505-ST Cold Exposure* standards
- Implement cold stress prevention measures as applicable at each work site.
- Develop/coordinate a work-warning regimen, as applicable.
- Confirm cold stress hazard assessments/evaluations were completed for the planned activities.
- Assign employees physically capable of performing the assigned tasks. Consider acclimation to cold weather when evaluating employee capability.
- Confirm employees are properly trained to recognize the symptoms of cold stress.

4.1.2 **Region SH&E Manager**

- Conduct/support cold stress assessments/evaluations.
- Conduct/support incident investigations related to potential cold stress-related illnesses.

- Assist project teams develop appropriate work-warming regimens.
- Provide cold stress awareness training.

4.1.3 **Supervisor**

- Identify the tasks that may be most impacted by cold stress and communicate the hazard to the assigned employees.
- Confirm that employees have been trained on the recognition of cold stress-related illnesses.
- Confirm that adequate supplies of warm fluids/drinks are readily available to employees.
- Confirm that a warm/sheltered rest area is available, as applicable.
- Conduct cold stress monitoring, as applicable.
- Implement the work-warming regimen.
- Confirm that first aid measures are implemented once cold stress symptoms are identified.
- Confirm that employees are physically capable of performing the assigned tasks and are not in a physically compromised condition.

4.1.4 **Employee**

- Observe each other for the early symptoms of cold stress-related illnesses.
- Maintain an adequate intake of available fluids.
- Report to work in a properly vested condition.
- Report all suspected cold stress-related illnesses.

4.2 Restrictions

4.2.1 Staff working in extreme cold (wind chill or ECT below 10^{o}F or -12^{o}C) shall not work alone.

4.2.2 All staff working in extreme cold or snow conditions should understand the following guidelines for preventing and detecting hypothermia and frost bite, refer to *S3NA-505-WI2 Symptoms and Treatment*:

- If you experience frost bite or hypothermia, find shelter and warmth and contact a medical practitioner if symptoms persist, refer to *S3NA-605-PR1 Medical Surveillance Program*.
- Take frequent short breaks in warm dry shelters to allow your body to warm up. Limit time of exposure.
- Schedule work for the warmest part of the day or when the wind is most calm.
- Avoid exhaustion or fatigue because energy is needed to keep muscles warm.
- Because prolonged exposure to cold air or to immersion in cold water at temperatures even well above freezing can lead to dangerous hypothermia, whole-body protection shall be used.

4.3 Training

Before they begin work in a cold environment, **employees** that might be exposed to cold stress will be informed of the potential for cold stress and how to prevent cold stress. **Employees** that have not had the training within the twelve prior months shall repeat the training before exposure to cold stress**,** refer to *S3NA-003-PR1 SH&E Training*. **Employees** potentially exposed to cold stress will receive training including, but not limited to:

- Sources of cold stress, the influence of protective clothing, and the importance of acclimatization;
- How the body loses heat;
- Recognition of cold-related illness symptoms;

- Cold stress preventative/corrective measures;
- The harmful effects of excessive alcohol consumption in a cold stress environment;
- The hazards associated with unstable snow or ice build ups; and
- First aid procedures for symptoms related to cold stress.

4.4 Personal Protective Equipment (PPE)

All PPE will comply with the requirements of *S3NA-208-PR1 Personal Protective Equipment* and consider the following requirements:

- Wear multiple layers of loose fitting clothing to maintain immobile layers of warm air next to the body.
- Avoid cotton, especially blue jeans.
- Wear proper clothing, including head coverings and gloves or mittens for cold, wet, and windy conditions.
- Use insulated footwear with adequate traction to prevent slips and falls.
- Confirm extra blankets or sleeping bags are on-site.
- Sunglasses and sunscreen should be used when there is a persistent combination of snow and direct sun.
- If shelter is not readily available, consider supplying temporary shelters
- Confirm that employees carry fire starter materials if working in remote areas.
- Pack warm, sweet drinks, and high calorie food for snacks.

4.5 General Cold Stress Prevention Measures

4.5.1 In order to prevent hypothermia:

- Wear multiple layers of clothing to maintain immobile layers of warm air next to the body. Avoid cotton, especially blue jeans.
- When active, ventilate excess heat by opening or removing outer layers of clothing to avoid sweating.
    - Start with the mitten or gloves, unless protection from ice, snow, or cold metal surfaces is needed.
    - Next remove head gear and neck wrappings.
    - Then coats/parkas should be opened at the waist and sleeves.
    - Finally, layers of clothing should be taken off.
    - When resting or tired, or colder conditions are encountered, add additional layers of clothing/ close outer layers in the reverse of the above order, or get out of the cold. Have a sweet drink but do not indulge in heavy eating.
- Garments worn to keep out rain and spray should also allow water vapor to escape.
- Take advantage of heat from the sun and stay out of the wind as much as possible.
- Have available emergency shelter providing protection from wind and rain and insulation from the ground.
- Replace wet clothing. If wet clothing cannot be replaced, then cover it with a layer of non-breathing material to prevent evaporation. Place an insulation layer over this non-breathing material.
- Get adequate rest; conserve energy.
- Get adequate nutrition to replenish energy stores; rest after meals.

- Drink adequate fluids to avoid dehydration.
- If any project staff member shows signs of hypothermia, stop and treat him/her.

4.5.2 In order to prevent frost bite:

- Dress to prevent hypothermia and protect the feet and hands.
- Avoid obstruction of circulation by, for example, tight boots or tightly fitting clothing.
- Avoid nicotine, particularly cigarettes, and alcohol.
- Keep ears and nose covered and out of the wind.
- Frostbite of the corneas of the eyes can be prevented by protective goggles.
- Adopt a “buddy system” of constantly watching the faces of others in the party for white skin tissue, which is evidence of frostbite (frostnip).
- Practice constant personal vigilance for signs of trouble in one’s own fingers and toes; when in doubt, investigate thoroughly before it is too late.

4.5.3 Adequate, insulating dry clothing that will help maintain core temperatures above 96.8oF (37oC) shall be provided to **employees** if work is performed in air temperatures below 40oF (5oC). Wind chill cooling rate and the cooling power of air are critical factors. The higher the wind speed and the lower the temperature in the work area, the greater the insulation value of the protective clothing required.

4.5.4 An Equivalent Chill Temperature (ECT) chart relating the actual dry bulb air temperature and the wind velocity is presented in *S3NA-505-WI1 Temperature Thresholds*. Unless unusual or extenuating circumstances exist, cold injury to other than hands, feet, and head is not likely to occur without the development of the initial signs of hypothermia. Superficial or deep local tissue freezing will occur only at temperatures below 32oF (0o C) regardless of wind speed. However, older **employees** or **employees** with circulatory problems require special precautionary protection against cold injury. The use of extra insulating clothing and/or a reduction in the duration of the exposure period are among the special precautions that should be considered.

4.5.5 Continuous exposure of skin should not be permitted when the air speed and temperature results in an ECT of –25oF (-32o C) or below.

4.5.6 At air temperatures of 40oF (5oC) or less, it is imperative that **employees** who become immersed in water or whose clothing becomes wet be immediately removed from the cold environment, provided a change of clothing, and be treated for hypothermia.

4.5.7 If the air velocity at the job site is increased by wind, draft, or artificial ventilating equipment, the cooling effect of the wind should be reduced by shielding the work area or by wearing an easily removable windbreak garment.

4.5.8 Adequate protection, such as general ventilation, shall be incorporated into any warming shelter design to prevent carbon monoxide poisoning.

4.5.9 Operation of internal combustion or similar devices within warming shelters is prohibited.

4.5.10 If the available clothing does not give adequate protection to prevent hypothermia or frostbite, work should be modified or suspended until adequate clothing is made available or until weather conditions improve.

4.5.11 Walking and working surfaces shall be cleared of ice and snow to prevent slips and falls.

4.5.12 Supplies such as PPE, fuels, enclosures, de-icing, traction aids, warm drinks, and batteries will be specified by the **Region SH&E Manager** and/or the **Project Manager**. These supplies will be inspected at least weekly during cold weather projects and replaced when necessary.

4.6 Cold Stress Prevention Measures for the Hands

4.6.1 Special protection of the hands is required to maintain manual dexterity for the prevention of accidents including, but not limited to the following:

- If fine work is to be performed with bare hands for more than 10 to 20 minutes in an environment below 60°F (15° C), special provisions should be established for keeping the employees' hands warm. For this purpose, warm air jets, radiant heaters (fuel burner or electric radiator), or contact warm plates may be utilized. Metal handles of tools and control bars should be covered by thermal insulating material at temperatures below 30°F (-1° C).
- If the air temperature falls below 60°F (15° C) for sedentary work, 40°F (5° C) for light work, or 20°F (-6° C) for moderate work, and fine manual dexterity is not required, **employees** should use gloves.

4.6.2 To prevent contact frostbite, **employees** should wear anti-contact gloves:

- When cold surfaces below 20oF (-6o C) are within reach, each **employee** should be warned to prevent inadvertent contact by bare skin.
- If the air temperature is 0oF (-18o C) or less, **employees** should protect their hands with mittens. Machine controls and tools for use in cold conditions should be designed so that they can be handled without removing the mittens.

4.6.3 Provisions for additional total body protection are required if work is performed in an environment at or below 40°F (5° C). The **employees** should wear cold protective clothing appropriate for the level of cold and physical activity.

4.6.4 Additional Cold Stress Prevention Measures:

For work practices at or below 10°F (-12° C) ECT, the following will apply:

- The **employee** should be under constant protective observation (buddy system or supervision).
- The work rate should not be so high as to cause heavy sweating that will result in wet clothing. If heavy work is being performed, rest periods should be taken in heated shelters and opportunities to change into dry clothing should be provided.
- New **employees** should not be required to work full time in the cold during the first days of employment until they become acclimated to the working conditions and required protective clothing.
- The weight and bulkiness of clothing should be included in estimating the required work performance and weights to be lifted by the employee.
- The work should be arranged in such a way that sitting still or standing still for long periods is minimized. Unprotected metal chair seats should not be used. The **employee** should be protected from drafts to the greatest extent possible.
- Workers should be instructed in safety and health procedures, which should address:
  - Proper rewarming procedures and appropriate first aid treatment,
  - Proper clothing practices,
  - Proper eating and drinking habits,
  - Recognition of impending frostbite,
  - Recognition of signs and symptoms of impending hypothermia or excessive cooling of the body even when shivering does not occur, and
  - Safe work practices.

4.6.5 Eye protection for employees employed outdoors in a snow and/or ice-covered terrain should be supplied. Special safety goggles to protect against blowing ice crystals and ultraviolet light and

glare (which can produce temporary conjunctivitis and/or temporary loss of vision) should be required when there is an expanse of snow coverage causing a potential eye exposure hazard.

4.6.6 **Employees** handling evaporative liquid (gasoline, alcohol, or cleaning fluids) at air temperatures below 40^{o}F should take special precautions to avoid soaking of clothing or gloves with the liquids because of the added danger of cold injury due to evaporative cooling. Special note should be taken of the particularly acute effects of splashes of “cryogenic fluids” or those liquids with a boiling point that is just above ambient temperature.

4.6.7 Trauma sustained in freezing or subzero conditions requires special attention, because an injured **employee** is predisposed to cold injury. Special provisions should be made to prevent hypothermia and freezing of damaged tissue in addition to providing for first aid treatment.

4.7 Work-Warming Regimen

4.7.1 If work is performed continuously in the cold at an equivalent chill temperature (ECT) at or below -15^{o}F (–26^{o}C), heated warming shelters (tents, cabins, rest rooms, etc.) should be made available nearby. The **employees** should be encouraged to use these shelters at regular intervals; the frequency will depend on the severity of the environmental exposure.

4.7.2 The onset of heavy shivering, minor frostbite (frostnip), the feeling of excessive fatigue, drowsiness, irritability, or euphoria are indications for immediate return to the shelter.

4.7.3 When entering the heated shelter, the outer layer of clothing should be removed and the remainder of the clothing should be loosened to permit sweat evaporation or a change of dry work clothing provided.

4.7.4 A change of dry work clothing should be provided as necessary to prevent **employees** from returning to the cold environment with wet clothing.

5.0 Records

5.1 Exposure assessments will be documented in the project files.

6.0 Attachments

6.1 S3NA-505-WI1 Temperature Thresholds

6.2 S3NA-505-WI2 Symptoms and Treatment

6.3 S3NA-505-ST Cold Exposure

Americas

Temperature Thresholds

S3NA-505-WI1

1.0 Purpose and Scope

1.1 The following table gives apparent temperatures (wind chill) for various combinations of wind and air temperature, as well as guidelines to the danger of skin exposure.

Table 1. Wind Chill Chart (C)

Actual Temp (°C)	Wind Speed in km/hour									
	8	16	24	32	40	48	56	64	72	80
	Ambient Temperature (°C)									
0	-2	-8	-11	-14	-16	-17	-18	-19	-19	-20
-5	-7	-14	-18	-21	-23	-25	-26	-27	-28	-28
-10	-12	-20	-25	-28	-31	-33	-34	-35	-36	-36
-15	-18	-26	-32	-35	-38	-40	-42	-43	-43	-44
-20	-23	-32	-38	-43	-46	-48	-50	-51	-52	-52
-25	-28	-38	-45	-50	-53	-56	-57	-59	-59	-60
-30	-33	-45	-52	-57	-61	-63	-65	-67	-67	-68
-35	-39	-51	-59	-64	-68	-71	-73	-75	-75	-76
-40	-44	-57	-65	-71	-75	-79	-81	-83	-83	-84
-45	-49	-63	-72	-78	-83	-86	-89	-90	-91	-92
-50	-54	-69	-79	-85	-90	-94	-96	-98	-99	-100

Note: A. Little Danger: if less than one hour of exposure to dry skin.
B. Danger: Exposed flesh freezes within one minute.
C. Great Danger: Flesh may freeze with in 30 seconds.

*Source: *2014 Threshold Limit Values (TLV™) and Biological Exposure Indices (BEI™) booklet; published by ACGIH, Cincinnati, Ohio.*

Table 2. Equivalent Chill Temperature Chart (F)

Estimated Wind Speed (mph)	Actual Temperature Reading (°F)									
	50	40	30	20	10	0	-10	-20	-30	-40
	Equivalent Chill Temperature (°F)									
Calm	50	40	30	20	10	0	-10	-20	-30	-20
5	48	37	27	16	6	-5	-15	-26	-36	-47
10	40	28	16	4	-9	-24	-33	-46	-58	-70
15	36	22	9	-5	18	-32	-45	-58	-72	-85
20	32	18	4	-10	-25	-39	-53	-67	-82	-96
25	30	16	0	-15	-29	-44	-59	-75	-88	-104
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109
35	27	11	-4	-20	35	-51	-67	-82	-98	-113
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116
Wind speeds >40 mph have little additional effect	LITTLE DANGER				INCREASING DANGER			GREAT DANGER		
	Trenchfoot and immersion foot may occur at any point on this chart.									

Table 3. Work-Warming Schedule Guidelines

Air Temp. (Sunny Sky) °F	No Noticeable Wind		5 mph Wind		10 mph Wind		15 mph Wind		20 mph Wind		25 mph Wind		Air Temp. (Sunny Sky) °C
	Max. Work Period	Breaks	Max. Work Period	Breaks	Max. Work Period	Breaks	Max. Work Period	Breaks	Max. Work Period	Breaks	Max. Work Period	Breaks	
above 5°	Normal Work Schedule		Normal Work Schedule		Normal Work Schedule		Normal Work Schedule		Normal Work Schedule		Normal Work Schedule		above -15°
5° to –1°											100 min	2	-15° to -17°
0° to –4°									100 min	2	75 min	2	-18° to -20°
-5° to –9°							100 min	2	75 min	2	55 min	3	-21° to -22°
-10° to –14°					100 min	2	75 min	2	55 min	3	40 min	4	-23° to -25°
-15° to –19°			100 min	2	75 min	2	55 min	3	40 min	4	30 min	5	-26° to -28°
-20° to –24°	100 min	2	75 min	2	55 min	3	40 min	4	30 min	5	Cease Work		-29° to -31°
-25° to –29°	75 min	2	55 min	3	40 min	4	30 min	5	Cease Work				-32° to -34°
-30° to –34°	55 min	3	40 min	4	30 min	5	Cease Work						-35° to -37°
-35° to –39°	40 min	4	30 min	5	Cease Work								-38° to -39°
-40° to –44°	30 min	5	Cease Work										-40° to -42°
-44° & below	Cease Work												-43° & below

Modified from ACGIH 2014 Threshold Limit Values for Chemical Substances and Physical Agents.

Note 1: Schedule describes the maximum continuous duration of work and number of 10-15 minute breaks to be observed during any 4-hour work period and assumes that period will be followed by an extended warm-up period (e.g., lunch). Allowed breaks should be taken in a warm environment.

Note 2: Schedule applies to moderate to heavy work performed by acclimated workers wearing appropriate layered clothing. For light to moderate work apply the schedule for conditions one step lower. For unacclimated workers apply the schedule for conditions two steps lower. These modifications are additive.

Note 3: For work under 25%–50% overcast/clouds, apply the schedule for conditions one step lower. For work at night or under greater then 50% overcast/clouds, apply the schedule for conditions two steps lower. These modifications are additive with any applicable modifications from Note 2.

Note 4: For wind speeds in excess of 25 mph, cease all nonemergency work when temperatures fall below 5°F.

Symptoms and Treatment

1.0 Cold Stress-related Illnesses

1.1 Frostbite

1.1.1 Frostbite is a localized cold injury characterized by freezing of the tissues with ice crystal formation.

1.1.2 This injury is almost always limited to the upper and lower extremities or to such appendages as the ears or nose.

1.1.3 Conditions conducive to frostbite include sub-zero temperatures, hypothermia (most important predisposing factor), dehydration, obstruction of the blood supply to the extremities (by constricting clothing, especially on the feet or at the wrists or ankles), contact with cold metal, contact with organic liquids (such as gasoline or solvents that have been left outdoors in sub-zero temperatures), use of substances that cause vasoconstriction (such as smoking tobacco), or other injury or shock.

1.1.4 Symptoms of frostbite include:

- Pain in the involved tissue is the earliest symptom;
- Sudden and complete cessation of cold or discomfort in affected fingers or toes, often followed by a pleasant feeling of warmth;
- Subsequently the only symptom may be the absence of any sensation in the frozen part;
- Paleness in the affected tissues;
- Firm or hard tissues; and
- Purple tissue, if a large area, such as an entire hand or food, is frostbitten.

1.1.5 If exposure occurs in temperatures that are below freezing (32ºF or below), frostbite or trench foot (immersion foot) may accompany or complicate the symptoms of hypothermia. Frostbite is the freezing of living tissues with a resultant breakdown of cell structure. Symptoms due to frostbite may include, but is not limited to:

- Superficial redness of the skin,
- Slight numbness,
- Blisters,
- Obstruction of blood flow (ischemia),
- Blood clots (thrombosis), and
- Skin discoloration due to insufficient oxygen in the blood (cyanosis).

1.1.6 Frostbite may occur if the skin comes into contact with objects with a surface temperature below freezing, such as metal tool handles. Trench foot is caused by continuous exposure to cold combined with persistent dampness or immersion in water. Injuries in this case include permanent tissue damage due to oxygen deficiency, damage to capillary walls, severe pain, blistering, tissue death, and ulceration.

1.1.7 Additionally, cold exposures may either induce or intensify vascular abnormalities. These include chilblain (a swelling or sore), Raynaud's disease, acrocyanosis (blueness of hands and feet) and thromboangiitis (inflammation of the innermost walls of blood vessels with accompanying clot formation). Workers suffering from these ailments should take particular precautions to avoid chilling.

1.2 Hypothermia

1.2.1 Hypothermia is a lower than normal body temperature that occurs when outer cold cools the body faster than the body can produce heat to stay warm.

1.2.2 Hypothermia can be caused by exposure to wind, cold, and/or moisture. The combination of wind, cold, and moisture can be deadly.

1.2.3 Early warning signs of hypothermia:

- Feeling of being cold and tired,
- Heavier breathing and increased pulse rate,
- Tendency to keep moving (e.g., stamping feet, rubbing hands, continued walking/pacing),
- Goose bumps, holding arms tightly wrapped around the body, hunching of shoulders, and
- Shivering.

1.2.4 Hypothermia damages both the body's internal temperature mechanisms (hypothalamus) and the peripheral mechanisms to prevent heat loss (vasoconstriction and perspiration.) These effects may last up to three years after the initial hypothermia episode. Symptoms of hypothermia may include, but are not limited to:

- Pain in the extremities,
- Severe shivering and numbness,
- Low core body temperature,
- Drowsiness and muscular weakness,
- Apathy,
- Mental confusion,
- Loss of consciousness,
- Shock, and
- Decreasing pulse and breathing rate.

2.0 Recommended Treatment for Cold Stress-related Illnesses

2.1 Frostbite

2.1.1 Wrap the victim in woollen blanket and keep dry until he or she can be brought inside.

2.1.2 Remove the victim from the cold environment.

2.1.3 Do not rub, chafe, or manipulate frozen parts.

2.1.4 Place the victim in warm water (102ºF to 105ºF) and make sure the water remains warm. Test the water by pouring it on the inner surface of your forearm. Never thaw affected body parts if the victim has to go back out into the cold; refreezing can cause significant tissue damage.

2.1.5 Do not use hot water bottles or a heat lamp, and do not place the victim near a hot stove.

2.1.6 Do not allow the victim to walk if his or her feet are affected.

2.1.7 Have the victim gently exercise the affected parts once they are thawed.

2.1.8 Seek immediate medical attention for thawing of serious frostbite.

2.2 Hypothermia

2.2.1 Bring the victim into a warm room or shelter as quickly as possible.

2.2.2 Give artificial respiration and stop any bleeding, if necessary.

2.2.3 If the victim cannot be moved (spinal injury, etc.), carefully place newspapers, blankets, or some other insulation between the victim and the ground.

2.2.4 Remove all wet clothing.

2.2.5 Provide an external heat source, because the body cannot generate its own heat. Wrap the victim in prewarmed blankets, place him or her in the liner of a portable hypothermia treatment unit, put the torso (not the extremities) into a tub of warm water, or use body-to-body contact to rewarm the body core. These measures will slowly reopen the peripheral circulation, minimizing the possibility of after-shock or after-drop (the flowing of cooled, stagnated blood from the limbs to the heart), which may cause ventricular fibrillation, cardiac arrest, or death.

2.2.6 Do not allow the victim to sleep.

2.2.7 Give warm, sweet drinks. Do not give alcohol or pain relievers.

2.2.8 Keep the victim still. Do not try to walk.

2.2.9 Do not rub numb skin.

2.2.10 Get medical attention as soon as possible.

Americas

Cold Exposure

S3NA-505-ST

The following Occupational Health and Safety regulations apply directly to cold and snow hazards:

Jurisdiction	Regulation
United States	
OSHA	Title 29, Code of Federal Regulations, Sections 1910.1027 and 1926.1127
Canada	
Alberta	n/a
British Columbia	OHS Regulation (1997) Sect 7.33 – 7.38
Manitoba	Workplace Health and Safety Regulation (217/2006) Sect 4.12, 4.14
New Brunswick	OHS Regulation (91-191) Sect 44
Newfoundland/Labrador	OHS Regulation (C.N.L.R. 1165/96) Sect 10
Nova Scotia	n/a
NWT/NU Territories	n/a
Ontario	O. Reg. 851 Sect 39, 129
Prince Edward Island	OHS Regulations (EC180/87) Sect 42.1
Quebec	OHS Regulation (R.R.Q., c. S-2.1, r.19.01 O.C. 885-2001) Schedule 4
Saskatchewan	OHS Regulation (R.R.S., c. O-1, r. 1) Sect 70 Cold Conditions Guidelines for Outside Workers
Yukon Territory	Occupational Health Regulations (O.I.C. 1986/164) Sect 9

Americas

Hazardous Materials Communication/WHMIS

S3NA-507-PR1

1.0 Purpose and Scope

1.1 Provides a Hazard Communication Program so that AECOM employees are informed of the hazards of the chemicals to which they may be exposed in the course of their work by way of container labeling and other forms of warning, safety data sheets (SDS), and employee training.

1.2 This procedure applies to all AECOM Americas-based employees and operations.

1.3 The program applies to the use of any hazardous substances which are known to be present in the workplace in such a manner that employees may be exposed under normal conditions of use or in a foreseeable emergency.

2.0 Terms and Definitions

2.1 **Acute Effect** – An adverse effect on the human body with immediate onset of symptoms.

2.2 **Article** – A manufactured item: (1) which is formed to a specific shape or design during manufacture; (2) which has end use function(s) dependent in whole or in part upon its shape or design during end use; and, (3) which does not release or otherwise result in exposure to, a hazardous chemical, under normal conditions of use.

2.3 **Carcinogen –** Those chemicals appearing in any of the following reference sources are established as carcinogens for hazard communication purposes:

- National Toxicology Program (NTP) Annual Report on Carcinogens.
- International Agency for Research on Cancer (IARC) Monographs, Volumes 1-34. Note: The Registry of Toxic Effects of Chemical Substances published by NIOSH indicates whether a substance has been found by NTP or IARC to be a potential carcinogen.

2.4 **Chemical Name –** The scientific designation of a substance in accordance with the nomenclature system developed by the International Union of Pure and Applied Chemistry or the system developed by the Chemical Abstracts Service.

2.5 **Chronic Effect –** An adverse effect on the human body with symptoms which develop slowly over a long period of time or which frequently recur.

2.6 **Combustible Liquid –** Any liquid having a flash point at or above 100°F (37.8°C) but below 200°F (93.3°C), except any mixture having components with flash points of 200°F (93.3°C), or higher, the total volume of which makes up 99% or more of the total volume of the mixture.

2.7 **Common Name –** Any designation or identification such as code name, code number, trade name or brand name used to identify a substance other than by its chemical name.

2.8 **Container –** Any bag, barrel, bottle, box, can, cylinder, drum, reaction vessel, storage tank or the like that contains a hazardous chemical. For purposes of this Safety Operating Procedure (SOP) and Occupational Safety and Health Administration (OSHA) standard, pipes or piping systems, and engines, fuel tanks, or other operating systems in a vehicle are not considered to be containers.

2.9 **Establishment –** Any separate and distinct AECOM office, laboratory or other company facility.

2.10 **Exposure –** Any situation arising from work operations where an employee may ingest, inhale, absorb through the skin or eyes or otherwise come into contact with a hazardous substance.

2.11 **Flammable –** A substance that falls into one of the following categories:

2.11.1 **Flammable Aerosol** – An aerosol that when tested by the method described in 16 CFR 1500.45, yields a flame projection exceeding 18 inches at full valve opening or flashback (a flame extending back to the valve) at any degree of valve opening;

2.11.2 **Flammable Gas** – A gas that at ambient temperature and pressure:

- Forms a flammable mixture with air at a concentration of 13% of volume or less; or
- Forms a range of flammable mixtures with air wider than 12% by volume, regardless of the lower limit.

2.11.3 **Flammable Liquid** – Any liquid having a flash point below 100°F (37.8°C), except any mixture having components with flash points of 100°F (37.8°C) or higher, the total of which make up 99% or more of the total volume of the mixture**.**

2.11.4 **Flammable Solid** – A solid, other than a blasting agent or explosive as defined in 8 CCR 5237(a), that is liable to cause fire through friction, absorption of moisture, spontaneous chemical change or retained heat from manufacturing or processing or which can be ignited readily and when ignited burns so vigorously and persistently as to create a serious hazard**.**

A chemical shall be considered to be a flammable solid if, when tested by the method described in 16 CFR 1500.44, it ignites and burns with a self-sustained flame at a rate greater than one-tenth of an inch per second along its major axis.

2.12 **Flash Point –** Minimum temperature of a liquid at which it gives off sufficient vapors to form an ignitable mixture with the air near the surface of the liquid or within the container used.

2.13 **Hazardous Chemical –** Those chemicals appearing in any of the following reference sources are established as hazardous chemicals for hazard communication purposes.

- 29 CFR Part 1910, Subpart Z, Toxic and Hazardous Substances, OSHA.
- Hazardous Products Act, R.C.S. 1985, c. H-3, section 2, Canada.
- For operations within the state of California, the list of hazardous substances prepared by the California Director of Industrial Relations pursuant to Labor Code Section 6382. The concentrations and footnotes, which are applicable to the list, shall be understood to modify the same substance on all other source lists or hazard determinations set forth in § 8 CCR 5194(d)(3)(B) and (d)(5)(D).

2.14 **Hazardous Substance –** A hazardous chemical or carcinogen, or a product or mixture containing a hazardous chemical or carcinogen provided that:

2.14.1 The hazardous chemical is 1% or more of the mixture or product or 2% if the hazardous chemical exists as an impurity in the mixture; or

2.14.2 The carcinogen is 0.1%or more of the mixture or product;

2.14.3 Manufacturers, importers and distributors will be relied upon to perform the appropriate hazard determination for the substances they produce or sell.

2.14.4 The following materials are not covered by the Hazard Communication Standard:

- Any hazardous waste as defined by the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act of 1976, as amended (42 USC 6901 et seq.) when subject to regulations issued under that act by the Environmental Protection Agency.
- Tobacco or tobacco products;
- Wood or wood products. Note: Wood dust is not exempt since the hazards of wood dust are not “self-evident” as are the hazards of wood or wood products;
- Consumer products (including pens, pencils, adhesive tape) used in the work place under typical consumer usage;
- Articles (i.e. plastic chairs);
- Foods, drugs, or cosmetics intended for personal consumption by employees while in the work place;

- Foods, drugs, cosmetics in retail store packaged for retail sale; and
- Any drug in solid form used for direct administration to the patient (i.e., tablets or pills).

2.15 **Hazardous Substance Inventory (HSI) / WHMIS Log –** A listing of all chemicals stored or used at an office or project site. Note that the list may be imbedded in a project Health and Safety Plan.

2.16 **Immediate Use –** Means that the hazardous chemical will be under the control of and used only by the person who transfers it from a labeled container and only within the work shift in which it is transferred.

2.17 **SDS –** A Safety Data Sheet prepared pursuant to state and federal regulations, OSHA Form 174 and Canada regulations (Controlled Products regulations, schedule 1).

2.18 **SDS Administrator –** The individual or group designated by the Office Manager (Operations) or Project Manager to maintain the establishment-specific inventory list or log and the SDS binder required if that establishment uses or stores hazardous substances.

2.19 **NFPA –** A system of categories, colors and numbers was created to provide basic hazard information. It enables firefighters and other emergency personnel to easily decide whether or not to evacuate an area or proceed with emergency control operations. The three principal categories of identification are Health, Flammability and Instability. A numerical range of “0 to 4” indicates the severity of the hazard. A “4” indicates the most severe and a “0” indicates a minimal hazard.

2.20 **Mixture –** Any solution or intimate admixture of two or more substances which do not react chemically with each other.

2.21 **Reactivity** – A measure of the tendency of a substance to undergo chemical reaction with the release of energy.

2.22 **Solubility –** The ability of substance to blend and mix uniformly with another.

2.23 **Specific Gravity (density) –** Ratio of the weight of a substance to the weight of the same volume of another substance. As used in this directive, specific gravity or density refers to the weight of substance as compared to the weight of an equal volume of water.

2.24 **Vapor Density –** The weight of a vapor-air mixture resulting from the vaporization of a volatile liquid at equilibrium temperature and pressure conditions, as compared with the weight of an equal volume of air under the same conditions.

2.25 **WHMIS –** The Workplace Hazardous Materials Information System (WHMIS) is Canada's national hazard communication standard. The key elements of the system are cautionary labeling of containers of WHMIS "controlled products", the provision of material safety data sheets (SDSs) and worker education and training programs.

3.0 References

3.1 Additional definitions can be found in the Hazardous Material Regulations (HMR), the Transportation of Dangerous Goods (TDG) Regulations, and the International Air Transport Association (IATA) Dangerous Goods Regulation (DGR)

3.2 S3NA-003-PR1 SH&E Training

3.3 S3NA-208-PR1 Personal Protective Equipment Program

3.4 S3NA-209-PR1 Project Hazard Assessment and Planning

3.5 S3NA-509-PR1 Hazardous Waste Operations and Emergency Response

4.0 Procedure

4.1 Roles and Responsibilities

4.1.1 **Region SH&E Manager / SH&E Department**

- Audit their regional offices to assure that they maintain an establishment-specific Hazardous Substance Inventory (HSI).
- Audit their regional offices to assure that if an establishment-specific HSI is required, that SDSs are available for each substance listed on the HSI.
- Provide interpretation of SDSs and hazard information for WHMIS labels/NFPA labels and other information to assist in training employees.
- Provide hazard communication training to AECOM employees and file documents of this training.
- Review SDS for adequacy of completion to meet the OSHA and Canadian standard and returning them to supplier, if necessary.

4.1.2 **Project Manager / Site Safety Officer (SSO)**

- Access or obtain, and maintain copies of SDS from:
  - All AECOM subcontractors bringing chemicals onto the project site; and
  - The client, for all of the client's chemicals to which AECOM or AECOM subcontract employees are potentially exposed.

4.1.3 **Office Manager (Operations)**

- Have an operations-specific, written hazard communication program which at least describes how the requirements of this Procedure and the US OSHA and Canadian Hazard Communication requirements for labels and other forms of warning, material safety data sheets, and employee information and training will be met.
- Appoint an SDS administrator for their establishment if they store or use hazardous substances.
- Confirm, if required, that the SDS Administrator maintains an HSI for their establishment.
- Confirm that SDS are available for all substances listed on their establishment's HSI.
- Confirm that a copy of this Procedure and the site-specific SDS are available to all employees. Employees shall be instructed in the location of this Procedure and the SDS.
- Confirm that all employees in their office affected by the HAZCOM standard are provided with the appropriate training, including new employees.

4.1.4 **Supervisor**

- Confirm that all employees under their supervision have received the initial and periodic training required by this SOP prior to assigning employees to tasks involve the use of, or potential exposure to, hazardous substances.
- Notify employees of hazardous substances covered by this SOP that are used in their work area.
- Determine the potential fire, toxic, or reactivity hazards which are likely to be encountered in the handling or utilization of a hazardous substance and will communicate this information to their affected employees, before any are permitted to work with it.
- Confirm that an SDS is available for each hazardous substance used, or potentially encountered, in the work areas or on the projects that are under their supervision.
- Notify subcontractors (working for AECOM) of any hazardous substances that are used or stored by AECOM to which the subcontractor's employees may be exposed.

- Notify clients or property owner/operators of chemicals brought onto their property by AECOM or AECOM's subcontractors.
- Request SDSs from all subcontractor organization for the relevant chemicals they bring onto an AECOM controlled site.

4.1.5 **Employee**

- Confirm that they have received appropriate hazard communication training prior to working with materials that fall under the standard.
- Only work with materials for which they have been instructed on how to find an SDS and how to work with that material safely.
- Provide a copy of all SDSs received to the SDS Administrator at their facility.
- Verify that an SDS is available in their work area for each hazardous substance that they use.

4.2 General Procedure

4.2.1 Confirm that containers of hazardous substances that they use are properly labelled. All employees have a right to, and should, know the properties and potential hazards of substances to which they may be exposed.

4.2.2 Should AECOM assign employees that do not read and speak English to tasks with chemical exposures, communications will be provided in the language understood by that employee.

4.3 Employee Information and Training

4.3.1 Each AECOM employee who handles or is exposed to hazardous substances must be provided information and training, refer to *S3NA-003-PR1 SH&E Training*, on hazardous substances in their work area:

- At the time of their initial assignment; and
- Whenever a new hazard is introduced into their work area.

4.3.2 As a minimum, the training requirements apply to employees in the following job categories:

- All employees who perform field work that involves the use of, or potential exposure to, hazardous substances; and
- Laboratory Employees.

4.3.3 The Initial Training will provide instruction in the following:

- Methods and observations that may be used to detect the presence or release of a hazardous substance in the work area (such as personal monitoring, visual appearance or odor of hazardous substances being released, etc.);
- The physical and health hazards of substances in the work area and measures and procedures AECOM has implemented to protect employees; and
- The details of this hazard communication program (SOP), including an explanation of the labelling system and the SDS, and how he/she can obtain and use appropriate hazard information.
- Any operations in their work area in which hazardous substances are present;
- Location and availability of this written hazard communications program (SOP);
- Their right to personally receive information regarding hazardous substances to which they may be exposed;
- Their right to have their physician receive information regarding hazardous substances to which they may be exposed; and

- Their right against discharge or other discrimination (in California) due to the employee's exercise of rights afforded pursuant to provisions of the California Hazardous Substances Information and Training Act.

4.3.4 Periodic Training and Training for Non-Routine Tasks

Additional training will be provided to employees who have received initial training whenever:

- A new hazardous substance is introduced into their work area;
- A new or revised SDS is received, which indicates significantly increased risks to employee health as compared to those stated on the previous SDS; and
- Non-routine tasks are performed, which will potentially result in exposure to hazardous substances, or exposure under circumstances, which were not addressed during initial training.

Supervisors, in coordination with their **Region SH&E Manager**, shall provide such training through an explanation of the information on the contents of the SDS for that substance.

When training their employees, supervisors shall explain:

- Any health hazards associated with use of the substance or mixture;
- Proper precautions for handling;
- Necessary personal protective equipment or other safety precautions to prevent or minimize exposure; and
- Emergency procedures for spills, fire, disposal, and first aid.

For most projects involving field work, this periodic training requirement will be facilitated through the implementation of the site specific HASP that has been developed for the project.

4.3.5 Documentation of Initial and Periodic Training

- All training required shall be documented at the time it is performed by having the employee sign a copy of a training attendance sheet.

4.4 Hazardous Waste Exemption

4.4.1 In the U.S., hazardous wastes are excluded from the state and federal Hazard Communication standards. AECOM employees who handle or are otherwise exposed to hazardous wastes are covered by the requirements of the Resource Conservation and Recovery Act (RCRA) and other local waste related laws and regulations and the OSHA Hazardous Waste Operations and Emergency Response (HAZWOPER) standard at 29 CFR 1910.120 and *S3NA-509-PR1 Hazardous Waste Operations and Emergency Response.*

4.5 Hazardous Substance Inventory and Chemical Usage

Establishment of a Specific Hazardous Substance Inventory (HSI) or WHMIS Log, as referenced or contained within the safe to work plan, refer *S3NA-209-PR1 Project Hazard Assessment and Planning*, shall include:

- If an AECOM establishment uses or stores additional hazardous substances, an establishment-specific HSI must be maintained at that establishment.
- If it is determined that an office-specific HSI is needed, the **Office Manager (Operations)** shall assure that one is developed and maintained by someone appointed as the establishment's SDS Administrator.
- The content of the office-specific written inventory shall be updated as new hazardous substances are procured for, or removed from, the establishment and shall be verified by the **Region SH&E Manager** through regular inspections of the establishment.

- In order to meet the 30-years-after-employment-termination record retention requirement, the office or project specific HSIs shall be managed as a permanent record.

Prior to using any chemical, a Task Hazard Analysis (THA) shall be completed by the employees assigned to use the chemical. The analysis will identify the hazards associated with the tasks to be performed and prescribe the Personal Protective Equipment (PPE) to be used, refer to *S3NA-208-PR1 Personal Protective Equipment Program.*

4.6 Safety Data Sheets (SDS)

4.6.1 Establishment-Specific SDS Inventory

- If it is determined that an AECOM establishment is required to maintain an establishment-specific inventory SDSs for the specific hazardous substances must be maintained on file at that establishment.
- The **Region SH&E Manager** shall audit the local office or project for SDS request and maintenance and report deficiencies to the appropriate management level, as necessary, to assure compliance with this SOP.

4.6.2 Field Project Sites and Client Facilities

- The **Project Manager** and/or the **Site Safety Officer** shall access or obtain, and maintain copies of SDS from:
  - All AECOM subcontractors bringing chemicals onto the project site; and
  - The client, for all of the client's chemicals to which AECOM or AECOM subcontract employees are potentially exposed.

4.6.3 Employee Access to SDSs

SDSs should be maintained at the local establishment that uses that hazardous substance. Copies of the SDS should be made available to the employee upon request to the office's SDS Administrator.

4.6.4 Field Access to SDSs

When hazardous substances are brought into the field, the user must assure that a copy of the SDS for that substance accompanies it and is available at the field location where it is to be used.

4.6.5 SDSs for AECOM Products

It is unlikely that AECOM activities would create a chemical for which a new SDS were needed. If such a chemical were created, the **SH&E Department** shall work with the appropriate operations groups to draft, review, and publish the new SDS.

4.6.6 Content of the Safety Data Sheet:

- Safety Data Sheets, previously referred to as Material Safety Data Sheets, will now require a 16-section format that is essentially the same as the ANSI standard for *Hazardous Workplace Chemicals-Hazard Evaluation and Safety Data Sheets and Precautionary Labeling Preparation* (ANSI Z400.1 & Z129.1 – 2010).
- Section 1, Identification includes product identifier; manufacturer or distributor name, address, phone number; emergency phone number; recommended use; restrictions on use.
- Section 2, Hazard(s) identification includes all hazards regarding the chemical; required label elements.
- Section 3, Composition/information on ingredients includes information on chemical ingredients; trade secret claims.
- Section 4, First-aid measures includes important symptoms/ effects, acute, delayed; required treatment.

- Section 5, Fire-fighting measures lists suitable extinguishing techniques, equipment; chemical hazards from fire.
- Section 6, Accidental release measures lists emergency procedures; protective equipment; proper methods of containment and cleanup.
- Section 7, Handling and storage lists precautions for safe handling and storage, including incompatibilities.
- Section 8, Exposure controls/personal protection lists OSHA's Permissible Exposure Limits (PELs); Threshold Limit Values (TLVs); appropriate engineering controls; personal protective equipment (PPE).
- Section 9, lists the chemical's characteristics.
- Section 10, Stability and reactivity lists chemical stability and possibility of hazardous reactions.
- Section 11, Toxicological information includes routes of exposure; related symptoms, acute and Section 9, Physical and chemical properties chronic effects; numerical measures of toxicity.
- Section 12, Ecological information
- Section 13, Disposal considerations
- Section 14, Transport information
- Section 15, Regulatory information
- Section 16, Other information, includes the date of preparation or last revision.

SDSs that do not contain this information shall be returned to the distributor or manufacturer to be updated.

4.6.7 Trade Secrets

Some hazardous substance suppliers may claim the information requested on SDSs is proprietary and not provide the information to AECOM.

When SDSs supplied to the **Region SH&E Manager** indicate that proprietary information has been withheld, the **Region SH&E Manager** will either obtain the necessary information to make a hazard assessment or reject the material for use within AECOM.

4.6.8 For Canadian operations, all relevant SDS must be current (no more than 3 years old) and readily available (in French and English) for all hazardous materials.

4.7 Labeling

4.7.1 Containers of hazardous substances used or stored in each AECOM establishment must be labeled, tagged or marked with the following information:

- Product name or Identifier;
- Hazard Pictogram;
- Signal Word;
- Physical, Health, Environmental Statements;
- Supplemental Information;
- Precautionary Measures and Pictograms;
- First Aid Statements;
- Name and Address of Company; and
- Telephone Number.

4.7.2 Labels on containers shall not be removed or defaced. Labels or other forms of warning shall be legible, in English and French (Canada), and prominently displayed on the container.

4.7.3 Any failure to have the appropriate labeling information on a container at any time will be cause to suspend use of the product until the container is properly labeled.

4.7.4 Carcinogen Labeling

Chemicals which have been indicated as positive or suspect carcinogens by either OSHA, ACGIH, the International Agency for Research on Cancer (IARC) (World Health Organization), or the National Toxicology Program (NTP) will be considered to be carcinogenic for purpose of the HCS. The following pictogram will be used to identify carcinogens:

4.7.5 Stationary Process Containers

If there is stationary process equipment within a work area, signs, placards, process sheets, batch tickets, operating procedures, or other such written materials may be used in lieu of fixed labels on the containers, as long as the alternative method conveys the appropriate hazard information. The written materials shall be readily accessible to the employees in the work area.

4.7.6 Portable Containers

Portable containers of hazardous substances need not be labelled when the substance is transferred from labelled containers and is intended for immediate use of the employee who performs the transfer.

Containers of hazardous substances transferred from labelled containers and not intended for the immediate use of the employee performing the transfer shall be labelled with the chemical name and a hazard warning label in accordance with the National Fire Protection Association's (NFPA) 704M Hazard Identification System shall be attached.

4.8 Chemical Storage

4.8.1 Hazardous chemicals are to be stored in labeled containers with the lids securely closed and taped if possible.

4.8.2 Flammable and combustible materials must be stored in fire impervious cabinets in designated stockroom areas. Chemicals must be stored in compliance with instructions provided on their labels, SDS, or the manufacturer's specifications.

4.8.3 All hazardous chemicals must be stored in a manner that prevents spillage and leakage from exposing people or the environment to the chemical.

4.8.4 Hazardous chemicals shall not be stored with foods or beverages. Food and beverages shall not be consumed in areas where hazardous chemicals are used or stored.

4.9 Chemical Use in Offices

4.9.1 In general, hazardous substances should not be taken into office areas, conference rooms, or break areas, contact the **SH&E Department** for guidance If this general requirement is infeasible.

4.9.2 General exceptions to this rule are the following:

- Liquid paper;
- Toner;
- Cleaners;
- Isobutylene calibration gas; and
- pH calibration solutions for instruments.

4.9.3 Each office or location using or storing hazardous materials will develop a written office/ location-specific Hazard Communication/WHMIS Program.

4.9.4 If the local office decides to implement the requirements of the standard in any way that differs from this procedure, they shall verify the changes with the **SH&E Department**, document the changes, and communicate the differences to all affected employees.

4.10 Canada-specific

4.10.1 Consumer products are exempt from supplier labels and SDS requirements. Some cleaning solvents may be packaged as consumer products and these must be labeled in accordance with the Consumer Product Act requirements.

4.10.2 In addition to the labelling of storage containers in the workplace, the contents of process piping (including valves), process vessels and reaction vessels are required to be identified through the use of colour coding, labels, placards or other modes of identifications that must be communicated to workers through training programs. It is very important for employees to be aware of and understand Client labelling requirements for these types of process systems.

5.0 Records

5.1 None

6.0 Attachments

6.1 None

Americas

Hazardous Waste Operations and Emergency Response Activities

S3NA-509-PR1

1.0 Purpose and Scope

1.1 Provides requirements for AECOM operations pertaining to hazardous waste and emergency response (HAZWOPER) services.

1.2 This procedure applies to all AECOM Americas-based employees and operations.

1.3 In Canada there is no direct federal or provincial counterpart to HAZWOPER; however, as due diligence and in compliance with applicable provincial duty of care/general duty clauses, staff working in Canada will comply with this procedure.

2.0 Terms and Definitions

2.1 **Emergency Response** – A response effort by employees from outside the immediate release area or by other designated responders (i.e., mutual-aid groups, local fire departments, etc.) to an occurrence that results, or is likely to result, in an uncontrollable release of a hazardous substance. Responses to incidental release of hazardous substances where the substance can be absorbed, neutralized, or otherwise controlled at the time of release by employees in the immediate release area or by maintenance personnel are not considered to be emergency responses within the scope of the HAZWOPER standard. Responses to releases of hazardous substances where there is no potential safety or health hazard are not considered to be emergency responses.

2.2 **Health and Safety Plan (HASP)** – A document prepared for each project that contains site-specific information including the Emergency Response Plan for the project.

2.3 **Incident Command System (ICS)** – ICS is a standardized on-scene incident management concept designed specifically to allow responders to adopt an integrated organizational structure equal to the complexity and demands of any single incident or multiple incidents without being hindered by jurisdictional boundaries. In the ICS the first person responding to an incident becomes the Incident Commander and turns that title and duties over to more qualified responders as they arrive on scene.

2.4 **First Responder** – First responders are individuals who are likely to witness or discover a hazardous substance release, injury, fire, or other incident and who have been trained to initiate an emergency response sequence by notifying the proper authorities of the release. They would take no further action beyond first aid, initial control of the incident, and notifying the authorities and others of the incident.

2.5 **Hazardous Materials Specialist** – Hazardous materials specialists are individuals who respond with and provide support to hazardous materials technicians. Their duties parallel those of the hazardous materials technician; however, those duties require a more directed or specific knowledge of the various substances they may be called upon to contain. The hazardous materials specialist would also act as the site liaison with federal, state, local, and other government authorities in regards to site activities.

2.6 **Hazardous Materials Technician** – Hazardous materials technicians are individuals who respond to releases or potential releases for the purpose of stopping the release. They assume a more aggressive role than a first responder in that they will approach the point of release in order to plug, patch, or otherwise stop the release of a hazardous substance.

2.7 **Incident Commander** – The Incident Commander (IC) is responsible for all aspects of the response, including developing incident objectives and managing all incident operations. The title and responsibilities are typically assumed by a qualified IC from the client or public sector.

2.8 **Hazardous Waste** – Hazardous waste is waste that is dangerous or potentially harmful to our health or the environment. Hazardous wastes can be liquids, solids, gases, or sludges. They can be discarded

commercial products, like cleaning fluids or pesticides, or the byproducts of manufacturing processes. Hazardous waste are divided into

- Listed wastes (http://www.epa.gov/osw/hazard/wastetypes/listed.htm),
- Characteristic wastes (http://www.epa.gov/osw/hazard/wastetypes/characteristic.htm),
- Universal wastes (http://www.epa.gov/osw/hazard/wastetypes/universal/index.htmwastes), and
- Mixed wastes
- Specific procedures determine how waste is identified (http://www.epa.gov/osw/hazard/wastetypes/wasteid/index.htm), classified, listed, and delisted.

2.9 **Hazardous Materials** – A hazardous material is any item or agent (biological, chemical, physical) that has the potential to cause harm to humans, animals, or the environment, either by itself or through interaction with other factors. Additionally a hazardous material may be defined as any substance or chemical which is a "health hazard" or "physical hazard," including chemicals that are carcinogens, toxic agents, irritants, corrosives, sensitizers; agents that act on the hematopoietic system; agents that damage the lungs, skin, eyes, or mucous membranes; chemicals that are combustible, explosive, flammable, oxidizers, pyrophorics, unstable-reactive, or water-reactive; and chemicals that in the course of normal handling, use, or storage may produce or release dusts, gases, fumes, vapors, mists, or smoke that may have any of the previously mentioned characteristics. This may be caused when released by spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, disposing into the environment, by being transported or moved, and items or chemicals that are "special nuclear source" or byproduct materials or radioactive substances.

3.0 References

3.1 Federal Emergency Management Agency—FEMA: Incident Command System www.fema.gov

3.2 29 CFCR 1910.120, Hazardous Waste Operations and Emergency Response

3.3 29 CFR 1910.38, Emergency Action Plans

3.4 I2-141-PR1 Subs Management Procedure

3.5 I2-221-PR1 Project Plan Procedure

3.6 Q3NA-141-PR1 Subs Management – Procurement, Oversight and Ratings

3.7 S3NA-003-PR1 SH&E Training

3.8 S3NA-004-PR1 Incident Reporting

3.9 S3NA-203-PR1 Emergency Response Planning, Field

3.10 S3NA-208-PR1 Personal Protective Equipment Program

3.11 S3NA-209-PR1 Project Hazard Assessment and Planning

3.12 S3NA-520-PR1 Spill Response, Incidental

3.13 S3NA-602-PR1 Exposure Monitoring

3.14 S3NA-604-PR1 Medical Records

3.15 S3NA-605-PR1 Medical Surveillance Program

4.0 Procedure

4.1 Roles and Responsibilities

4.1.1 **Office Manager (Operations)**

- Provide support to the implementation of Health and Safety Plans and Emergency Action Plans.

4.1.2 **Project Manager**

- Prepare or request a HASP for every AECOM project with Hazardous Waste Operations and Emergency Response Activities, refer to *S3NA-209-PR1 Project Hazard Assessment and Planning.*
- Verify that all personnel working on the project are qualified.
- Request client's emergency response procedures.
- Appoint a Site Safety Officer (SSO) for each project.
- Communicate the site-specific emergency response details to all employees assigned to a field project.
- Confirm that the necessary communications equipment for the project is available.
- Confirm that an accident/incident investigation is performed and a report is filed; refer to *S3NA-004-PR1 Incident Reporting*.

4.1.3 **Region SH&E Manager / SH&E Department**

- Provide technical guidance for the development and implementation of Health and Safety Plans and Emergency Action Plans.
- Prepare emergency action plans as part of project HASPs and emergency reference sheets.
- Interface with the local emergency responders when necessary.
- Interface with clients regarding facility emergency response procedures.

4.1.4 **Site Safety Officer (SSO)**

- Verify that a HASP is available for the project.
- Communicate the site-specific emergency response details to all employees assigned to a field project.
- Stop work and initiate emergency response procedures as required.
- Account for all AECOM and subcontractor employees after site evacuation.
- Conduct pre-entry briefing and daily tailgate meetings and review facility and site-specific emergency procedures.
- Brief on-site and off-site responders in the event of an emergency.

4.1.5 **Employees**

- Maintain HAZWOPER training.
- Follow the HASP and emergency procedures prepared for the project.
- Initiate emergency response via verbal communications or the alarm system if first to encounter the emergency.

4.1.6 All personnel (e.g., AECOM **employees**, general laborers, equipment operators, chemists, supervisors, etc.) performing activities at hazardous waste sites that expose or potentially expose them to hazardous wastes and health hazards are considered HAZWOPER site workers and must meet the training and medical surveillance requirements specified in 29 CFR 1910.120(e) and (f),

respectively. Additional training may be required based on site activities including related exposures and risks (e.g., confined space entry, excavations, fall protection, other materials [lead], etc.). These additional training requirements are to be outlined in the project- or site-specific health and safety plan (HASP).

4.2 Personnel Qualifications—Medical Surveillance and Training

4.2.1 HAZWOPER-qualified employees will participate in the following medical surveillance and training requirements. Medical surveillance and SH&E training requirements are further described in *S3NA-605-PR1 Medical Surveillance* and *S3NA-003-PR1 SH&E Training* respectively.

4.2.2 Medical Surveillance

Specific HAZWOPER medical examination protocols have been developed by **AECOM's Corporate Medical Provider (CMP)** to meet the requirements of 29 CFR 1910.120(f). To be medically qualified to perform HAZWOPER work, **employees** receive the following medical examinations:

- Initial (Baseline) Examination—The initial examination is part of pre-employment requirements and must be completed (with results received) prior to the employee's start of work date.
- Annual Examination—HAZWOPER-qualified employees will complete a medical examination once each year. Medical qualification expires on the anniversary date of the last examination completed. There will be no "grace period" exemptions beyond this date without the express approval of the **Region SH&E Manager**. At the recommendation of the **SH&E Department**, the CMP may approve an alternate examination frequency at periods of up to two years (biennial) in cases in which the worker's exposures to environmental contaminants are infrequent and typically well below any occupational exposure limits (e.g., senior management personnel).
- Termination Examination—When reassigned to non-HAZWOPER duties, or at the conclusion of employment at AECOM, HAZWOPER-qualified personnel will be provided with the opportunity to receive a termination medical examination.
- Special Examinations—The **SH&E Department** and the CMP will jointly determine the need for special examinations because of:
  - Unusual exposure conditions; and
  - In response to possible overexposures.

  The **CMP** will determine the medical protocol elements for each of these examinations based on exposure information provided by the **SH&E Department**. The **CMP** will evaluate the results of each employee's examination and will provide a written statement of medical clearance clearly stating medical compliance with the HAZWOPER regulatory standard (29 CFR 1910.120(f)) and approval of the employee to perform unrestricted HAZWOPER activities. for initial and annual examinations, the **CMP** will also evaluate the **employee** for the use of air purifying and supplied air respiratory protection. The written evaluation from these examinations will indicate the **CMP's** approval/limitations on the employee's use of respiratory protection.

4.2.3 Training

All personnel assigned to work at a hazardous waste site must participate in training meeting the requirements of 29 CFR 1910.120(e).

Initial 40-Hour Training—Before being assigned to a HAZWOPER site, AECOM employees must complete 40 hours of off-site training meeting the requirements of 29 CFR 1910.120(e)(3)(i). At the conclusion of training, personnel will receive a written certification of course completion, signed by the instructor, that indicates the course of instruction (40-hour HAZWOPER) and training dates. A copy of this certification must be provided to the employee's **Region SH&E Manager**. **Employees**

are responsible for maintaining their own copy of this certificate and for presenting it to the **site safety officer** when working on any HAZWOPER site.

In addition to the initial 40-hour training, the **employee** must receive three days of actual supervision by a trained experienced supervisor.

Available Training Sources:

- On-site training provided by the **SH&E Department**.
- Outsourced training providers approved by the **SH&E Department**.

Refresher 8-Hour Training—To remain qualified to perform on-site HAZWOPER work activities, each AECOM **employee** will complete 8 hours of HAZWOPER refresher training meeting the requirements of 29 CFR 1910.120(e)(8) at yearly intervals following completion of Initial 40-hour training. At the conclusion of training, personnel will receive a written certification of course completion, signed by the instructor, that indicates the course of instruction (8-hour HAZWOPER Refresher) and the training date. A copy of this certification must be provided to the employee's SH&E Coordinator. **Employees** are responsible for maintaining their own copy of this certificate and for presenting it to the site supervisor when working on any HAZWOPER site.

Available Training Sources:

- Internet-based training approved by **SH&E Department**;
- On-site training provided by the **SH&E Department**; and
- Outsourced training providers approved by the **SH&E Department**.

Supervisor 8-Hour Training—Any AECOM employee acting in a management capacity for HAZWOPER activities (e.g., **project manager**, **site safety officers**, etc.) must complete an additional 8 hours of HAZWOPER Supervisor training meeting the requirements of 29 CFR 1910.120(e)(4). Although this training is required only once, supervisors must maintain their overall HAZWOPER qualification through annual completion of refresher training. At the conclusion of Supervisor 8-Hour Training personnel will receive a written certification of course completion, signed by the instructor that indicates the course of instruction and the training date. A copy of this certification must be provided to the **Region SH&E Manager**. **Employees** are responsible for maintaining their own copy of this certificate and for presenting it to the senior site supervisor when working on any HAZWOPER site.

Available Training Sources:

- On-site training provided by the **SH&E Department**, and
- Outsourced training providers approved by the **SH&E Department**.

24-Hour HAZWOPER Training—Site support contractors and site visitors may qualify to substitute 24-hour HAZWOPER training in place of 40-hour training, as specified in 29 CFR 1910.120(e)(3)(ii). Personnel potentially qualifying for this alternative training include:

- Site support personnel who will not work in any Exclusion Zone areas.

Subcontractors and site visitors whose duties will not entail significant exposure to site contaminants defined as not working in any areas where airborne contaminant concentrations exceed one-half of any applicable occupational exposure limit, and no contact or exposure to materials with site contaminant concentrations exceeding natural background levels. The **Region SH&E Manager** or **SH&E department** designee must approve the substitution of 24-hour training for initial 40-hour training. Persons qualifying for 24-hour training must provide written certification of course completion prior to beginning work on site. Persons completing 24-hour training must complete 8 hours of annual refresher training at the required interval to maintain eligibility for on-site work and must provide proof of this training (as necessary to demonstrate retraining) prior to beginning work on site.

4.2.4 Subcontractor Personnel

Any subcontractor organization whose employees will support AECOM operations at a HAZWOPER site will:

- Provide the **Project Manager** with a copy of their written HAZWOPER medical surveillance and training program requirements. The elements of the program(s) must be similar to those for AECOM's own program, as detailed above, refer to *I2-141-PR1 Subs Management Procedure* and *Q3NA-141-PR1 Subs Management – Procurement, Oversight and Ratings*.
- Provide the **Project Manager** with written certification of a physician's approved medical clearance for each employee who will work on the site. Certification can be demonstrated by:
  - A copy of the physician's signed medical clearance for each **employee** (preferred), or
  - A letter identifying the medical status and clearance expiration date of every **employee**, signed by the company's safety director or an officer of the company.
  - A copy of the each employee's training certifications, which will include:
    - The initial 40-hour training certificate (24-hour training may be substituted with **Region SH&E Manager** approval).
    - The most current Refresher training certificate (must be current within the previous one-year period).
    - A copy of the Supervisor training certificate for each person serving in a site supervisory capacity (e.g., **project manager, site safety officers,** etc.).

4.3 Project SH&E Documentation—Health and Safety Plans (HASP)

4.3.1 The project SH&E documentation prepared for HAZWOPER activities is referred to as a site-specific Health and Safety Plan (HASP), and must meet the requirements presented in 29 CFR 1910.120(b)(4).

4.3.2 A safety and health risk or hazard analysis for each on-site task that will be performed.

4.3.3 The required HASP plan elements include:

- A description of the work location, the site history, and a summary of any information available concerning site hazards (including both physical hazards and contamination conditions);
- A summary of the work activities to be performed under AECOM's scope of activities;
- Identified risks must include both chemical and physical hazards to which personnel may be exposed during the conduct of the work task;
- Protective measures for each work task to prevent or mitigate the potential hazards identified in the hazard analyses;
- Personal protective equipment (PPE) requirements for each work task**,** refer to *S3NA-208-PR1 Personal Protective Equipment Program;*
- Frequency and types of air monitoring, personal monitoring, and environmental sampling techniques and instrumentation to be used;
- Site control measures;
- Decontamination procedures; and
- An emergency response plan, *S3NA-509-FM4 Emergency Information and Hazard Assessment*, addressing actions to be taken in the event of each type of credible incident that might result during the performance of planned work activities, including minor and major injuries, and chemical release and fire. Response plans must address the means for coordinating the evacuation of all on-site personnel in the event of a catastrophic incident.

4.3.4 Responsibility for development of each AECOM HASP will be coordinated between the **Project Manager** and the **Region SH&E Manager** or **SH&E Department** designee as part of project initiation. Regardless of where the HASP is developed, it will be reviewed and approved by the **SH&E Department** prior to submission to any agency outside of AECOM.

4.3.5 Contractors and Subcontractors

4.3.5.1 The health and safety of any contractor's or subcontractor's employees is solely the responsibility of that contractor or subcontractor, who shall evaluate the hazards and potential hazards to their own employees and shall adhere to their own Health and Safety Plan.

4.3.5.2 In addition, all AECOM subcontractors' Health and Safety Plans will, at a minimum conform to the requirements of the AECOM Health and Safety Plan. The AECOM Health and Safety Plan does not, nor is it intended to, address procedures of contractors or subcontractors during their site activities.

4.4 Personal Protective Equipment (PPE) Ensembles

4.4.1 Defined HAZWOPER PPE ensembles are specified for general use on all AECOM HAZWOPER operations. The project HASP may specify modifications to these requirements to meet site-specific conditions.

4.4.2 Level D Ensemble

The Level D ensemble provides a minimal level of skin protection (primarily against physical rather than chemical hazards) and no respiratory protection. Level D PPE is the minimum work uniform which will be used on HAZWOPER sites. Its use is appropriate when there is no significant potential for encountering hazardous substances or health hazards while working in controlled work areas.

Level D Equipment List:

- Hard hat,
- Eye protection,
- Safety-toe work boots,
- Shirts with sleeves and long pants (shorts are unacceptable for use), and
- Hearing protection (as required).

4.4.3 Modified Level D Ensemble

The Modified Level D ensemble provides moderate skin protection against contact with hazardous substances, but no respiratory protection. Its use is appropriate where there is a moderate-to-low potential for skin contact with known hazardous substances and health hazards, but no significant inhalation hazard is anticipated. The Modified Level D ensemble will consist of the Level D ensemble, supplemented by the addition of one or more of the following items:

Modified Level D Equipment List:

- Chemical-resistant disposable outer coveralls,
- Chemical-resistant outer gloves taped to outer coveralls,[1]
- Chemical-resistant inner gloves, and[1]
- Chemical-resistant safety-toe boots (taped to outer coveralls).

1 Selection of specific glove types/materials will be provided in the project HASP based on consideration of the contaminants and the physical conditions of the work.

4.4.4 Level C Ensemble

The Level C ensemble provides moderate skin protection against contact with hazardous substances and moderate respiratory protection. Its use is appropriate where there is the potential for skin contact with known hazardous substances and health hazards, together with a limited and well-defined potential for exposure via inhalation.

Level C Equipment List:

- Full-face air-purifying respirator (APR) equipped with cartridge types as designated in the project HASP,[2]
- Chemical-resistant disposable outer coveralls,
- Chemical-resistant outer gloves taped to outer coveralls,[3]
- Chemical-resistant inner gloves,[3]
- Hard hat,
- Safety-toe boots taped to coveralls; the use of boot covers (e.g., booties) or chemical-resistant boots may be specified, and
- Hearing protection (as required).

4.4.5 Level B Ensemble

The Level B ensemble provides both the highest level of inhalation exposure protection and considerable skin contact protection. Its use is appropriate where there are significant known or suspected hazardous substances and health hazards, involving both skin and inhalation exposure (up to and including Immediately Dangerous to Life or Health [IDLH] conditions) or where adverse atmospheric conditions cannot be mitigated by use of air purifying respirators (e.g., oxygen deficient atmospheres or chemicals with poor warning properties). The use of Level B PPE requires prior approval by the **Region SH&E Manager**.

Level B Equipment List:

- Supplied air respirator (SCBA or air line system with Grade D or better breathing air),
- Chemical-resistant disposable outer coveralls,
- Chemical-resistant outer glove taped to outer coveralls,[3]
- Chemical-resistant inner gloves,[3]
- Hard hat,
- Chemical resistant safety-toe boots taped to coveralls, and
- Hearing protection (as required).

4.4.6 Level A Ensemble

The Level A ensemble provides the highest level of both respiratory and skin protection, up to and including protection against skin contact with vapor-phase contaminants. The use of Level A PPE requires prior approval by the Americas SH&E Director.

Specific Level A ensemble components will be determined on a case-by-case basis by the **SH&E Department**.

2 Selection of specific cartridges will be made by the SH&E Department (or Competent Person – Respiratory Protection as designated by the DSM) based on contaminants present. A cartridge change-out frequency will also be specified in the HASP based on the manufacturer's cartridge performance data.

3 Selection of specific glove types/materials will be provided in the project HASP based on consideration of the contaminants and the physical conditions of the work.

4.5 Field Emergency Response Plans

4.5.1 AECOM employees are not expected to take action or to participate in rescues or responses to chemical releases beyond the initial discovery of the release and immediate mitigation actions such as closing a valve, placing absorbents, and notifying the client and or public emergency response system (911.) If AECOM employees are to participate in the response to a chemical release beyond the initial reaction, there must be a contractual provision for this response and the employees must be specifically trained for this response. This document is designed to provide guidelines on how to prepare a written plan that will ensure prompt and proper response to an emergency situation that arises during field investigations and to outline the duties of AECOM employees during a field emergency and the associated training requirements.

4.5.2 Site specific health and safety plans that are prepared to comply with the HAZWOPER standard (29 CFR 1910.120) must address emergency response. This standard specifically outlines the elements that must be contained in an emergency response plan. However, the definition of emergency response, as written in 29 CFR 1910.120, focuses on emergencies involving the uncontrolled release of hazardous substances. Under 29 CFR 1910.120, an employer can opt to evacuate employees from the danger area when such an emergency occurs. AECOM does not expect its employees to actively assist in the handling of uncontrollable chemical releases that may occur during the implementation of field programs. As such, and as provided by the HAZWOPER standard, AECOM is exempt from the emergency response plan requirements of the standard as long as it provides an emergency action plan within the HASP that complies with 29 CFR 1910.38 (a). Therefore, all emergency response plans required under 29 CFR 1910.120 will be written to comply with 29 CFR 1910.38 (a).

4.5.3 The HAZWOPER standard does not prohibit AECOM employees from performing limited response activities. AECOM employees can provide response assistance by placing absorbent pillows or vermiculite around a small, contained spill that occurs during sampling efforts. Refer to the *S3NA-520-PR1 Spill Response, Incidental* procedure which describes the specific procedures that AECOM will follow when responding to an incidental chemical spill.

4.5.4 Field Project Preparation

Every HASP that is prepared by AECOM will contain an emergency response section in which the required elements of an emergency action plan will be contained, refer to *S3NA-203-PR1 Emergency Response Planning, Field* for more specifics. For all projects that do not require a HASP, an emergency reference sheet will be prepared; minimally, the sheet will list the telephone numbers of the local emergency responders and the local hospital and provides directions to the local hospital. When AECOM is working at an operating facility, the emergency response procedures of the facility will be appended to the HASP or the emergency reference sheet.

There are two types of emergency situations that AECOM personnel must be prepared for and that must be addressed in the emergency action plan. These include:

- Emergencies related to the operations of our clients at the facility where AECOM is working.
- Emergencies related to our own on-site activities/investigations.

AECOM employees are typically not expected to take action or participate in responses to chemical releases beyond the initial discovery of the release and immediate mitigation actions such as closing a valve, placing absorbents, and notifying the client and or public emergency response system (911.)

Employees are not to accept the role of Incident Commander without specific authority from the **Region SH&E Manager** and the **Office Manager (Operations)** responsible for the project. Assuming the role of the Incident Commander requires training beyond the scope of this Procedure.

4.5.5 Client Facility Emergency Response Procedures

AECOM implements field programs on active properties, including manufacturing facilities. These facilities have typically developed an emergency response plan that is specific to facility-related

emergencies. If AECOM is working at an operating facility, emergency procedures established by the facility must be followed in the event of a facility catastrophe. AECOM personnel must be aware of and familiar with the alarm signals used at the facility to alert personnel to an emergency. AECOM personnel must also know where to assemble in the event of a facility evacuation as the facility must be able to account for all personnel, including subcontractors such as AECOM in the event of an evacuation.

The first priority in AECOM's preparation of a project emergency action plan is to ensure that the responsibilities under the client's emergency response plan are fully understood. Because of the nature of their business, many of our clients have in-house fire brigades, medical staff, and hazardous materials teams that can assist AECOM in the event of an emergency related to our field activities. In many instances, our clients prefer or require that subcontractors seek emergency assistance through their facility first before calling outside responders to the site.

A copy of the facility's procedures must be made available to AECOM so that the information can be incorporated into the HASP or attached to the emergency reference sheet. If this information is not available to AECOM prior to arriving on site, the **SSO** must meet with client representatives upon arrival to the facility to review procedures in the event of an emergency related to plant operations.

4.5.6 Emergency Action Plan

As a minimum, each emergency action plan must contain the following topics as required by 29 CFR 1910.38 (a):

- Procedures and contact information for reporting emergencies to public service responders and on-site (client or host employer) emergency control centers.
- Emergency escape procedures and emergency escape route assignments.
- Procedures to be followed by employees who remain to operate critical site operations before they evacuate.
- Procedures to account for all employees after emergency evacuation is complete.
- Rescue and medical duties for those employees who are to perform them.
- Preferred means of reporting fires and other emergencies.
- PPE to protect employees from expected exposures and potential exposures during an emergency.
- Names of persons or departments who can be contacted for further information (i.e. emergency reference sheet).
- Availability of medical surveillance for workers who might have been exposed to chemicals, bloodborne pathogens, or other biological agents as a result of project work or emergency response.

In addition, each plan must establish the specific alarm system that will be used on site to warn employees of an AECOM emergency. The chosen alarm signals should not conflict with alarm signals already in place at the facility.

4.5.7 Escape Routes and Procedures

Prior to the commencement of on-site activities, the **SSO** must determine how AECOM employees will evacuate each AECOM work area of the site. Two or more routes that are separate or remote from each other for each work area must be identified. Multiple routes are necessary in case one is blocked by fire or chemical spill. These routes must not overlap because, if a common point were obstructed, all intersecting routes would be blocked.

Prominent wind direction should also be considered when designating escape routes and assembly areas. Escape routes and assembly areas should be upwind of the site whenever possible.

Upon arrival to the site, the **SSO** must verify that the selected routes are appropriate for evacuation. During an emergency, the quickest and most direct route should be selected. However, when working at an operating facility, the established escape routes of the facility should be used whenever possible. In the event of a facility-related emergency, all AECOM employees must meet at the facility's assembly area so that the client can verify that AECOM has evacuated the property.

4.5.8 Accounting Method for All Employees after Evacuation

The **SSO** is responsible for determining that all AECOM employees have been successfully evacuated from the work area(s). It is the responsibility of each AECOM subcontractor to verify that all of its employees evacuated the site and to report this information to the **SSO**. All employees must meet at the designated assembly area. A headcount is an acceptable way to determine complete evacuation when the field team is of a small size. The site log-in book should be referenced when attempting to account for more than 10 people. In the event of a facility-related emergency, the **SSO** must notify facility representatives that all AECOM employees and AECOM subcontract employees have successfully evacuated the work area(s). The **SSO** must notify emergency responders if any employee is unaccounted for and where on the site they were last seen.

In the event of a project-related emergency, the **SSO** will provide off-site emergency responders or on-site HAZMAT teams or fire brigades (Incident Commander) with all available knowledge about the emergency situation upon their arrival to the scene.

4.5.9 Employees Who Remain to Operate Critical Site Operations Before They Evacuate

All equipment and operations are required to cease in accordance with the established alarm signal procedures. The only exception will be related to health and safety. The **SSO** must determine at the time of the emergency if health and safety will be jeopardized by immediate stoppage of any particular piece of equipment. If such a determination is made, personnel involved in critical operations must be minimized. Once it is determined that the operation is no longer needed or the threat to the operators is imminent, operations will cease and the operators will immediately evacuate.

4.5.10 Rescue and Medical Duties

Only currently trained individuals will administer first aid or CPR. If the injury is life threatening, the Emergency Medical System (EMS) should be called (911). Depending on the procedures established for the project, the **SSO** would contact an emergency responder directly or notify the facility representatives for medical assistance. If the employee needs medical attention that cannot be provided on-site, the **SSO** shall escort the individual to the local hospital identified on the emergency reference sheet and shall remain with the person until release or admittance is determined. The escort will relay all appropriate medical information to the Project Manager and **Region SH&E Manager**.

4.5.11 Preferred Means of Reporting

Unless facility representatives specifically indicate that they prefer AECOM personnel to notify them first of an emergency, the **SSO** will directly contact the appropriate emergency responders listed on the emergency reference sheet.

4.5.12 Alarm Signals

An emergency communication system must be in effect at all sites. The most simple and effective emergency communication system in many situations will be direct verbal communications. However, verbal communications must be supplemented any time voices cannot be clearly perceived above ambient noise levels and any time a clear line of sight can not be easily maintained among all AECOM personnel because of distance, terrain, or other obstructions.

Portable two-way radio communications may be used when employees must work out of the line of sight of other workers.

When verbal communications must be supplemented, the following emergency signals shall be implemented using handheld portable air horns, whistles, or similar devices. Signals must be capable of being perceived above ambient noise by all employees in the affected portions of the workplace.

- One Blast: General Warning—A relatively minor and localized, yet important, on-site event. An example of this type of an event would be a minor chemical spill where there is no immediate danger to life or health yet personnel working on the site should be aware of the situation so that unnecessary problems can be avoided. If one horn blast is sounded, personnel must stop all activity and equipment on-site and await further instructions from the **SSO**.
- Three Blasts: Medical Emergency—A medical emergency for which immediate first aid or emergency medical care is required. If three horn blasts are sounded, all first aid and/or CPR trained personnel should respond as appropriate. All other activity and equipment should stop and personnel should await further instructions from the **SSO**.
- Three Blasts Followed by One Continuous Blast: Immediate Threat to Life and Health—A situation that could present an immediate danger to life and health of personnel onsite. Examples include fires, explosions, large hazardous chemical release, severe weather-related emergencies, or security threats. If three horn blasts followed by a continuous blast are sounded, all activity and equipment must stop. All personnel must evacuate the site and meet in the designated assembly area where the **SSO** will account for all employees. The **SSO** will arrange for other emergency response actions if necessary. Information concerning the need to follow decontamination procedures during an emergency evacuation will be addressed in the emergency action plan.
- The **SSO** or his designate will acknowledge the distress signal with two short blasts on the air-horn or whistle.
- One Continuous Blast Following Any of the Above: All Clear/Return to Work—Personnel who sound the initial alarm are required to send an all clear signal when the emergency is over.

4.5.13 Emergency Reference Sheet

An emergency reference sheet (see *S3NA-509-FM4 Emergency Information and Hazard Assessment*) must be prepared for projects not requiring a HASP. Each emergency reference sheet must list the following:

- Emergency phone numbers for local police, fire, and ambulance service.
- In-house facility extensions for reporting an emergency (applies to operating facilities only).
- Phone number and address of closest hospital with an emergency room to the site.
- Directions to the hospital from the site.
- Map highlighting the site-to-hospital route.
- Phone number for the Poison Control Center.
- Names and phone numbers of AECOM representatives and facility representatives.

4.5.14 On-site and Off-site Communications

Regardless of the size or location of AECOM's field projects, it is extremely important that both on-site and off-site communications be maintained so that in the event of an emergency employees can contact each other or place a phone call immediately with the appropriate responder(s).

Walkie-talkies are required when members of the field team are working in separate areas of the site and verbal communications are no longer effective because of distance. A walkie-talkie must be available for each team that is working in a separate area of the site.

When AECOM is working at an occupied facility, access to a telephone may not be a problem. When AECOM is working on abandoned properties or when there is no access to a phone, a cellular telephone must be brought to the work location.

4.5.15 Evacuation

Although emergency evacuation procedures are included in AECOM's initial 40-hour HAZWOPER training, emergency procedures at each site will be different. Therefore, employees must be instructed about the specifics of the emergency procedures developed for the site during the site-specific pre-entry briefing that must be held daily prior to the commencement of field activities. Update training is required anytime escape routes or procedures change. An evacuation drill will be conducted for projects that are scheduled for one month or longer. Visitors and untrained employees shall not be allowed into the project area until they receive a safety briefing including evacuation alarms and procedures.

4.5.16 First Responder

First responders shall have sufficient training or have had sufficient experience to objectively demonstrate competency in the following areas:

- An understanding of what hazardous substances are, and the risks associated with them in an incident.
- An understanding of the potential outcomes associated with an emergency.
- The ability to recognize the presence of hazardous substances and physical hazards in an emergency.
- An understanding of the role of the first responder.
- The ability to realize the need for additional resources and to make appropriate notifications to the communication center.

4.5.17 First Responder HAZWOPER Operations Level

First responders at the operations level are individuals who respond to releases or potential releases of hazardous substances as part of the initial response to the site for the purpose of protecting nearby persons, property, or the environment from the effects of the release. They are trained to respond in a defensive fashion without actually trying to stop the release. Their function is to contain the release from a safe distance, keep it from spreading, and prevent exposures. First responders at the operational level shall have received at least eight hours of training or have had sufficient experience to objectively demonstrate competency in the following areas in addition to those listed for the awareness level and the employer shall so certify:

- Knowledge of the basic hazard and risk assessment techniques.
- Know how to select and use proper personal protective equipment provided to the first responder operational level.
- An understanding of basic hazardous materials terms.
- Know how to perform basic control, containment, and/or confinement operations within the capabilities of the resources and personal protective equipment available with their unit.
- Know how to implement basic decontamination procedures.
- An understanding of the relevant standard operating procedures and termination procedures.

4.5.18 Hazardous Materials Technician

Hazardous materials technicians shall have received at least 24 hours of training equal to the first responder operations level and in addition have competency in the following areas and the employer shall so certify:

- Know how to implement the employer's emergency response plan.

- Know the classification, identification, and verification of known and unknown materials by using field survey instruments and equipment.
- Be able to function within an assigned role in the Incident Command System, refer to *Federal Emergency Management Agency—FEMA: Incident Command System*.
- Know how to select and use proper specialized chemical PPE provided to the hazardous materials technician.
- Understand hazard and risk assessment techniques.
- Be able to perform advance control, containment, and/or confinement operations within the capabilities of the resources and personal protective equipment available with the unit.
- Understand and implement decontamination procedures.
- Understand termination procedures.
- Understand basic chemical and toxicological terminology and behavior.

4.5.19 Hazardous Materials Specialist

Hazardous materials specialists shall have received at least 24 hours of training equal to the technician level and in addition have competency in the following areas and the employer shall so certify:

- Know how to implement the local emergency response plan.
- Understand classification, identification, and verification of known and unknown materials by using advanced survey instruments and equipment.
- Know the state emergency response plan.
- Be able to select and use proper specialized chemical PPE provided to the hazardous materials specialist.
- Understand in-depth hazard and risk techniques.
- Be able to perform specialized control, containment, and/or confinement operations within the capabilities of the resources and personal protective equipment available.
- Be able to determine and implement decontamination procedures.
- Have the ability to develop a site safety and control plan.
- Understand chemical, radiological, and toxicological terminology and behavior.

4.6 Employee Exposure Monitoring

4.6.1 Exposure monitoring at HAZWOPER sites will be conducted to determine explosive and oxygen levels, monitor and control employee exposures to airborne contaminants, and to determine and regulate controlled work area boundaries (e.g., support zone, contamination reduction zone, and exclusion zone) for the protection of non-HAZWOPER workers and the general public.

4.6.2 Direct Reading Exposure Monitoring Requirements

Explosive levels, oxygen levels, and airborne contaminants present potential hazards to HAZWOPER personnel working within controlled work areas and to non-HAZWOPER workers and the general public present outside the controlled work areas. On-site exposure monitoring will be utilized to assess the magnitude of these hazards and to provide indications of any necessary control procedures to mitigate unacceptable hazards. *S3NA-509-FM1 Direct Reading Instrument Monitoring Log* will be used to record all monitoring efforts using direct reading instruments and will remain part of the project file.

Specific exposure monitoring requirements will be established in individual HASPs, refer to *S3NA-602-PR1 Exposure Monitoring*, and will be implemented by the project team(s) subject to the following requirements:

- Direct reading instrumentation will be used in accordance with the following table:

Direct Reading Instrument	Example Trade Names	Use
Flame Ionization Detector (FID)	OVA	Detection of select organic vapors
Photo ionization detector (PID)	miniRAE, Micro-TIP	Detection of select organic vapors
Portable gas chromatograph	OVA	Detection of select organic vapors
Explosive meter	MSA ALTAIR, QRAE II, BW GasAlert	Determine explosiveness (as a percent of the Lower Explosive Limit [LEL])
Oxygen monitor	MSA ALTAIR, QRAE II, BW GasAlert	Determine oxygen concentration (in percent)
Single gas meters (mono-tox) • Hydrogen sulfide • Carbon monoxide • Oxides of nitrogen • Cyanide		Determine airborne concentrations of selected contaminants (in parts per million)
Colorimetric Detector Tubes	Drager	Determine airborne concentrations of selected contaminants (in parts per million)
Aerosol monitor	Mini-RAM	Determine airborne particulate concentration (in milligrams per cubic meter)

- Selected instruments will be capable of discriminating contaminant concentrations to concentrations of at least one-half of the HASP-specified exposure limit. All direct-reading instrumentation will be calibrated daily as directed by the manufacturer. *S3NA-509-FM2 Instrument Calibration Log* will be used to record instrument calibrations.

4.6.3 Work Area Exposure Monitoring

- Work area exposure monitoring will include breathing zone readings for the maximum exposed worker(s).
- Results will be used to determine adequacy of PPE (especially respiratory protection). Specific criteria for upgrade/downgrade will be established in the HASP.

4.6.4 Perimeter Exposure Monitoring

- Perimeter air samples will be collected when the potential exists for airborne contaminants to migrate off-site.
- Perimeter exposure monitoring will be conducted at locations downwind from the project activities at a minimum (also upwind if the potential exists for offsite contamination to migrate onto the site).
- Sample results will be recorded in a log book or on the sample log form provided in *S3NA-509-FM3 Personal Sampling Data Sheet*
- Records will indicate individual name, SSN (last 4 digits is acceptable), and job/operation at the time of sample collection.
- Samples sent out for independent laboratory analysis will follow chain of custody requirements.
- Exposure results will be posted on site and explained in a safety briefing.

- **Employees** will receive a written statement of results within 15 days of receipt from the laboratory.
- Results of all personal exposure monitoring will be provided to the **SH&E department** for inclusion in the employee medical records**,** refer to *S3NA-604-PR1 Medical Records*.

5.0 Records

5.1 All forms and documents generated during a HAZWOPER project will be maintained in the project file.

6.0 Attachments

6.1 S3NA-509-FM1 Direct Reading Instrument Monitoring Log

6.2 S3NA-509-FM2 Instrument Calibration Log

6.3 S3NA-509-FM3 Personal Sampling Data Sheet

6.4 S3NA-509-FM4 Emergency Information and Hazard Assessment

Americas

Direct Reading Instrument Monitoring Log

S3NA-509-FM1

Project: _____ Job No.: _____

Date: _____ Operator: _____

Instrument: _____ Calibration: _____
(Amt, Component, Date)

Sampling Technique: _____

Sample Interval: _____

Background Reading: _____

Action Level/Response: _____

Time	Location	Reading (units)	Detection Limits (Scale)

Americas

Instrument Calibration Log

S3NA-509-FM2

Instrument Information	
Instrument Name:	Manufacturer:
Serial Number:	Last Service Date:
Parameter(s):	Calibration Gas:
Calibration Procedure:	
Daily Calibration Results	
Date:	Calibration Result:
Name:	Signature:
Notes:	
Date:	Calibration Result:
Name:	Signature:
Notes:	
Date:	Calibration Result:
Name:	Signature:
Notes:	
Date:	Calibration Result:
Name:	Signature:
Notes:	

Project: Job No.:

Date: Operator:

Instrument: Calibration:

Americas

Personal Sampling Data Sheet

SNA-509-FM3

Client: Method:

Site Location: Job No.: Sampling Media:

Sample ID.	Pump No.	Air Flow Calibration (L/min)			Start Time	Stop Time	Total Time Minutes	Volume (Liters)	Sampler's Initials	Date	Results		Remarks (Location of sampling, Employee name, SSN)
		Pre	Post	Average							Amount (mg)	Conc. ppm , mg/m^3	

Americas

Emergency Information and Hazard Assessment

S3NA-509-FM4

Emergency References:

Ambulance: 911

Fire: 911

Police: 911

Medical Services/Regional Hospital (including a map is advisable):

Poison Control Center: http://www.aapcc.org/poison4.htm

Emergency Muster Point:

In case of a site/facility emergency, please meet at:

The escape route from the site and an emergency muster point will be determined and provided to all workers during the project mobilization.

Client Contacts:

Office: Cell:

AECOM Project Representatives:

Office: Mobile:

AECOM Medical Records and Medical Consultant
WorkCare
Anaheim, CA 94502
Telephone: 800-455-6155

Americas

Hearing Conservation

S3NA-510-PR1

1.0 Purpose and Scope

1.1 Establishes procedures to confirm that personal noise exposure remains within acceptable limits and establishes the requirements of an acceptable hearing conservation program.

1.2 This procedure applies to all AECOM Americas-based employees and operations.

2.0 Terms and Definitions

2.1 **Decibel (dB)** – Logarithmic unit of measurement of sound level.

2.2 **Action Level** – An eight-hour, time-weighted average of 85 decibels measured on the A-scale, slow response, or equivalently; a noise dose of 50 percent.

2.3 **Standard Threshold Shift (STS)** – When one's hearing threshold has changed (relative to the baseline audiogram) an average of 10 dB or more at 2000, 3000, or 4000 Hz in either ear).

2.4 **Noise Reduction Rating (NRR)** – The measure, in decibels, of how well a hearing protector reduces noise, as specified by the Environmental Protection Agency.

2.5 **Time-Weighted Average Sound Level** – That sound level, which if constant over an 8-hour exposure, would result in the same noise dose as is measured.

3.0 References

3.1 S3NA-003-PR1 SH&E Training

3.2 S3NA-605-PR1 Medical Surveillance Program

4.0 Procedure

4.1 Roles and Responsibilities

4.1.1 **Region SH&E Manager**

- Provide access to initial and refresher hearing conservation training.
- Inform employees of noise monitoring results when full-shift noise exposure is at or above the action level.
- Designate areas and tasks where employees' exposure is at or above the action level.
- Conduct noise monitoring, as applicable, and support hazardous noise assessment/evaluation efforts.

4.1.2 **Project Manager / Office Managers (Operations)**

- Implement the hearing conservation program.
- Confirm that a hazardous noise assessment/evaluation has been conducted.
- Confirm that a hazardous noise assessment/evaluation is conducted when a change in equipment, procedures, or personnel may increase employee exposure to noise.
- Implement engineering controls to reduce noise levels when such measures are considered feasible and when required by regulation.
- Purchase, monitor, and replenish for employees' use a supply of hearing protection devices with a minimum Noise Reduction Rating (NRR) of 26 dBA.

Confirm that individuals included in the program receive training and that the training meets the criteria outlined in this program.

- Investigate and implement corrective action to all reports of nonconformance with this procedure, including reports of standard threshold shifts or employees' failure to wear hearing protectors in designated areas.Maintain an awareness of the noise levels in work areas for which he/she is responsible.
- Place warning signs in areas where sound levels would require the use of hearing protectors.
- Request that a hazardous noise assessment/evaluation be conducted when a change in equipment, procedures, or personnel may increase employee exposure to noise.
- Confirm that all employees are aware of the requirements for hearing protection for any designated area or task.
- Enforce the use of hearing protection by employees in designated areas and for designated tasks.

4.1.3 **Employee**

- Comply with the requirements of the Hearing Conservation program.
- Wear hearing protection devices in designated areas or for designated tasks.
- Inspect and maintain hearing protection devices.
- Report any suspected change in noise levels of work area to supervisor.
- Report any signs or symptoms experienced that could be the result of overexposure to noise to supervisor.
- Participate in audiometric testing and hearing protection training when required.

4.2 General Requirements

4.2.1 The requirements of this procedure apply to all locations/facilities/projects where employee noise exposure may equal or exceed 50 percent of the allowable noise dose or Permissible Exposure Limit (PEL). Table 1 provides information relative to the current PEL for noise exposure expressed as a time-weighted average.

Table 1. Permissible Exposure Limit

SOUND LEVEL (dBA)	TIME (hours)
90	8
95	4
100	2
105	1
110	1/2
115	1/4 or less

4.2.2 Table 2 provides information relative to the Action Level (or 50 percent allowable noise dose) expressed as a time-weighted average. The action levels outlined in the table below and PELs described in Table 1 are calculated without regard to the protection afforded by the use of hearing protectors.

Table 2. Action Levels for Hearing Conservation Program

SOUND LEVEL (dBA)	TIME (hours)
85	8
90	4
95	2
100	1
105	1/2
110	1/4 or less

4.3 Training

4.3.1 All employees with potential exposure above the action levels established in Table 2 of this procedure or who otherwise utilize any type of hearing protector will participate in a hearing conservation training program.

4.3.2 The initial and subsequent annual hearing conservation training will address, at a minimum, the following topics:

- The effects of noise on hearing, recognizing hazardous noise, and symptoms of overexposure to hazardous noise.
- When and/or where hearing protectors are required to be worn.
- The purpose of hearing protectors.
- The advantages, disadvantages, and effectiveness of various types of protectors.
- Instructions on how to select, use, fit, and care for hearing protectors.
- The purpose of audiometric testing, including an explanation of the test procedures.
- Hearing Conservation Program requirements and responsibilities.

4.3.3 Hearing protection training is conducted annually for all affected employees or more frequently for employees who do not properly use hearing protectors or otherwise fail to comply with this policy.

4.4 Audiometric Testing

4.4.1 All AECOM personnel with exposure greater than the action level shall be enrolled in the medical surveillance program and undergo a baseline audiogram within 6 months of the first exposure. Thereafter, annual audiograms will be compared with the baseline exam.

4.4.2 Enrolled employees will receive audiograms during their exit physicals; refer to *S3NA-605-PR1 Medical Surveillance Program*.

4.4.3 When a Standard Threshold Shift (STS), as identified by the AECOM Medical Consultant, is noted between the last valid baseline and the annual audiogram, the following steps will be taken:

- A retest will be conducted within 30 days to confirm the STS. The employee will not be exposed to workplace/hobby noise for 14 hours or will be provided with adequate hearing protection prior to testing.
- If the STS persist, ear protection will be upgraded to one with a greater NRR. The minimum NRR will be 26 dBA.
- The employee will be counseled and AECOM will obtain information regarding the employee's possible noise exposure away from the workplace or existing ear pathology.

- Qualified medical personnel will review the audiograms. This group will determine the need for a medical referral.
- The employee will be notified in writing by either the **Region SH&E Manager** or the AECOM Medical Provider of the STS, within 21 days of determination, as required by regulation.
- The employee's supervisor will be notified of the shift in hearing threshold.

4.4.4 If the employee who has experienced a STS is exposed to 85 dBA for eight hours or 80 dBA for 12 hours, mandatory use of ear protection is required.

4.5 Monitoring of Noise Levels

4.5.1 When information indicates that any employee's exposure may equal or exceed the action level as specified in Table 2, the **Region SH&E Manager** shall develop and implement a monitoring program to identify employees for inclusion in the hearing conservation program and to enable the proper selection of hearing protectors.

4.6 Hearing Protectors

4.6.1 Selection of appropriate hearing protectors must be based on actual or anticipated exposure levels. At a minimum, hearing protectors must provide a level of protection that brings actual or anticipated exposure below the PEL established for the time period shown in the table above. Additional information relative to hearing protector use is as follows:

- Hearing protection will be mandatory for all employees exposed to 85 dBA for eight hours.
- Hearing protection will be mandatory for all employees working in any area that has not been evaluated for noise exposure and the ambient noise level in the area is such that you must raise your voice to have a normal conversation with someone less than three feet from you and/or when within 25 feet of an operating piece of heavy equipment.
- Hearing protection will be mandatory for all employees who work on or near heavy equipment unless personal dosimetry or other techniques have been used to document actual exposure.
- Hearing protectors will be made available to all employees at no cost to the employees who may be exposed to 85 dBA for eight hours.
- Hearing protection will be mandatory for all employees exposed to 85 dBA for any period of time and who have experienced an STS.

5.0 Records

5.1 Noise exposure measurement records will be retained for two years at the project/facility.

5.2 Audiogram records will be retained in the employee's medical records as per *S3NA-605-PR1 Medical Surveillance Program*.

5.3 Employee training session documentation will be retained in accordance with *S3NA-003-PR1 SH&E Training*.

6.0 Attachments

6.1 S3NA-510-WI1 Hearing Protection Guidelines

6.2 S3NA-510-FM1 Site-Specific Hearing Conservation Program

Hearing Protection Guidelines

1.0 Comparison

Comparison of Hearing Protection	
Ear Plugs	**Ear Muffs**
Advantages: • small and easily carried • convenient to use with other personal protection equipment (can be worn with ear muffs) • more comfortable for long-term wear in hot, humid work areas • convenient for use in confined work areas	***Advantages:*** • less attenuation variability among users • designed so that one size fits most head sizes • easily seen at a distance to assist in the monitoring of their use • not easily misplaced or lost • may be worn with minor ear infections
Disadvantages: • requires more time to fit • more difficult to insert and remove • require good hygiene practices • may irritate the ear canal • easily misplaced • more difficult to see and monitor usage	***Disadvantages:*** • less portable and heavier • more inconvenient for use with other personal protective equipment • more uncomfortable in hot, humid work area • more inconvenient for use in confined work areas • may interfere with the wearing of safety or prescription glasses; wearing glasses results in breaking the seal between the ear muff and the skin and results in decreased hearing protection

2.0 Care and Use

2.1 Follow the manufacturer's instructions.

2.2 Check hearing protection regularly for wear and tear.

2.3 Replace ear cushions or plugs that are no longer pliable.

2.4 Replace a unit when head bands are so stretched that they do not keep ear cushions snugly against the head.

2.5 Disassemble ear muffs to clean.

2.6 Wash ear muffs with a mild liquid detergent in warm water, and then rinse in clear warm water. Sound-attenuating material inside the ear cushions must not get wet.

2.7 Use a soft brush to remove skin oil and dirt that can harden ear cushions.

2.8 Squeeze excess moisture from the plugs or cushions and then place them on a clean surface to air dry.

Americas

Site-Specific Hearing Conservation Program

S3NA-510-FM1

_____ Site (Project)

1.0 Monitoring

As per regulation, noise monitoring will be conducted by the following procedure:

_____

Such monitoring will consist of (*check those that apply*):

☐ Noise Dosimetry ☐ Sound Level Meter Survey

Specific instrumentation to be used is (make/model):

Make	Model

and will be calibrated at a frequency of _____ and documented in the _____.

Monitoring strategy is as follows (*list all equipment and activities on site that may involve sound pressure levels above 80 dBA and an explanation of the strategy to document actual exposures*):

Area/Equipment	Monitoring Strategy

Where areas or equipment are not clearly identified, all monitoring will be documented utilizing an illustrated layout (*attach form developed for the specific site*). Monitoring frequency will be in accordance with the strategy outlined above and when the following changes in site conditions/activities occur:

1.
2.
3.
4.
5.

2.0 Employee Notification

All site employees exposed above the regulated action level (85 dBA – 8 hour TWA) will be notified of the monitoring results by (*insert name/title*) _____ at an interval not to exceed _____ after completion of monitoring.

Notification shall be written, with a copy to the SH&E Department. Documentation of employee notifications and corresponding signatures of notified employees will be kept in the site health and safety logbook/files.

3.0 Observation of Monitoring

All employees affected by the monitoring, or a designated employee representative, shall be given the opportunity to observe noise monitoring procedures. This will be achieved by:

4.0 Audiometric Testing Program and Requirements

AECOM employees who perform field activities where noise exposure above action levels is expected are required to participate in an audiometric testing program. Additionally, any subcontractors performing work on AECOM projects where noise levels exceeding action level will be required to provide documentation that they participate in an audiometric testing program that meets the applicable regulations. Documentation of participation in the testing program will be maintained by _____ and will be located at _____.

5.0 Hearing Protectors and Estimating Attenuation

A selection of suitable hearing protectors will be made available to all employees who are expected to have 8-hour TWA noise exposures above 85 dBA. The types anticipated to be available include:

Protection Type	Attenuation

Hearing protector attenuation will be evaluated by for specific noise environments according to the following method prior to determining their suitability for use:

1.
2.
3.

The following site employees will be required to wear hearing protectors during specific activities and the results of site-specific monitoring conducted in accordance with this procedure. (*This section can be completed after monitoring, if necessary*).

Employee Name	Activity Type	Type of Protection

Hearing protectors will be properly fitted by _____ upon initial distribution to site workers.

Training in the use and care of hearing protectors shall be conducted by _____ during the initial site-specific health and safety training. Training contents shall meet the requirements set forth in this procedure and the applicable regulations.

Hearing protectors will be distributed by _____ from the storage location at the _____.

6.0 Access to Information and Training Materials

All information required by regulation to be made available to the employees will be posted by (*insert name/title*) _____ at the _____.

Local Occupational Health and Safety Regulations will also be kept on site.

7.0 Recordkeeping

Records required by AECOM's Hearing Conservation Program and Regulations shall be completed by and shall be maintained at the _____ and placed on permanent file at the _____ for the minimum duration required by the standard. Employees can access their individual records by contacting _____.

All records required by this section will be transferred to any employee's successive employer if AECOM ceases to do business.

8.0 Approvals

Project Manager: _____ Date: _____

SH&E Representative: _____ Date: _____

Americas

Heat Illness Prevention

S3NA-511-PR1

1.0 Purpose and Scope

1.1 Establishes a Heat Illness Prevention Program to help ensure that employees know and recognize the symptoms of heat stress-related illnesses and are prepared to take appropriate corrective action.

1.2 This procedure applies to all AECOM Americas-based employees and operations.

2.0 Terms and Definitions

2.1 **Acclimated** – Employees who have developed physiological adaptation to hot environments characterized by increased sweating efficiency, circulation stability, and tolerance of high temperatures without stress. Acclimatization occurs after 7 to 10 consecutive days of exposure to heat and much of its benefit may be lost if exposure to hot environments is discontinued for a week.

2.2 **Chemical Protective Clothing (CPC) –** Apparel that is constructed of relatively impermeable materials intended to act as a barrier to physical contact of the Employee with potentially hazardous materials in the workplace. Such materials include Tyvek® coveralls (all types) and polyvinyl chloride coveralls and rain suits.

2.3 **Heat Cramps** – A form of heat stress brought on by profuse sweating and the resultant loss of salt from the body.

2.4 **Heat Exhaustion** – A form of heat stress brought about by the pooling of blood in the vessels of the skin and in the extremities.

2.5 **Heat Rash** – A heat-induced condition characterized by a red, bumpy rash with severe itching.

2.6 **Heat Stress** – The combination of environmental and physical work factors that constitute the total heat load imposed on the body.

2.7 **Heat Stroke** – The most serious form of heat stress, which involves a profound disturbance of the body's heat-regulating mechanism.

2.8 **Sunburn** – Caused by unprotected exposure to ultraviolet light that is damaging to the skin. The injury is characterized by red painful skin, blisters, and/or peeling.

2.9 **Unacclimated** – Employees who have not been exposed to hot work conditions for one week or more or who have become heat-intolerant due to illness or other reasons.

3.0 References

3.1 S3NA-003-PR1 SH&E Training

3.2 S3NA-004-PR1 Incident Reporting (Americas)

3.3 S3NA-203-PR1 Emergency Response Planning, Field

3.4 S3NA-208-PR1 Personal Protective Equipment

3.5 S3NA-209-PR1 Project Hazard Assessment and Planning

3.6 American Conference of Governmental Industrial Hygienists (ACGIH)

4.0 Procedures

4.1 Roles and Responsibilities

4.1.1 **Project Managers**

- Evaluate the need for heat illness prevention measures and incorporate as appropriate into the Safe Work Plan or Task Hazard Analysis.
- Allocate sufficient resources for the management of heat illness in the field including the provision of water, a shaded break area, and sufficient schedule to allow for breaks.

4.1.2 **Region Safety, Health and Environment (SH&E) Manager**

- Provide heat illness awareness training.
- Assist project teams in developing appropriate work-rest schedules.
- Conduct/support incident investigations related to potential heat stress-related illnesses.

4.1.3 **Supervisor**

- Identify those tasks that may be most impacted by heat stress and communicate the hazard to the assigned Employees.
- Ensure that Employees have been trained on the recognition of heat illness.
- Ensure that adequate supplies of appropriate fluids are readily available to Employees.
- Ensure that a proper rest area is available.
- Conduct heat illness monitoring, as applicable.
- Implement the work-rest schedule.
- Ensure that first aid measures are implemented once heat stress symptoms are identified.
- Ensure personnel are physically capable of performing the assigned tasks and are not in a physically compromised condition.
- Report all suspected heat illnesses.

4.1.4 **Employee**

- Observe each other for the early symptoms of heat illnesses.
- Maintain an adequate intake of available fluids.
- Be familiar with heat stress hazards, predisposing factors, and preventative measures.
- Report to work in a properly vested and hydrated condition.
- Report all suspected heat stress-related illnesses.

4.2 Restrictions

4.2.1 The Buddy System is required when working in high heat conditions; Employees shall not work alone. Employees shall not be exposed to levels that exceed those listed in the screening criteria for heat stress exposure in the heat stress and strain section of the ACGIH Standard. Also refer to the *S3NA-511-ST Heat Exposure* standards.

4.2.2 Clothing corrections shall be applied in accordance with the heat stress and strain section of the ACGIH Standard.

4.3 Exposure Controls

4.3.1 If **Employees** are or may be exposed, the **Supervisor** shall:

- Conduct a heat stress assessment to determine the potential for hazardous exposure of Employees, and
- Develop and implement a heat stress exposure control plan within the Safe Work Plan or Task Hazard Analysis, refer to *S3NA-209-PR1 Project Hazard Assessment and Planning*.

4.3.2 If **Employees** are or may be exposed, the **Supervisor** shall implement engineering controls (e.g., shelters, cooling devises, etc.) to reduce the exposure of **Employees** to levels below those listed in

the screening criteria for heat stress exposure in the heat stress and strain section of the ACGIH Standard.

4.3.3 If engineering controls are not practicable, the **Supervisor** shall reduce the exposure of **Employees** to levels below those listed in the screening criteria for heat stress exposure in the heat stress and strain section of the ACGIH Standard by providing administrative controls, including a work-rest cycle or personal protective equipment, if the equipment provides protection equally effective as administrative controls.

4.3.4 If **Employees** are or may be exposed, the **Supervisor** shall provide and maintain an adequate supply of cool, potable water close to the work area for the use of a heat exposed **Employee**.

4.3.5 If an **Employee** shows signs or reports symptoms of heat stress or strain, they shall be removed from the hot environment and treated by an appropriate first aid attendant on site, if available, or by a physician, refer to *S3NA-511-WI2 Symptoms and Treatment* for more specifics.

4.4 Heat Stress Planning

4.4.1 Heat stress can be a significant field site hazard, especially for Employees wearing CPC. To prepare the field for emergency response planning, refer to *S3NA-203-PR1 Emergency Response Planning, Field* procedure. The project and site specific risks need to be planned using a Safe Work Plan or Task Hazard Analysis, refer to the *S3NA-209-PR1 Project Hazard Assessment and Planning* procedure.

4.4.2 The workforce will gradually work up to a full workload under potentially stressful conditions to allow for proper acclimation.

4.4.3 **Employees** shall be instructed in the recognition of heat stress symptoms, the first aid treatment procedures for severe heat stress, and the prevention of heat stress injuries. **Employees** must be encouraged to immediately report any heat stress that they may experience or observe in fellow **Employees**. **Supervisors** must use such information to adjust the work-rest schedule to accommodate such problems.

4.4.4 Wherever possible, a designated break area should be established in an air conditioned space, or in shaded areas where air conditioning is impractical. The break area should be equipped to allow **Employees** to loosen or remove protective clothing, and sufficient seating should be available for all **Employees**. During breaks, **Employees** must be encouraged to drink plenty of water or other liquids, even if not thirsty, to replace lost fluids and to help cool off. Cool water should be available at all times in the break area, and in the work area itself unless hygiene/chemical exposure issues prevent it.

4.5 Symptoms and Treatment

4.5.1 **Employees** who exhibit ANY signs of significant heat stress (e.g., profuse sweating, confusion and irritability, pale, clammy skin) shall be relieved of all duties at once, made to rest in a cool location, and provided with large amounts of cool water.

4.5.2 Anyone exhibiting symptoms of heat stroke (red dry skin, or unconsciousness) must be taken immediately to the nearest medical facility. Steps must be taken to cool the person during transportation (clothing removal, wet the skin, air conditioning, etc.).

4.5.3 Severe heat stress (heat stroke) is a life-threatening condition that must be treated by a competent medical authority.

4.6 Prevention

4.6.1 All **Employees** working in extreme heat or sun should understand the following guidelines for preventing and detecting heat exhaustion and heat stroke.

- Take frequent short breaks in areas sheltered from direct sunlight; eat and drink small amounts frequently.
- Try to schedule work for the coolest part of the day, early morning and evening.

- Avoid strenuous physical activity outdoors during the hottest part of the day.
- Wear a hat and light-colored, loose-fitting clothing to reflect the sun.
- Avoid sudden changes of temperature, refer to *S3NA-511-WI1 Temperature Thresholds*.
- Air out a hot vehicle before getting into it.
- If you take diuretics, ask your doctor about taking a lower dose during hot weather.
- When working in heat, drink 1 quart of water per hour of work.
- Avoid caffeine and alcohol as they increase dehydration.
- Monitor urine frequency and color to detect dehydration, refer to the *S3NA-511-GL1 Dehydration Chart*.

4.6.2 Personal Protective Equipment

- Review the *S3NA-208-PR1 Personal Protective Equipment* procedure.
- Wear a hat and light-colored, loose-fitting clothing to reflect the sun.
- Apply sunscreen to exposed skin (SPF 30 or greater, follow directions on label).
- Wear sunglasses with UV protection.
- Pack extra water to avoid dehydration (try freezing water in bottles overnight to help keep the water cooler for longer during the day).

4.7 Work-Rest Schedule Practices

- Intake of fluid will be increased beyond that which satisfies thirst, and it is important to avoid "fluid debt," which will not be made up as long as the individual is sweating.
- Two 8-ounce glasses of water should be taken prior to beginning work, then up to 32 ounces (1 quart) per hour during the work shift; fluid replacement at frequent intervals is most effective.
- The best fluid to drink is water; liquids like coffee or soda do not provide efficient hydration and may increase loss of water.
- If commercial electrolyte drinks (e.g., Gatorade) are used, the drink should be diluted with water, or 8 ounces of water should be taken with each 8 ounces of electrolyte beverage.
- Additional salt is usually not needed and salt tablets should not be taken.
- Replacement fluids should be cool, but not cold.
- Breaks will be taken in a cool, shaded location, and any impermeable clothing should be opened or removed.
- Dry clothing or towels will be available to minimize chills when taking breaks.
- Manual labor will not be performed during breaks, other than paperwork or similar light tasks.
- Other controls that may be used include:
  - Scheduling work at night or during the cooler parts of the day (6 a.m.–10 a.m., 3 p.m.–7 p.m.).
  - Erecting a cover or partition to shade the work area.
  - Wearing cooling devices such as vortex tubes or cooling vests beneath protective garments. If cooling devices are worn, only physiological monitoring will be used to determine work activity.

4.8 Evaluating the Work-Rest Schedule's Effectiveness

4.8.1 Once a work-rest schedule is established, the **Supervisor** must continually evaluate its effectiveness through observation of **Employees** for signs/symptoms of heart stress. Measurement of each employee's vitals (e.g., pulse, blood pressure, and temperature) can provide additional information in determining if the schedule is adequate, and is accomplished as follows:

- At the start of the workday each employee's baseline pulse rate (in beats per minute [bpm]) is determined by taking a pulse count for 15 seconds and multiplying the result by four or by using an automated pulse count device. Pulse rates can then be measured at the beginning and end of each break period to determine if the rest period allows adequate cooling by applying the following criteria:
    - Each employee's maximum heart rate at the start of any break should be a bpm of less than 180 minus employee's age. If this value is exceeded for any **Employee**, the duration of the following work period will be decreased by at least 10 minutes.
    - At the end of each work period, all employees' heart rates must have returned to within +10% of the baseline pulse rate. If any employee's pulse rate exceeds this value the break period will be extended for at least 5 minutes, at the end of which pulse rates will be remeasured and the end-of-break criteria again applied.
- Use a clinical thermometer or similar device to measure the oral/ear temperature at the beginning (before drinking liquids) and end of each break period and apply the following criteria:
    - If the oral temperature exceeds 99.6 degrees Fahrenheit (°F) (36.6 degrees Celsius [°C]), shorten the next work cycle by one-third without changing the rest period.
    - If the oral temperature still exceeds 99.6°F (36.6°C) at the beginning of the next rest period, shorten the following work cycle by one-third.
- Use of an automated or similar blood pressure device will be used to assess each employee's blood pressure at the beginning and end of each break period to determine if the rest period allows adequate cooling by applying the following criteria:
    - If the blood pressure of an Employee is outside of 90/60 to 150/90, then the **Employee** will not be allowed to begin or resume work; extend the break period by at least five minutes, at the end of which blood pressure rates will be remeasured and the end-of-break criteria again applied.

4.8.2 All physiological monitoring of heat stress will be documented using *S3NA-511-FM1 Heat Stress Monitoring Log*.

4.9 Provision of Water

4.9.1 Water shall be provided (paid) by the project or program; if **Employees** purchase their own drinking water because water is not otherwise available on site, they shall be reimbursed.

4.10 Training

4.10.1 **Employees** and their **Supervisors** that may be exposed to the hazard will be oriented to the hazard and the controls prior to work commencing.

4.10.2 Those **Employees** potentially exposed to heat stress will receive training, refer to the *S3NA-003-PR1 SH&E Training* procedure. Training will include, but is not limited to:

- Sources of heat stress (environmental and personal), influence of protective clothing, and importance of acclimatization;
- How the body handles heat and acclimatization;
- Recognition of heat-related illness symptoms;
- Preventative/corrective measures;
    - Employees will be informed of the harmful effects of excessive alcohol consumption in the prevention of heat stress.
    - All employees will be informed of the importance of adequate rest and proper diet in the prevention of heat stress.

- First aid procedures for heat stress-related illnesses; and
- Immediate reporting of any heat-related incident (injury, illness, near-miss), refer to the *S3NA-004-PR1 Incident Reporting (Americas)* procedure.

5.0 Records

5.1 None

6.0 Attachments

6.1 S3NA-511-WI1 Temperature Thresholds

6.2 S3NA-511-WI2 Symptoms and Treatment

6.3 S3NA-511-FM1 Heat Stress Monitoring Log

6.4 S3NA-511-GL1 Dehydration Chart

6.5 S3NA-511-ST Heat Exposure

Americas

Temperature Thresholds

S3NA-511-WI1

1.0 Work-Rest Schedule

The prevention of heat stress is best performed through Supervisor observation of Employees and routine heat stress awareness training activities. However, it is also necessary to implement a work routine that incorporates adequate rest periods to allow Employees to remove protective clothing, drink fluids (vital when extreme sweating is occurring), rest and recover. The frequency and length of work breaks must be determined by the Supervisor based upon the ambient temperature, amount of sunshine, humidity, the amount of physical labor being performed, the physical condition of the Employees (e.g., acclimated/not), and protective clothing being used.

1.1 Establishing a Work-Rest Schedule:

1.1.1 AECOM permits the use of either of two techniques to initially determine an appropriate daily work-rest schedule. These methods are:

- Wet Bulb Globe Thermometer (WBGT) Method: This method is preferred if a WBGT meter is available.
- Adjusted Temperature Method: This method should be used only if WBGT data is not available.

1.1.2 Either procedure will provide the Supervisor with a recommended routine; however, adjustments to this routine may be required to accommodate the specific daily conditions at the work site.

1.2 WBGT Work-Rest Schedule Guidelines:

1.2.1 Table 1, the Non-CPC Activities WBGT Chart, is intended for use where personnel are not utilizing Chemical Protective Clothing (CPC). Where workers are required to utilize CPC, Table 2, the CPC Activities WBGT Chart, will be used.

1.2.2 WBGT readings are compared directly with the values of the applicable WBGT Chart for the applicable work rate (where light work corresponds to minimal physical activity besides standing/watching; very heavy work corresponds to significant, continuous physical labor) to determine the work-rest frequency.

Table 1. Non-CPC Activities WBGT Chart

Work-Rest Regimen	WBGT			
	Light Work	Moderate Work	Heavy Work	Very Heavy Work
Continuous Work	85°F (29.4°C)	81°F (27.2°C)	78°F (25.6°C)	
75% Work – 25% Rest	86°F (30°C)	83°F (28.3°C)	81°F (27.2°C)	
50% Work – 50% Rest	88°F (31.1°C)	85°F (29.4°C)	83°F (28.3°C)	81°F (27.2°C)
25% Work – 75% Rest	90°F (32.2°C)	87°F (30.6°C)	86°F (30°C)	85°F (29.4°C)

Modified from ACGIH's 20`4 *Threshold Limit Values for Chemical Substances and Physical Agents*, for acclimatized workers

Table 2. CPC Activities WBGT chart

Work-Rest Regimen	WBGT			
	Light Work	Moderate Work	Heavy Work	Very Heavy Work
Continuous Work	74°F (23.3°C)	70°F (21.1°C)	67°F (19.4°C)	
75% Work – 25% Rest	75°F (23.9°C)	72°F (22.2°C)	70°F (21.1°C)	
50% Work – 50% Rest	77°F (25°C)	74°F (23.3°C)	72°F (22.2°C)	70°F (21.1°C)
25% Work – 75% Rest	79°F (26.1°C)	76°F (24.4°C)	75°F (23.9°C)	74°F (23.3°C)

Modified from ACGIH's 2014 *Threshold Limit Values for Chemical Substances and Physical Agents*, for acclimatized workers

1.3 Adjusted Temperature Work-Rest Schedule Guidelines:

This method can be utilized where WBGT data is not available, and requires only that the ambient temperature be known. Adjustment factors are applied to the ambient temperature to account for departures from ideal conditions (sunny conditions, light winds, moderate humidity and a fully acclimated work force). The adjustments will be made by addition or subtraction to the ambient temperature reading, or changes in table position, as indicated in Table 3. Adjustments are independent and cumulative, all applicable adjustments should be applied. The result is the Adjusted Temperature, which can be compared with the values in Table 4 for the applicable work rate (where light work corresponds to minimal physical activity besides standing/watching; very heavy work corresponds to significant, continuous physical labor) to determine the work-rest schedule.

Table 3. Temperature Adjustment Factors

Time of Day	
Before daily temperature peak[1]	+2°F (+1.11°C)
10 am – 2 pm (peak sunshine)	+2°F (+1.11°C)
Sunshine	
No clouds	+1°F (+0.56°C)
Partly Cloudy (3/8 – 5/8 cloud cover)	-3°F (-1.67°C)
Mostly Cloudy (5/8 – 7/8 cloud cover)	-5°F (-2.78°C)
Cloudy (>7/8 cloud cover)	-7°F (-3.89°C)
Indoor or nighttime work	-7°F (-3.89°C)
Wind (*ignore if indoors or wearing CPC*)	
Gusts greater than 5 miles per hour at least once per minute	-1°F (-0.56°C)
Gusts greater than 10 miles per hour at least once per minute	+2°F (+1.11°C)
Sustained greater than 5 miles per hour	-3°F (-1.67°C)
Sustained greater than 10 miles per hour	-5°F (-2.78°C)
Humidity (*ignore if wearing CPC*)	
Relative Humidity greater than 90%	+5°F (+2.78°C)
Relative Humidity greater than 80%	+2°F (+1.11°C)
Relative Humidity less than 50%	-4°F (-2.23°C)
Chemical Protective Clothing (CPC)	
Modified Level D (coveralls, no respirator)	+5°F (+2.78°C)
Level C (coveralls w/o hood, full-face respirator)	+8°F (+4.45°C)
Level C (coveralls with hood, full-face respirator)	+10°F (+5°C)

[1] This adjustment accounts for temperature rise during the day. If the temperature has already reached its daytime peak it can be ignored.

Level B with airline system	+9°F (+5.56°C)
Level B with SCBA	+9°F (+5.56°C) and right one column[2]
Level A	+14°F (+7.78°C) and right one column[2]
Other	Specified in the HASP
Miscellaneous	
Unacclimated work force	+5°F (+2.78°C)
Partially acclimated work force	+2°F (+1.11°C)
Working in shade	-3°F (-1.67°C)
Breaks taken in air conditioned space	-3°F (-1.67°C)

Table 4. Work-Rest Schedule Based on Adjusted Temperature

Work-Rest Regimen	Adjusted Temperature			
	Light Work	**Moderate Work**	**Heavy Work**	**Very Heavy Work**
No specified requirements	< 80°F (22.67°C)	< 75 (23.88°C)	< 70 (21.11°C)	< 65 (18.33°C)
15 minute break every 90 minutes of work	80°F – 90°F (22.67°C) - (32.22°C)	75 – 85 (23.88°C) - (29.44°C)	70 – 80 (21.11°C) - (22.67°C)	65 – 75 (37.77°C) - (23.88°C)
15 minute break every 60 minutes of work	>90 – 100 (32.22°C) - (37.77°C)	> 85 – 95 (23.88°C) - (35°C)	>80 – 85 (22.67°C) - (23.88°C)	>75 – 80 (23.88°C) - (22.67°C)
15 minute break every 45 minutes of work	>100 – 110 (37.77°C) - (43.33°C)	>95 – 100 (35°C) - (37.77°C)	>85 – 90 (23.88°C) - (32.22°C)	>80 – 85 (22.67°C) - (23.88°C)
15 minute break every 30 minutes of work	>110 – 115 (43.33°C) - (46.11°C)	>100 – 105 (37.77°C) – (40.55°C)	>90 – 95 (32.22°C) - (35°C)	>85 – 90 (23.88°C) - (32.22°C)
15 minute break every 15 minutes of work	>115 – 120 (46.11°C) - (48.88°C)	>105 – 110 (40.55°C) - (43.33°C)	>95 -100 (35°C) - (37.77°C)	>90 – 95 (32.22°C) - (35°C)
Stop Work	**>120** (48.88°C)	**>110** (43.33°C)	**>100** (37.77°C)	**>95** (35°C)

Note: Time spent performing decontamination or donning/doffing CPC should not be included in calculating work or break time lengths.

[2] Locate the proper column based on work rate, then move one column to the right (next higher work rate) before locating the corresponding adjusted temperature.

Americas

Symptoms and Treatment

S3NA-511-WI2

1.0 Heat Illness Symptoms

1.1 The following are three stages of heat-related illness:

1.1.1 Heat Cramps

Heat cramps are painful muscle cramps caused by over-exertion in extreme heat. Symtpoms include:

- Muscle spasms; and
- Pain in the hands, feet, and abdomen.

1.1.2 Heat Exhaustion

Heat exhaustion is the next stage. Symptoms include:

- Cool, moist, pale, flushed or red skin;
- Heavy sweating;
- Headache;
- Nausea or vomiting;
- Dizziness ;
- Exhaustion;
- Mood changes (irritable, or confused/can't think straight); and
- Fainting

1.1.3 Heat Stroke

Heat exhaustion can sometimes lead to heat stroke, which can be fatal and requires emergency treatment. Heat stroke happens when you stop sweating and your body temperature continues to rise, often to 105 degrees Fahrenheit (°F) (40.5 degrees Celsius [° C]) or higher. Symptoms of heat stroke:

- Vomiting;
- Decreased alertness level or complete loss of consciousness;
- High body temperature (sometimes as high as 105°F [40.5°C])
- Red, hot, usually dry skin
- Lack of or reduced perspiration
- Skin may still be moist or the victim may stop sweating and the skin may be red, hot, and dry;
- Rapid, weak pulse or rapid, strong pulse;
- Rapid, shallow breathing;
- Nausea;
- Dizziness and confusion; and
- Coma.

2.0 Recommended Treatment for Heat Stress-related Illnesses

2.1 Heat Cramps

2.1.1 Treatment for heat cramps includes:

- Gently stretch the cramped muscle and hold the stretch for about 20 seconds, then gently massage the muscle. Repeat these steps if necessary.

- Take more frequent breaks and drink more water.
- Move victim to a cool place.
- Administer drinks of cool water.
- Apply manual pressure to cramped muscles.
- Seek medical attention if symptoms are not alleviated or if more serious problems are indicated.

2.1.2 Heat Exhaustion

Treatment of heat exhaustion includes:

- Get out of the sun to a cool location and drink lots of water, a little at a time.
- Remove or loosen tight clothing.
- If you are nauseated or dizzy, lie down.
- Move the victim to a cool place.
- Remove as much clothing as possible and elevate the feet.
- Administer drinks of cool water and fan to cool.
- Seek medical attention immediately.

2.1.3 Heat Stroke

Treatment of heat stroke, or if a person's temperature exceeds 102°F (38.9 °C) includes:

- Call for immediate medical help and then try to lower the temperature as quickly as possible:
  - Apply cool (not cold) water the person's whole body, then fan the person.
  - Wrap in wet sheet.
  - If available, use cold packs under arms, neck, and ankles
  - Stop cooling once the person's temperature appears to be down; be careful not to overcool.
- Do not give aspirin or acetaminophen to reduce the temperature.
- Treat as a true medical emergency. Seek medical help immediately
- Protect from injury during convulsion.
- Ensure that the person's airway is open.
- Transfer to a medical facility immediately.

Americas

Heat Stress Monitoring Log

S3NA-511-FM1

The purpose of this form is to monitor employees for heat illness. It is the responsibility of the Foreman or Supervisor-in-Charge to ensure that each person completes the required information.

Project Name:					**Foreman/Supervisor:**							**Work/Rest Schedule1:**	IN *(min)*		OUT *(min)*	
Date:	**Water Provided[1]**		**Acclimated[2]**		**Initial Vitals[3]**			**Vital Signs and Time In/Out[3]**			**Celcius/ Farenheit (circle one)**					
Employee Name	Yes	No	Yes	No	**Vitals**	In	Out	**Vitals**	In	Out	**Vitals**	In	Out	**Vitals**	In	Out
					P			**P**			**P**			**P**		
					BP			**BP**			**BP**			**BP**		
					Temp			**Temp**			**Temp**			**Temp**		
					P			**P**			**P**			**P**		
					BP			**BP**			**BP**			**BP**		
					Temp			**Temp**			**Temp**			**Temp**		
					P			**P**			**P**			**P**		
					BP			**BP**			**BP**			**BP**		
					Temp			**Temp**			**Temp**			**Temp**		
					P			**P**			**P**			**P**		
					BP			**BP**			**BP**			**BP**		
					Temp			**Temp**			**Temp**			**Temp**		
					P			**P**			**P**			**P**		
					BP			**BP**			**BP**			**BP**		
					Temp			**Temp**			**Temp**			**Temp**		
					P			**P**			**P**			**P**		
					BP			**BP**			**BP**			**BP**		
					Temp			**Temp**			**Temp**			**Temp**		

1. Each employee should be provided a sufficient amount of water or sports drink before entering the hot zone. Drinks such as coffee and cola should be discouraged.
2. Am Employee is “acclimated” if he/she has worked in a hot environment for at least 7 to 10 consecutive days. If an Employee is acclimated, check “Yes.” If an Employee is not acclimated, check “No” and reduce the “Min In” by 50 percent for that Employee until the 7- to 10-day period is reached.
3. “Vitals” refers to Employee vital signs (e.g., pulse [P], blood pressure [BP], body temperature [Temp], etc.). Initial vitals must be taken and recorded before the start of work and at each break period, or as specified in the Heat Stress Exposure Control Plan.

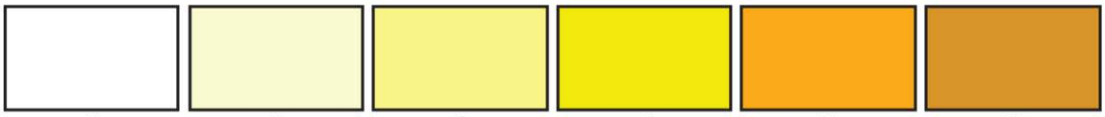
Americas

Dehydration Chart

S3NA-511-GL1

GUIDANCE TOOL FOR MONITORING DEHYDRATION

URINE COLORATION CHART



1 2	3 4	5 6
Target	**Dehydration**	**Severe Dehydration**
CONTINUE DRINKING WATER TO MAINTAIN CURRENT HYDRATION LEVELS.	INCREASE WATER CONSUMPTION TO IMPROVE HYDRATION LEVELS, INCREASE BREAKS FREQUENCY, TAKE BREAKS IN A COOL SHADED AREA.	**STOP WORK!** FIND A SHADED AREA AND BEGIN TO DRINK COOL TO ROOM TEMPERATURE WATER SLOWLY AND STEADILY.

PREVENTING DEHYDRATION

- Start hydrating at least 3 days prior to working in high heat conditions
- Always bring enough water to maintain hydration. CalOSHA requires consuming 1 quart per hour of your work shift - more may be needed

Note: This information is guidance only and should not supersede the recommendation or instruction of a personal physician or medical professional. Contact your physician or medical professional if you have a personal medical condition or take medication for a personal condition which may be adversely affected by dehydration. Urine color can be affected by medications, vitamins and or other personal health conditions.

Americas

Heat Illness Prevention

S3NA-511-ST1

The following Occupational Health and Safety regulations apply directly to heat stress hazards:

Jurisdiction	Regulation
United States	
OSHA	1910.132
California	8 California Code of Regulations 3395
Canada	
Alberta	n/a
British Columbia	OHS Regulation (1997) Sect 7.28 – 7.32, 8.21, 12.72, 12.73
Manitoba	Workplace Health and Safety Regulation (217/2006) Sect 4.12, 4.13
New Brunswick	OHS Regulation (91-191) Sect 44
Newfoundland/Labrador	OHS Regulation (C.N.L.R. 1165/96) Sect 10
Nova Scotia	n/a
NWT/NU Territories	n/a
Ontario	O. Reg. 213/91 Sect 112 O. Reg. 851 Sect 129 Heat Stress (Health and Safety Guidelines) (April 2003)
Prince Edward Island	OHS Regulations (EC180/87) Sect 42.1
Quebec	OHS Regulation (R.R.Q., c. S-2.1, r.19.01 O.C. 885-2001) Sect 121 – 124, Schedule 4, Schedule 5
Saskatchewan	OHS Regulation (R.R.S., c. O-1, r. 1) Sect 70
Yukon Territory	Occupational Health Regulations (O.I.C. 1986/164) Sect 9, 12

Appendix B2

Aztech Health & Safety Plan

Aztech
Technologies, Inc.

HEALTH AND SAFETY PROGRAM

KINGSBURY LANDFILL

HUDSON FALLS, NY

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
SITE PIN NO. 558008

Health and Safety Officer:

Garth Barrett, Aztech Technologies, Inc.
Office Phone: 518-885-5383
Fax Number: 518-885-5385
Cell Phone: 518-361-8450

Individual responsible for Health and Safety at the Site:

Terry Bohn, Aztech Technologies, Inc.
Cell Phone: 518-852-0666

Signature: _____

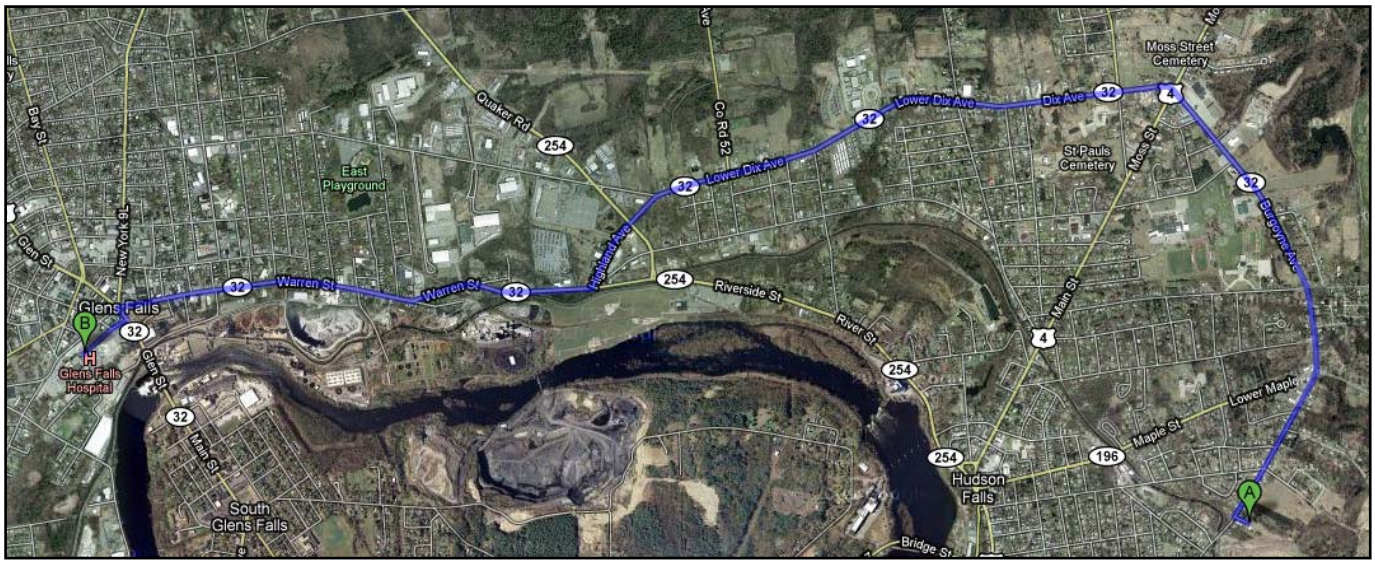
Fil L. Fina, III, Vice President
Aztech Technologies, Inc.

EMERGENCY SERVICES

Hospital	Glens Falls Hospital	100 Park Street Glens Falls, NY 12801 (518) 926-1000
Ambulance		911
Fire Department		911
Police Department		911
NYS Spill Hotline	NYSDEC	800-457-7362
National Response Center (for all emergencies)	USCG	800-424-8802
Aztech Technologies, Inc.		
In case of accident notify:	Jutta Farrell	518-885-5383

Directions to Glens Falls Hospital

1. Head northeast on 37/Burgoyne Ave toward Patten Dr
2. Continue to follow Burgoyne Ave
3. Continue onto Dix Ave/Lower Dix Ave/NY-32 S
4. Continue to follow NY-32 S
5. Turn right at NY-32 S/Warren St
6. Turn left at Glen St
7. Turn right at Park St



INTRODUCTION

Aztech Technologies, Inc. will provide their employees with a safe work environment in accordance with applicable OSHA safety regulations. The mechanism to provide this is a health and safety policy which includes the following sections:

- Section 1 Site Specific Hazards
- Section 2 Hazard Communications Program
- Section 3 Confined Space Entry Program
- Section 4 LockOut/Tag Out Program
- Section 5 Scaffolding/Staging Program
- Section 6 Fall Protection Program
- Section 7 Aerial Lifts
- Section 8 Cranes and Hoisting Equipment
- Section 9 Forklifts
- Section 10 Trenching and Shoring Program
- Section 11 Ladders
- Section 12 Railway Safety Program
- Section 13 Personal Protective Equipment
- Section 14 Respiratory Protection Program
- Section 15 Work Over or Near Water
- Section 16 Special Hazards Program
- Section 17 Injury/Illness Recordkeeping
- Section 18 Job Site Safety Meetings
- Section 19 Job Safety Analysis Sheets
- Section 20 Work site inspection program
- Section 21 Safety Training Program
- Section 22 Material Safety Data Sheets

The above program represents the primary safety areas that currently impact the company. As operations change and develop additional programs will be developed and implemented. The Aztech Technologies, Inc. health and safety policy receives management review and outside consultant review at least annually and where applicable specific programs will be developed for individual jobs.

Management responsibility will be to make sure that all employees have access to this policy, review this policy, and subsequently provide employees with the resources to ensure their safety. Management will provide trained supervisory staff to evaluate jobs and to make sure employees receive proper instruction on safety and follow prescribed company policies. In the event there are no Aztech Technologies, Inc. employees involved in day to day construction activity, but Aztech Technologies, Inc. acts as a general contractor the subcontractor will be required to provide appropriate training and documentation and adhere to safe work practices.

Employee responsibility will be to conduct their work in a safe manner as instructed through the company policy and their safety training. Employees will be responsible for following safety procedures and wearing and using safety equipment when provided. Employees will be responsible for attending all safety meetings, and for attending company sponsored and paid for safety training. Employees who violate safety policies and procedures will be warned and where appropriate disciplined.

SECTION 1

SITE SPECIFIC HAZARDS

The site is known to have or suspected to have the following contaminants present in the soil and/ or groundwater: 1,1-Dichloroethane, Acetone, Antimony, Arsenic, Chlorobenzene, Iron Metal, Magnesium, Manganese, Sodium, Toluene and Xylenes.

1,1-DICHLOROETHANE: A colorless, oily liquid with a slight chloroform like odor. Hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation. The substance is toxic to kidneys, lungs, liver, central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage.

ACETONE: A colorless/clear liquid with a fruity, mint-like, fragrant odor. Taste is pungent, sweetish. Hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation. Slightly hazardous in case of skin contact (permeator). The substance is toxic to central nervous system (CNS). The substance may be toxic to kidneys, the reproductive system, liver, skin. Repeated or prolonged exposure to the substance can produce target organs damage

ANTIMONY: A solid. Very hazardous in case of ingestion. Hazardous in case of skin contact (irritant), of eye contact (irritant), of inhalation. Slightly hazardous in case of skin contact (permeator). The substance is toxic to blood, kidneys, lungs, the nervous system, liver, mucous membranes. Repeated or prolonged exposure to the substance can produce target organs damage.

ARSENIC: A silvery, lustrous solid. Very hazardous in case of ingestion, of inhalation. Slightly hazardous in case of skin contact (irritant), of eye contact (irritant). The substance is toxic to kidneys, lungs, the nervous system, mucous membranes. Repeated or prolonged exposure to the substance can produce target organs damage.

CHLOROBENZENE: A colorless liquid with an almond-like odor. Very hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation. Hazardous in case of skin contact (corrosive, sensitizer, permeator). Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering. Potential Chronic Health Effects: Very hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation. Hazardous in case of skin contact (corrosive, sensitizer, permeator). The substance is toxic to kidneys, lungs, the nervous system, liver, mucous membranes. Repeated or prolonged exposure to the substance can produce target organs damage. Repeated or prolonged inhalation of vapors may lead to chronic respiratory irritation.

IRON METAL: A black to grey solid or solid metallic powder with no odor or taste. Slightly hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation. The substance may be toxic to liver, cardiovascular system, upper respiratory tract, pancreas. Repeated or prolonged exposure to the substance can produce target organs damage.

MAGNESIUM: A silver-white metal solid with no odor. Slightly hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation. Repeated or prolonged exposure is not known to aggravate medical condition.

MANGANESE: A grayish-white solid with no odor. Hazardous in case of inhalation. Slightly hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion. The substance may be toxic to blood, lungs, brain, central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage.

SODIUM: A silvery metal solid. Very hazardous in case of skin contact (irritant), of eye contact (irritant). Hazardous in case of skin contact (permeator), of ingestion, of inhalation. Inflammation of the eye is

characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering. Repeated or prolonged exposure is not known to aggravate medical condition.

TOLUENE: A colorless liquid with a sweet, pungent, benzene-like odor. Hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation. Slightly hazardous in case of skin contact (permeator). The substance may be toxic to blood, kidneys, the nervous system, liver, brain, central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage.

XYLENES: A colorless, clear liquid with a sweetish odor. Hazardous in case of skin contact (irritant, permeator), of eye contact (irritant), of ingestion, of inhalation. The substance may be toxic to blood, kidneys, liver, mucous membranes, bone marrow, central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage.

The appropriate Material Safety Data Sheets are included.

SECTION 2

HAZARD COMMUNICATIONS PROGRAM[1]

All Aztech Technologies, Inc. employees will receive Hazard Communication Training upon initial hire. The training required of 29 CFR 1910.1200 will consist of reviewing material safety data sheets (MSDS), labels and chemical specific hazards. All Aztech Technologies, Inc. subcontractors will be responsible for providing their own written Hazard Communications Programs and Training.

AZTECH TECHNOLOGIES, INC. PROJECT RESPONSIBILITIES:

- All chemicals used for construction projects must have accompanying material safety data sheets.
- All vendors, distributors etc. are required to provide material safety data sheets on individual chemicals.
- A binder with all material safety data sheets will be provided for each job containing material safety data sheets for that project.
- All employees and subcontractors will have access to the information contained in the material safety data sheets at any time.

LABELS

All chemical containers such as drums, bottles, jugs, dispensers, etc. will have their warning labels kept intact. Chemicals which are transferred to smaller containers or new containers will have their label information transferred.

HAZARD EVALUATION

Chemicals which are used in the construction process, while routine in nature may present unique hazards such as flammability or corrosivity. Prior to introducing these chemicals to any job a MSDS review will be conducted to evaluate chemical specific hazards. At this time any unique hazards requiring special personal protective equipment will be identified and employees using the chemical will be informed.

[1] 29 CFR 1910.1200

TRAINING

All employees will receive hazard communication training prior to job assignment. Training will constitute how to read a material safety data sheet, chemical hazards such as toxicity, flammability, reactivity, and corrosivity. Additional information would consist of personal protective equipment, first aid and medical treatment as well as emergency response and fire protection.

- Aztech Technologies, Inc. employees will be trained on the technical elements of 29 CFR 1910.1200 by a qualified individual.

- All subcontractors will be required to provide training documentation and written program.

SECTION 3

CONFINED SPACE ENTRY PROGRAM[2]

A confined space is an area which:

1. potentially contains a hazardous atmosphere or engulfment hazard;
2. has limited means of entry or exit;
3. is not designed for human occupancy.

Common confined spaces are tanks and pits.

When you encounter a confined space, DO NOT ENTER IT*, not even to assist someone in trouble*. If you encounter someone in trouble inside a confined space, immediately call the trained emergency response team.

Confined spaces must be evaluated and may require special testing or permits to allow for entry. Heed all safety signs in the area.

Assume that every confined space is dangerous. This includes above ground as well as below ground areas. Before entering a confined space, the confined space entry procedure shall be followed and the proper permit filled out and posted.

CONFINED SPACE ENTRY PERMIT

A confined space entry permit is a check list which is used to evaluate specific confined space hazards.

HOT-WORK

Hot-work areas are those areas where possible fires may be started by flame or electrical (welding, grinding, burning, sparks) work being performed in a hazardous area. A previous inspection by the facility should be performed to establish designated areas. As per specific facility requirements, hot work permits may be required prior to performing hot work. Such areas should be prominently marked and before hot-work is done within any such area, permit tags must be secured in order to help ensure that the area will be as free as possible from fire hazards and that proper precautions will have been taken.

AIR MONITORING

Air monitoring will be conducted to evaluate atmospheric hazards. Depending on site requirements air monitoring may be conducted by Aztech Technologies, Inc. employees, subcontractor, or facility health and safety personnel.

[2] 29 CFR 1910.146

ATTENDANT'S DUTIES

The individual acting as the attendant will be responsible for monitoring the entrance in the confined space, immediate conditions associated with the confined space, and potential surrounding conditions. The attendant is not to enter a confined space unless relieved by another trained attendant. Primary function of the attendant is to summon rescue services if they are needed and provide a comprehensive safety watch for the entrance.

ENTRANTS

The entrants must be aware of any hazards associated with the confined space he/she is working in. The entrant must be aware of the signs, symptoms, and over exposure of chemical hazards.

ENTRY SUPERVISOR

The entry supervisor is responsible for reviewing the confined space permit and ensuring the conditions of the permit are safely met prior to entry in the confined space.

TRAINING

- Aztech Technologies, Inc. employees will be trained on the technical elements of 29 CFR 1910.146 by a qualified individual.

- All subcontractors will be required to provide training documentation and written program.

Appendix C

Community Air Monitoring Plan

COMMUNITY AIR MONITORING PLAN

1.0 Community Air Monitoring Plan

Real-time air monitoring for volatile compounds and particulates at the perimeter of the hot zone will be performed during all intrusive activities.

VOCs will be monitored at the downwind perimeter of the hot zone if total organic vapors in the worker breathing zone exceed 5 ppm above background, or at least twice every hour. Monitoring will be conducted with a PID equipped with a 10.2 or 10.6 eV lamp. If total organic vapor levels exceed 1 ppm above background at the perimeter, excavation activities must be halted and monitoring continued. All readings must be recorded and be available for State (NYSDEC & NYSDOH) personnel to review.

If dust becomes a concern, particulates will be monitored downwind of the hot zone with a portable particulate monitor that will have an alarm set at 150 mg/m^3. Background particulate levels will be established at the start of work. If downwind particulate levels, integrated over a period of 15 minutes, exceed 150 mg/m^3, then particulate levels upwind of the survey or work site will be measured. If the downwind particulate level is more than 100 mg/m^3 greater than the upwind particulate level, then excavation activities will be stopped and dust suppression techniques will be employed. Activities will also cease and corrective action will be taken if particulate levels exceed 2.5 times the background particulate level. All readings must be recorded and be available for review by the NYSDEC and/or NYSDOH. These action levels will be modified if particulates are better characterized and identified.

1.1 Vapor Emission Response Plan

If the ambient air concentration of organic vapors exceeds 1 ppm above background at the perimeter of the hot zone, excavation activities will be halted or odor controls will be employed, and monitoring continued. If the organic vapor level decreases below 1 ppm above background, excavation activities can resume provided:

- The organic vapor level 200 ft. downwind of the hot zone or half the distance to the nearest residential or commercial structure, whichever is less, is below 1 ppm over background; and
- More frequent intervals of monitoring, as directed by the SSO, are conducted.

If the organic vapor level is greater than 1 ppm above background at the perimeter of the hot zone, work activities must be shut down or odor controls must be employed. When work shut-down occurs, downwind air monitoring as directed by the SSO will be implemented to ensure

that vapor emission does not impact the nearest residential or commercial structure at levels exceeding those specified in the Major Vapor Emission section.

1.2 Major Vapor Emission

If any organic levels greater than 1 ppm over background are identified 200 feet downwind from the work site, or half the distance to the nearest residential or commercial property, whichever is less, all work activities must be halted or odor controls must be implemented.

If, following the cessation of the work activities, or as the result of an emergency, organic levels persist above 1 ppm above background 200 feet downwind or half the distance to the nearest residential or commercial property from the hot zone, then the air quality must be monitored within 20 feet of the perimeter of the nearest residential or commercial structure (20 Foot Zone).

If either of the following criteria is exceeded in the 20 Foot Zone, then the Major Vapor Emission Response Plan shall automatically be implemented.

- Sustained organic vapor levels approaching 1 ppm above background for a period of more than 30 minutes, or

- Organic vapor levels greater than 5 ppm above background for any time period.

1.3 Major Vapor Emission Response Plan

Upon activation, the following activities will be undertaken:

1. The local police authorities will immediately be contacted by the SSO and advised of the situation;

2. Frequent air monitoring will be conducted at 30 minute intervals within the 20 Foot Zone. If two successive readings below action levels are measured, air monitoring may be halted or modified by the SSO; and

3. All Emergency contacts will go into effect as appropriate.

Appendix D

Field Forms and Inspection Forms

Site Name: *KINGSBURY LANDFILL*

Site Location: *KINGSBURY (T), WASHINGTON COUNTY*

GROUNDWATER SAMPLING LOG

Well Number: _____

Sampled by:		**Date:**	
Flush Mount or Riser:		**Weather:**	
Measuring Point:	**Top of Riser or Top of Casing**	**Purging Equipment:**	
Measuring Point Elev.	**feet**	**Sampling Equipment:**	
Depth to Product:	**feet**	**Decon. method:**	
Depth to Water:	**feet**	**Riser diameter:**	**feet**
Depth to Well Bottom:	**feet**	**Well Volume:**	**gallons**
Water Table Elevation:	**feet**	**(0.163 x length of water column for 2" well)**	
Length of Water Column:	**feet**	**(0.652 x length of water column for 4" well)**	
Product Thickness:	**feet**	**Three Well Volumes:**	**gallons**
Observations:			
Color of groundwater:			
Odors:			

VOLUME REMOVED	TURBIDITY (ntu)	SP. COND. (µmhos)	pH (s.u.)	TEMP. (°C)

NOTES: _____

FORM 1

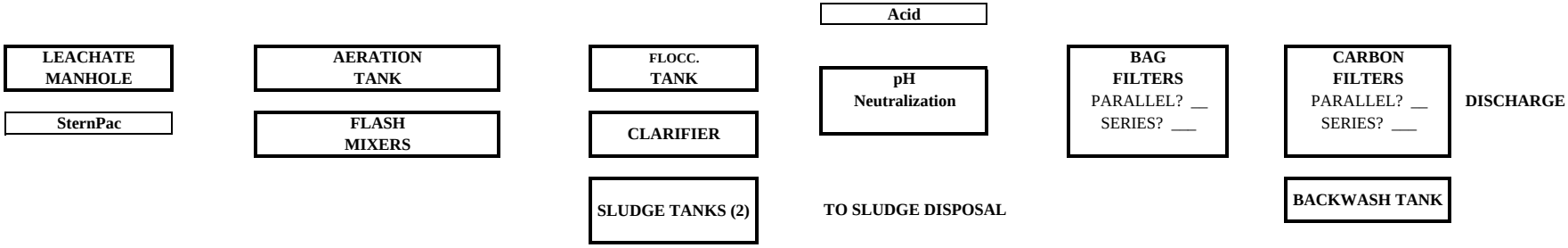
KINGSBURY LANDFILL OM&M

WEEKLY SUMMARY OF DAILY SITE ACTIVITIES

DATE	DESCRIPTION

FORM 2
KINGSBURY LANDFILL ILCTS OM&M - DAILY FIELD MEASUREMENTS

DATE:	**TIME:**	**ACTIVITIES:**
OUTSIDE TEMP (^{o}F):		**WEATHER:**
PERSONS AT SITE:		**EQUIPMENT ON SITE:**
SITE OBSERVATIONS:		
TREATMENT SYSTEM:		
CAP:		
ACCESS GATE:		**OTHER:**



FIELD MEASUREMENTS

	FLOW			TOTAL IRON (ppm)				FLOC CHARACTERISTICS	SUPERNATANT CHARACTERISTICS	REMARKS
	SYSTEM (gpm)		VOLUME (gal)	Inf.	Clar.	Filt.	Disch.			
	IN	OUT	DAILY/TOTAL							
BASELINE	*20*	*20*		*15-50*	*<0.5*	*<0.5*	*<0.5*			
TODAY (start)										
TODAY (finish)										

OTHER PARAMETERS	pH (s.u.)				CARBON (PRESSURE, psi)				FILTER BANK (PRESSURE, psi)								FILTER BAGS REPLACED? TIME
	Inf.	Floc.	Clar.	Neutr.	UNIT 1		UNIT 2		FILTER 1		FILTER 2		FILTER 3		FILTER 4		
					IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT	
BASELINE	*7*	*8.8*	*8.3*	*6.1*	*<15*	*5*	*<15*	*0*	*Pressure drop less than 35*								
TODAY																	
TODAY																	

FORM 2
KINGSBURY LANDFILL ILCTS OM&M - DAILY FIELD MEASUREMENTS

CHEMICAL USAGE/MAKEUP AND SLUDGE HANDLING					
STERNPAC		**POLYMER**	**ACID**	**SLUDGE**	**CARBON BACKWASH**
USAGE:		USAGE:	USAGE:	VOLUME:	UNIT #:
DELIVERY		MAKEUP:	DELIVERY	REMOVAL:	TIME:
				TANK NO:	VOLUME:

O&M CHECKLIST		ON/Yes	OFF/No	OPERATION AND MAINTENANCE ACTIVITIES
1. Polymer feed pump		NOT USED		
2. Aluminate feed pump				
3. Sulfuric acid feed pump				
4. Aeration blowers (1 or 2)				
5. Aeration tank turbulence				
6. Aluminate mixer				
7. Polymer mixer		NOT USED		
8. Floc. Tank agitator				
9. Neutralization Tank agitator				
10. Bag filter replaced				
11. Carbon backwashed				
12. Sludge pumped from clarifier				
13. Sludge for disposal				
14. Any ALARM conditions				
15. Water main supply				
16. Backwash water reserve				

FORM 3
KINGSBURY LANDFILL OM&M
WATER LEVEL MEASUREMENTS

DATE:	**TIME:**	**ACTIVITIES:**
OUTSIDE TEMP (^{o}F):		**WEATHER:**
PERSONS AT SITE:		**EQUIPMENT ON SITE:**
SITE OBSERVATIONS:		
TREATMENT SYSTEM:		**OTHER:**
CAP:		
ACCESS GATE:		

WELL ID	GROUND ELEV. (ft)	TOP Eelev. (ft)	WELL DEPTH (ft)	08/20/02 (baseline)		TODAY'S READINGS		REMARKS
				Depth	Elev.	Depth	Elev.	
GMW-2	196.68	198.26		12.40	185.86			
GMW-3	178.66	181.39		5.34	176.05			
GMW-4	184.19	187.47		9.95	177.52			
GMW-5	221.02	223.18		21.05	202.13			
GMW-6	226.67	228.66		26.79	201.87			
RW-1	213.30	215.62		13.60	202.02			
MW-90-1	218.97	221.76		11.28	210.48			
MW-90-2A	213.75	216.38		7.85	208.53			
MW-90-2B	213.43	216.37		6.15	210.22			
MW-90-2C	213.77	216.42		6.10	210.32			
MW-90-3A	220.16	222.58		19.00	203.58			
MW-90-3B	220.16	222.51		20.13	202.38			
MW-90-3C	220.28	223.13		21.05	202.08			
MW-90-4	217.07	219.41		8.90	210.51			
MW-90-5	209.63	212.58		4.00	208.58			
MW-90-6A	213.14	215.57		16.50	199.07			
MW-90-6B	212.32	215.35		10.87	204.48			
MW-90-6C	212.24	215.14		8.25	206.89			
MW-90-7A	218.85	221.53		22.65	198.88			
MW-90-7B	218.36	221.45		20.70	200.75			
MW-90-7C	218.01	221.08		19.05	202.03			
MW-90-8A	204.62	207.43		26.13	181.30			
MW-90-8B	203.78	206.64		26.65	179.99			
MW-90-9A	210.82	213.92		23.35	190.57			
MW-90-9B	210.84	213.9		18.51	195.39			
MW-90-10A	203.41	206.19		15.98	190.21			
MW-90-10B	203.47	205.87		16.57	189.30			
MW-90-10C	202.9	205.98		19.00	186.98			
MW-90-11A	209.11	212.15		20.10	192.05			
MW-90-11B	208.73	211.86		16.33	195.53			
MW-90-11C	208.82	211.86		9.82	202.04			
MW-90-12	213.23	216.14		5.75	210.39			
MW-90-13	209.41	212.04		4.86	207.18			
MW-90-14	185.06	187.73		13.80	173.93			
PW-90-2	209.04	212.23						
PW-90-1	213.31	216.16						
SDW								
DDW								
DDE								
SDE								
MH-1								
MH-2								

FORM 3A
KINGSBURY LANDFILL OM&M
WATER LEVEL MEASUREMENTS

WELL ID	GROUND ELEV. (ft)	TOP Eelev. (ft)	WELL DEPTH (ft)	08/20/02 (baseline)		DATE									
				Depth	Elev.	Depth	Elev.	Depth	Elev.	Depth	Elev.	Depth	Elev.	Depth	Elev.
WEATHER															
TEMP (^{o}F))															
REMARKS															
GMW-2	196.68	198.26		12.40	185.86										
GMW-3	178.66	181.39		5.34	176.05										
GMW-4	184.19	187.47		9.95	177.52										
GMW-5	221.02	223.18		21.05	202.13										
GMW-6	226.67	228.66		26.79	201.87										
RW-1	213.30	215.62	X	13.60	202.02										
MW-90-1	218.97	221.76		11.28	210.48										
MW-90-2A	213.75	216.38		7.85	208.53										
MW-90-2B	213.43	216.37		6.15	210.22										
MW-90-2C	213.77	216.42		6.10	210.32										
MW-90-3A	220.16	222.58		19.00	203.58										
MW-90-3B	220.16	222.51		20.13	202.38										
MW-90-3C	220.28	223.13		21.05	202.08										
MW-90-4	217.07	219.41		8.90	210.51										
MW-90-5	209.63	212.58		4.00	208.58										
MW-90-6A	213.14	215.57	X	16.50	199.07										
MW-90-6B	212.32	215.35	X	10.87	204.48										
MW-90-6C	212.24	215.14		8.25	206.89										
MW-90-7A	218.85	221.53		22.65	198.88										
MW-90-7B	218.36	221.45		20.70	200.75										
MW-90-7C	218.01	221.08		19.05	202.03										
MW-90-8A	204.62	207.43		26.13	181.30										
MW-90-8B	203.78	206.64		26.65	179.99										
MW-90-9A	210.82	213.92		23.35	190.57										
MW-90-9B	210.84	213.9		18.51	195.39										
MW-90-10A	203.41	206.19		15.98	190.21										
MW-90-10B	203.47	205.87		16.57	189.30										
MW-90-10C	202.9	205.98		19.00	186.98										
MW-90-11A	209.11	212.15		20.10	192.05										
MW-90-11B	208.73	211.86		16.33	195.53										
MW-90-11C	208.82	211.86	X	9.82	202.04										
MW-90-12	213.23	216.14		5.75	210.39										
MW-90-13	209.41	212.04		4.86	207.18										
MW-90-14	185.06	187.73		13.80	173.93										
PW-90-2	209.04	212.23													
PW-90-1	213.31	216.16													
SDW			16.40												
DDW			16.90												
DDE			14.00												
SDE			16.90												
MH-1			18.30												
MH-2			12.60												

FORM 3A
KINGSBURY LANDFILL OM&M
WATER LEVEL MEASUREMENTS

WELL ID	GROUND ELEV. (ft)	TOP Eelev. (ft)	WELL DEPTH (ft)	08/20/02 (baseline)		DATE									
				Depth	Elev.	Depth	Elev.	Depth	Elev.	Depth	Elev.	Depth	Elev.	Depth	Elev.
WEATHER															
TEMP (^{o}F))															
REMARKS															
RW-1	213.3	215.6	76.6	17.1	198.5										
GMW-6	226.7	228.7	80.3	30.2	198.5										
MW-90-11C	208.8	211.9	54.8	13.7	198.1										
SDW	208.3	211.9	16.4	13.8	198.1										
DDE	205.5	209.4	14.0	11.6	197.8										
SDE	206.7	210.7	16.9	13.0	197.8										
MH-1	207.1	207.1	18.3	16.1	191.0										
MH-2	207.8	207.8	12.6	10.4	197.4										

FORM 6
KINGSBURY LANDFILL OM&M
DAILY OPERATION CHECKLIST

ITEM	DESCRIPTION	NOTES	RECORD
(1) SITE CONDITIONS	A. Check weather, access gate		
	B. Check entrance to treatment building		Site conditions
	C. Check inside building		
(2) SYSTEM PLC STATUS	A. CHECK SYSTEM ALARM CONDITIONS	> PS1 shuts of all but blowers; reset	Alarm conditions
(3) FIELD READINGS	A. Read south wall pressure gauges (carbon filter in and out)	> Monitor every 30 min while in operation	Flows/pressures
	B. Read Filter bank pressure gauges	> Two pairs in series: 25 µm to 10 µm to out	Sequence
	C. Read flow meters - west wall; check total flow		
(4) POLYMER TANK		> NOT USED	
		> makeup liquid polymer (SW 6460) as per table	Chemical makeup
(5) STERNPAC	A. Check level of drum contents	> order translucent drums as required - mark levels	
	B. Check pump ON/OFF	> One 55 gallon drum lasts 4 weeks	Pump on/off
	C. Order chemical if near empty		
(6) SULFURIC ACID ALUMINATE	A. Check level of drum contents	> FULL PROTECTION GEAR REQUIRED	
	B. Check pump ON/OFF	> One 30 gallon drum lasts 1 week	Pump on/off
	C. Order chemical if near empty	> Input pH 8.3; output pH set at 6.1s.u.	
(7) AERATION BLOWER	A. Check ON/OFF		Pump on/off
	B. Alternating use	> Programmed control 12 hours on/12hours off each	
(8) AERATION TANK	A. Check level of liquid	> Measure or mark normal liquid level	
	B. Check air turbulence - i.e. blower operating		Air on/off
(9) FLASH MIX U-TUBE	A. Check Sodium Aluminate mixer ON/OFF		Mixers on/off
	B. Check Polymer mixer ON/OFF	> variable speed - box attached to mixer	
(10) FLOCCULATION TANK	A. Check level of liquid		
	B. Check if mixer/agitator on	> variable speed control at west wall	Mixer on/off
	C. Check condition of flocs		Flocs size
(11) CLARIFIER/SETTLING TANK	A. Check level of liquid	> Mark level at interior of tank	
	B. Check flow/turbulence at side hopper	> At end of season, pressure wash tank sides	Mixer on/off
(12) pH NEUTRALIZATION/ FILTER FEED TANK	A. Check level of liquid against tank marks	> Tank operates on level control	
	B. Check if mixer/agitator on	> Level fluctuates from bottom of TEE to top of tank	Mixer on/off
	C. Check condition of supernatant		supernatant quality
(13) BAG FILTERS	A. Check pressure drops (High pressure shut off 55 psi)	> All four filter in operation	Sequence
	B. Change bags if necessary (Δ of 35 psi in/out)	> Check sequence of operation	
(14) CARBON FILTERS	A. Units to be run in series or parallel	> Pressure at Carbon units regulated to 10 psi	Backwash
	B. Check pressure drops; backwash lead unit if necessary	> Unit 1 lead: Open valves [1], [5], [6], [7], [12], [14], [15]	Sequence
		> Unit 2 lead: Open valves [ ], [ ], [ ], [ ], [ ], [ ], [ ]	Lead unit
		> Parallel: Open valves [ ], [ ], [ ], [ ], [ ], [ ], [ ]	
(15) SOLIDS HOLDING TANKS	A. Check liquid levels in both tanks	> Mark level at tank exterior for reference	Disposal
	B. Condition of sludge as it fills	> Drum and dispose when full	
(16) BACKWASH TANK	A. Have water filled to mark	> Mark level at tank exterior for reference	Backwash

FORM 7
KINGSBURY LANDFILL OM&M
CALCULATIONS FOR CHEMICAL DOSAGE

STERNPAC 50				
Polyaluminum Chloride Sulfate			5.4% as Al	
1.20 Specific gravity				
LEACHATE FLOW RATE (gpm)	FEED RATE		DOSAGE (mg/L)	
	(gph)	(mL/min)	as Bulk	as Al
4	0.1	6.5	500	27
	0.2	12.9	1000	54
6	0.1	6.5	333	18
	0.2	12.9	667	36
8	0.1	6.5	250	14
	0.2	12.9	500	27
10	0.1	6.5	200	11
	0.2	12.9	400	22

FORM 8
KINGSBURY LANDFILL OM&M
OPERATOR'S ACTIVITY LOG

DATE	ACTIVITY	PROBLEM IDENTIFIED	PROBLEM RESOLVED DATE	OPERATOR INITIALS

KINGSBURY LANDFILL
INSPECTION LOG SHEET

INSPECTOR (print): _____

INSPECTOR (signature): _____

INSPECTION DATE: _____

	INSPECTOR'S INITIALS	COMMENTS
1. Fencing, Gates and Site Access		
A. Security Fence		
B. Road Gates and Gate Locks		
C. Transformer Fence		
D. Transformer Gate and Gate Locks		
E. Site Access Road		
2. ILTS Building		
A. Building Structure		
B. Piping and Pipe Bridge		
C. Door Locks		

AECOM Technical Services Northeast, Inc.

	INSPECTOR'S INITIALS	COMMENTS
3. Landfill Gas Treatment System		
A. Carbon Units		
B. Pressure Gauge Readings (4 psig maximum)		
Unit #1 _____ Unit #2 _____ Unit #3 _____		
C. Carbon Replacement		
4. Wells, Drains and Manholes		
A. Standpipe/Manhole Enclosures, Covers and Locks		
1. GMW-1		
2. GMW-2		
3. GMW-3		
4. GMW-4		
5. GMW-5		
6. GMW-6		
7. RW-1		
8. RW-2		
9. MW #1		
10. MW #2		
11. West End DD		
12. West End SD		
13. East End DD		
14. East End SD		
15. MW-90-1		
16. MW-90-2A		
17. MW-90-2B		

	INSPECTOR'S INITIALS	COMMENTS
18. MW-90-2C		
19. MW-90-3A		
20. MW-90-3B		
21. MW-90-3C		
22. MW-90-4		
23. MW-90-5		
24. MW-90-6A		
25. MW-90-6B		
26. MW-90-6C		
27. MW-90-7A		
28. MW-90-7B		
29. MW-90-7C		
30. MW-90-8A		
31. MW-90-8B		
32. MW-90-9A		
33. MW-90-9B		
34. MW-90-10A		
35. MW-90-10B		
36. MW-90-10C		
37. MW-90-11A		
38. MW-90-11B		
39. MW-90-11C		
40. MW-90-12		
41. MW-90-13		
42. MW-90-14		
43. PW-90-1		
44. PW-90-2		

AECOM Technical Services Northeast, Inc.

INSPECTOR'S INITIALS COMMENTS

5. Cap and Drainage Trench Integrity

A. Cap Deterioration (note locations on Figure 1) _____ _____

B. Drainage Trenches (note locations on Figure 1) _____ _____

C. Pan Lysimeter Measurement _____ _____

Lysimeter #	Depth to Water From Top of PVC Standpipe (inches)	Pan Lysimeter Measurement (ml)	Lysimeter Equiv. Rainfall	GFWS Rainfall (inches)	% Effect.
1					
2					
3					
4					

FORMULAS:

1. $\frac{\text{ml} \times 0.061 \text{ cu. Inches/ml}}{\text{3600 sq. inches}}$ = equivalent inches of rain in pan lysimeter

2. $\frac{\text{Total Local Rainfall} - \text{Rainfall Collected By Pan Lys. (Inches)}}{\text{Total Local Rainfall (Inches)}} \times 100 = \%$ Effectiveness

Appendix E

O&M Forms

Interim Leachate Control Treatment System Equipment List					
Equipment Designation	Description	Manufacturer & Type	Function	Weight	Power Requirement
P-1, P-2	Submersible Manhole Sump Pumps (Deep-Well, Shallow-Well)	Hydromatic Model OSP33	Transfer Leachate to Aeration System	60 lb (ea)	1/3 HP, 230 V, 60 HZ, 1 Phase
LC-1, LC-2	Manhole Level Controls	Hydromatic Model 3900 float-type level switches	Controls for pumps P-1 & P-2	10 lb (ea)	120 V, AC
T-1	Aeration Tank	8'W x 14'L x 10' D, epoxy coated	Aeration Tank	8,000 lb	NA
B-1, B-2	Aeration System Blowers	Sutorbilt, California series F Rotary blowers, Model 3HV	Supplies 30 ACFM of air to aeration tank	200 lb (ea)	1- ½ HP, 230 V, 60 HZ, 1 phase
Rapid Mixing Tank	U-shaped	12" ID SCH 40 epoxy coated steel pipe	Mix coagulant and flocculant with leachate	300 lb	NA
Sternpac	Metering pump	Liquid Metronics, Inc. Model A161-61	Feeds Sternpac to rapid mixing tank	10 lb	115 V, 50/60 HZ
T-4	Flocculation Tank	4'ID x 10'D epoxy coated steel	Provides retention time for flocculant coagulation	10,000 lb	NA
Flocculation Tank Mixer	Flocculation Tank Mixer	Grovhac Model 700-1000GD	Provides slow mixing of flocculation tank		
T-2	Clarifier with hopper bottom and media pack	6'W x 6'L x 9'6" D	Settling of suspended solids and precipitated iron	15,000 lb	NA
P-5A	Clarifier solids pump (centrifugal)	Ingersoll-Rand Model HOC II single stage centrifugal pump	Transfer solids from clarifier to solids collection tanks	85 lb (ea)	3 HP, 460 V, 60 HZ, 3 phase
P-5B	Clarifier solids pump (pneumatic)		Transfer solids between solids collection tanks		3 HP, 460 V, 60 HZ, 3 phase
T-5	Solids collection tanks	7' ID x 9'6" D epoxy coated steel	Remove solids from the clarifier	22,000 lb (ea)	NA
T-3	Filter feed tank	5' ID x 5' D epoxy coated steel	Reservoir for filter feed pumps	7,000 lb	NA
LC-3	Filter feed tank level controls	Hydromatic Model 3900 float-type level switches	Control Pumps P-3 & P-4, shut off pumps P-1 & P-2 on high level	10 lb	120 V, AC
P-3, P-4	Filter feed pumps	Ingersoll-Rand Model HOC II single stage centrifugal pumps	Supply water to suspended solids and carbon filter systems	85 lb (ea)	3 HP, 460 V, 60 HZ, 3 phase
Redux 390 Metering pump	Metering pump	Liquid Metronics, Inc. Model D131-25HV	Feeds Redux 390 to rapid mixing tank	10 lb	115 V, 50/60 HZ
F-1, F-2, F-3, F-4	Bag Filter Housing	FSI Model FSP35	Remove residual suspended solids from leachate prior to carbon filtration	100 lb (ea)	NA
CF-1 & CF-2	Primary carbon filters	Siemens 1,000 lb Carbon Vessels	Removal of dissolved PCBs and residual VOCs from pre-treated leachate	1,200 lb (ea)	NA
10 gpm flow restrictors	Flow restrictors	Dole Model 10 GX (total of 4)	Restrict flow through each carbon vessel to 10 gpm	1 lb (ea)	NA
FM	Totalizing water meter	Neptune Model Trident 10	Records total flow through the carbon vessels	10 lb	NA

Interim Leachate Control Treatment System Equipment List (continued)					
Equipment Designation	Description	Manufacturer & Type	Function	Weight	Power Requirement
S-1	Recharge (Floor) Sump	2'6" W x 2'6" L x 5.0' D	Sump for recharge (floor) sump pump		
LC-4	Recharge sump level control	Hydromatic Model 3900 float-type level switches	Controls pump P-6	10 lb	120 V, AC
P-6	Recharge (floor) sump sump Pump	Hydromatic Model SP100H	Transfers treated leachate back to deep manhole	60 lb	1 HP, 460 V, 60 HZ, 3 phase
PG-1	Pressure Gauges	Ametek series 1900 4-½ Solfrunt gauges (total 8 0-60 psig) (total 8 0-15 psig)	Provide indication of pump, blower and filter operation	1 lb (ea)	NA
Backwash Tank	520 gallon poly tank		Storage of potable water for carbon backwash		

Kingsbury Landfill ILCTS O & M
ILCTS Alarm Conditions

ILCTS System Component	Process Task	Logic	Explanation	Action
Aeration System	07	IF AP_ALM is OFF and ALM_AP is ON THEN Delay for 2 Seconds, Send FAX, Switch AP_ALM ON	Insufficient Air Pressure – Possible Blower Fault (B-1, B-2)	Activates Alarm; Sends Fax
Aeration System	11	IF AIRPRS is HI or LO and _STOP_ is OFF THEN Delay for 1 Minute, Send FAX, Switch _STOP_ ON	Blower Pressure Fault	Virtual Shutdown* Sends Fax
Recharge (floor) Sump	13	IF SUMPHH is ON and _STOP_ is OFF THEN Delay for 2 Seconds, Send FAX, Switch _STOP_ ON and SMPALM ON	Recharge (floor) Sump High/High float Activated	Virtual Shutdown* Sends Fax
Collection Trench Manhole	17	IF BYPFLO is OFF and INFLOW is LO and __DEEP is ON and _STOP_ is OFF THEN Delay for 30 Seconds, Send FAX, Switch _STOP_ ON and FLOALM ON	Insufficient Inflow From Collection Trench	Virtual Shutdown* Sends Fax
Filter Feed Tank	25	IF TANKHI is ON and TANKLO is ON and TANKLL is ON and FPUMP1 is ON and FPUMP2 is OFF and PMPALM is OFF THEN Delay for 2 Seconds, Send FAX, Switch PMPALM ON	Filter Feed Tank (T-3) Is Over-Level During Attempted Pumpdown	Activates Alarm; Sends Fax
Filter Feed Tank	26	IF TANKHI is ON and TANKLO is ON and TANKLL is ON and FPUMP1 is OFF and FPUMP2 is ON and PMPALM is OFF THEN Delay for 2 Seconds, Send FAX, Switch PMPALM ON	Filter Feed Tank (T-3) Is Over-Level During Attempted Pumpdown	Activates Alarm; Sends Fax
Filter Feed Tank	28	IF PREBAG is HI and FPUMP1 is ON and _STOP_ is OFF and BAGALM is OFF THEN Delay for 5 Seconds, Send FAX, Switch _STOP_ ON and BAGALM ON	Bag Filter Pressure Is High	Virtual Shutdown* Sends Fax
Filter Feed Tank	29	IF PREBAG is HI and FPUMP2 is ON and _STOP_ is OFF and BAGALM is OFF THEN Delay for 5 Seconds, Send FAX, Switch _STOP_ ON and BAGALM ON	Bag Filter Pressure Is High	Virtual Shutdown* Sends Fax
Filter Feed Tank	30	IF TANKHH is ON and _STOP_ is OFF and TNKALM is OFF THEN Delay for 2 Seconds, Send FAX, Switch _STOP_ ON and TNKALM ON	Filter Feed Tank (T-3) Is Over-Level	Virtual Shutdown* Sends Fax
Recharge (floor) Sump	36	IF SEALLK is ON and SEALAL is OFF THEN Delay for 2 Seconds, Send FAX, Switch SEALAL ON	Recharge (floor) sump Sump Pump (P-6) Seal Leak	Activates Alarm; Sends Fax
Remedial Building Interior	37	IF TEMP is HI or LO and TMPALM is OFF THEN Delay for 5 Seconds, Send FAX, Switch TMPALM ON	Temperature of Remedial Building Interior is outside of High/Low Temperature Limits	Activates Alarm; Sends Fax
***Virtual Shutdown**	49	IF_STOP_ is ON THEN Delay for 1 second, Switch __DEEP OFF and SHALLOW OFF and STRNIN OFF and OK_SHA OFF	Shut Down Leachate Pumps (P-1 & P-2) from Collection Trenches; Shut Off Sternpac Metering Pump	Virtual Shutdown Includes Process Tasks #49, #50 & #51.
	50	IF _STOP_ is ON THEN Delay for 2 Hours, Switch BLOWR1 OFF and BLOWR2 OFF and STRNIN OFF and OK_BLO OFF and OK_INJ OFF	After 2-hour delay, Shut Down Aerator Blowers (B-1 & B-2), Shut Down Metering Pumps	
	51	IF _STOP_ is ON THEN Delay for 3 Hours, Switch RDUXIN OFF and FPUMP1 OFF and FPUMP2 OFF and OK_FP OFF	After 3-hour delay, shut down Filter Feed Tank Pumps (FFP-1 & FFP-2)	

Kingsbury Landfill ILCTS O & M
System Start-Up Checklist

Pre Start-Up System Checks

Aeration System Blowers

Step-1: "Bump" each blower motor separately to verify proper blower rotation.

Step-2: Once blower rotation is verified, turn one blower on and verify free flow of air to all spargers in the aeration tank.

Step-3: Adjust blower pressure relief valves.

- With one blower running, slowly close main air header valve on discharge of running blower until the pressure gauge on the blower discharge reads 4-½ psig.
- Adjust the relief valve spring tension nut until the relief valve begins to open at the 4-½ psig gauge pressure.
- After adjustment of the relief valve is complete, fully close the main air header valve and verify that the relief valve opens.
- Repeat sequence for second blower.

Manhole Leachate Supply Pumps

The manhole level controls operate the manhole leachate supply pumps as follows:

Manhole	Float No.	Ground-Water Elevation	Function
MH-1 (Deep-Well)	1	-	Available Contact
	2	195.00	Pump P-1 ON
	3	194.00	Pump P-1 OFF
	4	193.00	Pump P-1 Redundant OFF
MH-2 (Shallow-Well)	1	-	Available Contact
	2	198.00	Pump P-2 ON (if P1 is OFF)
	3	197.00	Pump P-2 OFF
	4	196.00	Pump P-2 Redundant OFF

Step-1: Momentarily apply power to the control panel to verify that the manhole leachate supply pumps are operable.

Step-2: Verify operation of manhole level controls.

Step-3: Observe piping for leaks.

Filter Feed Pumps/Filter Systems

The filter feed tank level controls operate the filter feed pumps as follows:

Float No.	Depth	Function
1	3' 4"	Pumps P1 and P2 (from leachate manholes) OFF
2	3' 0"	Pump P-4 ON (if P3 is OFF)
3	2' 9"	Pump P-3 ON (if P4 is OFF)
4	1' 0"	Pump P-3 and P4 OFF

Note:
Depth represents depth of liquid in Filter Feed Tank

Step-1: Install a 10 micron filter bag in each of the four (4) solids filters

Step-2: Apply power to the filter feed pump control panel. Manually raise the level control floats to verify the level control functions described above.

Step-3: Fill the tank to a depth of 4.0 feet with potable water.

Step-4: With the filter feed pump discharge valves closed, apply power to the filter feed pump control panel. Slowly open the valve on the discharge of the pump which is running.

Step-5: Slowly open the valves on the inlet and discharge of each solids filter so that the four (4) filters are operating in parallel. Observe the system piping for leaks.

Step-6: Slowly open the valves on the inlet and discharge of each carbon filter along with the effluent discharge drain to the Glens Falls Feeder Canal. Observe the filters and interconnecting piping for leaks. Note: it will be necessary to add more water to the filter feed tank while performing this test.

Step-7: After the inlet and discharge valves on all solids filters and carbon filters have been opened, allow the system to operate for one to two hours, observing all systems for leaks. Repeat Steps 2 through 6 with the second filter feed pump. The operation of the totalizing flow meter should also be checked.

Kingsbury Landfill ILCTS O & M
System Start-Up Checklist
(Continued)

Pre Start-Up System Checks (Continued)

Aeration Tank

Step-1: Fill the aeration tank with potable water to a depth approximately 1.0 foot above the air inlet header.

Step-2: Following verification of the Aeration System Blowers, start one of the blowers and observe the distribution of air in the aeration tank.

Flocculation Tank

Step-1: Fill the flocculation tank with potable water to a depth approximately 1.0 foot below the discharge pipe. Verify that the flocculation tank is free of leaks.

Step-2: Verify that the variable speed slow mixer is operable.

Clarifier

Step-1: Verify that the clarifier bottom is free of solids.

Step-2: Verify that the clarifier media is in place and clean.

Step-3: Fill the clarifier with potable water to a level 1.0 foot below the media pack. Verify that the clarifier is free of leaks

Solids Collection System

Step-1: Open the inlet valve to the pneumatic solids pump.

Step-2: Open the air valve to the pneumatic solids pump and slowly open discharge valve to one of the solids collection tanks.

Step-3: Verify that the piping is free of leaks and that the liquid is being transferred from the clarifier to the solids collection tank.

Step-4: Open the discharge valve to the second solids collection tank and close the discharge valve to the solids collection tank originally being filled.

Step-5: Verify that the piping is free of leaks.

Step-6: Shut off air to the pneumatic solids pump. Close inlet and discharge valves

Step-7: Drain the water in solids collection tanks to the recharge (floor) sump.

Chemical Feed System

Step-1: Fill the U-shaped rapid mix tank with potable water. Verify that the rapid mix tank is free of leaks.

Step-2: Verify that the variable speed rapid mixer is operable.

Step-3: Verify that the Sternpac suction line is in place in reagent drum and properly connected to metering pump.

Step-4: Verify that the Sternpac supply line is properly connected to metering pump and rapid mix tank.

Step-5: Activate Sternpac metering pump and verify that it is operable. Check all connections for leaks. Adjust speed and stroke controls for the required chemical dosage.

Step-6: Repeat Step-3 through Step 5 for Redux addition.

Recharge (Floor Sump) System

The recharge (floor) sump level controls operate the recharge (floor) sump pump as follows:

Float No.	Depth	Function
1	4’ 0”	Pump P-6 redundant ON
2	3’ 6”	Pump P-6 ON
3	1’ 6”	Pump P-6 OFF
4	1’ 0”	Pump P-6 redundant OFF

Note:
Depth represents depth of liquid in Recharge (floor) Sump

Step-1: Apply power to the recharge (floor) sump pump control panel. Manually raise the level control floats to verify the level control functions at the elevations described above.

Step-2: Fill the sump to a depth of 4.0 feet with potable water.

Step-3: With the recharge (floor) sump pump discharge valve closed, apply power to the recharge (floor) sump pump control panel and slowly open the discharge valve.

Step-4: Observe the system piping for leaks and verify a flow back to the deep drain manhole (MH-1).

Kingsbury Landfill ILCTS O & M
System Start-Up Checklist
(Continued)

Treatment System Start-Up

Following completion of the pre-startup system checks, the treatment system is ready for start-up. Start-Up as follows:

Step-1: Verify that all drain valves on all components are closed. _____

Step-2: Open the discharge valves on the manhole leachate supply pumps and apply power to the manhole pumps via the main control panel. This should start the flow of leachate to the aeration tank. _____

Step-3: Fill the aeration tank to a depth 6.0-inches below the aeration tank overflow. After the aeration tank is full, shut the power off to the manhole leachate supply pumps and close the discharge valve. _____

Step-4: Turn the aeration system blower on and allow the aeration system to operate for a minimum of 4.0 hours _____

Step-5: After the aeration system has operated for a minimum of 4.0 hours, open the manhole leachate supply pump discharge valves and turn the power on to the desired manhole leachate supply pump via the main control panel. This will restore the flow of leachate to the aeration tank. _____

Step-6: Allow the aeration tank to fill and overflow into the rapid mixing tank. _____

Step-7: Start up the rapid mixer and chemical feed pump to begin chemical treatment of the leachate. _____

Step-8: Allow the flocculation tank to fill and overflow into the clarifier. Start the variable speed slow mixer on the flocculation tank. Adjust the slow mixer to give only enough agitation to prevent solids accumulation in the bottom of the flocculation tank (approximately 20 rpm). _____

Step-9: Allow the clarifier to fill and overflow into the filter feed tank. _____

Step-10: Before starting the filter feed pumps, allow the filter feed tank to fill to a level of 3 feet 6 inches above the bottom of the tank. Verify that the filter feed tank level control will stop the manhole pump in the event of a tank overfill. Make adjustments to the level controls as necessary. _____

Step-11: Following verification of the filter feed tank level controls, open the valves on filter feed pump discharge. _____

Step-12: Open the inlet and discharge valves on the solids filters. _____

Step-13: Open the valves on the inlet and discharge of the carbon filters. Open the discharge valve to the recharge (floor) sump and close the discharge valve to the Glens Falls Feeder Canal. Open the valve to the deep drain manhole (MH-1) and close the valve to the shallow drain manhole (MH-2). _____

Step-14: Record the total flow registered on the totalizing flow meter at the discharge of the carbon filter system. _____

Step-15: Start the filter feed pump. _____

Step-16: Start the recharge (floor) sump pump. _____

Step-17: Allow the system to operate and stabilize for 4.0 hours before sampling. Observe the system for leaks or other problems. _____

Step-18: After allowing the treatment system to stabilize for 4.0 hours, begin sampling the system in accordance with the temporary discharge permit requirements. _____

Step-19: Following sampling, shut down the system until analytical results confirm compliance with the temporary discharge permit requirements.

Note:
When the system is restarted following compliance testing (or after routine maintenance), discharge will be directed to the Glens Falls Feeder Canal as indicated in Step-13. Step-16 through Step-19 will not be required.

Kingsbury Landfill ILCTS O & M
System Start-Up Checklist
(Continued)

Treatment System Shutdown

Temporary Shutdown (less than 72 hours)

Step-1: Shut off circuit breakers to pumps P-1, P-2, P-3, P-4, and P-5; and the chemical metering pumps.

Step-2: Leave blowers B-1 and B-2, and the Sternpac rapid mixer and flocculation slow mixer operating.

Step-3: Pump solids out of clarifier.

Step-4: Verify that building heating system is in operation

Extended Shutdown

Step-1: Shut off circuit breakers to pumps P-1, P-2, P-3, P-4, P-5, and -6; blowers B-1 and B-2: the chemical metering pumps; and the Sternpac rapid mixer and flocculation slow mixer. Unplug all mixers.

Step-2: Empty water and sediment from all equipment and piping systems (see note below).

Step-3: Remove carbon from all carbon filters and dispose in accordance with applicable regulations (see note below).

Step-4: Follow manufacturers' instructions for storage of all equipment.

Note:

Water, sediment, spent carbon and filter bags from the treatment system are likely to contain PCBs and **must** be handled as hazardous substances. Personal protective equipment will be required during handling of these materials.)

Form 1

Kingsbury Landfill ILCTS O & M

Summary of Daily Site Activities

Date	Description

Form 2
Kingsbury Landfill ILCTS O &M
Daily Field Measurements

Date:	Time:	Activities:
Outside Temp:		Weather:
Persons at Site:		Equipment On-Site:
Site Observations:		
Treatment System:		
CAP:		
Access Gate:		Other:

Acid

Leachate Manhole | Aeration Tank | Flocc Tank | pH Neutralization | Bag Filters Parallel ? ____ Series ? ____ | Carbon Filters Parallel ? ____ Series ? ____ | Discharge

Sternpac | Flash Mixers | Clarifier

Solids Tanks (2) | To Solids Disposal | Backwash Tank

Field Measurements											
	Flow			Total Iron				Floc Characteristics	Supernatant Characteristics	Remarks
	System		Volume	Inf.	Clar	Filt	Disch.			
	In	Out	Daily Total (gallons)							
Baseline	20	20		15 - 50	< 0.5	< 0.5	< 0.5			
Today (start)										
Today (finish)										

Other Parameters	pH				Carbon Pressure				Filter Bank Pressure								Filter Bags Replaced ? Time
	Inf.	Floc.	Clar.	Eff.	Unit 1		Unit 2		Filter 1		Filter 2		Filter 3		Filter 4		
					In	Out	In	Out	In	Out	In	Out	In	Out	In	Out	
Baseline	7	8.8	8.3	6.1	< 15	5	< 15	0	Pressure Drop Less Than 35								
Today (start)																	
Today (finish)																	

Form 2
Kingsbury Landfill ILCTS O &M
Daily Field Measurements
(Continued)

Chemical Usage/Makeup and Sludge Handling				
Sternpac	**Polymer**	**Acid**	**Sludge**	**Carbon Backwash**
Usage:	Usage:	Usage:	Volume:	Unit #:
Delivery:	Delivery:	Delivery:	Removal:	TIme:
			Tank No.:	Volume:

O & M Checklist	On/Yes	Off/No	Operation and Maintenance Activities
1. Sternpac Feed Pump			
2. Redux Feed Pump			
3. Sulfuric Acid Feed Pump			
4. Aeration Blowers (1 or 2)			
5. Aeration Tank Turbulence			
6. Sternpac Mixer			
7. Flocculation Tank Agitator			
8. Neutralization Tank Agitator			
9. Bag Filter Replaced			
10. Carbon Backwashed			
11. Sludge Pumped from Clarifier			
12. Sludge for Disposal			
13. Any Alarm Conditions			
14. Water Main Supply			
15. Backwash Water Reserve			

Form 3
Kingsbury Landfill ILCTS O &M
Water Level Measurements

					Date:								
					Weather								
					Temp (^{o}f)								
					Remarks:								
Well ID	**Ground Elev. (ft)**	**Top Elev. (ft)**	**Well Depth (ft)**	**March 2010 Baseline**		**DTW**	**DTW**	**DTW**	**DTW**	**DTW**	**DTW**	**DTW**
				Depth	**Elev.**							
DDE	205.5	209.4	14.0	11.5	197.84							
SDE	206.7	210.7	16.9	13.2	197.54							
MH-1	207.1	207.1	18.3	10.5	196.65							
MH-2	207.8	207.8	12.6	9.2	198.63							
SDW	208.3	211.9	16.4	13.9	198.04							
DDW	206.8	210.8	16.9	NM	-							
GMW-6	226.7	228.7	79.2	30.7	198.17							
MW-90-11C	208.8	211.9	54.8	13.8	198.02							
MW-90-3C	220.2	223.6	53.8	24.5	198.65							
MW-90-2C	213.5	217.0	45.2	5.7	210.80							
GMW-5	221.1	223.9	28.3	3.2	199.48							
MW-90-4	216.9	219.7	44.8	8.3	210.90							
MW-90-7C	218.0	221.1	56.4	22.5	198.44							
MW-90-6C	212.2	215.1	34.8	7.2	207.69							
MW-90-5	209.6	212.6	24.9	3.2	209.27							
RW-1	213.3	215.6	76.6	17.4	198.18							
SMW-3	178.7	181.4	36.1	4.0	177.11							
MW-8	NM	NM	17.7	4.8	NM							
GMW-4	184.2	187.5	18.5	8.7	178.44							
MW-90-10C	202.9	206.0	55.2	18.8	187.21							

Appendix F

Equipment Manufacturers Information Sheets and Manuals

Kingsbury Landfill

Interim Leachate Collection and Treatment System

Operations and Maintenance Manual

Equipment Manufacturers Information Sheets and Manuals

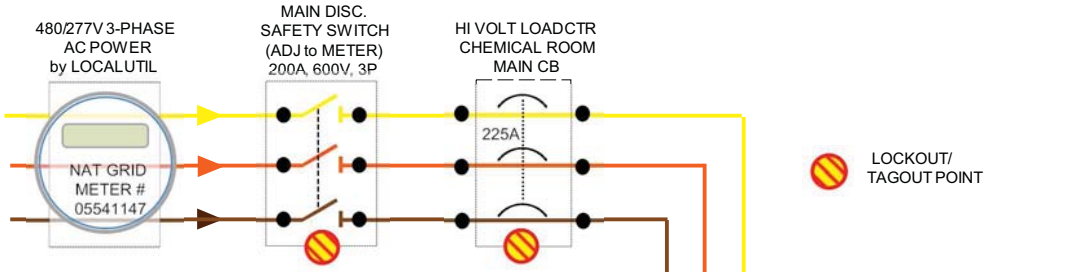
Table of Contents

Power Distribution & Control Wiring Diagram

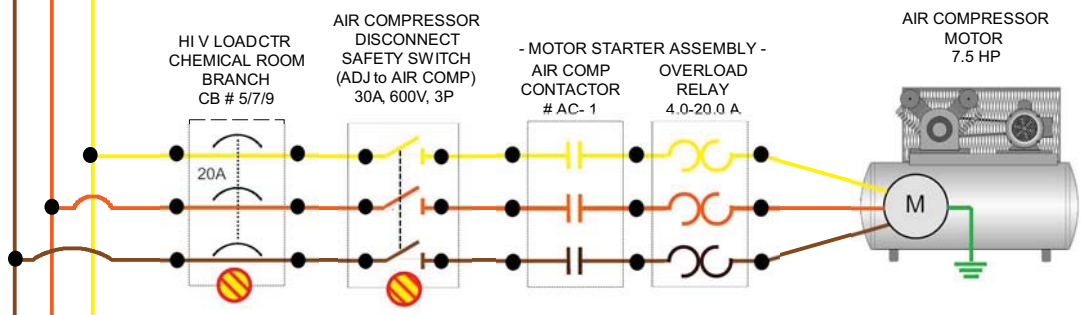
NYSDEC AECOM AZTECH KINGSBURY LANDFILL PROJECT
POWER DISTRIBUTION AND CONTROL WIRING SCHEMATIC

Aztech Technologies, Inc.

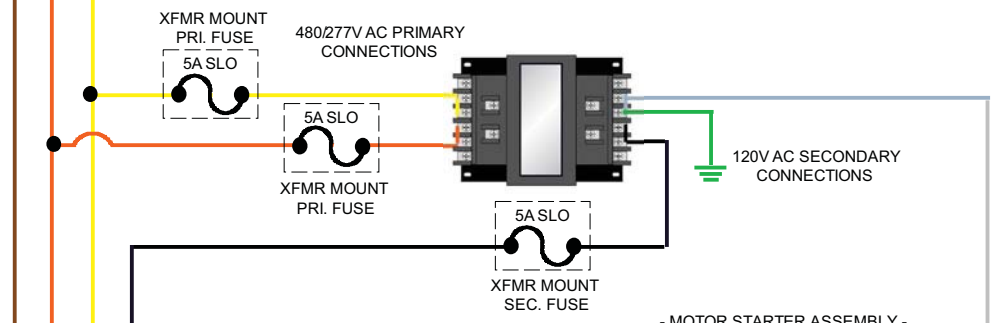
Section 1: 480/277V AC 3-Phase: AIR COMPRESSOR CONTROL
Sourced from 480V Local Utility Drop



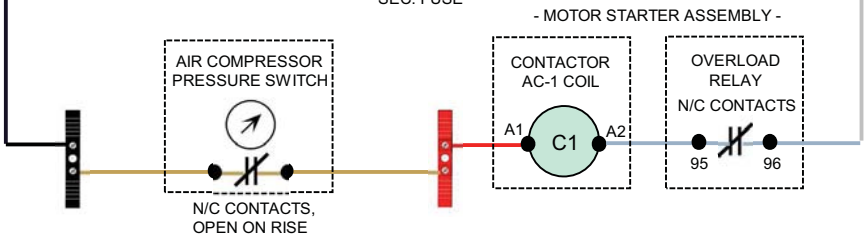
1.00 AC Power Infeed: Outdoor HV Disc. Safety Switch Feeds HV Load Ctr.



1.01 Air Compressor Motor Power Circuit See Control Circuit Line 1.03



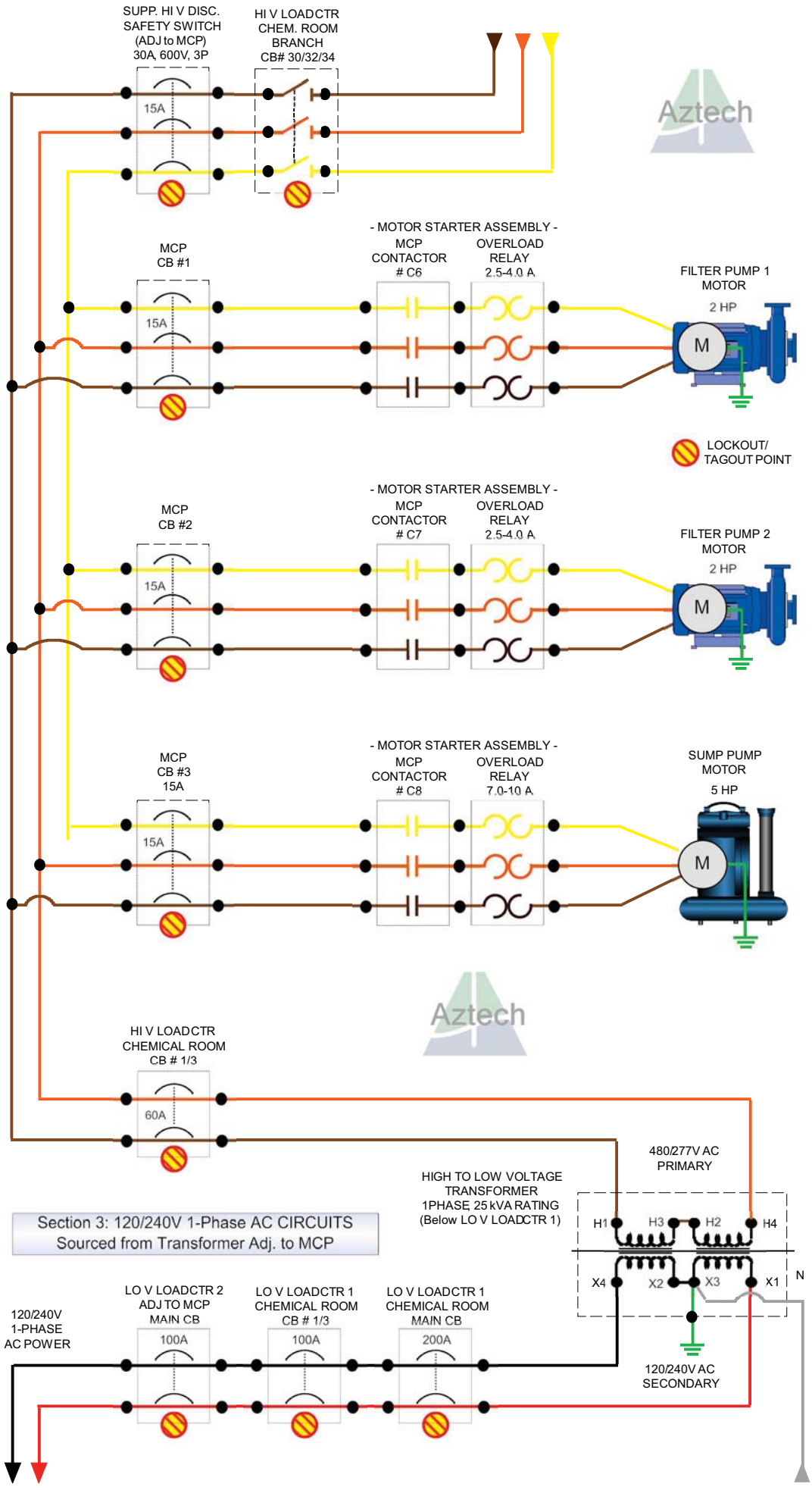
1.02 Air Compressor Control Panel Internal Transformer: Converts 480V AC to 120V AC for Local Control Power Usage Only



1.03 Air Compressor Control Circuit - See Motor Power Circuit Line 1.01

Section 2: 480/277V AC 3-Phase: HI VOLTAGE PROCESS POWER
(All Process Loads except Air Compressor) - Sourced from 480V Local Utility Drop

2.00 System Main Process 480V AC Power Feed - From Chemical Room to Main Control Panel



2.01 High Voltage Load Ctr. Circuit Breaker 30/32/34 and/or Supplemental HV Disconnect Switch (Adj. to MCP) Depowers all 480V Process Loads except Air Compressor

2.02 Filter Pump #1 Motor Power Circuit See Control Circuit 5.08

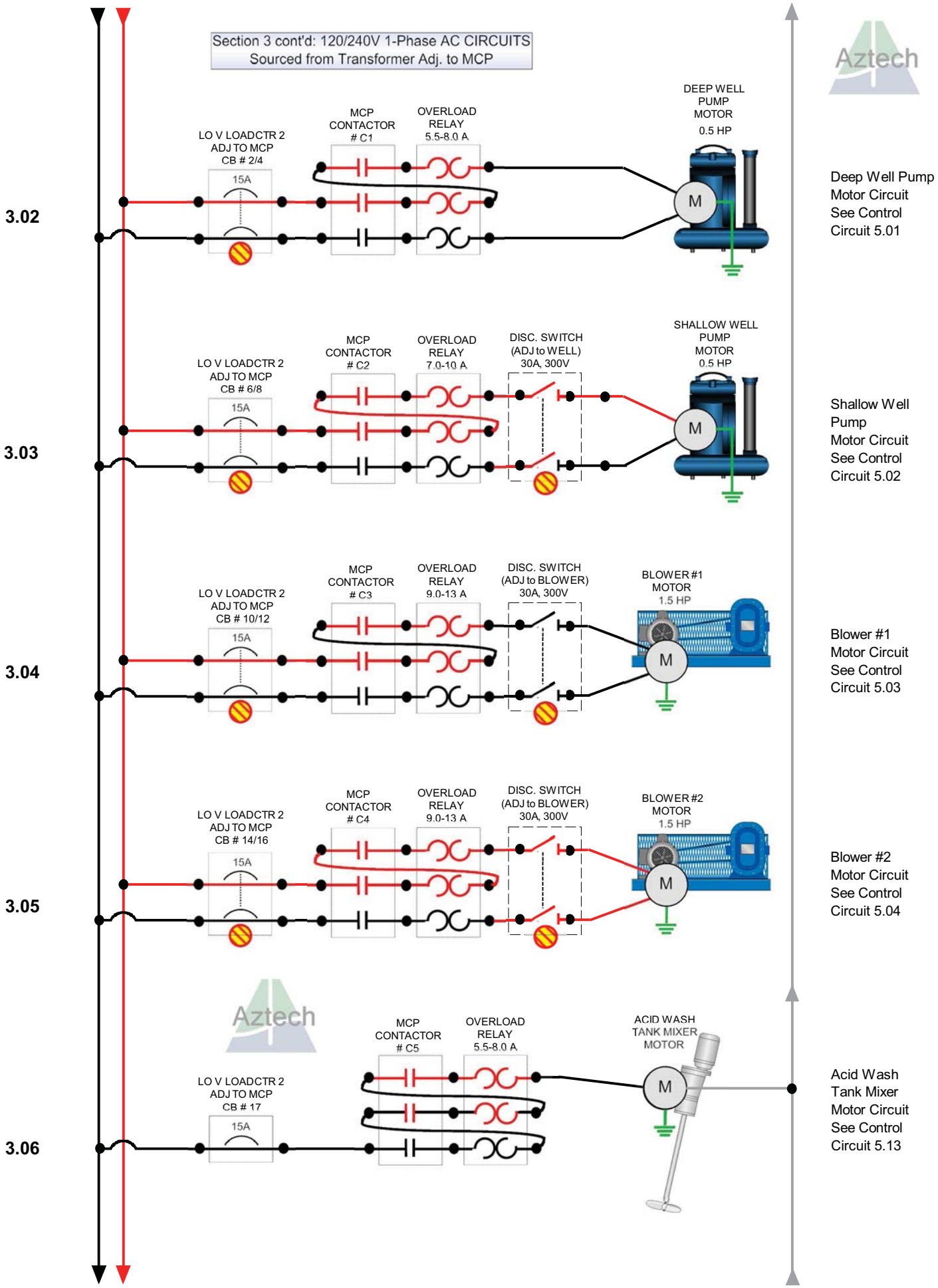
2.03 Filter Pump #2 Motor Power Circuit See Control Circuit 5.09

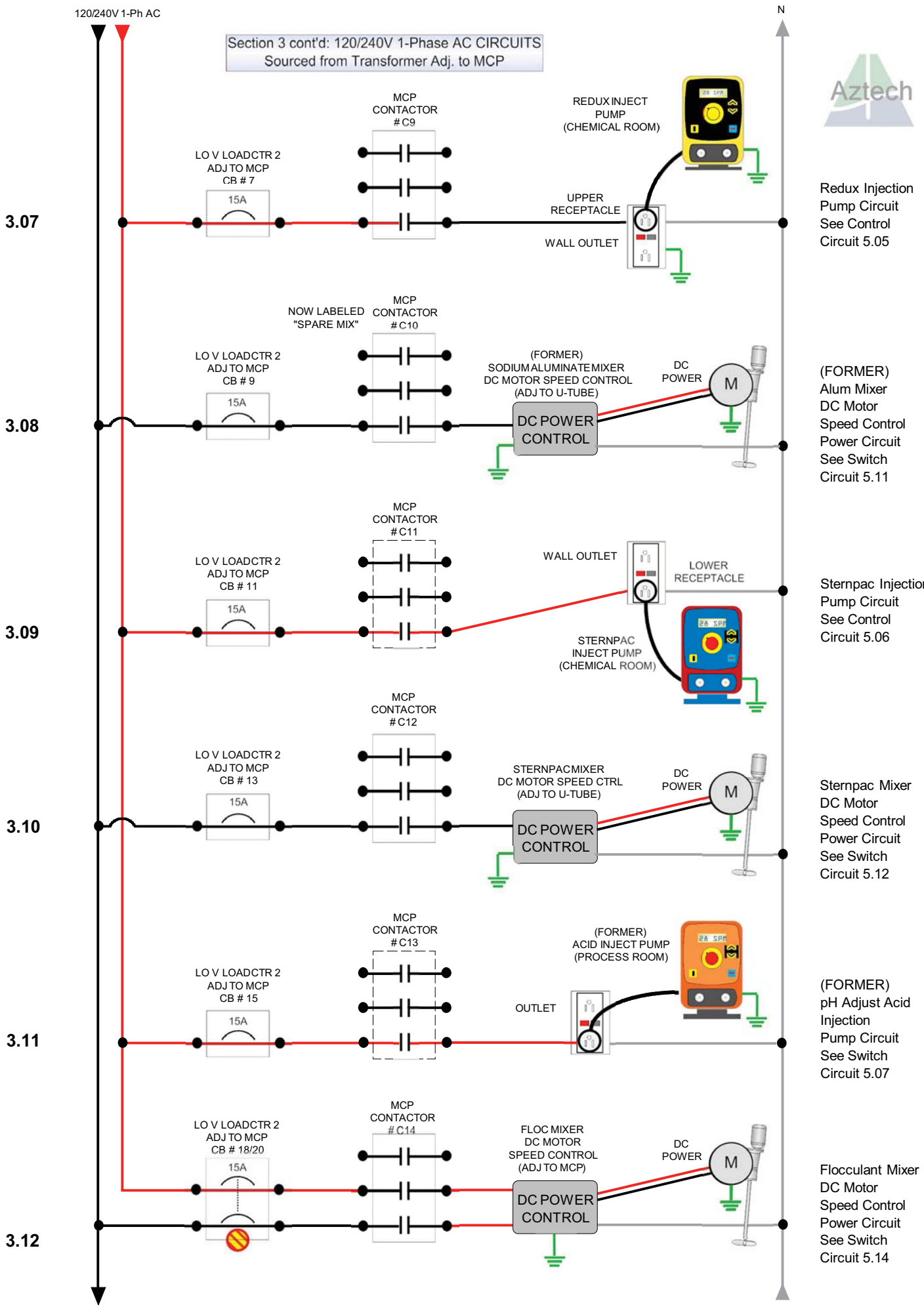
2.04 Floor Sump Pump Motor Power Circuit See Control Circuit 5.10

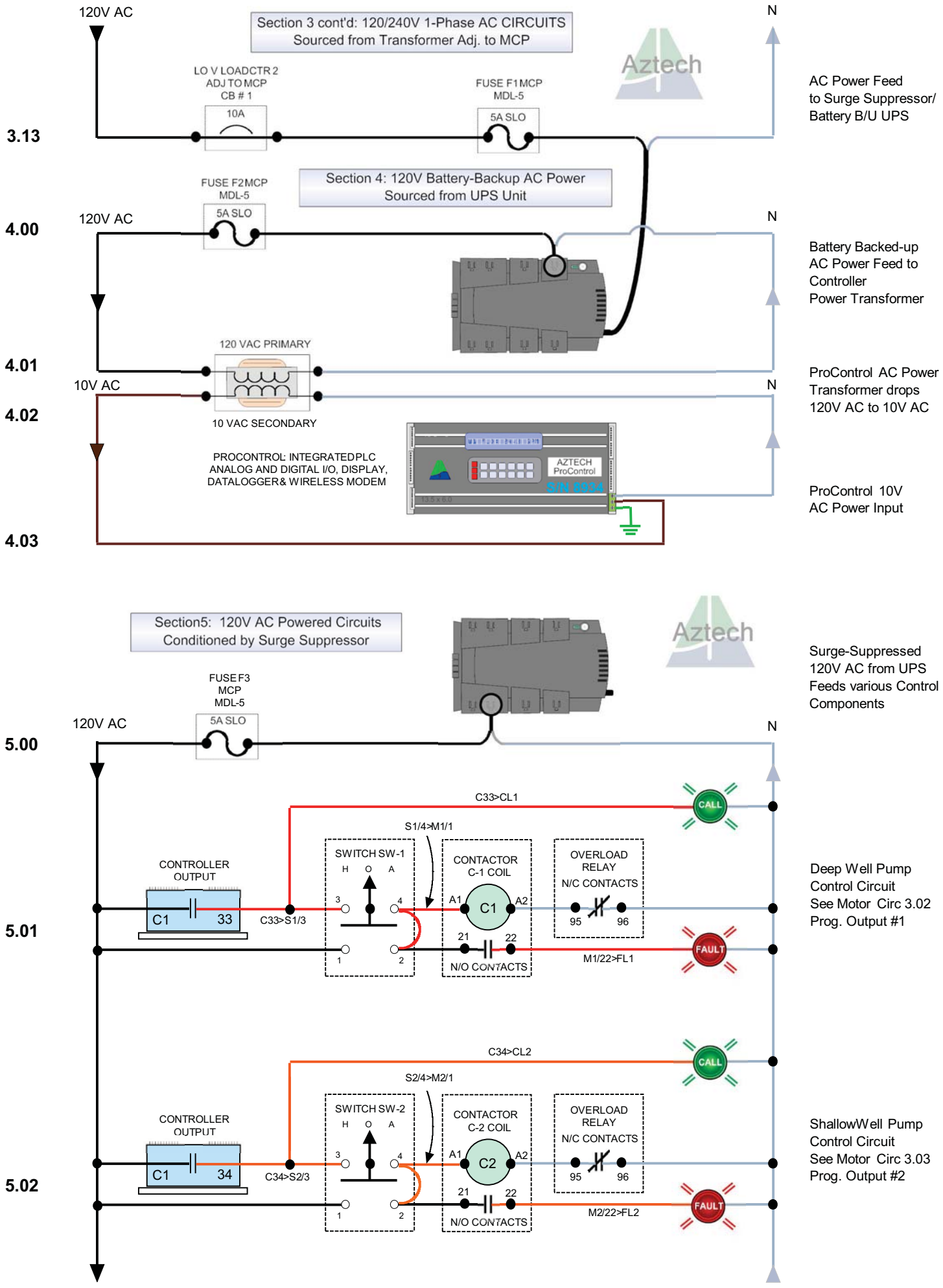
2.05 HV Power Feed to Transformer Primary

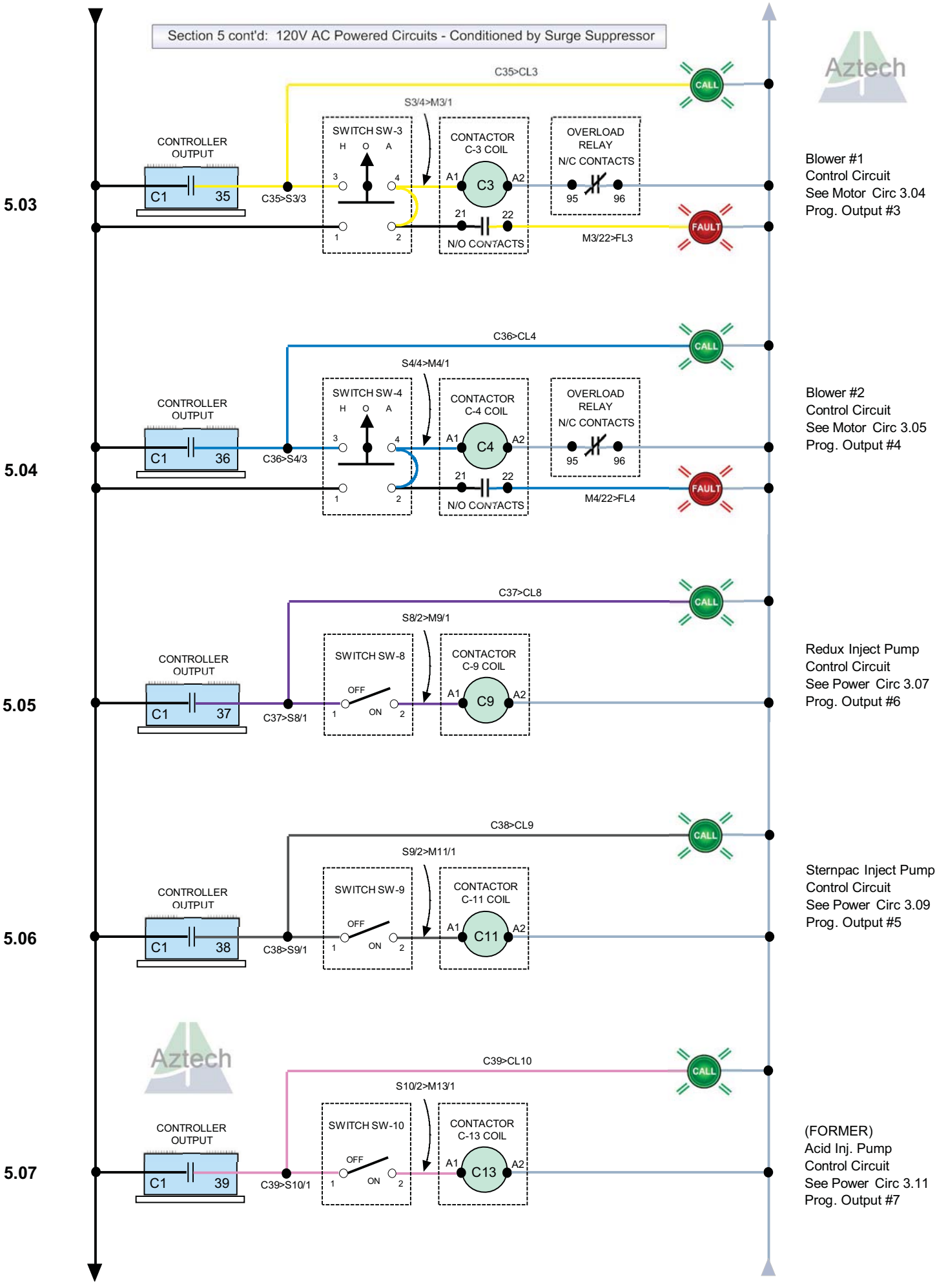
3.00 AC Power Transformer 480/277V Primary 120/240V Secondary 1-Phase, 25 kVA. Derived Neutral Bonded @ Transformer

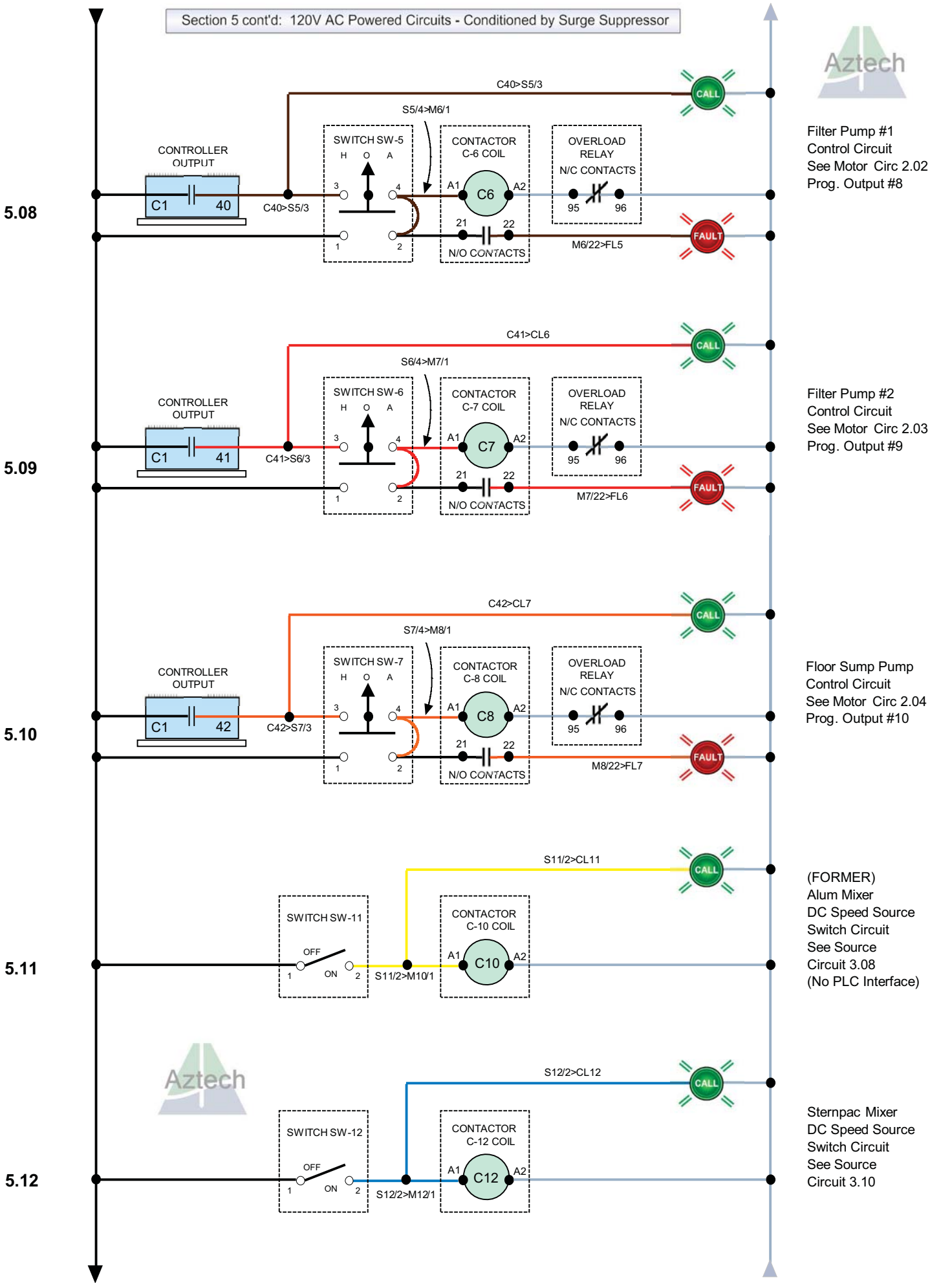
3.01 LV Power Output Feeds LV Load Center Panel 1 (above XFMR). LV Load Center Panel 1 Feeds LV Load Ctr. Panel 2 (Located adjacent to MCP)

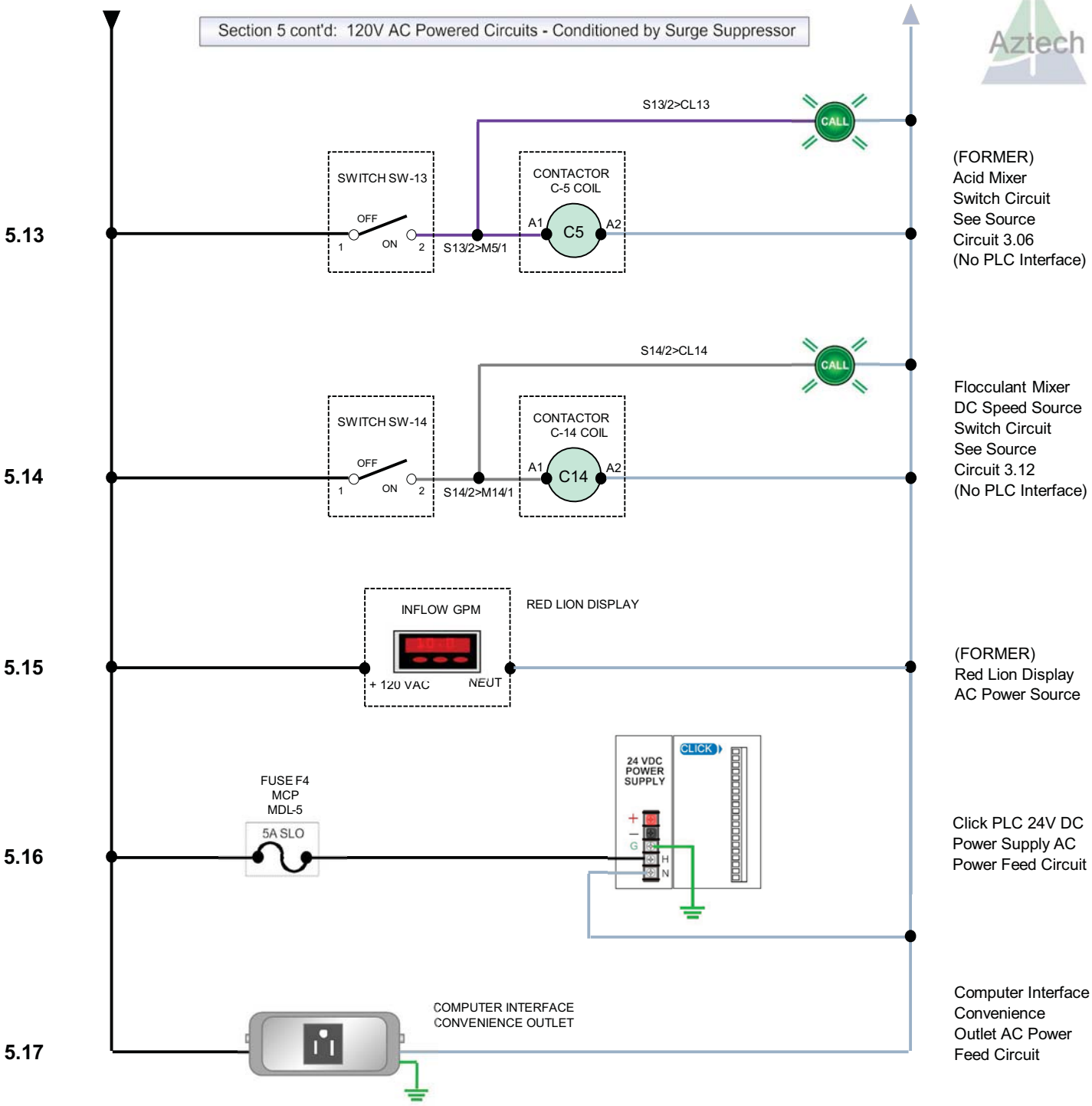

Section 3 cont'd: 120/240V 1-Phase AC CIRCUITS
Sourced from Transformer Adj. to MCP
3.02
LO V LOADCTR 2
ADJ TO MCP
CB # 2/4
15A
MCP
CONTACTOR
C1
OVERLOAD
RELAY
5.5-8.0 A
DEEP WELL
PUMP
MOTOR
0.5 HP
M
Deep Well Pump
Motor Circuit
See Control
Circuit 5.01
3.03
LO V LOADCTR 2
ADJ TO MCP
CB # 6/8
15A
MCP
CONTACTOR
C2
OVERLOAD
RELAY
7.0-10 A
DISC. SWITCH
(ADJ to WELL)
30A, 300V
SHALLOW WELL
PUMP
MOTOR
0.5 HP
M
Shallow Well
Pump
Motor Circuit
See Control
Circuit 5.02
3.04
LO V LOADCTR 2
ADJ TO MCP
CB # 10/12
15A
MCP
CONTACTOR
C3
OVERLOAD
RELAY
9.0-13 A
DISC. SWITCH
(ADJ to BLOWER)
30A, 300V
BLOWER #1
MOTOR
1.5 HP
M
Blower #1
Motor Circuit
See Control
Circuit 5.03
3.05
LO V LOADCTR 2
ADJ TO MCP
CB # 14/16
15A
MCP
CONTACTOR
C4
OVERLOAD
RELAY
9.0-13 A
DISC. SWITCH
(ADJ to BLOWER)
30A, 300V
BLOWER #2
MOTOR
1.5 HP
M
Blower #2
Motor Circuit
See Control
Circuit 5.04
3.06
LO V LOADCTR 2
ADJ TO MCP
CB # 17
15A
MCP
CONTACTOR
C5
OVERLOAD
RELAY
5.5-8.0 A
ACID WASH
TANK MIXER
MOTOR
M
Acid Wash
Tank Mixer
Motor Circuit
See Control
Circuit 5.13


120/240V 1-Ph AC
N
Section 3 cont'd: 120/240V 1-Phase AC CIRCUITS
Sourced from Transformer Adj. to MCP
Aztech
3.07
LO V LOADCTR 2
ADJ TO MCP
CB # 7
15A
MCP
CONTACTOR
C9
REDUX INJECT
PUMP
(CHEMICAL ROOM)
UPPER
RECEPTACLE
WALL OUTLET
Redux Injection
Pump Circuit
See Control
Circuit 5.05
3.08
LO V LOADCTR 2
ADJ TO MCP
CB # 9
15A
NOW LABELED
"SPARE MIX"
MCP
CONTACTOR
C10
(FORMER)
SODIUM ALUMINATE MIXER
DC MOTOR SPEED CONTROL
(ADJ TO U-TUBE)
DC POWER
CONTROL
DC
POWER
M
(FORMER)
Alum Mixer
DC Motor
Speed Control
Power Circuit
See Switch
Circuit 5.11
3.09
LO V LOADCTR 2
ADJ TO MCP
CB # 11
15A
MCP
CONTACTOR
C11
WALL OUTLET
LOWER
RECEPTACLE
STERNPAC
INJECT PUMP
(CHEMICAL ROOM)
Sternpac Injection
Pump Circuit
See Control
Circuit 5.06
3.10
LO V LOADCTR 2
ADJ TO MCP
CB # 13
15A
MCP
CONTACTOR
C12
STERNPAC MIXER
DC MOTOR SPEED CTRL
(ADJ TO U-TUBE)
DC POWER
CONTROL
DC
POWER
M
Sternpac Mixer
DC Motor
Speed Control
Power Circuit
See Switch
Circuit 5.12
3.11
LO V LOADCTR 2
ADJ TO MCP
CB # 15
15A
MCP
CONTACTOR
C13
(FORMER)
ACID INJECT PUMP
(PROCESS ROOM)
OUTLET
(FORMER)
pH Adjust Acid
Injection
Pump Circuit
See Switch
Circuit 5.07
3.12
LO V LOADCTR 2
ADJ TO MCP
CB # 18/20
15A
MCP
CONTACTOR
C14
FLOC MIXER
DC MOTOR
SPEED CONTROL
(ADJ TO MCP)
DC POWER
CONTROL
DC
POWER
M
Flocculant Mixer
DC Motor
Speed Control
Power Circuit
See Switch
Circuit 5.14


Section 3 cont'd: 120/240V 1-Phase AC CIRCUITS
Sourced from Transformer Adj. to MCP
120V AC
N
LO V LOADCTR 2
ADJ TO MCP
CB # 1
10A
FUSE F1 MCP
MDL-5
5A SLO
3.13
AC Power Feed
to Surge Suppressor/
Battery B/U UPS
Section 4: 120V Battery-Backup AC Power
Sourced from UPS Unit
FUSE F2 MCP
MDL-5
5A SLO
120V AC
4.00
N
Battery Backed-up
AC Power Feed to
Controller
Power Transformer
120 VAC PRIMARY
4.01
10V AC
4.02
N
10 VAC SECONDARY
ProControl AC Power
Transformer drops
120V AC to 10V AC
PROCONTROL: INTEGRATED PLC
ANALOG AND DIGITAL I/O, DISPLAY,
DATALOGGER & WIRELESS MODEM
AZTECH
ProControl
S/N 0004
ProControl 10V
AC Power Input
4.03
Section5: 120V AC Powered Circuits
Conditioned by Surge Suppressor
Surge-Suppressed
120V AC from UPS
Feeds various Control
Components
FUSE F3
MCP
MDL-5
120V AC
5A SLO
5.00
N
C33>CL1
CALL
S1/4>M1/1
SWITCH SW-1
H O A
CONTACTOR
C-1 COIL
OVERLOAD
RELAY
N/C CONTACTS
CONTROLLER
OUTPUT
C1 33
C33>S1/3
3
4
1
2
A1
C1
A2
95
96
21
22
N/O CONTACTS
M1/22>FL1
FAULT
5.01
Deep Well Pump
Control Circuit
See Motor Circ 3.02
Prog. Output #1
C34>CL2
CALL
S2/4>M2/1
SWITCH SW-2
H O A
CONTACTOR
C-2 COIL
OVERLOAD
RELAY
N/C CONTACTS
CONTROLLER
OUTPUT
C1 34
C34>S2/3
3
4
1
2
A1
C2
A2
95
96
21
22
N/O CONTACTS
M2/22>FL2
FAULT
5.02
ShallowWell Pump
Control Circuit
See Motor Circ 3.03
Prog. Output #2

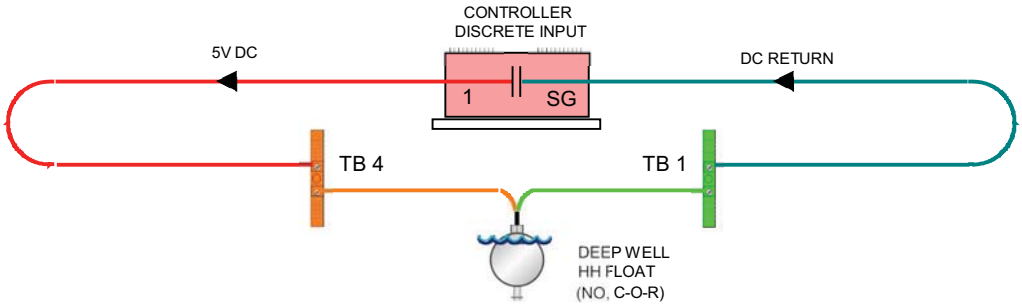

Section 5 cont'd: 120V AC Powered Circuits - Conditioned by Surge Suppressor
5.03
CONTROLLER OUTPUT
C1
35
C35>S3/3
C35>CL3
S3/4>M3/1
SWITCH SW-3
H O A
3
4
1
2
CONTACTOR C-3 COIL
A1
C3
A2
21
22
N/O CONTACTS
OVERLOAD RELAY
N/C CONTACTS
95
96
M3/22>FL3
CALL
FAULT
Blower #1
Control Circuit
See Motor Circ 3.04
Prog. Output #3
5.04
CONTROLLER OUTPUT
C1
36
C36>S4/3
C36>CL4
S4/4>M4/1
SWITCH SW-4
H O A
3
4
1
2
CONTACTOR C-4 COIL
A1
C4
A2
21
22
N/O CONTACTS
OVERLOAD RELAY
N/C CONTACTS
95
96
M4/22>FL4
CALL
FAULT
Blower #2
Control Circuit
See Motor Circ 3.05
Prog. Output #4
5.05
CONTROLLER OUTPUT
C1
37
C37>S8/1
C37>CL8
S8/2>M9/1
SWITCH SW-8
OFF
ON
1
2
CONTACTOR C-9 COIL
A1
C9
A2
CALL
Redux Inject Pump
Control Circuit
See Power Circ 3.07
Prog. Output #6
5.06
CONTROLLER OUTPUT
C1
38
C38>S9/1
C38>CL9
S9/2>M11/1
SWITCH SW-9
OFF
ON
1
2
CONTACTOR C-11 COIL
A1
C11
A2
CALL
Sternpac Inject Pump
Control Circuit
See Power Circ 3.09
Prog. Output #5
5.07
CONTROLLER OUTPUT
C1
39
C39>S10/1
C39>CL10
S10/2>M13/1
SWITCH SW-10
OFF
ON
1
2
CONTACTOR C-13 COIL
A1
C13
A2
CALL
(FORMER)
Acid Inj. Pump
Control Circuit
See Power Circ 3.11
Prog. Output #7


Section 5 cont'd: 120V AC Powered Circuits - Conditioned by Surge Suppressor
5.08
CONTROLLER OUTPUT
C1
40
C40>S5/3
SWITCH SW-5
H O A
3
4
1
2
S5/4>M6/1
CONTACTOR C-6 COIL
A1
C6
A2
21
22
N/O CONTACTS
OVERLOAD RELAY
N/C CONTACTS
95
96
C40>S5/3
CALL
M6/22>FL5
FAULT
Filter Pump #1
Control Circuit
See Motor Circ 2.02
Prog. Output #8
5.09
CONTROLLER OUTPUT
C1
41
C41>S6/3
SWITCH SW-6
H O A
3
4
1
2
S6/4>M7/1
CONTACTOR C-7 COIL
A1
C7
A2
21
22
N/O CONTACTS
OVERLOAD RELAY
N/C CONTACTS
95
96
C41>CL6
CALL
M7/22>FL6
FAULT
Filter Pump #2
Control Circuit
See Motor Circ 2.03
Prog. Output #9
5.10
CONTROLLER OUTPUT
C1
42
C42>S7/3
SWITCH SW-7
H O A
3
4
1
2
S7/4>M8/1
CONTACTOR C-8 COIL
A1
C8
A2
21
22
N/O CONTACTS
OVERLOAD RELAY
N/C CONTACTS
95
96
C42>CL7
CALL
M8/22>FL7
FAULT
Floor Sump Pump
Control Circuit
See Motor Circ 2.04
Prog. Output #10
5.11
SWITCH SW-11
OFF
ON
1
2
S11/2>M10/1
CONTACTOR C-10 COIL
A1
C10
A2
S11/2>CL11
CALL
(FORMER)
Alum Mixer
DC Speed Source
Switch Circuit
See Source
Circuit 3.08
(No PLC Interface)
5.12
SWITCH SW-12
OFF
ON
1
2
S12/2>M12/1
CONTACTOR C-12 COIL
A1
C12
A2
S12/2>CL12
CALL
Sternpac Mixer
DC Speed Source
Switch Circuit
See Source
Circuit 3.10


Section 5 cont'd: 120V AC Powered Circuits - Conditioned by Surge Suppressor
S13/2>CL13
CALL
SWITCH SW-13
OFF
ON
1
2
S13/2>M5/1
CONTACTOR
C-5 COIL
A1
C5
A2
5.13
(FORMER)
Acid Mixer
Switch Circuit
See Source
Circuit 3.06
(No PLC Interface)
S14/2>CL14
CALL
SWITCH SW-14
OFF
ON
1
2
S14/2>M14/1
CONTACTOR
C-14 COIL
A1
C14
A2
5.14
Flocculant Mixer
DC Speed Source
Switch Circuit
See Source
Circuit 3.12
(No PLC Interface)
INFLOW GPM
RED LION DISPLAY
+ 120 VAC
NEUT
5.15
(FORMER)
Red Lion Display
AC Power Source
FUSE F4
MCP
MDL-5
5A SLO
24 VDC
POWER
SUPPLY
CLICK
+
–
G
H
N
5.16
Click PLC 24V DC
Power Supply AC
Power Feed Circuit
COMPUTER INTERFACE
CONVENIENCE OUTLET
5.17
Computer Interface
Convenience
Outlet AC Power
Feed Circuit

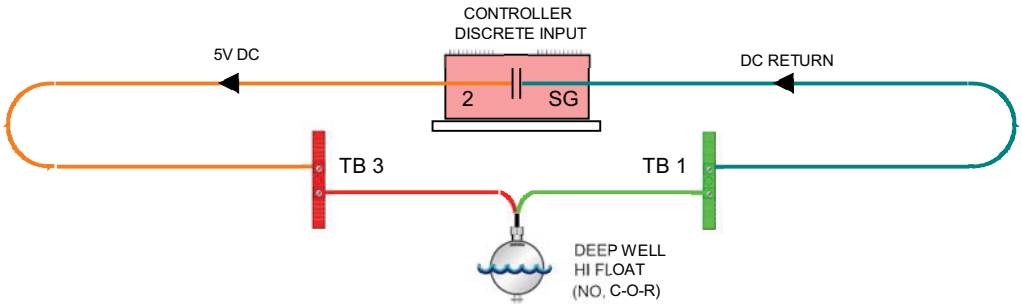
Section 6: Controller-sourced 5V DC Power - Discrete Sensor Signal Circuits

6.00



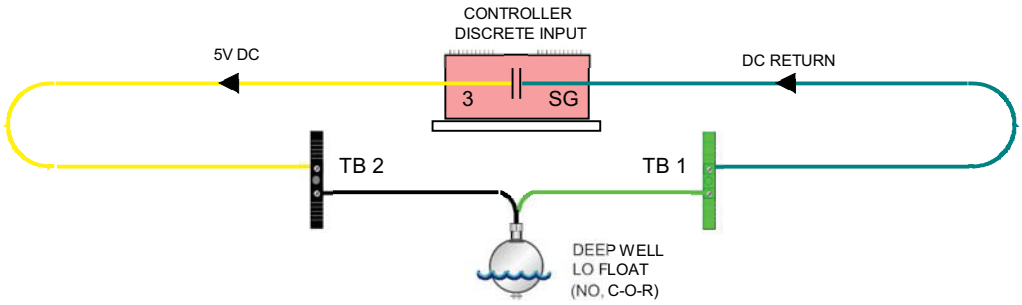
Controller
Input #1
Deep Well
HH Float

6.01



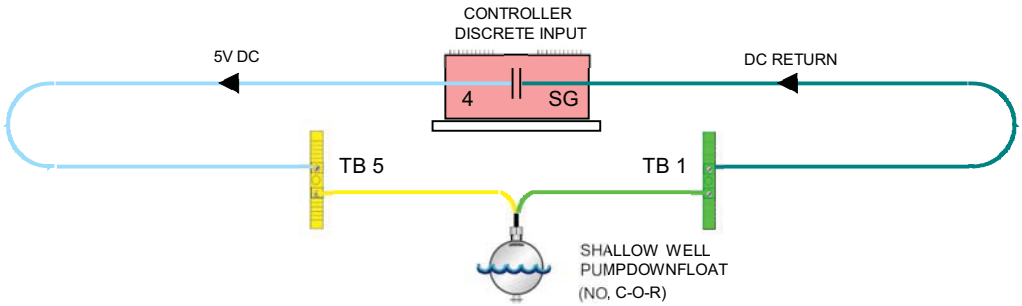
Controller
Input #2
Deep Well
HI Float

6.02



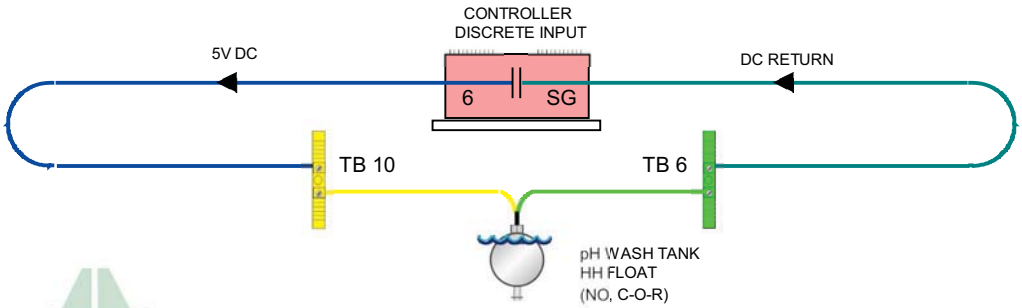
Controller
Input #3
Deep Well
LO Float

6.03



Controller
Input #4
Shallow Well
Pumpdown Float

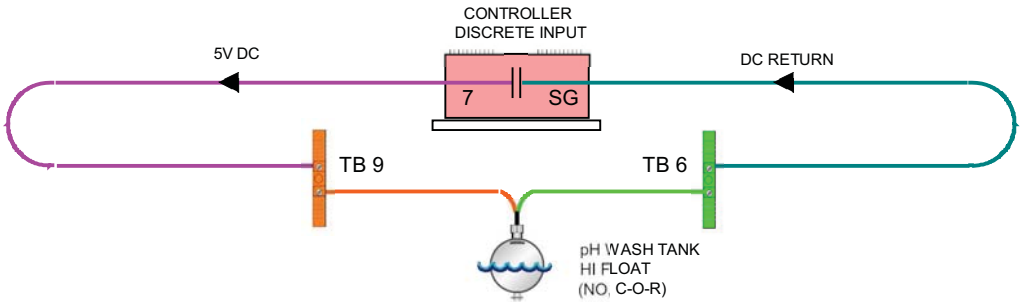
6.04



Controller
Input #6
pH Wash Tank
HH Float

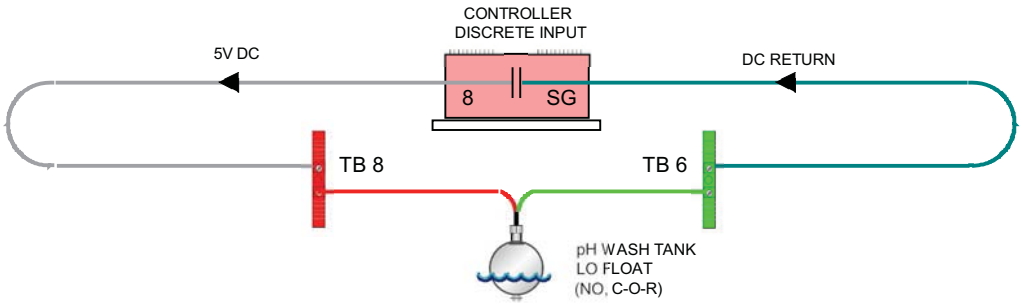
Section 6 cont'd: Controller-sourced 5V DC Power - Discrete Sensor Signal Circuits

6.05



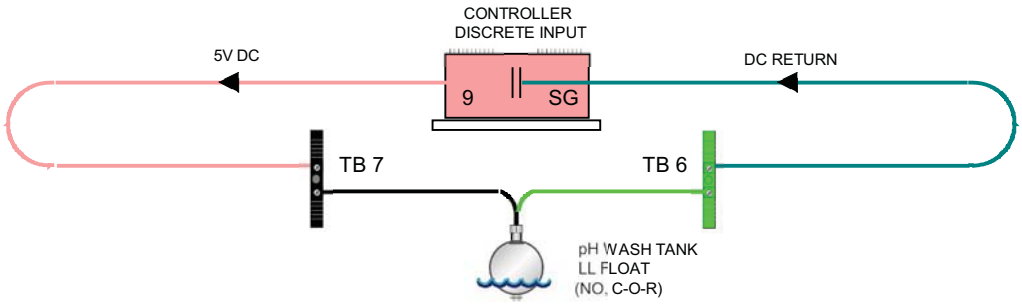
Controller
Input #7
pH Wash Tank
HI Float

6.06



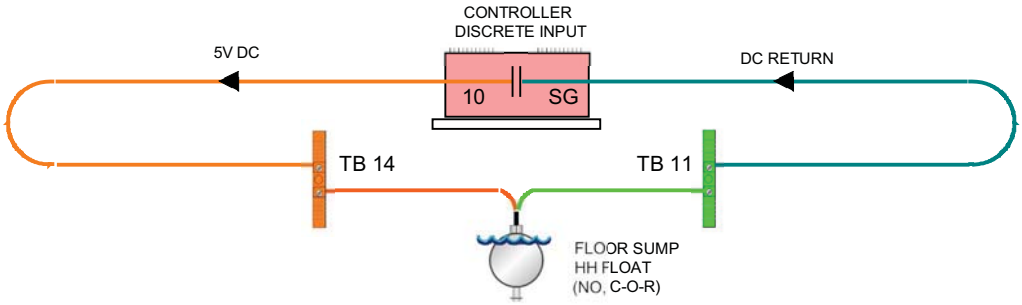
Controller
Input #8
pH Wash Tank
LO Float

6.07



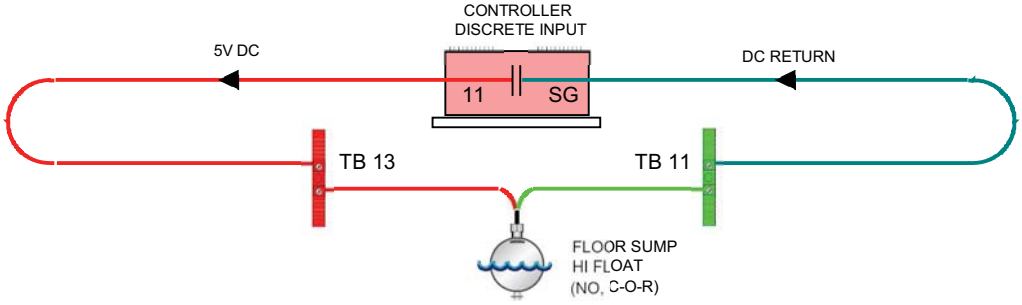
Controller
Input #9
pH Wash Tank
LL Float

6.08



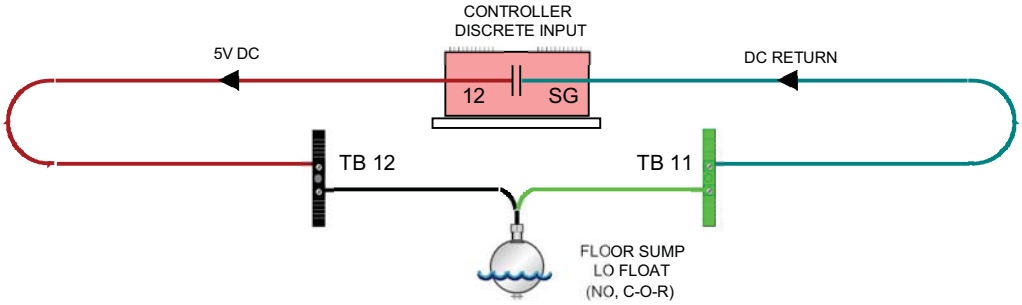
Controller
Input #10
Floor Sump
HH Float

6.09



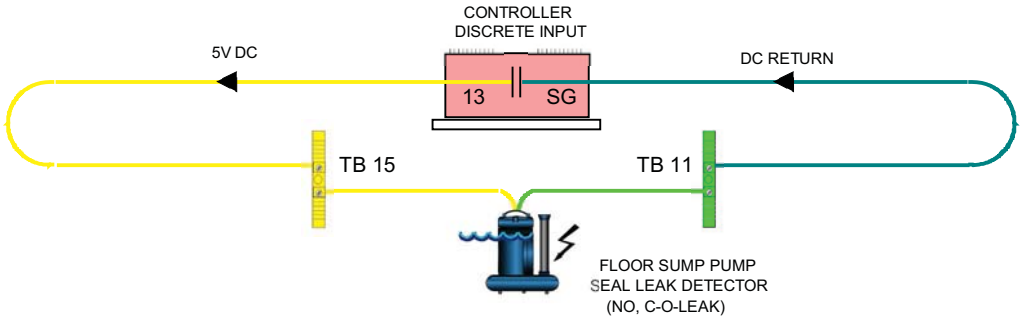
Controller
Input #11
Floor Sump
HI Float

6.10



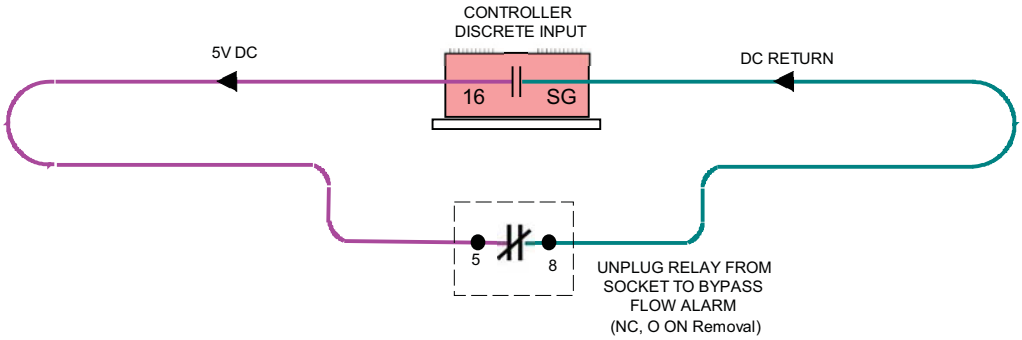
Controller Input #12 Floor Sump LO Float

6.11



Controller Input #13 Floor Sump Pump Motor Seal Leak Detector

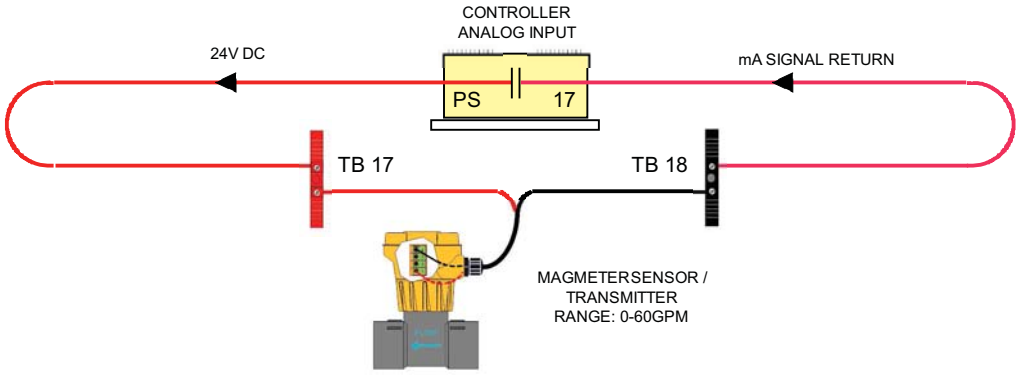
6.12



Controller Input #16 Flow Alarm Bypass Relay

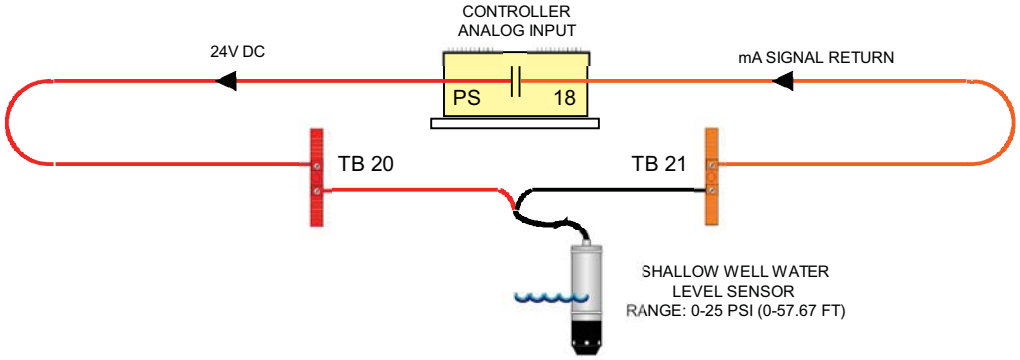
Section 7: Controller-sourced 24V DC Power - Analog Sensor Signal Input Circuits

7.00



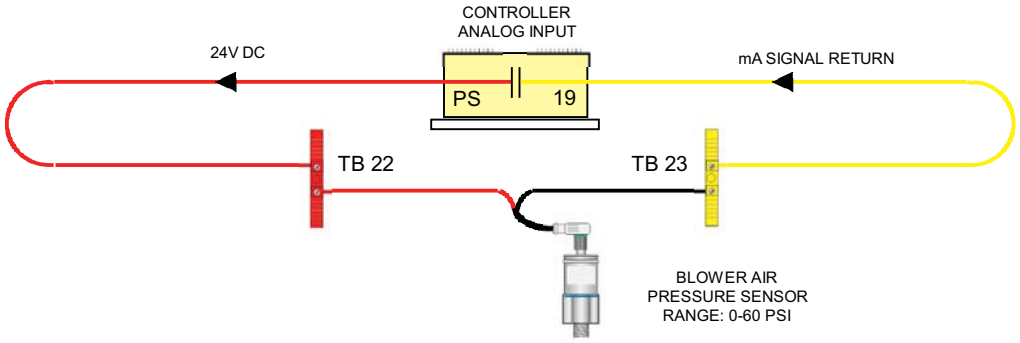
Controller Input #17 In Flow (Liquid from Wells) Sensor / Transmitter

7.01



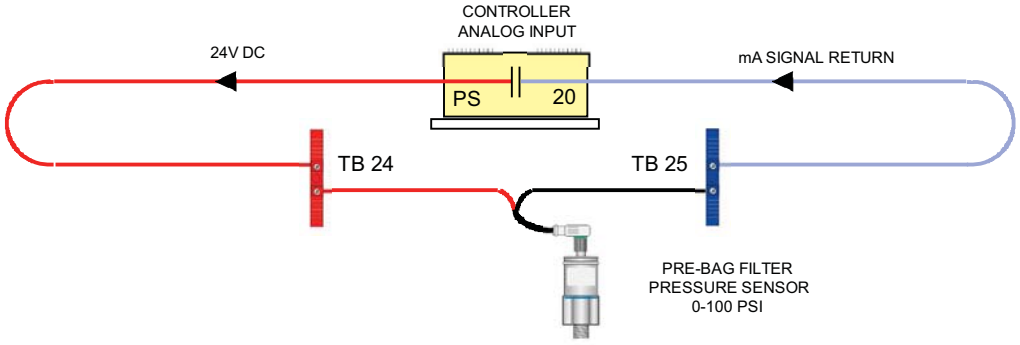
Controller Input #18 Shallow Well Level Sensor

7.02



Controller Input #19 Blower Air Pressure Sensor

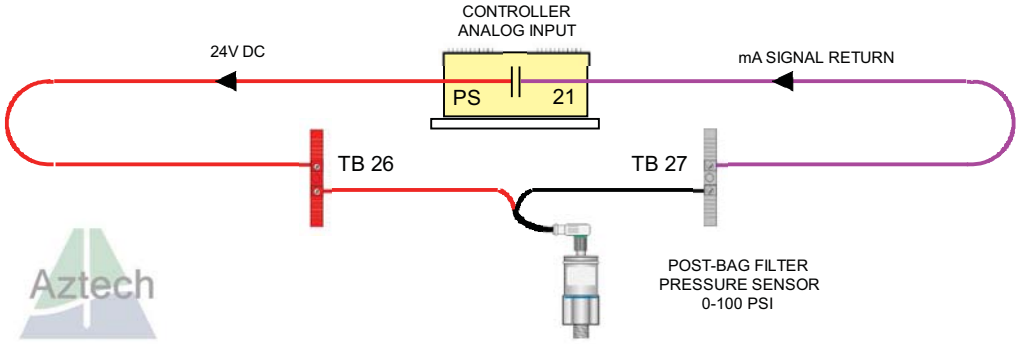
7.03



Controller Input #20 Pre-Bag Filter Pressure Sensor

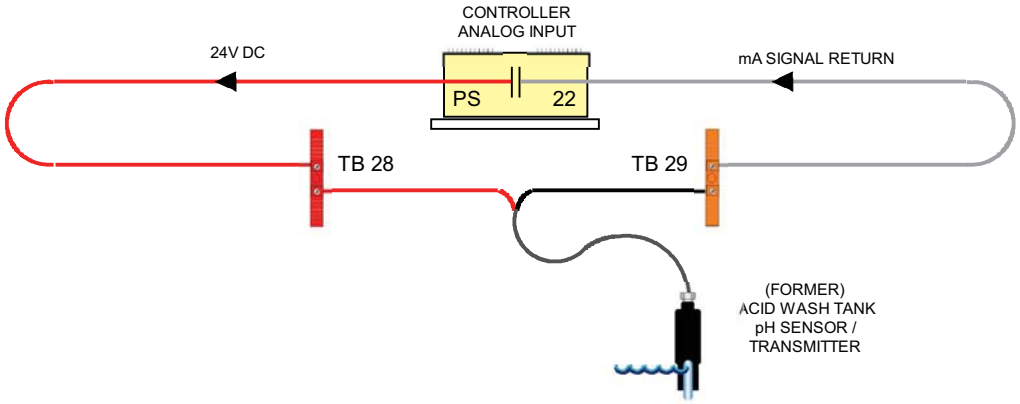
Section 7 cont'd: Controller-sourced 24V DC Power - Analog Sensor Signal Input Circuits

7.04



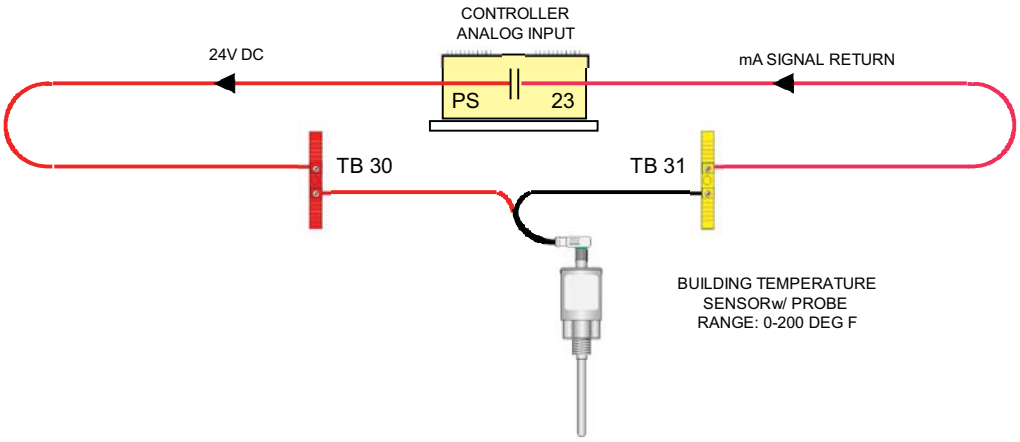
Controller Input #21 Post-Bag Filter Pressure Sensor

7.05



Controller Input #18 (Fmr.) Acid Wash Tank pH Sensor / Transmitter

7.06

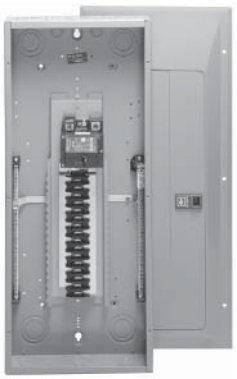


Controller Input #23 Building Interior Temperature Sensor

Load Centers/Circuit Breakers/Miscellaneous Components

Product Description

Loadcenters are enclosures specifically designed to house the branch circuit breakers and wiring required to distribute power to individual circuits. They contain either a main breaker when used at the service entrance point or a main lug when used as a sub-panel to add circuits to existing service. The main breaker protects the main entire panel and can be used as a service disconnect. The branch breakers protect the wires leading to individual electrical loads such as fixtures and outlets.



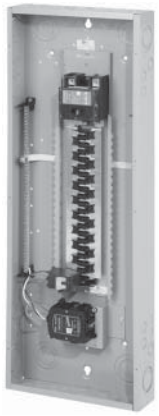
Single-Phase Main Circuit Breaker — Top or Bottom Feed — NEMA® 1 Enclosure

Separately Packaged Covers

Three-Phase Main Circuit Breaker — NEMA 3R Enclosure

MLO Panel

Cutler-Hammer® Type CH Breaker Family



Surge Panel

Cutler-Hammer Type CH Convertible Family

Spa Panel or Ground Fault Protection Kit

Application Description

Loadcenter Construction

Cutler-Hammer Type CH loadcenters by Eaton Corporation feature silver flash plated copper bus in all interiors. Fingers are rated 200 amperes throughout the CH line. Therefore, the sum of the handle ratings connected to any one stab is limited to 200 amperes maximum. NEMA 1 boxes are manufactured from cold rolled 16 gauge sheet steel. Raintight boxes are manufactured from galvanized steel. All boxes and trims are finished using an electrostatic powder coat, baked urethane paint process.

Neutrals

Cutler-Hammer Type CH loadcenters feature three types of neutrals:

Factory-Bonded Split Neutral

Single-phase main circuit breaker panels are supplied with a factory-bonded twin neutral. When used as a sub-panel, the bonding strap should be removed, and the bonding screw should be reinstalled. The bonded side is now the ground, and the un-bonded side is the neutral. When used as a service entrance panel, the unused neutral holes on either side may be used for terminating ground wires.

Insulated Split Neutral

Most single-phase main lug panels (12 circuits and greater) are supplied with a twin neutral with an insulated cross strap. These panels are shipped in an un-bonded state. For service entrance applications, the neutral must be bonded utilizing the bonding strap supplied with the panel. For sub-feed applications, the panel may be installed as is. Separate ground bars are provided on these panels.

Insulated/Bondable Single Neutral

When a panel is supplied with a single neutral, it arrives from the factory in an "unbonded" state. All that is required to bond the neutral in a service entrance application is to loosen the bonding screw and the neutral screw directly beside it, insert the bonding strap into the neutral bar, and re-tighten both connections. The single neutral can be moved by the contractor to the other side of the panel, if desired. In a service entrance application, where the neutral is bonded, unused neutral connections may be used for the termination of equipment grounds.

Grounds

In service entrance applications where the neutral is bonded, unused neutral holes may be used for terminating ground conductors. In sub-feed panels, the neutral must be isolated (non-bonded), and ground wires must be terminated on a separate ground bar.

The Factory Bonded Split Neutral panels have sufficient terminations for both ground and neutral conductors. The Insulated Split Neutral panels are supplied with a separate factory-installed ground bar. Insulated/Bondable Single Neutral panels are supplied without a ground bar (unless otherwise noted), and ground bar kits if needed must be purchased separately.

Surge Protectors

The CHSURGE Surge Protector has indicating lights that indicate when the units should be replaced. The CHSA01 and CHSA03 Surge Protectors internally short, causing the circuit breaker feeding the surge protector to trip. All but the CHSURGE Surge Protector should be wired to the load side of 15 or 20 ampere feeder circuit breakers mounted adjacent to the main incoming device.

The CHSPULTRA Cutler-Hammer Home Surge Protector is an externally mounted TVSS unit that provides industrial level surge protection in a residential design.

The CHSPULTRA is also available factory installed in the loadcenter and carries a lifetime warranty.

Standards and Certifications

UL® Listings

All Cutler-Hammer Type CH loadcenters by are listed under UL File E8741.

Neutral and Ground Terminals

The standard terminals on grounds and neutrals are rated to accept (3) — #14 – #10 Cu/Al or (1) — #14 – 4 wires. For larger cables, add-on neutral lugs may be ordered from the accessories on **Pages 3-23** and **3-24**.

Note: NEC® allows only one current carrying conductor per hole on neutrals unless otherwise noted.

Bottom-Fed Loadcenters

When the power cable is brought into the loadcenter from below the panel; then the main lug panels, and single-phase, 225 amperes and below, loadcenters can be rotated 180 degrees to allow straight-in wiring of power cables to the main terminals. Because the CSR main circuit breaker handle operates horizontally, the orientation of the main circuit breaker handle is consistent with the requirements of NEC Article 240-81.

Gutter Splicing

Loadcenters are not UL listed as wiring troughs. Therefore, gutter splicing of riser cables to tap off to the main device is not permitted. Refer to NEC Article 373-8.

Fire Rating

Due to the numerous openings in both loadcenter boxes and trims, they should not be mounted in firewalls. There is no approval method for sealing the enclosures for this application.

Date Code

The date of manufacture of each loadcenter is printed on the outside of the carton as well as inside the loadcenter. On the carton, the date code is printed on the end carton label. In the loadcenter, the date code is located on the small white label located on the right side wall (with the main device on top).

The date code is in the following format: F # # # &. The "F" is the numeric code for the Lincoln, IL plant, and the three numbers are the year and week of manufacture e.g., 023. The "&" sign at the end signifies the decade of the 2000s. Therefore, the date code F023& would indicate that the product was manufactured in the 23rd week of 2000. The 1980s are represented by a "+" sign and the 1990s are represented by a "=" at the end of the code.

Plug-on Type CH Breakers

Description

Quick-make, quick-break switch mechanism combined with inverse time element tripping operation and trip-free handle design. Type CH circuit breakers trip to the OFF position eliminating nuisance callbacks. The thermal-magnetic trip curve avoids nuisance tripping on mild overloads while reacting almost instantaneously to severe short circuit conditions. Multipole breakers have internal common trip connection to operate all poles simultaneously. Handles are marked with ON-OFF indication and ampere rating of the breaker. Type CH breakers meet UL Standard 489, NEMA standards, and Federal Spec Classification W-C 375 b/Gen. They are UL listed under File Number E11713, E8741, E3624 and E51287: and CSA certified file number LR87196, except Type CHT breakers.

Type CH Circuit Breaker Ratings

Single- and double-pole CH breakers rated 15 and 20 amperes have low instantaneous magnetic trip levels. The 15 and 20 ampere breakers with "HM" suffix have high magnetic trip settings recommended for circuits with inherently high inrush currents. All Type CH breakers are marked for heating, air conditioning and refrigeration (HACR) equipment application. Single-pole 15 – 20 ampere breakers are also suitable for switching duty (SWD). Shunt trip coils operate on 120 Vac and require one additional pole space per breaker.

Features, Benefits and Functions

Extra 1.5-Inch (38.1 mm) Knockout for Bundling

Provides for easier installation, less installation time.

Top or Bottom Feed

- Straight-in wiring saves labor and material.
- Only one panel for either application — no modifications necessary.

Commercial Grade Main Breaker

- 35 kAIC series rated main breaker in 150 and 200 ampere loadcenters.
- 42 and 100 kAIC series ratings available.

Drywall Marking on Enclosure

Indicates proper mounting depth for flush applications.

One-Piece Silver Flash Plated Copper Bus

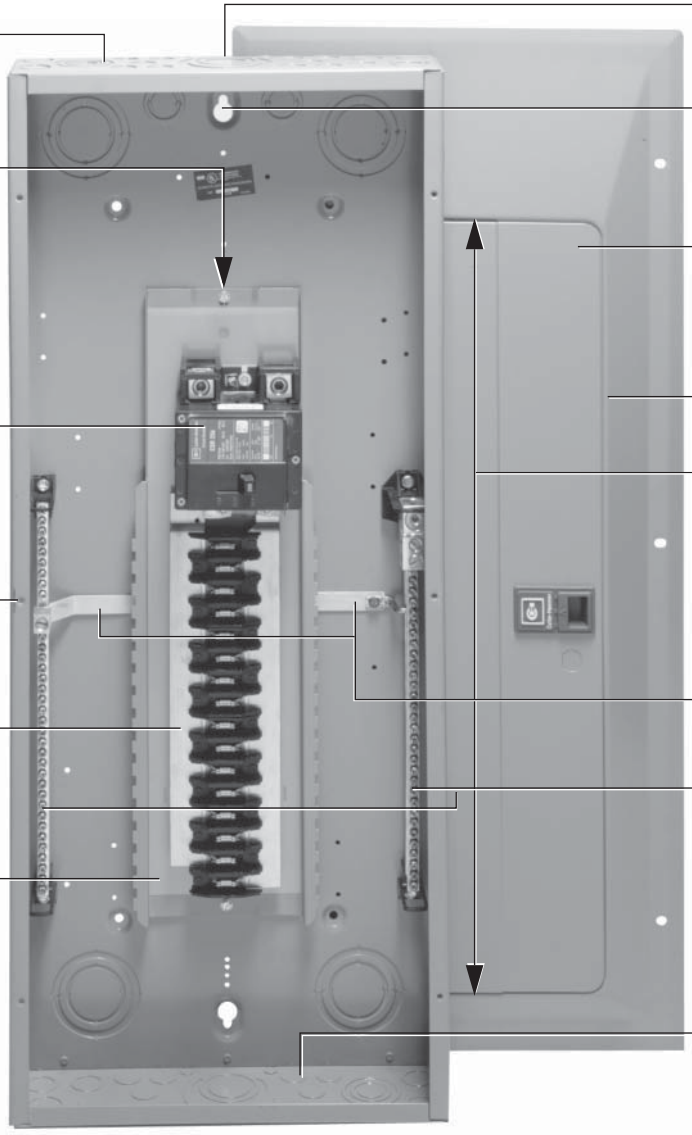
Provides superior conductivity throughout the entire product line.

Steel Backpan

- Provides positive, reliable breaker mounting.
- One-piece designed for stability.

Convertible Styles Available

- Uses field installable main breaker or main lug kits.
- Flexible inventory — same breaker is used in loadcenter and circuit breaker enclosures.



Type CH Loadcenter

"Tangential" Center Knockout

For easier installation

Single Keyhole Mounting

Just one keyhole at top and bottom for easier mounting and leveling.

Unique Sandalwood Finish

Immediately recognizable, esthetically appealing, scratch resistant powder coating.

Separately Packaged Covers

- Full line of "true" surface and combination covers.
- Built-in flush leveling feature.
- Choice of circuit identification by breaker labels or circuit directory.

Neutral Design (For styles as indicated)

- Bonding strap is easily removable for sub-panel applications providing a ground and neutral.
- Factory bonded for service entrance applications providing a split neutral.
- Ample additional 2/0 lugs provided; no kits necessary.
- 200% size neutral.

Improved Endwall Knockouts

Larger KOs are balanced to enhance installed appearance and to ease use of existing wiring.

3

Product Specifications

General

A. The Contractor shall furnish and install loadcenters incorporating circuit breakers of the number, rating and type as specified herein and as shown on the contract drawings.

B. The loadcenter and all components shall be designed, manufactured and tested in accordance with the latest applicable standards of UL and NEMA including:

1. UL 67 — Standards for Panelboards
2. UL 50 — Standards for Cabinets and Boxes
3. UL 489 — Standards for Molded Case Circuit Breakers
4. Federal Spec Classification W-C 375
5. UL 1699 — All Fault Interrupting

Qualifications

A. The manufacturer of the loadcenter shall be the manufacturer of the circuit breaker within the load center. All breakers shall be full size.

B. For the equipment specified herein, the manufacturer shall be ISO® 9000 certified.

C. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of seven (7) years.

Manufacturers

A. Eaton

Ratings

A. Loadcenters shall be rated for 240 Vac and shall have short circuit ratings as shown on the drawings or as herein scheduled, but not less than 10,000 amperes rms symmetrical.

B. Breakers shall be full size and a minimum of 125 ampere frame. Breakers 10 through 125 ampere trip size shall take up the same pole spacing.

C. Loadcenters shall be labeled with a UL short circuit rating. When series ratings are applied with integral or remote devices, a label shall be provided. Series ratings shall cover all trip ratings of installed frames. It shall state the conditions of the UL series ratings including:

1. Size and type of upstream device.
2. Branch devices that can be used.
3. UL series short circuit rating.

Construction

A. All interiors, with the exception of the branch circuit breakers shall be completely factory assembled with main breakers, main lugs or no main device.

B. Interiors shall be so designed that circuit breakers can be replaced without disturbing adjacent units and without removing the main bus connectors and shall be so designed that circuits may be changed without machining, drilling or tapping.

C. Physical means must be provided to prevent the installation of more overcurrent devices than that number for which the enclosure was designed. Full size breakers are required.

Bus

A. Bus bars for the main and cross connectors shall be of silver flash plated copper construction in accordance with UL standards. Bussing shall be braced to 65 kAIC.

B. Neutral bussing shall have a suitable lug for each outgoing feeder requiring a neutral connection of same ampacity as branch.

Wiring/Termination

A. All wire connectors and terminals shall be of the anti-turn solderless type and suitable for copper or aluminum wire of the sizes indicated. All connectors shall meet the “Requirements for Wire Connectors and Soldering Lugs” UL 486B.

B. All loadcenters where marked shall be suitable for use with 60/75°C rated wire.

Circuit Breakers

A. Circuit breakers shall be molded case type, 3/4-inch (19.1 mm) wide per pole. Multipole circuit breakers shall be of a stack pole design to provide electrical phase isolation and have an internal common trip.

B. Each pole of the circuit breaker will have inverse time delay overload and instantaneous short circuit protection by means of both thermal and magnetic sensors. Circuit breakers shall be quick-make/quick-break.

C. The circuit breaker calibration shall not be affected by environmental changes in relative humidity. Breakers shall be calibrated after assembly.

D. All circuit breakers shall be operated by a toggle-type handle and multipole circuit breakers shall have an internal common trip mechanism. The circuit breakers shall incorporate trip mechanisms that are mechanically trip-free from the handle. The handle position shall provide good visual trip indication.

E. Contacts shall be of non-welding silver alloy.

F. All branch breaker handles shall be of a different color than the case of the breaker.

G. All terminals shall be listed for use with copper or aluminum conductors. Terminals shall be of the box lug design. The terminals shall meet UL 486B requirements and shall be suitable for use with either 60° or 75°C wire.

H. Breakers shall be SWD rated and/or HACR rated as required.

I. Arc Fault Interrupting circuit breakers, (AFC), shall be provided on all 15 and 20 ampere single-phase 120/240 Vac circuits except those indicated as remote controlled breakers. AFI breakers shall be “Classified for mitigating the effects of arcing faults,” or conforming to UL Standard 1699 and as defined by per article 210-12 Section A of the 1999 NEC Code.

Enclosures

A. Loadcenters shall have NEMA 1 general purpose or NEMA 3R rainproof enclosures as indicated on the drawings and shall be surface or flush mounted except where noted.

B. For indoor applications, enclosures shall be rated NEMA 1. Enclosures shall be manufactured from cold-rolled code-gauge sheet steel having multiple knockouts and painted per paint specification. For outdoor applications, enclosures shall be rated NEMA 3R. Enclosures shall be manufactured from galvanized steel which shall be painted per the painted as specified. Enclosures shall be of sufficient size to meet or exceed NEC wire bending space.

C. The cover shall have an easy adjustment feature for flush applications.

D. Boxes shall be factory assembled into a single rigid structure.

E. Provide circuit breaker marking labels and directories.

Finish

A. Boxes and trims shall be finished with a high scratch-resistant aesthetically pleasing finish. The finish shall be polyurethane coating electrostatically applied to a thickness of 1.8 to 2 mils.

B. All loadcenters shall be provided with provisions for accepting a paintable or wall paperable decorator accessory cover. Where loadcenters are installed in living areas, provide manufacturer designed and tested decorator cover kits.

Warranty

The minimum warranty for Residential loadcenters, breakers and surge protection devices shall be as follows:

- Lifetime loadcenter warranty
- Lifetime warranty on all Arc Fault Circuit Interrupting Circuit Breakers
- Lifetime Warranty on CHSPULTRA including $5000 connected load warranty
- Lifetime warranty on all thermal magnetic and GFCI branch circuit breakers
- 1-year warranty on plug-in surge protection device (CHSURGE)

3

Product Selection

Table 3-1. CH Loadcenter Selection Chart

Service	■ Single-phase, three-wire, 120/240 Vac. ■ Three-phase, three-wire, 240V corner grounded delta (see Accessories **Page 3-24**).	■ Three-phase, four-wire, 208Y/120 Vac. ■ Three-phase, three-wire, 240 Vac delta.
Short Circuit Current Rating	■ 10,000 AIC: All single- and three-phase loadcenters 40 through 400 amperes, 2 to 42 circuits except when series ratings are applied. ■ 35,000 AIC: All convertible and factory installed main breakers single-phase loadcenters rated 150 through 225 amperes using Type CSH main breakers. ■ 42,000 and 100,000 are available on some styles: single-phase and three-phase.	
Main Breaker/Main Lug Loadcenters	Single-Phase ■ Main Breaker: 100, 125, 150, 200, 225, 400 amperes. ■ Main Lugs: 40, 70, 125, 150, 200, 225, 400 amperes.	Three-Phase ■ Main Breaker: 150, 200, 225, 300, 400 amperes. ■ Main Lugs: 125, 150, 200, 225, 400 amperes.
Convertible Loadcenters	■ Main Breaker or Main Lugs: single-phase up to 225 amperes	
Branch Breakers	■ Type CH: 10 to 150 amperes. One-, two-, and three-pole. Selected amperages available in shunt trip, HACR and switching duty. ■ Ground Fault Breakers: 15 to 60 amperes. ■ Type CH-HID: 15 to 30 amperes. One-, two- and three-poles. ■ PMPCI Breakers. ■ CH-HM High Magnetic. ■ CH-M50 High Ambient.	■ Type CH-AFCI arc fault circuit interrupter. ■ Type CHP: 10 to 125 amperes. One-, two- and three-pole. Three-position commercial trip. Selected amperages available in HACR switching duty. ■ Type CHP-HID: 15 to 30 amperes. One-, two- and three-pole. ■ Type CHP-GFCI: 15 to 30 amperes. One-pole ground fault breakers.
Enclosures	■ NEMA Type 1 indoor. ■ NEMA Type 3R outdoor.	■ Meets or exceeds UL requirements for indoor or outdoor applications.
Loadcenter and Breaker Accessories	■ Branch Circuit Breaker: Auxiliary components Hold down kits Handle ties Lockoffs Lockdogs ■ Complete Line of Ground Bar Kits 5, 10, 14 and 21 circuits, some with additional #2/0 lugs. Each terminal will accommodate: (3) #14 – #10 Cu/Al or (1) #14 – #4 Cu/Al. ■ Sub-feed Lugs 125, 150 amperes — two- and three-pole. ■ Shunt trips.	■ Surge Protection: Single-phase whole home surge protector Single-phase plug-on surge protector Single-phase bottle type surge protector Three-phase bottle type surge protector ■ Universal rainproof conduit hubs Group One: 3/4, 1, 1-1/4, 1-1/2, 2 inches (19.1, 25.4, 31.8, 38.1, 50.8 mm). Group Two: 2, 2-1/2, 3 inches (50.8, 63.5, 76.2 mm). ■ Adapter plate.
Bussing	■ Silver Flash Plated Copper Bus is a standard feature.	

Table 3-2. Loadcenters 100 – 225 Amperes and 12 – 42 Circuits Catalog Numbering System

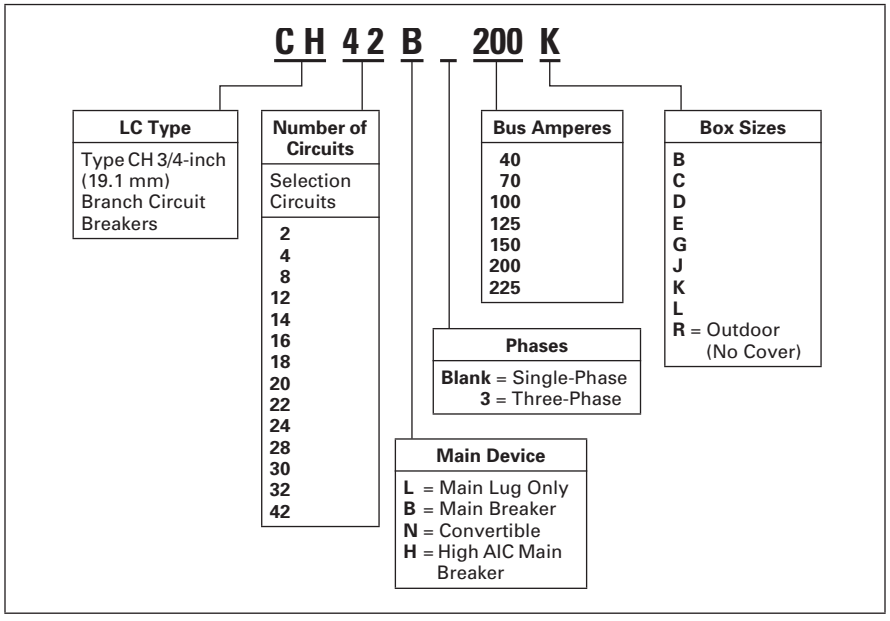
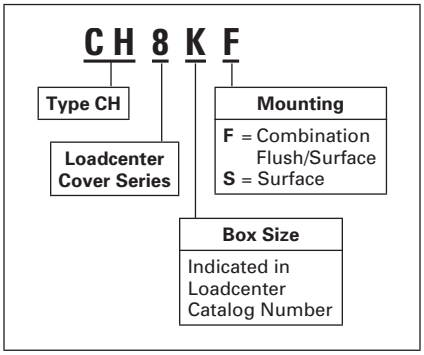


Table 3-3. Indoor Covers Ordered Separately



Note: All combinations are not valid, refer to the catalog section.

Single-Phase — Main Circuit Breaker Loadcenters
10,000/35,000 Amperes Interrupting Capacity

Table 3-4. Single-Phase 3-Wire — 120/240 Vac — Factory Bonded Split Neutral (Unless Otherwise Noted)

Main Breaker Type	Main Ampere Rating	Maximum Number 3/4-Inch (19.1 mm) Poles	Enclosure Type	Box Size	Wire Size Range Cu/Al 60°C or 75°C for Main Breaker	Loadcenter ①② Catalog Number	Price U.S. $	Loadcenter Cover Catalog Number		Price U.S. $
								Combination ③	Surface	
CH 10 kAIC	100	14	Indoor	B	#6 – 1/0	**CH14B100B** ④⑤		**CH8BF**	**CH8BS**	
		14	Outdoor	B		**CH14B100R** ⑥⑦		—	—	
		18	Indoor	C		**CH18B100C** ④⑤		**CH8CF**	**CH8CS**	
		18	Outdoor	C		**CH18B100R** ⑥⑦		—	—	
		22	Indoor	C		**CH22B100C** ④⑤		**CH8CF**	**CH8CS**	
		22	Outdoor	C		**CH22B100R** ⑥⑦		—	—	
		30	Indoor	D		**CH30B100D** ④⑤		**CH8DF**	**CH8DS**	
		30	Outdoor	D		**CH30B100R** ⑥⑦		—	—	
	125	22	Indoor	C	#6 – 1/0	**CH22B125C** ④⑤		**CH8CF**	**CH8CS**	
		22	Outdoor	C		**CH22B125R** ⑥⑦		—	—	
		30	Indoor	D		**CH30B125D** ④⑤		**CH8DF**	**CH8DS**	
		30	Outdoor	D		**CH30B125R** ⑥⑦		—	—	
CSH 35 kAIC ⑧	150	8	Outdoor	E	#2 – 300 kcmil	**CH8B150RF** ⑥⑥⑨		—	—	
		24	Indoor	E		**CH24B150E** ④⑤		**CH8EF**	**CH8ES**	
		24	Outdoor	E		**CH24B150R** ⑥⑦		—	—	
		32	Indoor	J		**CH32B150J** ④⑤		**CH8JF**	**CH8JS**	
		32	Outdoor	J		**CH32B150R** ⑥⑦		—	—	
	200	8	Outdoor	E	#2 – 300 kcmil	**CH8B200RF** ⑥⑥⑨		—	—	
		24	Indoor	E		**CH24B200E** ④⑤		**CH8EF**	**CH8ES**	
		24	Outdoor	E		**CH24B200R** ⑥⑦		—	—	
		32	Indoor	J		**CH32B200J** ④⑤		**CH8JF**	**CH8JS**	
		32	Outdoor	J		**CH32B200R** ⑥⑦		—	—	
		42	Indoor	K		**CH42B200K** ④⑤		**CH8KF**	**CH8KS**	
		42	Outdoor	K		**CH42B200R** ⑥⑦		—	—	
	225	32	Indoor	J	#2 – 300 kcmil	**CH32B225J** ④⑤		**CH8JF**	**CH8JS**	
		32	Outdoor	J		**CH32B225R** ⑥⑦		—	—	
		42	Indoor	K		**CH42B225K** ④⑤		**CH8KF**	**CH8KS**	
		42	Outdoor	K		**CH42B225R** ⑥⑦		—	—	
DK 10 kAIC	300	42	Indoor	PM	(2) 3/0 – 250 kcmil	**CH42PM300**		**CH7PMF** ⑩	**CH7PMS**	
	400	42	Indoor	PM	(2) 3/0 – 250 kcmil	**CH42PM400**		**CH7PMF** ⑩	**CH7PMS**	

① All main circuit breaker loadcenters are listed for use as service entrance equipment.
② Ground bar kits priced separately. See **Page 3-24.**
③ Combination style covers may be used in surface or flush applications.
④ Loadcenters are factory bonded for service entrance applications. Remove bonding strap for separate neutral and ground bars for sub-feed applications.
⑤ Can be top or bottom fed by rotating the enclosure and trim 180 degrees.
⑥ Loadcenter contains single insulated/bondable neutral.
⑦ Rainproof panels are furnished with hub closure plates. For rainproof hubs, refer to **Page 3-24**.
⑧ 35,000 AIC series combination rating is obtained when Types CH, CHT and CHP branch breakers are used with CSH main.
⑨ Panel includes #4 – 300 kcmil feed-through lugs.
⑩ This cover is for flush applications only (not combination).

Box Sizes . . . . . **Pages 3-38** and **3-39**
Discount Symbol **22CD**

3

Single-Phase — High Interrupting Rated Main Circuit Breaker Loadcenters 42,000/100,000 Amperes Interrupting Capacity

Table 3-5. Single-Phase 3-Wire — 120/240 Vac — Factory Bonded Split Neutral (Unless Otherwise Noted)

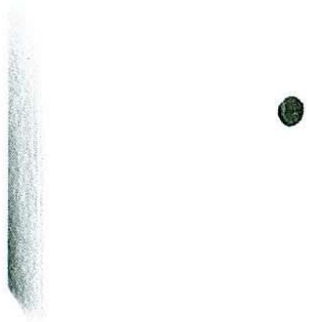
Main Breaker Type	Main Ampere Rating	Maximum Number 3/4-Inch (19.1 mm) Poles	Enclosure Type	Box Size	Wire Size Range Cu/Al 60°C or 75°C for Main Breaker	Loadcenter ① Catalog Number	Price U.S. $	Loadcenter Cover Catalog Number		Price U.S. $
								Combination ②	Surface	
CHB4 42 kAIC ③	100	20 20 28 28	Indoor Outdoor Indoor Outdoor	C C D D	#6 – 1/0	**CH20H100C** ④⑤ **CH20H100R** ⑥⑦ **CH28H100D** ④⑤ **CH28H100R** ⑥⑦		**CH8CF** — **CH8DF** —	**CH8CS** — **CH8DS** —	
CHH 100 kAIC ⑧	150	32 32	Indoor Outdoor	L L	#2/0 – 300 kcmil	**CH32H150L** ④ **CH32H150R** ⑥⑦		**CH8LF** —	**CH8LS** —	
	200	32 32 42 42	Indoor Outdoor Indoor Outdoor	L L L L	#2/0 – 300 kcmil	**CH32H200L** ④ **CH32H200R** ⑥⑦ **CH42H200L** ④ **CH42H200R** ⑥⑦		**CH8LF** — **CH8LF** —	**CH8LS** — **CH8LS** —	
	225	42 42	Indoor Outdoor	L L	#2/0 – 300 kcmil	**CH42H225L** ④ **CH42H225R** ⑥⑦		**CH8LF** —	**CH8LS** —	

① All main circuit breaker loadcenters are listed for use as service entrance equipment.
② Combination style covers may be used in surface or flush applications.
③ Series rated for 42,000 AIC with all Types CH, CHT and CHP breakers.
④ Loadcenters are factory bonded for service entrance applications. Remove bonding strap for separate neutral and ground bars for sub-feed applications.
⑤ Loadcenter can be top or bottom fed by rotating the enclosure and trim 180 degrees.
⑥ Rainproof panels are furnished with hub closure plates. For rainproof hubs, refer to **Page 3-24**.
⑦ Loadcenter contains single insulated/bondable neutral.
⑧ Series rated for 100,000 AIC with all Types CH, CHT and CHP breakers.

Box Sizes..... **Pages 3-38** and **3-39**
Discount Symbol **22CD**

HUBBELL WIEGMANN

Enclosures for Electrical Electronic Equipment



Application

Designed to house and protect electrical and electronic components from harsh, dirty environments. For use in installations where dust, dirt, oil, water or other contaminants are present. Streamlined styling, flush latching, and attractive, durable finish complement any high-tech electronic equipment.

Construction

- Fabricated from 14 gauge steel
- Plasma welded seams
- Door and body stiffeners are provided in larger enclosures for extra rigidity
- Print pocket is provided
- Closed cell polyurethane poured in place gasket
- Collar studs provided for mounting optional subpanels
- Grounding provisions provided
- Concealed hinges
- Increased tub openings to accommodate larger size (optional) subpanels
- Optional subpanels must be ordered separately
- Doors are interchangeable and easily removable (open to 90° to remove door)
- 1/4 turn semi-flush oil tight latches are supplied to hold door securely closed
- Mounting holes in rear of enclosure body
- Optional mounting foot kit is available (required to maintain the NEMA Types 4, 12 and 13 ratings)

Finish

- ANSI-61 gray polyester powder inside and outside over phosphatized surfaces
- Optional subpanels are white polyester powder over phosphatized surfaces

Listings

- UL 508, Types 4, 12 and 13 (UL file E64791)
- CSA Certified, Types 4, 12 and 13 (CSA file LL66078)
- Meets NEMA/EEMAC Types 4, 12 and 13 requirements
- JIC EL-1-71

Enclosure Shipping Schedule		
Same day	1 - 7 days	1 - 10 days

Color indicates shipping lead time in business days.

Part Number	Price	Box/Door Gauge	Enclosure Size HxWxD	Subpanel Part Number	Price	Subpanel Size AxB	C	E	Door Stiffener
N412121206C	<---->	14/14	12x12x6 (305x305x152)	NP1212C	<---->	10.2x10.2 (259x259)	6 (152)	-	No
N412161206C	<---->	14/14	16x12x6 (406x305x152)	NP1612C	<---->	14.2x10.2 (361x259)	8 (203)	-	No
N412161208C	<---->	14/14	16x12x8 (406x305x203)	NP1612C	<---->	14.2x10.2 (361x259)	8 (203)	-	No
N412161606C	<---->	14/14	16x16x6 (406x406x152)	NP1616C	<---->	14.2x14.2 (361x361)	8 (203)	-	No
N412161608C	<---->	14/14	16x16x8 (406x406x203)	NP1616C	<---->	14.2x14.2 (361x361)	8 (203)	-	No
N412162006C	<---->	14/14	16x20x6 (406x508x152)	NP2016C	<---->	14.2x18.2 (361x462)	8 (203)	-	No
N412162008C	<---->	14/14	16x20x8 (406x508x203)	NP2016C	<---->	14.2x18.2 (361x462)	8 (203)	-	No
N412201606C	<---->	14/14	20x16x6 (508x406x152)	NP2016C	<---->	18.2x14.2 (462x361)	10 (254)	-	No
N412201608C	<---->	14/14	20x16x8 (508x406x203)	NP2016C	<---->	18.2x14.2 (462x361)	10 (254)	-	No
N412202006C	<---->	14/14	20x20x6 (508x508x152)	NP2020C	<---->	18.2x18.2 (462x462)	10 (254)	-	No
N412202008C	<---->	14/14	20x20x8 (508x508x203)	NP2020C	<---->	18.2x18.2 (462x462)	10 (254)	-	No
N412202012C	<---->	14/14	20x20x12 (508x508x305)	NP2020C	<---->	18.2x18.2 (462x462)	10 (254)	-	No
N412202408C	<---->	14/14	20x24x8 (508x610x203)	NP2420C	<---->	18.2x22.2 (462x564)	10 (254)	-	No
N412241606C	<---->	14/14	24x16x6 (610x406x152)	NP2416C	<---->	22.2x14.2 (564x361)	12 (305)	-	No

Note: Subpanels must be ordered separately. Dimensions in inches (millimeters); letters in table correspond to letters on dimensional drawings.

NEMA 4 and 12 Single-Door Wall Mount

Part Number	Price	Box/Door Gauge	Enclosure Size HxWxD	Subpanel Part Number	Price	Subpanel Size AxB*	C	E	Door Stiffener
N412242006C	<--->	14/14	24x20x6 (610x508x152)	NP2420C	<--->	22.2x18.2 (564x462)	12 (305)	-	No
N412242008C	<--->	14/14	24x20x8 (610x508x203)	NP2420C	<--->	22.2x18.2 (564x462)	12 (305)	-	No
N412242012C	<--->	14/14	24x20x12 (610x508x305)	NP2420C	<--->	22.2x18.2 (564x462)	12 (305)	-	No
N412242406C	<--->	14/14	24x24x6 (610x610x152)	NP2424C	<--->	22.2x22.2 (564x564)	4 (102)	16 (406)	No
N412242408C	<--->	14/14	24x24x8 (610x610x203)	NP2424C	<--->	22.2x22.2 (564x564)	4 (102)	16 (406)	No
N412242412C	<--->	14/14	24x24x12 (610x610x305)	NP2424C	<--->	22.2x22.2 (564x564)	4 (102)	16 (406)	No
N412242416C	<--->	14/14	24x24x16 (610x610x406)	NP2424C	<--->	22.2x22.2 (564x564)	4 (102)	16 (406)	No
N412242420C	<--->	14/14	24x24x20 (610x610x508)	NP2424C	<--->	22.2x22.2 (564x564)	4 (102)	16 (406)	No
N412243008C	<--->	14/14	24x30x8 (610x762x203)	NP3024C	<--->	22.2x28.2 (564x716)	4 (102)	16 (406)	No
N412302008C	<--->	14/14	30x20x8 (762x508x203)	NP3020C	<--->	28.2x18.2 (716x462)	4 (102)	22 (559)	No
N412302408C	<--->	14/14	30x24x8 (762x610x203)	NP3024C	<--->	28.2x22.2 (716x564)	4 (102)	22 (559)	No
N412302412C	<--->	14/14	30x24x12 (762x610x305)	NP3024C	<--->	28.2x22.2 (716x564)	4 (102)	22 (559)	No
N412302420C	<--->	14/14	30x24x20 (762x610x508)	NP3024C	<--->	28.2x22.2 (716x564)	4 (102)	22 (559)	No
N412303008C	<--->	14/14	30x30x8 (762x762x203)	NP3030C	<--->	28.2x28.2 (716x716)	4 (102)	22 (559)	No
N412303012C	<--->	14/14	30x30x12 (762x762x305)	NP3030C	<--->	28.2x28.2 (716x716)	4 (102)	22 (559)	No
N412362408C	<--->	14/14	36x24x8 (914x610x203)	NP3624C	<--->	34.2x22.2 (869x564)	4 (102)	28 (711)	No
N412362412C	<--->	14/14	36x24x12 (914x610x305)	NP3624C	<--->	34.2x22.2 (869x564)	4 (102)	28 (711)	No
N412363008C	<--->	14/14	36x30x8 (914x762x203)	NP3630C	<--->	34.2x28.2 (869x716)	4 (102)	28 (711)	No
N412363012C	<--->	14/14	36x30x12 (914x762x305)	NP3630C	<--->	34.2x28.2 (869x716)	4 (102)	28 (711)	No
N412363016C	<--->	14/14	36x30x16 (914x762x406)	NP3630C	<--->	34.2x28.2 (869x716)	4 (102)	28 (711)	No
N412363020C	<--->	14/14	36x30x20 (914x762x508)	NP3630C	<--->	34.2x28.2 (869x716)	4 (102)	28 (711)	No
N412363608C	<--->	14/14	36x36x8 (914x914x203)	NP3636C	<--->	34.2x34.2 (869x869)	4 (102)	28 (711)	No
N412363612C	<--->	14/14	36x36x12 (914x914x305)	NP3636C	<--->	34.2x34.2 (869x869)	4 (102)	28 (711)	No
N412402412C	<--->	14/14	40x24x12 (1016x610x305)	NP4024C	<--->	38.2x22.2 (970x564)	20 (508)	-	No
N412423612C	<--->	14/14	42x36x12 (1067x914x305)	NP4236C	<--->	40.2x34.2 (1021x869)	21 (533)	-	No
N412482412C	<--->	14/14	48x24x12 (1219x610x305)	NP4824C	<--->	46.2x22.2 (1173x564)	24 (610)	-	No
N412483612C	<--->	14/14	48x36x12 (1219x914x305)	NP4836C	<--->	46.2x34.2 (1173x869)	24 (610)	-	No
N412483616C	<--->	14/14	48x36x16 (1219x914x406)	NP4836C	<--->	46.2x34.2 (1173x869)	24 (610)	-	No
N412603612C	<--->	14/14	60x36x12 (1524x914x305)	NP6036C	<--->	58.2x34.2 (1478x869)	30 (762)	-	No

Note: Subpanels must be ordered separately. Dimensions in inches (millimeters); letters in table correspond to letters on dimensional drawings.

26

Single-Phase — Main Circuit Breaker Loadcenters
10,000/35,000 Amperes Interrupting Capacity

Table 26.2-6. Single-Phase 3-Wire — 120/240 Vac — Factory Bonded Split Neutral (Unless Otherwise Noted)

Main Breaker Type	Main Ampere Rating	Maximum Number 3/4-Inch (19.1 mm) Poles	Enclosure Type [1]	Box Size	Dimensions			Wire Size Range Cu/Al 60°C or 75°C for Main Breaker	Loadcenter [2,3] Catalog Number	Loadcenter Cover Catalog Number	
					Height	Width	Depth			Combination [4]	Surface
CH 10 kAIC	100	14	Indoor	B	16.75	14.31	3.88	#6 – 1/0	CH14B100B	CH8BF	CH8BS
		14	Outdoor	B	16.75	14.31	5.19		CH14B100R	—	—
		18	Indoor	C	21.00	14.31	3.88		CH18B100C	CH8CF	CH8CS
		18	Outdoor	C	21.00	14.31	5.19		CH18B100R	—	—
		22	Indoor	C	21.00	14.31	3.88		CH22B100C	CH8CF	CH8CS
		22	Outdoor	C	21.00	14.31	5.19		CH22B100R	—	—
		30	Indoor	D	29.13	14.31	3.88		CH30B100D	CH8DF	CH8DS
		30	Outdoor	D	29.13	14.31	5.19		CH30B100R	—	—
	125	22	Indoor	C	21.00	14.31	3.88	#6 – 1/0	CH22B125C	CH8CF	CH8CS
		22	Outdoor	C	21.00	14.31	5.19		CH22B125R	—	—
		30	Indoor	D	29.13	14.31	3.88		CH30B125D	CH8DF	CH8DS
		30	Outdoor	D	29.13	14.31	5.19		CH30B125R	—	—
CSH 35 kAIC [5]	150	8	Outdoor	E	29.13	14.31	5.19	#2 – 300 kcmil	CH8B150RF	—	—
		24	Indoor	E	29.13	14.31	3.88		CH24B150E	CH8EF	CH8ES
		24	Outdoor	E	29.13	14.31	5.19		CH24B150R	—	—
		32	Indoor	J	34.13	14.31	3.88		CH32B150J	CH8JF	CH8JS
		32	Outdoor	J	34.13	14.31	5.19		CH32B150R	—	—
	200	8	Outdoor	E	29.13	14.31	5.19	#2 – 300 kcmil	CH8B200RF	—	—
		24	Indoor	E	29.13	14.31	3.88		CH24B200E	CH8EF	CH8ES
		24	Outdoor	E	29.13	14.31	5.19		CH24B200R	—	—
		32	Indoor	J	34.13	14.31	3.88		CH32B200J	CH8JF	CH8JS
		32	Outdoor	J	34.13	14.31	5.19		CH32B200R	—	—
		42	Indoor	K	37.00	14.31	3.88		CH42B200K	CH8KF	CH8KS
		42	Outdoor	K	37.00	14.31	5.19		CH42B200R	—	—
	225	32	Indoor	J	34.13	14.31	3.88	#2 – 300 kcmil	CH32B225J	CH8JF	CH8JS
		32	Outdoor	J	34.13	14.31	5.19		CH32B225R	—	—
		42	Indoor	K	37.00	14.31	3.88		CH42B225K	CH8KF	CH8KS
		42	Outdoor	K	37.00	14.31	5.19		CH42B225R	—	—
DK 10 kAIC	300	42	Indoor	PM	62.63	21.00	6.00	(2) 3/0 – 250 kcmil	CH42PM300	CH7PMF	CH7PMS
	400	42	Indoor	PM	62.63	21.00	6.00	(2) 3/0 – 250 kcmil	CH42PM400	CH7PMF	CH7PMS

[1] Outdoor units are furnished with hub closure plates.
[2] All main circuit breaker loadcenters are listed for use as service entrance equipment.
[3] Ground bar kits ordered separately.
[4] Combination style covers may be used in surface or flush applications.
[5] CSH Main and Branch Breaker types CH, CHT and CHP results in a 35 kAIC Series Rating.

Single-Phase — High Interrupting Rated Main Circuit Breaker Loadcenters
42,000/100,000 Amperes Interrupting Capacity

Table 26.2-7. Single-Phase 3-Wire — 120/240 Vac — Factory Bonded Split Neutral (Unless Otherwise Noted)

Main Breaker Type	Main Ampere Rating	Maximum Number 3/4-Inch (19.1 mm) Poles	Enclosure Type [6]	Box Size	Dimensions			Wire Size Range Cu/Al 60°C or 75°C for Main Breaker	Loadcenter [7,8] Catalog Number	Loadcenter Cover Catalog Number	
					Height	Width	Depth			Combination [9]	Surface
CHB4 42 kAIC [10]	100	20	Indoor	C	21.00	14.31	3.88	#6 – 1/0	CH20H100C	CH8CF	CH8CS
		20	Outdoor	C	21.00	14.31	5.19		CH20H100R	—	—
		28	Indoor	D	29.13	14.31	3.88		CH28H100D	CH8DF	CH8DS
		28	Outdoor	D	29.13	14.31	5.19		CH28H100R	—	—
CHH 100 kAIC [11]	150	32	Indoor	L	39.00	14.31	3.88	#2/0 – 300 kcmil	CH32H150L	CH8LF	CH8LS
		32	Outdoor	L	39.00	14.31	5.19		CH32H150R	—	—
	200	32	Indoor	L	39.00	14.31	3.88	#2/0 – 300 kcmil	CH32H200L	CH8LF	CH8LS
		32	Outdoor	L	39.00	14.31	5.19		CH32H200R	—	—
		42	Indoor	L	39.00	14.31	3.88		CH42H200L	CH8LF	CH8LS
		42	Outdoor	L	39.00	14.31	5.19		CH42H200R	—	—
	225	42	Indoor	L	39.00	14.31	3.88	#2/0 – 300 kcmil	CH42H225L	CH8LF	CH8LS
		42	Outdoor	L	39.00	14.31	5.19		CH42H225R	—	—

[6] Outdoor units are furnished with hub closure plates.
[7] All main circuit breaker loadcenters are listed for use as service entrance equipment.
[8] Ground bar kits ordered separately.
[9] Combination style covers may be used in surface or flush applications.
[10] CHB4 Main and Branch Breaker types CH, CHT and CHP result in a 42 kAIC Series Rating.
[11] CHH Main and Branch Breaker types CH, CHT and CHP results in a 100 kAIC Series Rating.

Single-Phase — Main Lug Loadcenters

Table 26.2-4. Single-Phase 3-Wire — 120/240 Vac — Insulated/Bondable Neutral

Main Ampere Rating	Maximum Number 3/4-Inch (19.1 mm)		Enclosure Type	Type of Trim (Included)	Box Size	Dimensions in Inches			Wire Size Range Cu/Al 60°C or 75°C for Main Lugs	Loadcenter Catalog Number [2]
	Space	Poles				Height	Width	Depth		
40	2	4 [1]	Indoor	Surface (No Door)	5	9.50	4.50	3.13	#14 – 6	CH2L40SP [3]
	2	4 [1]	Outdoor	—	5R	9.50	4.50	3.13		CH2L40RP [3]
	2	4 [1]	Indoor	Flush (No Door)	5	9.50	4.50	3.13		CH2L40FP [3]
70	2	4 [1]	Indoor	Surface (No Door)	5	9.50	4.50	3.13	#14 – 2	CH2L70SP [3]
	2	4 [1]	Outdoor	—	5R	9.50	4.50	3.13		CH2L70RP [3]
	2	4 [1]	Indoor	Flush (No Door)	5	9.50	4.50	3.13		CH2L70FP [3]
125	2	4 [1]	Indoor	Surface (No Door)	6	11.38	6.88	3.39	#14 – 1/0	CH2L125SP [3]
	2	4 [1]	Outdoor	—	6R	11.75	4.50	4.50		CH2L125RP [3]
	2	2	Outdoor	—	—	—	—	—		CH2L125RSE2P
	2	4 [1]	Indoor	Flush (No Door)	6	11.38	6.88	3.39		CH2L125FP [3]
	4	8 [1]	Indoor	Surface (No Door)	7	13.00	11.00	3.69	#14 – 1/0	CH4L125SP
	4	8 [1]	Outdoor	—	7R	13.00	11.00	3.69		CH4L125RP
	4	8 [1]	Indoor	Flush (No Door)	7	13.00	11.00	3.69		CH4L125FP
	8	16 [1]	Indoor	Surface (No Door)	7	13.00	11.00	3.69	#6 – 1/0	CH8L125SP
	8	16 [1]	Outdoor	—	7R	13.00	11.00	3.69		CH8L125RP
	8	16 [1]	Indoor	Flush (No Door)	7	13.00	11.00	3.69		CH8L125FP

[1] Requires the use of Type CHNT breakers.

[2] Ground bar kits ordered separately.
- For 2/4 circuit loadcenters use Type GBK5 or GBK520 ground bar
- For 4/8 and 8/16 circuit loadcenters use Type GBK10 ground bar
- Ground bars mount to the left side wall of the enclosure for the 4/8 and 8/16 circuit loadcenters.

[3] Suitable for use as service equipment when not more than two service disconnecting mains are provided or when not used as a lighting and appliance panelboard (see Article 408.34 of the NEC).

Single-Phase — Main Lug Loadcenters

Table 26.2-5. Single-Phase 3-Wire — 120/240 Vac — Twin Neutral — Factory-Installed Ground Bar

Main Ampere Rating	Maximum Number 3/4-Inch (19.1 mm) Poles	Enclosure Type	Box Size	Dimensions			Wire Size Range Cu/Al 60°C or 75°C for Main Lugs	Loadcenter Catalog Number	Loadcenter Cover Catalog Number	
				Height	Width	Depth			Combination	Surface
125	12	Indoor	B	16.75	14.31	3.88	#6 – 2/0	CH12L125B [4]	CH8BF	CH8BS
	12	Outdoor	B	16.75	14.31	5.19		CH12L125R [4,5]	—	—
	16	Indoor	B	16.75	14.31	3.88		CH16L125B [4]	CH8BF	CH8BS
	16	Outdoor	B	16.75	14.31	5.19		CH16L125R [4,5]	—	—
	20	Indoor	C	21.00	14.31	3.88		CH20L125C [4]	CH8CF	CH8CS
	20	Outdoor	C	21.00	14.31	5.19		CH20L125R [4,5]	—	—
	24	Indoor	C	21.00	14.31	3.88		CH24L125C [4]	CH8CF	CH8CS
	24	Outdoor	C	21.00	14.31	5.19		CH24L125R [4,5]	—	—
150	24	Indoor	D	29.13	14.31	3.88	#4 – 300 kcmil	CH24L150D [4]	CH8DF	CH8DS
	24	Outdoor	D	29.13	14.31	5.19		CH24L150R [5,6]	—	—
	32	Indoor	D	29.13	14.31	3.88		CH32L150D [4]	CH8DF	CH8DS
	32	Outdoor	D	29.13	14.31	5.19		CH32L150R [5,6]	—	—
200	12	Indoor	D	29.13	14.31	3.88	#4 – 300 kcmil	CH12L200D [4]	CH8DF	CH8DS
	12	Outdoor	D	29.13	14.31	5.19		CH12L200R [5,6]	-	—
	16	Indoor	D	29.13	14.31	3.88		CH16L200D [4]	CH8DF	CH8DS
	16	Outdoor	D	29.13	14.31	5.19		CH16L200R [5,6]	—	—
225	24	Indoor	D	29.13	14.31	3.88	#4 – 300 kcmil	CH24L225D [4]	CH8DF	CH8DS
	24	Outdoor	D	29.13	14.31	5.19		CH24L225R [5,6]	—	—
	32	Indoor	D	29.13	14.31	3.88		CH32L225D [4]	CH8DF	CH8DS
	32	Outdoor	D	29.13	14.31	5.19		CH32L225R [5,6]	—	—
	42	Indoor	G	34.13	14.31	3.88		CH42L225G [6]	CH8GF	CH8GS
	42	Outdoor	G	34.13	14.31	5.19		CH42L225R [5,6]	—	—
400	42	Indoor	P	54.38	21.00	6.00	(2) 1/0 – 300 kcmil (1) 750 kcmil	CH42PL400 [7]	CH7PF [8]	CH7PS

[4] Suitable for use as service equipment when not more than six disconnecting means are provided and when not used as a lighting and appliance panelboard (see Article 408.34 of the NEC).

[5] Rainproof panels are furnished with hub closure plates. For rainproof hubs, refer to accessories.

[6] Suitable for use as service equipment when a circuit breaker is used as a main breaker. The main breaker is backfed and requires hold-down bracket kit catalog number **CH125RB**.

[7] Suitable for use as service equipment when a circuit breaker is used as a main breaker. The main breaker is backfed and must be a Type CHB. **The breaker cannot be a Type CH.**

[8] This cover is for flush application only (not combination).

Series 67 – Multi-Function Control Duplex Pump System Control

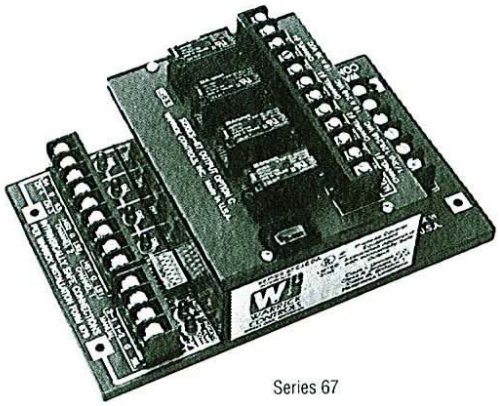
- Inverse or Direct Acting, Field Selectable
- Solid State Reliability
- Compact Size
- Four Independent Channels – 2 Single, 2 Differential
- Field Adjustable, Sensitivity and Mode Selection
- LED Channel Indicators
- Built-in Silence/Acknowledge Circuit
- U.L. "Intrinsically Safe"

Warrick's Series 67 four channel level control is an ideal solution to liquid level problems in hazardous applications for the sewage, waste water, chemical and groundwater remediation industries.

Connected to floats or conductance probes this versatile control provides simplex or duplex pump/solenoid valve control; automatic or manual alternation; high and/or low level alarms with silence/ acknowledge capabilities.

The Series 67 can be used in hazardous applications as an intrinsically safe interface to non-powered contacts and sensors such as push button operators, limit, temperature, pressure and vacuum switches.

Designed for hazardous applications, its low cost, integrated features and compact size also make it ideal for non-hazardous applications.



Series 67

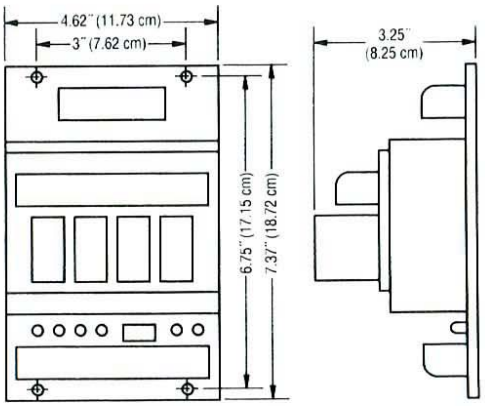
Applications

- Hazardous Atmospheres
- Multiple Functions
- Simplex or Duplex
- High/Low Level Alarms
- Auto or Manual Alternation
- Pump/Solenoid Valves
- Sewage Lift Stations
- Wastewater Treatment
- Chemical Plants
- Groundwater Remediation

Specifications

Contact Design	Standard N.O., N.C. (form C); Optional N.O., N.C.
Contact Rating (30VDC, 120/240VAC)	10 amp (style C); 5 amp (style A)
Primary Voltage	120 VAC, 240 VAC (+10%/-15%) 50/60 Hz
Secondary Voltage	12 VAC @ 6mA RMS
Sensitivity	4.7K - 100K ohms maximum specific resistance, factory set
Temperature	-40°F to 150°F
Approvals	U.L. 913 File # 7112 Vol. 1, Sec. 4

Dimensions



How to Order

Use the **Bold** characters from the chart below to construct a product code.

67 X X X X X

Series
67

Sensitivity
A – 4.7K **D** – 50K
B – 10K **E** – 100K
C – 26K

Supply Voltage
1 – 120 VAC **2** – 240 VAC

Contact Design
A – 1 Form A & B (N.O. & N.C. isolated) for each channel
C – 1 Form C (N.O., N.C., Common) for each channel

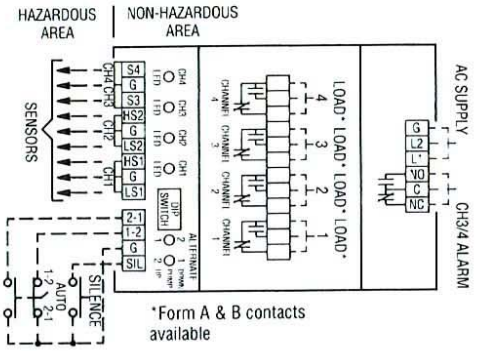
Enclosure
0 – None **1** – NEMA 1 **4** – NEMA 4

D.C. Probe Circuit Option
A – No option **D** – D.C. Probe Circuit*

*Eliminates short cycles

→ 67C1CØA

Wiring



See Our Interstitial Tank Monitoring Products on page A-22.

TeSys™ D-Line Contactors and Starters
Selection of Contactors for Motor Control

The tables below show the kilowatt ratings (for international applications) and horsepower ratings (for North American applications) of contactors for motor control.

AC and DC Control Circuit — 3-pole Contactors with Touch-safe Terminals for Power Cabling (AC-3 category)

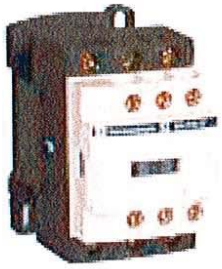
Maximum horsepower ratings						Maximum Inductive Current in AC-3 Category 600 V	Standard power ratings of 3-phase motors 50/60 Hz in category AC-3							Rated Operating Current in AC-3 up to 440 V	Instantaneous Auxiliary Contacts		Catalog Number ▼♦	Weight lb (kg)
1-phase 50/60 Hz		3-phase 50/60 Hz					220 V 230 V	380 V 400 V	415 V	440 V	500 V	660 V 690 V	1000 V					
115/ 120 V	230/ 240 V	200/ 208 V	220/ 240 V	460/ 480 V	575 V 600 V										N.O.	N.C.		
HP	HP	HP	HP	HP	HP	A	kW	kW	kW	kW	kW	kW	kW	A				
0.5	1	2	2	5	7.5	9	2.2	4	4	4	5.5	5.5	–	9	1	1	LC1D09••	0.71 (0.320)
1	2	3	3	7.5	10	12	3	5.5	5.5	5.5	7.5	7.5	–	12	1	1	LC1D12••	0.72 (0.325)
1	3	5	5	10	15	18	4	7.5	9	9	10	10	–	18	1	1	LC1D18••	0.73 (0.330)
2	3	7.5	7.5	15	20	25	5.5	11	11	11	15	15	–	25	1	1	LC1D25••	0.82 (0.370)
2	5	10	10	20	30	32	7.5	15	15	15	18.5	18.5	–	32	1	1	LC1D32••	0.83 (0.375)
Not for North American applications ■						38	9	18.5	18.5	18.5	18.5	18.5	–	38	1	1	LC1D38••	0.84 (0.380)
3	5	10	10	30	30	40	11	18.5	22	22	22	30	22	40	1	1	LC1D40••	3.11 (1.400)
3	7.5	15	15	40	40	50	15	22	25	30	30	33	30	50	1	1	LC1D50••	3.11 (1.400)
5	10	20	20	50	50	65	18.5	30	37	37	37	37	37	65	1	1	LC1D65••	3.11 (1.400)
7.5	15	25	30	60	60	80	22	37	45	45	55	45	45	80	1	1	LC1D80••	3.53 (1.590)
Not for North American applications ■						95	25	45	45	45	55	45	45	95	1	1	LC1D95••	3.58 (1.610)
–	–	30	40	75	100	115	30	55	59	59	75	80	75	115	1	1	LC1D115••	5.38 (2.420)
–	–	40	50	100	125	150	40	75	80	80	90	100	90	150	1	1	LC1D150••	5.42 (2.440)

♦ For **LC1D09** to **LC1D38**: clip-on mounting on 35 mm DIN rail **AM1DP** or screw mounting.
For **LC1D40** to **LC1D95**: clip-on mounting on 35 mm DIN rail **AM1DE** or 75 mm DIN rail **AM1DL** or screw mounting.
For **LC1D115** and **LC1D150**: clip-on mounting on 2 x 35 mm DIN rails **AM1DP** or screw mounting.

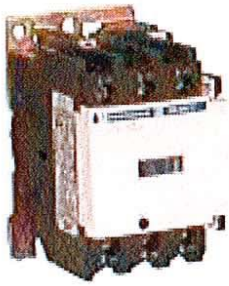
▼ Use voltage codes on page 115 "Voltage Code Table" to complete catalog number.

■ Devices are UL Listed at the same HP ratings as 32 and 80 amp devices, respectively.

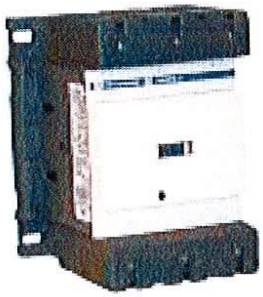
LC1D09••

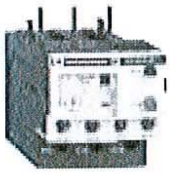


LC1D65••



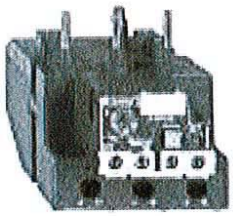
LC1D150••





LRD08

LRD21



LRD33

LRD083

Differential (Single Phase Sensitive) Thermal Overload Relays

Compensated Relays with Manual or Automatic Reset, with Relay Trip Indicator, for ac or dc.

Short-circuit Protection for North American Applications				By Circuit Breaker	Select in Accordance with NEC and Local Codes	
				By Fuses	Maximum 400% of Motor FLA	
Relay Setting Range	Fuses to be used with Selected Relay			For use with Contactor LC1-	Catalog Number	Weight lb. (kg)
	aM	gG	BS88			
A	A	A	A			
Class 10 with Connection by Screw Clamp Terminals						
0.10 to 0.16	0.25	2	–	D09 to D38 (2)	**LRD01**	0.27 (0.124)
0.16 to 0.25	0.5	2	–	D09 to D38 (2)	**LRD02**	0.27 (0.124)
0.25 to 0.40	1	2	–	D09 to D38 (2)	**LRD03**	0.27 (0.124)
0.40 to 0.63	1	2	–	D09 to D38 (2)	**LRD04**	0.27 (0.124)
0.63 to 1	2	4	–	D09 to D38 (2)	**LRD05**	0.27 (0.124)
1 to 1.6	2	4	6	D09 to D38 (2)	**LRD06**	0.27 (0.124)
1.6 to 2.5	4	6	10	D09 to D38 (2)	**LRD07**	0.27 (0.124)
2.5 to 4	6	10	16	D09 to D38 (2)	**LRD08**	0.27 (0.124)
4 to 6	8	16	16	D09 to D38 (2)	**LRD10**	0.27 (0.124)
5.5 to 8	12	20	20	D09 to D38 (2)	**LRD12**	0.27 (0.124)
7 to 10	12	20	20	D09 to D38 (2)	**LRD14**	0.27 (0.124)
9 to 13	16	25	25	D12 to D38 (2)	**LRD16**	0.27 (0.124)
12 to 18	20	35	32	D18 to D38 (2)	**LRD21**	0.27 (0.124)
16 to 24	25	50	50	D25 to D38 (2)	**LRD22**	0.27 (0.124)
23 to 32	40	63	63	D25 to D38 (2)	**LRD32**	0.27 (0.124)
30 to 38	50	80	80	D32 and D38 (2)	**LRD35**	0.27 (0.124)
17 to 25	25	50	50	D40 to D95	**LRD3322**	1.12 (0.510)
23 to 32	40	63	63	D40 to D95	**LRD3353**	1.12 (0.510)
30 to 40	40	100	80	D40 to D95	**LRD3355**	1.12 (0.510)
37 to 50	63	100	100	D40 to D95	**LRD3357**	1.12 (0.510)
48 to 65	63	100	100	D50 to D95	**LRD3359**	1.12 (0.510)
55 to 70	80	125	125	D50 to D95	**LRD3361**	1.12 (0.510)
63 to 80	80	125	125	D65 to D95	**LRD3363**	1.12 (0.510)
80 to 104	100	160	160	D80 and D95	**LRD3365**	1.12 (0.510)
80 to 104	125	200	160	D115 and D150	**LRD4365**	1.98 (0.900)
95 to 120	125	200	200	D115 and D150	**LRD4367**	1.98 (0.900)
110 to 140	160	250	200	D150	**LRD4369**	1.98 (0.900)
80 to 104	100	160	160	D115 and D150	**LRD33656** (1)	2.20 (1.000)
95 to 120	125	200	200	D115 and D150	**LRD33676** (1)	2.20 (1.000)
110 to 140	160	250	200	D115 and D150	**LRD33696** (1)	2.20 (1.000)
Class 10 with Spring Terminal Connections (for direct mounting on the contactor only)						
0.10 to 0.16	0.25	2	–	D09 to D38 (2)	**LRD013**	6.31 (0.140)
0.16 to 0.25	0.5	2	–	D09 to D38 (2)	**LRD023**	6.31 (0.140)
0.25 to 0.40	1	2	–	D09 to D38 (2)	**LRD033**	6.31 (0.140)
0.40 to 0.63	1	2	–	D09 to D38 (2)	**LRD043**	6.31 (0.140)
0.63 to 1	2	4	–	D09 to D38 (2)	**LRD053**	6.31 (0.140)
1 to 1.6	2	4	6	D09 to D38 (2)	**LRD063**	6.31 (0.140)
1.6 to 2.5	4	6	10	D09 to D38 (2)	**LRD073**	6.31 (0.140)
2.5 to 4	6	10	16	D09 to D38 (2)	**LRD083**	6.31 (0.140)
4 to 6	8	16	16	D09 to D38 (2)	**LRD103**	6.31 (0.140)
5.5 to 8	12	20	20	D09 to D38 (2)	**LRD123**	6.31 (0.140)
7 to 10	12	20	20	D09 to D38 (2)	**LRD143**	6.31 (0.140)
9 to 13	16	25	25	D12 to D38 (2)	**LRD163**	6.31 (0.140)
12 to 18	20	35	32	D18 to D38 (2)	**LRD213**	6.31 (0.140)
16 to 24	25	50	50	D25 to D38 (2)	**LRD223**	6.31 (0.140)

Class 10 with Ring-Tongue Terminals for LRD01 through LRD35 (load side terminals only)

Select the appropriate overload relay with screw clamp terminals from the table above and add **6** to the end of the reference.
Example: **LRD01** becomes **LRD016**.

Thermal Overload Relays for use on single phase loads

Class 10 with connection by screw clamp terminals

Change the prefix in the references above from **LRD** (except **LRD4●●●**) to **LR3D**. Example: **LRD01** becomes **LR3D01.**

Thermal Overload Relays for use on 1000 V Supplies

Class 10 with connection by screw clamp terminals

For relays LRD-01 to LRD-35 only, for an operating voltage of 1000 V. and only for independent mounting, the reference becomes **LRD33 A66**. Example: **LRD12** becomes **LRD3312A66.**
Order an **LA7D3064** terminal block separately: see page 137.

(1) These are special separate mounted versions of the LRD43 overload relays for the LC1D115 and D150 contactors. Part number includes overload relay, terminal block and 6 connectors (unit is not UL/CSA approved).

(2) When used with D25-D38 contactors, order spacer clip (part number W816366180111). See page 137.

ProSense™ PTD25 Series Pressure Transmitters

Features

The pressure sensor detects the system pressure and converts it into an analog output signal.

- Ceramic sensing element provides high burst/overpressure protection
- Output options: 4-20 mA or 0-10 V
- Analog output via 4-pin Micro DC connector
- Flexible film circuit results in excellent shock and vibration resistance
- Robust stainless steel housing

Agency Approvals

- cULus File number E320431
- CE

NOTE: CHECK THE CHEMICAL COMPATIBILITY OF THE SENSOR'S WETTED PARTS WITH THE MEDIUM TO BE MEASURED. FOR GASEOUS MEDIA, LIMIT THE PROCESS PRESSURE TO 363 PSI (25 BAR) MAXIMUM.

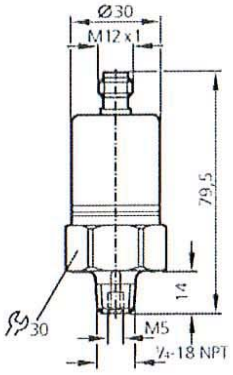
ProSense Series Pressure Transmitters					
Part Number	*Description*	*Pcs/Pkg*	*Wt(lb)*	*Price*	*Cable Assemblies*
PTD25-10-VH	Vacuum transmitter, 10 to 0 V output, -14.5 to 0 psi range vacuum, 1/4" NPT male port	1	0.48	<--->	CD12L-0B-020-A0 CD12L-0B-020-C0 CD12M-0B-070-A1 CD12M-0B-070-C1 (see page 18-64 for specs)
PTD25-10-0100H	Pressure transmitter, 0 to 10 V output, 0 to 100 psi range, 1/4" NPT male port	1	0.48	<--->	
PTD25-10-0500H	Pressure transmitter, 0 to 10 V output, 0 to 500 psi range, 1/4" NPT male port	1	0.48	<--->	
PTD25-10-1000H	Pressure transmitter, 0 to 10 V output, 0 to 1000 psi range, 1/4" NPT male port	1	0.48	<--->	
PTD25-20-VH	Vacuum transmitter, 20 to 4 mA output, -14.5 to 0 psi range vacuum, 1/4" NPT male port	1	0.48	<--->	
PTD25-20-0100H	Pressure transmitter, 4 to 20 mA output, 0 to 100 psi range, 1/4" NPT male port	1	0.48	<--->	
PTD25-20-0500H	Pressure transmitter, 4 to 20 mA output, 0 to 500 psi range, 1/4" NPT male port	1	0.48	<--->	
PTD25-20-1000H	Pressure transmitter, 4 to 20 mA output, 0 to 1000 psi range, 1/4" NPT male port	1	0.48	<--->	

ProSense PTD25 Series General Specifications	
Housing Material	Stainless steel (316S12); FPM (Viton); PA; EPDM/X (Santoprene)
Materials (wetted parts)	Stainless steel (303S22); ceramics; FPM (Viton)
Operating Temperature	–13 to 176°F (–25 to 80°C)
Medium Temperature	–13 to 194°F (–25 to 90°C)
Storage Temperature	–40 to 212°F (–40 to 100°C)
Protection	IP 68 / IP 69K (Units with pressure range 1000 PSI and higher)
Protection	IP 65 (Units with pressure range 500 PSI and lower)
Protection Class	III
Accuracy	< ± 0.75 (limit point calibration)
Repeatability	< ± 0.15 of full range
Insulation Resistance	> 100 MΩ (500 V DC)
Shock Resistance	50g (DIN / IEC 68-2-27, 11ms)
Vibration Resistance	20g (DIN / IEC 68-2-6, 10 - 2000 Hz)
EMC (PTD25-10-xxxxx)	
EN 61000-4-2 ESD	4 kV/8 kV AD
EN 61000-4-3 HF Radiated	30 V/m
EN 61000-4-4 Burst	2 kV
EN 61000-4-6 HF Conducted	10 V
EMC (PTD25-20-xxxxx)	
EN 61000-4-2 ESD	4 kV/8 kV AD
EN 61000-4-3 HF Radiated	30 V/m
EN 61000-4-4 Burst	2 kV
EN 61000-4-6 HF Conducted	10 V
Radiation of Interference	2004/104/EC / CISPR25 according to the road vehicle guideline
Noise Immunity	2004/104/EC / ISO 11452-2 according to the road vehicle guideline
HF Conducted	100 V/m
Pulse Resistance	According to ISO7637-2; Severity level 3

ProSense PTD25 Series Technical Specifications	
Technical Specifications PTD25-10-xxxxx	
Operating Voltage PTD25-10-xxxx	16 to 32 VDC[1]
Current Consumption	< 18 mA
Analog Output	0 to 10 V (min/max 0 to 10.5V)
Minimum Load	2000 Ω
Step Response Time Analog Output	3 ms
Technical Specifications PTD25-20-xxxxx	
Operating Voltage PTD25-20-xxxx	9.6 to 32 VDC
Analog Output	4 to 20 mA (min/max 3.35 to 22 mA)
Maximum Load	(supply voltage - 9.6) x 50Ω. For example, (24 VDC - 9.6) x 50) = 720Ω
Step Response Time Analog Output	3 ms
Characteristics Deviation (in % of the span)*	
PTD25-xx-3000H	< ± 0.35 (BFSL) / < ± 0.75 (LS)
PTD25-xx-1000H	< ± 0.35 (BFSL) / < ± 0.75 (LS)
PTD25-xx-0500H .	< ± 0.35 (BFSL) / < ± 0.75 (LS)
PTD25-xx-0100H	< ± 0.35 (BFSL) / < ± 0.75 (LS)
PTD25-xx-VH	< ± 0.25 (BFSL) / < ± 0.5 (LS)
Repeatability (in % of the span)	
PTD25-xx-3000H	< 0.15
PTD25-xx-1000H	< 0.15
PTD25-xx-0500H	< 0.15
PTD25-xx-0100H	< 0.15
PTD25-xx-VH	< 0.1
Temperature Coefficients (TEMPCO) Greatest TEMPCO of the zero point of the Span	Temperature range 0 to 80°C (–13 to 176°F) (in % of the span/10°C(50°F))
PTD25-xx-3000H	0.2 / 0.3
PTD25-xx-1000H	0.2 / 0.3
PTD25-xx-0500H	0.15 / 0.2
PTD25-xx-0100H	0.2 / 0.3
PTD25-xx-VH	0.15 / 0.2
[1] *per EN50178, SELV, PELV*	
**Note: BFSL = Best Fit Straight Line / LS = Limit Value Setting*	

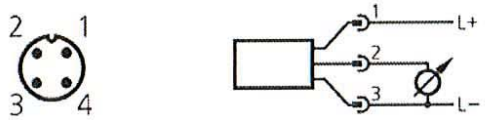
Applications (Type of Pressure: Relative Pressure, Liquids and Gases)			
Part Number	*Measuring Range*	*Permissible Overload Pressure*	*Bursting Pressure*
	PSI	*PSI*	*PSI*
PTD25-10-1000H PTD25-20-1000H	0 to 1000	4350	9400
PTD25-10-0500H PTD25-20-0500H	0 to 500	2175	5075
PTD25-10-0100H PTD25-20-0100H	0 to 100	1087	2175
PTD25-10-VH PTD25-20-VH	-14.5 to 0 (vacuum)	145	450

Dimensions (mm)

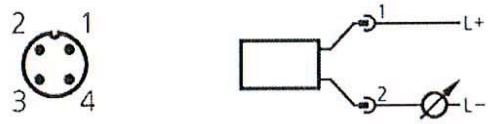


All dimensions in millimeters
25.4 mm = 1 inch

PTD25-10 Wiring Diagrams



PTD25-20 Wiring Diagrams

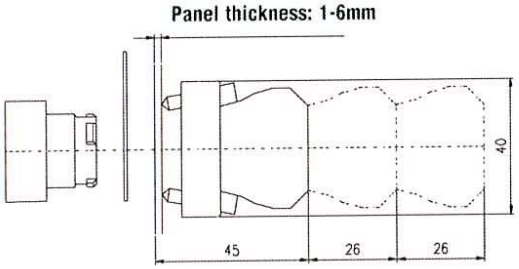


WARNING! AVOID STATIC AND DYNAMIC OVERPRESSURE EXCEEDING THE GIVEN OVERLOAD PRESSURE.
EXCEEDING THE BURSTING PRESSURE FOR EVEN A SHORT TIME CAN CAUSE DESTRUCTION OF THE UNIT AND POSSIBLE INJURIES!

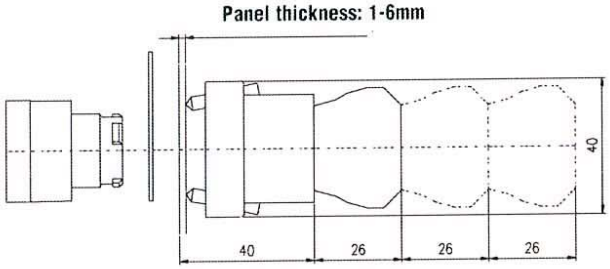
Assembly information

These pushbuttons and indicator lights are supplied with the appropriate contact blocks. Use these drawings as a guide to make sure there is adequate clearance behind the panel.

Pushbuttons and selector switches



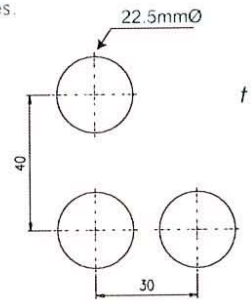
Lighted pushbuttons and selector switches/pilot lights



Panel holes

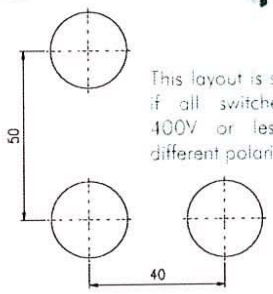
For safe operation, use these mounting hole drawings to ensure that there is adequate space between switches.

This layout is suitable if all switches are 230V or less and the same polarity.



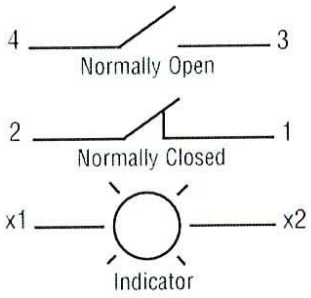
† Note

NOTE: Contact blocks can be arranged up to three deep by two wide.



This layout is suitable if all switches are 400V or less and different polarity.

Typical Wiring



Specifications

These specifications apply to all the 22 mm metal pushbuttons and switches.

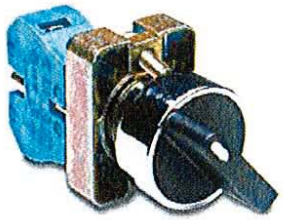
Physical Specifications	
Standards Reference	IEC EN 60947_5_1, CSA C22-2 n.14
Approvals	CSA # 066746-0-000, IMQ (where specified). UL File E189258 (ECX 1030, 1040, 1041, 1042 contact blocks and ECX 1050 lamp holder with support base)
Enclosure Material	Zn + Al + Mg alloy, chromium plated
Contacts Material	Silver
Protection Degree	IP 65 according to IEC 144 CEI 70-1, (unless otherwise stated) (see page 31-10 for explanation of IP 65)
Temperature Ratings	Storage: -40° to 80°C (-40° to 176° F) Operating: -25° to +70°C (-13° to 158° F)
Working Positions	All working positions are allowed
Mechanical Life	Pushbuttons, selector switches, joy stick switches: 1 000 000 operations Mushroom pushbuttons: 300 000 operations

Electrical Specifications	
Rated Thermal Current (contact block)	A300, Q300 (Refer to page 23-30 for more information.)
Rated Insulation Voltage	Ui 660V according to CEI EN 60947-5-1 300V according to CSA C22-2 n.14 and UL 508
Dielectric Strength	3KV (1 second)
Insulation Resistance	2MΩ min. (500V DC)
Initial Contact Resistance	≤25mΩ
Short-Circuit Protection (Recommended, not supplied)	Cartridge fuses gl 10 A-500V AC 10.3x38/1.100 KA
Terminal Markings	According to CENELEC EN 50013
Connections	Single screw with non-loosening plate clamp, 14AWG max.
Contacts Operation	Self-cleaning types EN01 (N.C.) EN 10 (N.O.) slow action positive opening
Operation Frequency	3600 operations per hour max.
Utilization Category (rated operation current)	**AC15** (Control of AC electromagnetic loads) 24 V AC at 10 amps 130 V AC at 6.5 amps 400 V AC at 4 amps **DC13** (Control of DC electromagnetic loads) 24 V DC at 2.8 amps 110 V DC at 0.5 amps 250 V DC at 0.27 amps

† Note: **All dimensions are in millimeters. 25.4mm = 1 inch. For example, 30 mm in inches = 30/25.4 = 1.181 inches.**

22 mm Metal Selector Switches

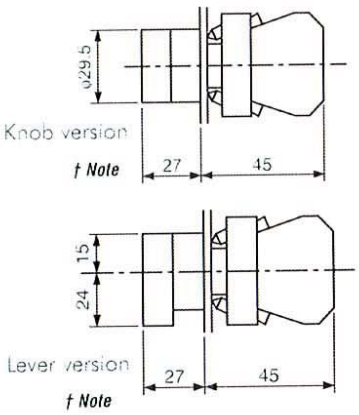
Two-position selector switches



GCX1300 Knob version

GCX1350 Lever version

Part Number	Description - 2-Position Switches	Price
GCX1300	22 mm metal selector switch, two-position **maintained**, black knob **One N.O.** contact block	<--->
GCX1310	22 mm metal selector switch, two-position **spring-return from right**, black knob **One N.O.** contact block	<--->
GCX1350	22 mm metal selector switch, two-position **maintained**, black lever **One N.O.** contact block	<--->
GCX1360	22 mm metal selector switch, two-position **spring-return from right**, black lever **One N.O.** contact block	<--->



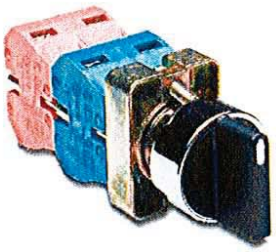
Contact Closure Sequence - 2-Position Switch

Contact Blocks	Contact Arrangement (viewed from front)		Switch Position (viewed from front)	
	Left	Right	Left (Note 1)	Right (Note 2)
1 x NC	NC		X	
		NC	X	
1 x NO	NO			X
		NO		X
2 x NC	NC	NC	XX	
2 x NO	NO	NO		XX

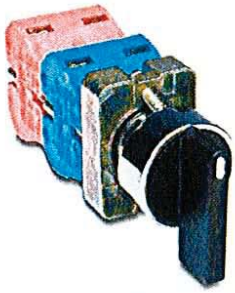
Note 1: Left switch position deactivates all contacts.
Note 2: Right switch position activates all contacts.

Note:

Three-position selector switches



GCX1320-22 Knob version



GCX1370-22 Lever version

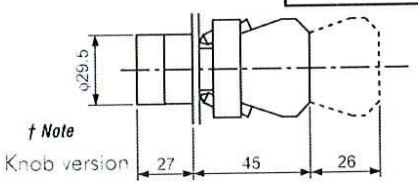
Part Number	Description - 3-Position Switches	Price
GCX1320-22	22 mm metal selector switch, three-position **maintained**, black knob **Two N.O.** and **two N.C.** contact blocks	<--->
GCX1330-22	22 mm metal selector switch, three-position **spring-return to center**, black knob **Two N.O.** and **two N.C.** contact blocks	<--->
GCX1370-22	22 mm metal selector switch, three-position, **maintained**, black lever **Two N.O.** and **two N.C.** contact blocks	<--->
GCX1380-22	22 mm metal selector switch, three-position **spring-return to center**, black lever **Two N.O.** and **two N.C.** contact blocks	<--->

Note: When using switches having two-deep contact blocks with the 22 mm plastic enclosures, be sure to use enclosures that are 74 mm deep; 51 mm-deep enclosures are too shallow and the switch body will not fit.

Contact Closure Sequence - 3-Position Switch

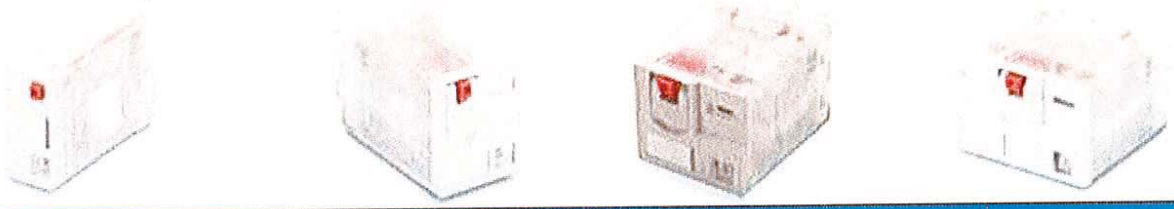
Contact Blocks	Contact Arrangement (viewed from front)		Switch Position (viewed from front)		
	Left	Right	Left (Note 1)	Center (Note 2)	Right (Note 3)
1 x NC	NC			X	X
		NC	X	X	
1 x NO	NO		X		
		NO			X
2 x NC	NC	NC	X	XX	X
2 x NO	NO	NO	X		X

Note 1: Left switch position activates left side contacts (viewed from front).
Note 2: Center switch position deactivates all contacts.
Note 2: Right switch position activates right side contacts (viewed from front).



Note: You will find our extensive line of accessories on pages A22-22 through A22-24, and A22-33.

† Note: All dimensions are in millimeters. 25.4mm = 1 inch. For example, 30 mm in inches = 30/25.4 = 1.181 inches.



Specification	781 Series	782 Series	783 Series	784 Series
Coil Voltages	110/120VAC, 220VAC, 24VAC, 24VDC	110/120VAC, 220VAC, 24VAC, 24VDC	110/120VAC, 220VAC, 24VAC, 24VDC	110/120VAC, 220VAC, 24VAC, 24VDC
Configuration	1PDT	2PDT	3PDT	4PDT
Contact Rating	15A	15A	15A	15A
Base Socket	5 pin spade terminal	8 pin spade terminal	11 pin spade terminal	14 pin spade terminal
Agency Approvals	UL Recognized (E191059), CE Approval pending, CSA 97899	UL Recognized (E191059), CE Approval pending, CSA Approval pending	UL Recognized (E225080), CE Approval IEC Std 947-4-1 and 947-5-1, CSA 40737	UL Recognized (E191059), CE Approval pending, CSA Approval pending
Prices starting at	<---->	<---->	<---->	<---->

The ice cube style relays are power relays designed for applications demanding high power control in various factory machines and control panels. They are ideal for electric control panels requiring stable and reliable relays.

Features

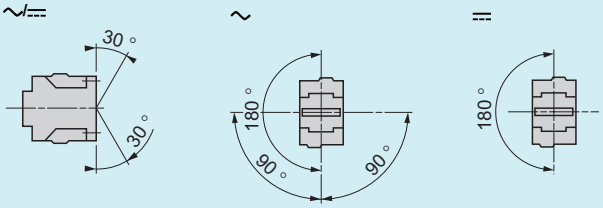
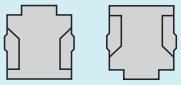
- Small package design
- Silver Cadmium Oxide gold flashed contact
- High open contact dielectric strength (1,000 VAC)
- High reliability and long life
- High vibration and shock resistance
- LED indicator on all models, so you can easily see if the relay is working properly without using a voltmeter
- Flag indicator shows relay status in manual or powered condition
- A pushbutton allows manual operation of the relay without the need for power to the coil
- Lock-Down door, when activated, holds push button and contacts in the operate position allowing circuits to be analyzed. **This feature is not available on 781 series.**
- SPDT, 2PDT, 3PDT and 4PDT models
- Finger grip cover allows easier removal of relays from sockets than conventional relays
- I.D. tag/write labels for identifying relays in multi-relay circuits

78 Series Relays Selection Guide

NOTE: Not recommended for low current switching. Find contacts' Minimum Switching Requirement on page 24-20.
For low current switching, please see the QM4N1 and QM4X1 series on page 24-8.

Part Number	Price	Coil Voltage	Configuration	Contact Rating	Dimensions	Relay Socket Part Number	Price	Dimensions
781-1C-24D	<---->	24VDC						
781-1C-24A	<---->	24VAC	SPDT	15A	Figure 1	781-1C-SKT	<---->	Figure 5
781-1C-120A	<---->	120VAC						
781-1C-240A	<---->	240VAC		12A				
782-2C-24D	<---->	24VDC						
782-2C-24A	<---->	24VAC	DPDT	15A	Figure 2	782-2C-SKT	<---->	Figure 6
782-2C-120A	<---->	120VAC						
782-2C-240A	<---->	240VAC						
783-3C-24D	<---->	24VDC						
783-3C-24A	<---->	24VAC	3PDT	15A	Figure 3	783-3C-SKT	<---->	Figure 7
783-3C-120A	<---->	120VAC						
783-3C-240A	<---->	240VAC		12A				
784-4C-24D	<---->	24VDC						
784-4C-24A	<---->	24VAC	4PDT	15A	Figure 4	784-4C-SKT-1	<---->	Figure 8
784-4C-120A	<---->	120VAC						
784-4C-240A	<---->	240VAC		12A				

TeSys contactors
Model d

Contactor type		LC1		D09…D18 DT20 and DT25	D25…D38 DT32 and DT40	D40	D50…D95	D115 and D150
Environment								
Rated insulation voltage (Ui)	Conforming to IEC 60947-4-1, overvoltage category III, degree of pollution: 3		**V**	690		1000		
	Conforming to UL, CSA		**V**	600				
Rated impulse withstand voltage (Uimp)	Conforming to IEC 60947		**kV**	6		8		
Conforming to standards				IEC 60947-1, 60947-4-1, NFC 63-110, VDE 0660, BS 5424, JEM 1038. EN 60947-1, EN 60947-4-1. GL, DNV, PTB, RINA pending				
Product certifications				UL, CSA Complies with SNCF, Sichere Trennung recommendations				
Separation insulation	Conforming to VDE 0106 part 101 and A1 (draft 2/89)		**V**	400				
Degree of protection *(1)* (front face only)	Conforming to VDE 0106							
	Power connection			Protection against direct finger contact IP 2X				
	Coil connection			Protection against direct finger contact IP 2X				
Protective treatment	Conforming to IEC 60068			"TH"				
Ambient air temperature around the device	Storage		**°C**	- 60…+ 80				
	Operation		**°C**	- 5…+ 60				
	Permissible		**°C**	- 40…+ 70, for operation at Uc				
Maximum operating altitude	Without derating		**m**	3000				
Operating positions *(2)*	Without derating in the following positions							
	Positions that are not permissible			For ⎓ contactors LC1 D09 to D38 				
Flame resistance	Conforming to UL 94			V1				
	Conforming to IEC 60695-2-1		**°C**	960				
Shock resistance *(3)* 1/2 sine wave = 11 ms	Contactor open			10 gn	8 gn	8 gn	8 gn	6 gn
	Contactor closed			15 gn	15 gn	10 gn	10 gn	15 gn
Vibration resistance *(3)* 5…300 Hz	Contactor open			2 gn				
	Contactor closed			4 gn	4 gn	4 gn	3 gn	4 gn

(1) Protection provided for the cabling c.s.a.'s indicated on the next page and for connection by cable.
(2) For other operating positions, please consult your Regional Sales Office.
(3) Without change of contact states, in the most unfavourable direction (coil energised at Ue).

Contactor type		LC1		D09 and D12 DT20 and DT25	D18 (3P)	D25 (3P)	D32	D38	D18 and D25 (4P) DT32 and DT40	D40	D50 and D65	D80 and D95	D115 and D150
Power circuit connections													
Connection by cable													
Tightening torque				Screw clamp terminals					Connector 2 inputs	Screw clamp terminals	Connector 1 input		Connector 2 inputs
Flexible cable without cable end	1 conductor		**mm²**	1…4	1.5…6	1.5…10	2.5…10		2.5…10	2.5…25	2.5…25	4…50	10…120
	2 conductors		**mm²**	1…4	1.5…6	1.5…6	2.5…10		2.5…10	2.5…16	2.5…16	4…25	10…120 + 10…50
Flexible cable with cable end	1 conductor		**mm²**	1…4	1…6	1…6	1…10		2.5…10	2.5…25	2.5…25	4…50	10…120
	2 conductors		**mm²**	1…2.5	1…4	1…4	1.5…6		2.5…10	2.5…10	2.5…10	4…16	10…120 + 10…50
Solid cable without cable end	1 conductor		**mm²**	1…4	1.5…6	1.5…6	1.5…10		2.5…16	2.5…25	2.5…25	4…50	10…120
	2 conductors		**mm²**	1…4	1.5…6	1.5…6	2.5…10		2.5…16	2.5…16	2.5…16	4…25	10…120 + 10…50
Screwdriver	Philips			N° 2	N° 2	N° 2	N° 2		N° 2	–	–	–	–
	Flat screwdriver Ø			Ø 6	Ø 6	Ø 6	Ø 6		Ø 6	Ø 6…Ø 8	Ø 6…Ø 8	Ø 6…Ø 8	–
Key for hexagonal headed screw				–	–	–	–		–	–	–	4	4
Tightening torque			**N.m**	1.7	1.7	2.5	2.5		1.8	5	5	9	12
Spring terminal connections *(1)*													
Flexible cable without cable end	1 conductor		**mm²**	2.5 (4: DT25)	4	4	4	–	10	–	–	–	
	2 conductors		**mm²**	2.5 (except DT25)	4	4	4	–	–	–	–	–	
Connection by bars or lugs													
Bar cross-section				–	–	–	–		–	–	–	3 x 16	5 x 25
Lug external Ø			**mm**	8	8	10	10		8 *(2)*	13	16	17	25
Ø of screw			**mm**	M3.5	M3.5	M4	M4		M3.5	M5	M6	M6	M8
Screwdriver	Philips			N° 2	N° 2	N° 2	N° 2		N° 2	N° 2	N° 3	–	–
	Flat screwdriver Ø			Ø 6	Ø 6	Ø 6	Ø 6		Ø 6	Ø 8	Ø 8	Ø 8	–
Key for hexagonal headed screw				–	–	–	–		–	–	–	10	13
Tightening torque			**N.m**	1.7	1.7	2.5	2.5		1.8	5	5	9	12
Control circuit connections													
Connection via cable (tightening via screw clamps)													
Flexible cable without cable end	1 conductor		**mm²**	1…4	1…4	1…4	1…4		1…4	1…4	1…4	1…4	1…2.5
	2 conductors		**mm²**	1…4	1…4	1…4	1…4		1…4	1…4	1…4	1…4	1…2.5
Flexible cable with cable end	1 conductor		**mm²**	1…4	1…4	1…4	1…4		1…4	1…2.5	1…2.5	1…2.5	1…2.5
	2 conductors		**mm²**	1…2.5	1…2.5	1…2.5	1…2.5		1…2.5	1…2.5	1…2.5	1…2.5	1…2.5
Solid cable without cable end	1 conductor		**mm²**	1…4	1…4	1…4	1…4		1…4	1…4	1…4	1…4	1…2.5
	2 conductors		**mm²**	1…4	1…4	1…4	1…4		1…4	1…4	1…4	1…4	1…2.5
Screwdriver	Philips			N° 2	N° 2	N° 2	N° 2		N° 2	N° 2	N° 2	N° 2	N° 2
	Flat screwdriver Ø			Ø 6	Ø 6	Ø 6	Ø 6		Ø 6	Ø 6	Ø 6	Ø 6	Ø 6
Tightening torque			**N.m**	1.7	1.7	1.7	1.7		1.7	1.2	1.2	1.2	1.2
Spring terminal connections *(1)*													
Flexible cable without cable end	1 conductor		**mm²**	2.5	2.5	2.5	2.5	–	2.5	–	–	–	–
	2 conductors		**mm²**	2.5	2.5	2.5	2.5	–	2.5	–	–	–	–
Connection by bars or lugs													
Lug external Ø			**mm**	8	8	8	8		8	8	8	8	8
Ø of screw			**mm**	M3.5	M3.5	M3.5	M3.5		M3.5	M3.5	M3.5	M3.5	M3.5
Screwdriver	Philips			N° 2	N° 2	N° 2	N° 2		N° 2	N° 2	N° 2	N° 2	N° 2
	Flat screwdriver Ø			Ø 6	Ø 6	Ø 6	Ø 6		Ø 6	Ø 6	Ø 6	Ø 6	Ø 6
Tightening torque			**N.m**	1.7	1.7	1.7	1.7		1.7	1.2	1.2	1.2	1.2

(1) If cable ends are used, choose the next size down (example: for 2.5 mm², use 1.5 mm²) and square crimp the cable ends using a special tool.

*(2) To connect cables with a c.s.a. > 4mm² and up to 10 mm², it is essential to use special connectors, sold in bags of 100 (reference: **LAD 96180**).*

TeSys contactors
Model d

Contactor type		LC1		D09 (3P)	DT20 D098	D12 (3P)	DT25 D128	D18 (3P)	DT32 D188	D25 (3P)	DT40 D258
Pole characteristics											
Rated operational current (Ie) (Ue ≤ 440 V)	In AC-3, θ ≤ 60 °C		**A**	9		12		18		25	
	In AC-1, θ ≤ 60 °C		**A**	25 *(1)*	20	25 *(1)*	25	32 *(1)*	32	40 *(1)*	40
Rated operational voltage (Ue)	Up to		**V**	690		690		690		690	
Frequency limits	Of the operating current		**Hz**	25…400		25…400		25…400		25…400	
Conventional thermal current (Ith)	θ ≤ 60 °C		**A**	25 *(1)*	20	25 *(1)*	25	32 *(1)*	32	40 *(1)*	40
Rated making capacity (440 V)	Conforming to IEC 60947			250		250		300		450	
Rated breaking capacity (440 V)	Conforming to IEC 60947			250		250		300		450	
Permissible short time rating No current flowing for preceding 15 minutes with θ ≤ 40 °C	For 1 s		**A**	210		210		240		380	
	For 10 s		**A**	105		105		145		240	
	For 1 min		**A**	61		61		84		120	
	For 10 min		**A**	30		30		40		50	
Protection by fuses against short-circuits (U ≤ 690 V)	Without thermal overload relay, gG fuse	type 1	**A**	25		40		50		63	
		type 2	**A**	20		25		35		40	
	With thermal overload relay		**A**	See pages 24514/2 and 24514/3, for aM or gG fuse ratings corresponding to the associated thermal overload relay							
Average impedance per pole	At Ith and 50 Hz		**mΩ**	2.5		2.5		2.5		2	
Power dissipation per pole for the above operational currents	AC-3		**W**	0.20		0.36		0.8		1.25	
	AC-1		**W**	1.56		1.56		2.5		3.2	
Control circuit characteristics, a.c. supply											
Rated control circuit voltage (Uc)	50/60 Hz		**V**	12…690							
Control voltage limits											
50 or 60 Hz coils	Operational			–							
	Drop-out			–							
50/60 Hz coils	Operational			0.8…1.1 Uc on 50 Hz and 0.85…1.1 Uc on 60 Hz at 60 °C							
	Drop-out			0.3…0.6 Uc at 60 °C							
Average consumption at 20 °C and at Uc ∼ 50 Hz	Inrush	50 Hz coil	**VA**	–							
		Cos φ		0.75							
		50/60 Hz coil	**VA**	70							
	Sealed	50 Hz coil	**VA**	–							
		Cos φ		0.3							
		50/60 Hz coil	**VA**	7							
∼ 60 Hz	Inrush	60 Hz coil	**VA**	–							
		Cos φ		0.75							
		50/60 Hz coil	**VA**	70							
	Sealed	60 Hz coil	**VA**	–							
		Cos φ		0.3							
		50/60 Hz coil	**VA**	7.5							
Heat dissipation 50/60 Hz			**W**	2…3							
Operating time *(2)*	Closing "C"		**ms**	12…22							
	Opening "O"		**ms**	4…19							
Mechanical durability in millions of operating cycles	50 or 60 Hz coil			–							
	50/60 Hz coil on 50 Hz			15							
Maximum operating rate at ambient temperature ≤ 60 °C	In operating cycles per hour			3600							

(1) Versions with spring terminal connections:
*16 A for **LC1 D093** and **LC1 D123** (20 A possible with 2 x 2.5 mm² cables in parallel), 25 A for LC1 D183 to LC1 D323 (32 A possible for LC1 D183 connected with 2 x 4 mm2 cables in parallel; 40 A possible for LC1 D253 and LC1 D323 connected with 2 x 4 mm2 cables in parallel).*

(2) The closing time "C" is measured from the moment the coil supply is switched on to initial contact of the main poles. The opening time "O" is measured from the moment the coil supply is switched off to the moment the main poles separate.

Selection : pages 24565/2 to 24572/5 | References : pages 24501/2 to 24502/3 | Dimensions : pages 24531/2 to 24531/5 | Schemes : pages 24532/2 and 24532/3

D32	D38	D40	D50	D65	D80	D95	D115	D150
32	38	40	50	65	80	95	115	150
50 *(1)*	50	60	80	80	125	125	200	200
690	690	1000	1000	1000	1000	1000	1000	1000
25…400	25…400	25…400	25…400	25…400	25…400	25…400	25…400	25…400
50	50	60	80	80	125	125	200	200
550	550	800	900	1000	1100	1100	1260	1660
550	550	800	900	1000	1100	1100	1100	1400
430	430	720	810	900	990	1100	1100	1400
260	310	320	400	520	640	800	950	1200
138	150	165	208	260	320	400	550	580
60	60	72	84	110	135	135	250	250
63	63	80	100	160	200	200	250	315
63	63	80	100	125	160	160	200	250
See pages 24514/2 and 24514/3, for aM or gG fuse ratings corresponding to the associated thermal overload relay								
2	2	1.5	1.5	1	0.8	0.8	0.6	0.6
2	3	2.4	3.7	4.2	5.1	7.2	7.9	13.5
5	5	5.4	9.6	6.4	12.5	12.5	24	24
12…690		24…660					24…500	
–		0.85…1.1 Uc at 55 °C					0.85…1.1 Uc at 55 °C	
–		0.3…0.6 Uc at 55 °C					0.3…0.5 Uc at 55 °C	
0.8…1.1 Uc on 50 Hz and 0.85…1.1 Uc on 60 Hz at 60 °C		0.8…1.1 Uc on 50 Hz and 0.85…1.1 Uc on 60 Hz at 55 °C					0.8…1.15 Uc on 50/60 Hz at 55 °C	
0.3…0.6 Uc at 60 °C		0.3…0.6 Uc at 55 °C					0.3…0.5 Uc at 55 °C	
–		200					300	–
0.75		0.75					0.8	0.9
70		245					280…350	280…350
–		20					22	–
0.3		0.3					0.3	0.9
7		26					2…18	2…18
–		220					300	–
0.75		0.75					0.8	0.9
70		245					280…350	280…350
–		22					22	–
0.3		0.3					0.3	0.9
7.5		26					2…18	2…18
2…3		6…10					3…8	3…4.5
12…22		20…26	20…26	20…26	20…35	20…35	20…50	20…35
4…19		8…12	8…12	8…12	6…20	6…20	6…20	40…75
–		16	16	16	10	10	8	–
15		6	6	6	4	4	8	8
3600		3600	3600	3600	3600	3600	2400	1200

TeSys contactors
Model d

Contactor type				LC1 D09…D38 LC1 DT20…DT40	LC1 or LP1 D40…D65	LC1 or LP1 D80 LC1 D95	LC1 D115 and LC1 D150
d.c. control circuit characteristics							
Rated control circuit voltage (Uc)	⎓		V	12…440	12…440		24…440
Rated insulation voltage	Conforming to IEC 60947-1		V	690			
	Conforming to UL, CSA		V	600			
Control voltage limits	Operational	Standard coil		0.7…1.25 Uc at 60 °C	0.85…1.1 Uc at 55 °C		0.75…1.2 Uc at 55 °C
		Wide range coil		–	0.75…1.2 Uc at 55 °C		–
	Drop-out			0.1…0.25 Uc at 60 °C	0.1…0.3 Uc at 55 °C		0.15…0.4 Uc at 55 °C
Average consumption at 20 °C and at Uc	⎓	Inrush	W	5.4	22	22	270 to 365
		Sealed	W	5.4	22	22	2.4…5.1
Average operating time at Uc *(1)*	Closing	"C"	ms	63 ± 15 %	85…110	95…130	20…35
	Opening	"O"	ms	20 ± 20 %	20…35	20…35	40…75
				Note : *The arcing time depends on the circuit switched by the poles. For all normal 3-phase applications, the arcing time is less than 10 ms. The load is isolated from the supply after a time equal to the sum of the opening time and the arcing time.*			
Time constant L/R (L/R)			ms	28	65	75	25
Mechanical durability at Uc	In millions of operating cycles			30	20	20	8
Maximum operating rate at ambient temperature ⩽ 60 °C	In operating cycles per hour			3600	3600	3600	1200
Low consumption control circuit characteristics							
Rated insulation voltage	Conforming to IEC 60947-1		V	690	–		
	Conforming to UL, CSA		V	600	–		
Maximum voltage	Of the control circuit on ⎓			250	–		
Average consumption d.c. at 20 °C and at Uc	Wide range coil (0.7…1.25 Uc)	Inrush	W	2.4	–		
		Sealed	W	2.4	–		
Operating time *(1)* at Uc and at 20 °C	Closing	"C"	ms	77 ± 15 %	–		
	Opening	"O"	ms	25 ± 20%	–		
Voltage limits (θ ⩽ 60 °C) of the control circuit	Operational			0.7 to 1.25 Uc	–		
	Drop-out			0.1…0.3 Uc	–		
Time constant L/R (L/R)			ms	40	–		
Mechanical durability	In millions of operating cycles			30	–		
Maximum operating rate	At ambient temperature ⩽ 60 °C		ops/h	3600	–		

(1) The operating times depend on the type of contactor electromagnet and its control mode. The closing time "C" is measured from the moment the coil supply is switched on to initial contact of the main poles.
The opening time "O" is measured from the moment the coil supply is switched off to the moment the main poles separate.

Selection : pages 24565/2 to 24572/5 | References : pages 24501/2 to 24502/3 | Dimensions : pages 24531/2 to 24531/5 | Schemes : pages 24532/2 and 24532/3

Characteristics of auxiliary contacts incorporated in the contactor

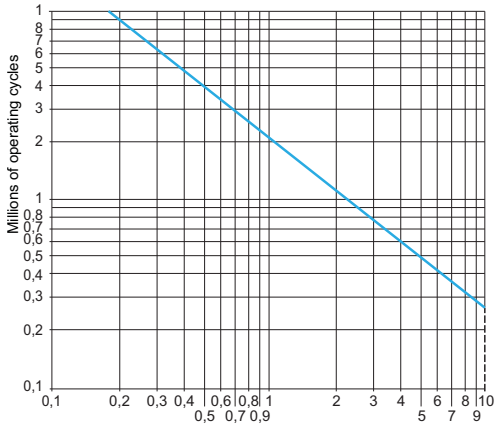
Mechanically linked contacts	Conforming to IEC60947-5-1			Each contactor has 2 N/O and N/C contacts mechanically linked on the same movable contact holder
Mirror contact	Conforming to IEC60947-4-1			The N/C contact on each contactor represents the state of the power contacts and can be connected to a PREVENTA safety module
Rated operational voltage (Ue)	Up to		**V**	690
Rated insulation voltage (Ui)	Conforming to IEC 60947-1		**V**	690
	Conforming to UL, CSA		**V**	600
Conventional thermal current (Ith)	For ambient temperature ≤ 60 °C		**A**	10
Frequency of the operational current			**Hz**	25…400
Minimum switching capacity $\lambda = 10^{-8}$	U min		**V**	17
	I min		**mA**	5
Short-circuit protection	Conforming to IEC 60947-5-1			gG fuse: 10 A
Rated making capacity	Conforming to IEC 60947-5-1, I rms		**A**	∼: 140, ⎓: 250
Short-time rating	Permissible for	1 s	**A**	100
		500 ms	**A**	120
		100 ms	**A**	140
Insulation resistance			**MΩ**	> 10
Non-overlap time	Guaranteed between N/C and N/O contacts		**ms**	1.5 on energisation and on de-energisation

Operational power of contacts
conforming to IEC 60947-5-1

a.c. supply, categories AC-14 and AC-15
Electrical durability (valid for up to 3600 operating cycles/hour) on an inductive load such as the coil of an electromagnet: making current (cos φ 0.7) = 10 times the power broken (cos φ 0.4).

	V	**24**	**48**	**115**	**230**	**400**	**440**	**600**
1 million operating cycles	**VA**	60	120	280	560	960	1050	1440
3 million operating cycles	**VA**	16	32	80	160	280	300	420
10 million operating cycles	**VA**	4	8	20	40	70	80	100

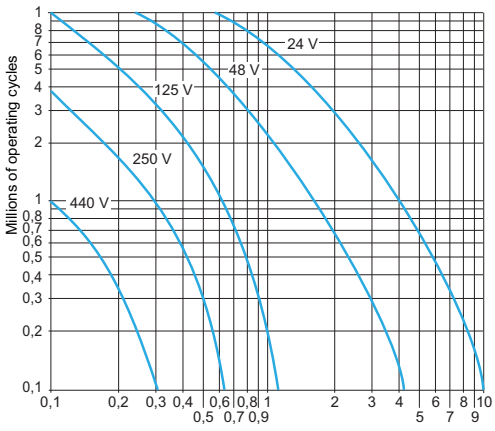
AC-15



d.c. supply, category DC-13
Electrical durability (valid for up to 1200 operating cycles/hour) on an inductive load such as the coil of an electromagnet, without economy resistor, the time constant increasing with the load.

V	**24**	**48**	**125**	**250**	**440**
W	96	76	76	76	44
W	48	38	38	32	–
W	14	12	12	–	–

DC-13



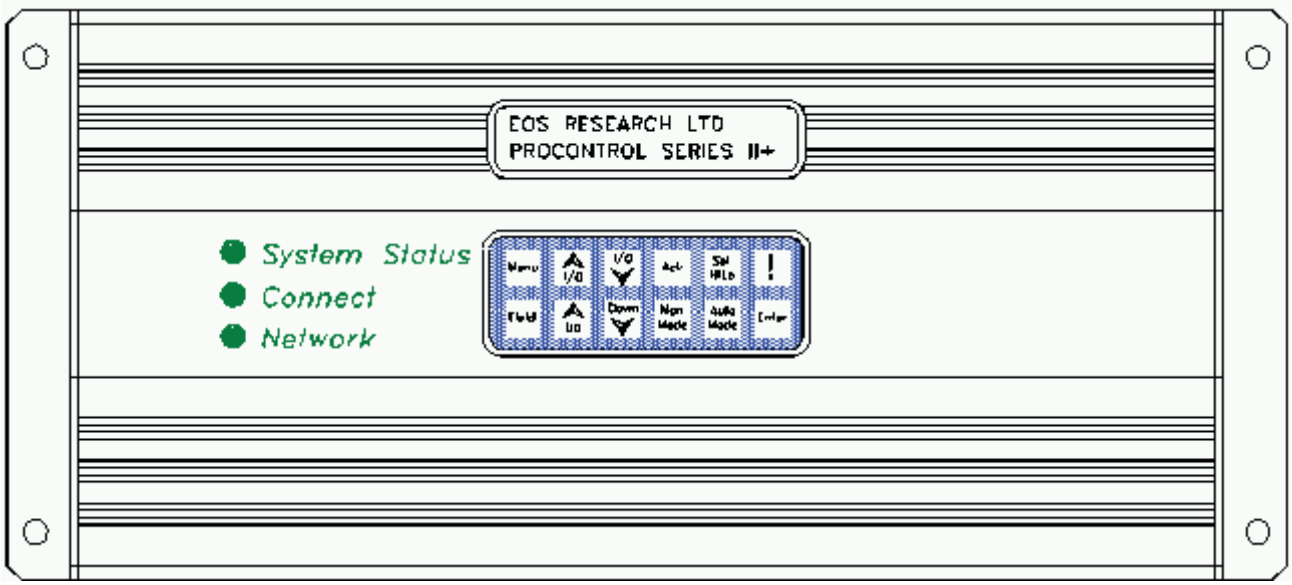
Programmable Logic Controller

ProControl Series 2^{plus} Type A

PROCONTROL SERIES 2*plus*

Type A

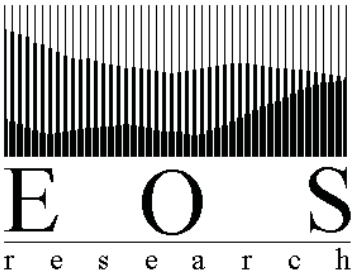
Product Specification



The next generation **Type A** ProControl features a capacity of up to 78 industrially-hardened inputs and outputs in a small and easy-to-use package. The **Series 2*plus*** contains everything you need for the core of your control/telemetry system, including the ability to drive motor starters, solenoids and other devices directly from built-in relay outputs. The **Series 2*plus*** includes expanded datalogging and reporting capability, a built-in power supply for your instruments and transducers, as well as pluggable connectors for all I/O. The **Type A** features higher I/O counts, large datalog memory, greater process control capacity, and a vacuum fluorescent display.

	Model A1	**Model A2**
Inputs		
Discrete	Sixteen (16) protected discrete inputs. Support for 4 flowmeters or pulse accumulators with rates to 500Hz.	Twenty-Four (24) protected discrete inputs (Eight of these are status inputs). Support for 4 flowmeters or pulse accumulators with rates to 500Hz.
Analog	Sixteen (16) 4-20ma inputs with built-in 24Vdc supply. Inputs are surge and short-circuit protected and may also be used as discrete inputs	Sixteen (16) 4-20ma inputs with built-in 24Vdc supply. Inputs are surge and short-circuit protected and may also be used as discrete inputs
Outputs		
Discrete	Twenty-Two (22) relay outputs rated at 1/2A, 120VAC	Thirty (30) relay outputs rated at 1/2A, 120VAC
Analog		Eight (8) 4-20ma outputs. PID loop control.
Price	**$3,495**	**$3,995**

	Model A1	Model A2
Datalogging		
Discrete	30,000 points standard. All logging occurs on change of state.	30,000 points standard. All logging occurs on change of state.
Analog	80,000 points standard (5000 per channel)	80,000 points standard (5000 per channel)
Event	10,000 points standard.	10,000 points standard.
Communications		
Modem	ProView Software, PC to ProControl Interface - 9600 baud.	
FAX	Alarm and Status Reports. Group 3, Class 2 FAX reporting at 9600 baud	
Pager	TAP standard numeric and alpha-numeric paging at 300 to 2400 baud.	
Local	Direct RS-232 Serial interface with automatic local/remote switching.	
e-mail	Via third-party service, alarm and status reports	
Network	Optional - Can be linked via RS-485 for distributed control or higher I/O counts	
User Interface		
Display	VFD (Vacuum Fluorescent Display) 2 x 20 character display	
Keypad	2 x 6 membrane keypad.	
LEDs	LEDs: System Status, Communications Link, Networking	
Process Control		
System	Up to 64 regular system processes total with 16 startup and 16 shutdown processes. Processes run every 0.35 seconds.	
Alarms	Generate shutdowns, two FAX reports and/or two Pager messages.	
Loops	PID loop control with user control of setpoint, proportional, integral and derivative gains and max change per calculation. Also open loop proportional algorithm.	
Power		
System	10VAC, 50VA, external transformer provided	
I/O Supply	24 VDC, 15V and 9V available for powering sensors/instruments.	
Environmental		
Dimensions	13.5” long x 6” wide x 3.5” high.	
Weight	7 lbs.	
Power Dissipation	30W	
Operating Temperature	-20C to +50C	
Humidity	95% R.H. non-condensing	



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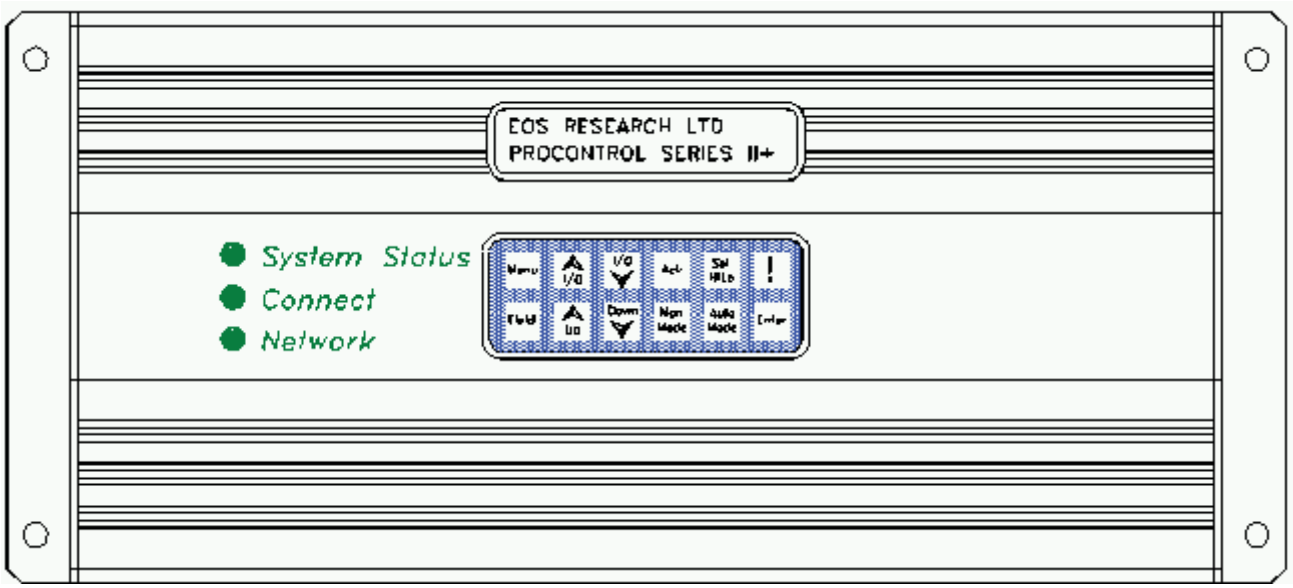
PROCONTROL

SERIES 2*plus* USER MANUAL



Version 2.X

LIMITED WARRANTY

EOS Research Ltd. (EOS) warrants its products to be free from defects in materials and workmanship for a period of one year from the date of purchase. Its obligation under this warranty is limited to repairing or replacing, at its sole option, any such defective products. This warranty includes parts and labor. This warranty does not apply to equipment which has been damaged by accident, negligence or misapplication or has been altered or modified in any way.

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This warranty gives you specific legal rights and you may also have other rights which vary from state to state.

IMPORTANT SAFETY PRECAUTIONS

Any complex hardware or software may be difficult to document, explain or understand. It is important to consider the consequences or unexpected or abnormal behavior which may be caused by a defect or human failure to comprehend. In order to protect people and property from damage, a thorough safety analysis should always be performed. When the consequences of a failure are serious, it is essential to protect life and property against such a failure with redundant backup systems or safety devices. It is agreed between the purchaser and EOS Research Ltd. that protection against and the consequences of any such failure are entirely the purchaser's responsibility.

This device is not approved for use in life support or medical systems.

As installed, this product may be part of a system which is required to meet various electrical, fire, safety or other codes and regulations. Compliance with these codes is the purchaser's responsibility.

Specifications subject to change without notice.

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TABLE OF CONTENTS

Please see the ProView manual for operation of the remote access software which is supplied with the ProControl Series **2*plus***.

1.0 SYSTEM OVERVIEW

1.1 General

The *ProControl Series* **2**^{plus} is a small but powerful microprocessor based control/ telemonitoring system. By combining a control panel and remote monitor in one unit, the Series **2**^{plus} can act as a central supervisory and data management tool for any stand-alone operation. The *ProControl Series* **2**^{plus} can perform multiple tasks:

- **Stand-Alone Control:** The *ProControl Series* **2**^{plus} is a sophisticated programmable logic controller that will efficiently supervise and control your operation. It can interface with up to 70 electrical devices (float switches, pressure transducers, pH transmitters, flow meters, pumps, blowers, etc.), and execute numerous control functions simultaneously. Automatic shutdown routines can be programmed in to protect you operation during alarm conditions. It is extremely versatile in terms of the control algorithms it can execute.

- **Remote Control and Monitoring:** The *ProControl Series* **2**^{plus} gives you a window into your operation from any remote location, using the easy-to-use Windows-based software supplied with the system. You communicate with the ProControl over a modem link, which allows you to view all of your system's operating conditions, while also providing the same access to control functions that you would have if you were at the site (e.g., turning pumps on and off, adjusting alarm setpoints, etc.). No other telemonitoring device gives you the ProControl's level of remote control capability.

- **Reporting:** The *ProControl Series* **2**^{plus} will keep you informed. It will send you periodic fax status reports of your project operations on a schedule specified by you, and will alert you immediately either by fax or by numeric or alpha-numeric pager if an alarm condition warrants attention. No longer do you have to assume what's happening at your remote operation.....the ProControl will tell you exactly.

- **Datalogging:** The *ProControl Series* **2**^{plus} is your information manager. It is a powerful datalogger that automatically records all operating conditions in its battery-backed memory. You can access your logged data remotely at any time, and download it to your office computer for further processing. The datalogging capability is an invaluable tool for reporting purposes, troubleshooting, and trend graphing.

One or more of these features can be used in your installation; they are standard in every ProControl unit.

1.2 Key Concepts

The following are the building blocks of any Series **2***plus* monitoring and control system.

Inputs and Outputs (I/O's)

No system can be effective in the real world without communication and one of the principal ways the ProControl communicates is by responding to information collected by sensors and by issuing "commands" to other electronic or electrical devices. Sensor information constitutes an *Input* while a "command" to another device constitutes an *Output*. The Series **2***plus* works with all of the more important types of I/O devices in general use. Appendix A demonstrates how a variety of I/O devices are connected to the ProControl.

Digital Inputs

These inputs are designed to detect the closure of switch contacts such as those found on float switches or overpressure sensors. They can respond to any normally open or normally closed dry contact. The Series **2***plus* provides its own wetting (supply) voltage of 5 volts DC for each digital input circuit. The Series **2***plus* can respond to changes in state as fast as 4 Hz or 3 Hz (cycles per second) depending on the model purchased. Digital inputs are "debounced" for 125 or 150 milliseconds, respectively. This means that a switch or other input that changes state (becomes open or closed) must stay in that state for 125 or 150 milliseconds before the Series **2***plus* will respond to the change.

Eight high-speed digital inputs can also be used for traditional digital (pulse-output) flow meters. These inputs can detect signal changes at up to a 200/500 Hz rate. All high-speed digital inputs are "debounced" for 1250/500 microseconds. The faster rate applies only to those systems containing the 18.432 MHz processor.

Analog Inputs

These inputs are compatible with sensors which send out a 4 - 20 milliamp (mA) signal. Most analog sensors are available with this type of signal, examples being pressure transducers, pH transmitters, and many flow meters. These inputs allow the operator to read the actual "value" of a parameter, such as pressure, instead of an on/off signal.

Digital Outputs

Digital outputs turn things like pumps, solenoid valves, and alarm lights on and off. The Series **2***plus* digital outputs are relay outputs designed to switch small loads directly, such as motor starters, lamps, and solenoid valves.

Analog Outputs

Analog outputs are typically used in process control schemes where a controlled piece of equipment can accept a signal which is variable over a range. This output is expressed as a percentage (0 - 100%) and is used to control pump speeds, chemical dosing rates, etc., instead of conventional on/off operation. The equipment that the ProControl sends the analog output to must accept a 4 - 20 mA signal. Often, an analog output is used in conjunction with an analog input such as a pH transmitter to form a control scheme known as *feedback control*. In essence, the input and output will work together to maintain a user set input level. This concept is described further in the next section under *Analog Output Processes*.

Tagnames

Each input and output is given a descriptive *Tagname* by the user that uniquely identifies it to the system operator. For instance, a digital input could be called "TANKHI", an analog input could be called "AIRFLO" and a digital output could be called "PUMP_1". This tagname is used by the local LCD display, the FAX report and by the ProView software. The analog inputs are also given a *Units Tagname* which identifies the unit of measure associated with the input sensor. Each tagname can be up to six characters long and each units tagname can be up to three characters long ("PSI", for instance). The tagnames can include the uppercase letters A-Z, the numbers 0-9, a blank space, and the underscore (_) character.

1.3 Control Basics

The status of all inputs or outputs can easily be monitored both locally and remotely. What gives the Series **2*plus*** its real power, however, is the ability to automatically initiate actions based on the status of the inputs and your pre-programmed instructions (this is often called *Process Control*). These actions can include switching certain outputs, faxing back a report, sending an alphanumeric or numeric page, shutting down the entire system or sounding the local alarm. Process control functions are programmed into your ProControl by EOS Research or one of our technology partners according to your specifications.

Active State

Central to the use of control on the Series **2**^{plus} is the concept of *Active State*. Each input on the ProControl receives certain signals from a sensor which constitute "normal" operation and other signals which constitute an exception to normal operation.

A digital input can monitor only two states, ON or OFF (alternatively, CLOSED or OPEN). The *Active State* would be the state in which the controller would respond to the digital input, and perform certain actions or generate an alarm. For example, if a high level float switch in a tank is tripped (turned ON) by rising fluid level, we can say that its *Active State* correlates to a situation in which the fluid level is high. The active state of the float switch could cause the Series **2**^{plus} to trigger an alarm, turn off a pump, or initiate some other action. The Series **2**^{plus} can be set up so that either ON or OFF is the active state.

An analog input sensor can take on many states (or values) between the minimum and maximum of its measurement range. The ProControl operator, however, can set two threshold values which divide the total input span into two functional regions. These threshold values are more commonly called the *Low Alarm Limit* and the *High Alarm Limit*, although on the Series **2**^{plus} these thresholds are somewhat more flexible in use than those names imply. An analog input which has transcended either its Low Alarm Limit or High Alarm Limit is said to be in its active state.

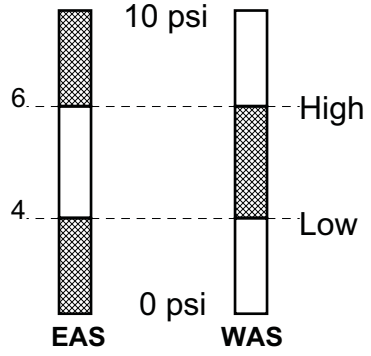


Figure 1. Active State

For instance, consider an analog input sensor which measures pressure from 0 to 10 PSI. The system operator could set the low limit to 4 PSI and the high limit to 6 PSI. In this case the *Active State* would usually be considered as the input state greater than 6 PSI or less than 4 PSI. This interpretation is called *Endpoint Active State* (EAS) on the Series **2**^{plus} because the endpoints of the range are the areas which need to trigger action or generate alarms. The opposite interpretation is also possible and is called *Window Active State* (WAS). Any input values between 4 PSI and 6 PSI would trigger action or generate alarms.

If the ProControl has *Alarms Set*, when any input enters its active state, a local beeper will sound on the ProControl. The word *Alarm* here applies only to the sounding of a local beeper and is not associated with any process control. The active state condition is indicated on the LCD display and can be acknowledged by the operator. The beeper is silenced when it has been acknowledged or after 30 seconds have elapsed. The beeper only operates when the system is operating in Manual mode.

Startup Sequence

The *Startup Sequence* is a series of control algorithms or steps which run in succession and which are designed to place the system in its normal operating mode. It can be as simple as turning all the outputs on simultaneously, or as complex as a multi-stage delay with many conditions. Up to 8 or 16 individual startup steps can be declared depending on the model of the controller. The ProControl can be configured to automatically run this sequence when the unit is powered up.

Process Tasks

A *Process Task* is an ongoing control algorithm which runs continuously. Think of each process task as an IF-THEN statement, in which an action is initiated if a certain condition or combination of conditions exists. Some examples are:

- IF Tank Level Sensor 2 is on, THEN turn Pump 2 off
- IF Air Flow Rate < 10 cfm AND Reactor Temperature > 250^{o}, THEN open Bleed Valve 2

Up to 16 or 64 separate process tasks can be run simultaneously depending on the model of the controller. Process tasks can trigger FAX reports, pager alerts, and system shutdowns.

Shutdown Sequence

The *Shutdown Sequence* is a series of control steps which run in succession and which are designed to shut your system down in a manner which is best for the equipment or treatment processes involved. The shutdown sequence can be activated manually or automatically due to an alarm condition. Here is a typical shutdown sequence:

- Turn off Well Pumps 1 and 2
- Wait 5 minutes, then turn off Stripper Blower
- Open Bleed Valve 2
- When Oxidizer Temperature < 150^{o}, turn off SVE Blower

Automatic Operation

The use of the startup sequence, process tasks, and the shutdown sequence constitutes *Automatic Operation* of your system with the ProControl Series ***2^{plus}*** (otherwise known as *Auto Mode*). The Series ***2^{plus}*** will be placed into auto mode (automatically) when your system has been started up using the programmed startup sequence. If one condition of the programmed startup sequence is not met during the startup process, your system will be completely shut down by the ProControl as a safety measure. Once the startup sequence has been successfully completed, the ProControl begins running the process tasks continuously. **PROCESS TASKS WILL RUN ONLY WHEN IN AUTO MODE**. Please note that the audible beeper will not sound even if the ProControl has *Alarms Set* when it is in Auto Mode, since the process tasks will control these situations as the user has specified.

Manual Operation

You can override the Series **2**^{plus} programmed control functions by operating in *Manual Mode*. In manual mode, your process will respond only to operator input from the keypad of the ProControl, or to commands issued from the ProView software. **PLEASE NOTE THAT PROCESS TASKS AND THEIR ERROR-CHECKING MECHANISMS DO NOT RUN DURING MANUAL MODE!** Manual mode is useful when you wish to troubleshoot your system, but none of the system safeguards built into auto mode are available. You can place your operation into auto mode any time by issuing the command from the keypad.

Analog Output Processes

In some cases, you may want to use an analog output to control equipment that maintains an analog input at a certain constant level. For example, you may wish to automatically maintain a pH of 8.5 in a reaction tank by varying the dosing rate of a chemical feed pump. The pH you wish to maintain (8.5) is called the *SetPoint* of the analog output process. An analog input to the ProControl (in this case, a pH transmitter) is said to provide *feedback* to the unit, and combined with an analog output, constitute *feedback control*.

PID Loops

A reliable type of feedback control can be obtained through a *PID Loop*. PID stands for *Proportional-Integral-Derivative*, and is a commonly-used process control technique. We'll skip the details of the mathematics involved, but suffice it to say that a PID loop is the favored control technique for most analog output processes. With only a *Proportional* term applied in the equation, the analog output is controlled based on an error signal generated from the difference between the SetPoint and the actual analog input. The PID loop can also improve its performance as it continues to run if an *Integral* term is used and can respond to quick changes in the controlling analog input if a *Derivative* term is used. EOS Research will configure your PID loops for you and can provide further information if necessary.

Proportional Outputs

In some cases, it may be desirable to base an analog output signal on an analog input value. In this situation, no specific SetPoint is used because there is a direct relationship between the output and input values. For example, if you wanted to base the output of a metering pump on some flow rate, you might use a proportional output to relate the amount of chemical metered to the flow rate.

2.0 ON-SITE OPERATION

2.1 LCD Display

If your unit did not come with an LCD display, the following sections *do not* apply.

The 2 line x 20 character LCD display is used to display and control system operations. The display is divided into separate areas or fields, as outlined below.

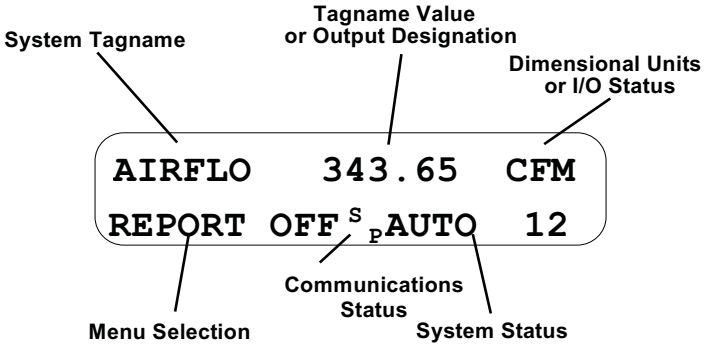


Figure 2. Display Fields

System Tagname This six-character field is used to identify the I/O point displayed. Descriptive names such as WELL1 or BLOWER are used.

Tagname Value For analog inputs, this field displays the value of the input, the high alarm limit, or the low alarm limit. For digital outputs, OUTPUT is displayed. For digital inputs, this field is unused. For analog outputs, this field displays the output percentage, the output level, or the associated input setpoint.

Dimensional Units or I/O Status For analog inputs, this three-character field displays the dimensional units associated with the input sensor, such as GPM or PSI. For digital inputs and outputs, this field displays either ON or OFF. For analog outputs, this field abbreviates percent with PCT. In the case of digital outputs, if the particular output displayed has been designated a lamp output (*see ProView manual*), and a lamp test is currently running, an asterisk (*) will appear before ON or OFF to indicate the lamp is illuminated despite the indicated output status (the output will return to this indicated status once the lamp test has been completed).

Menu Selection This field displays the current menu selection.

Communications Status

This field displays one of five different descriptors which indicate any of several special functions of the ProControl. If no communications action is being taken, ">" will appear. Communications messages include: **SP** (Sending Page) - indicates that the unit is attempting to send either an alphanumeric or numeric page; **EF** (Encoding Fax) - indicates that the unit is presently encoding a facsimile report as a result of a request by either the operator or the unit itself; **SF** (Sending Fax) - indicates that the unit is attempting to send a fax report; and **DC** (Data Communications) - indicates that the unit is presently interfaced with ProView.

System Status

This area displays the current system status: AUTO, MANUAL, START, or SHUTD and an associated process task number indicating the last successfully completed Auto process, current Startup process, or current Shutdown process.

2.2 Keypad

The Series **2**^{plus} keypad contains 12 buttons which are used along with the LCD Display to control the operations of the system.

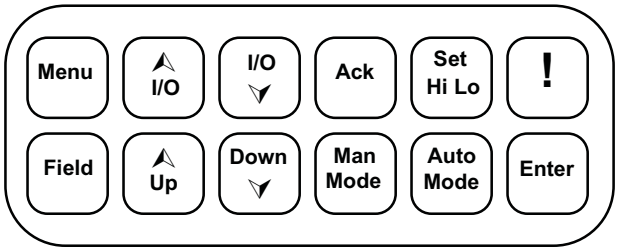


Figure 3. Series 2^{plus} Keypad

Menu

This key is used to scroll through a series of options which are displayed on the LCD screen, and which allow the user to configure various aspects of system behavior.

I/O I/O

These keys are used to display information about particular I/O points on the LCD Screen. The keys allow the user to scroll through all of the system I/O points either forward or backward.

Ack

The Acknowledge key is used to silence the audible beeper or to acknowledge a memo sent from a remote ProView user.

Set Hi Lo

The Set Hi Lo key allows the user to change the high and low alarm limits for analog inputs or to toggle the display in the I/O Summary.

!

The Emergency Shutdown key is used to turn off all outputs and return the system to manual mode. The programmed shutdown sequence is <u>not</u> executed using this key.

Field

The Field key is used to select a character position to be edited. It is used in conjunction with any direct alphanumeric entry.

Up Down

These keys are used to toggle system variables from one state to the next or to scroll through possible character entries when used in conjunction with the Field key.

Man Mode

This key is used to place the system in manual mode.

Auto Mode

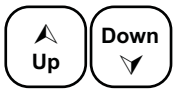
This key is used to place the system in auto mode.

Enter

The Enter key is used to initiate certain actions selected by other keys or to confirm alphanumeric editing done using other keys.

2.3 Password

When the system is first turned on the password screen is displayed and the user is prompted to enter the password to gain access to the system. "EOS" is the default password. The password on the Series **2**^{plus} was designed as a *low-level* security feature. It is not sufficient in and of itself to withstand a determined effort at system entry. The ProControl unit can be configured to bypass the password screen when the unit is powered up.




```
CUSTOMER ID TAGNAME
ENTER PASSWORD: BAA
```

Use the Up and Down keys to change the character displayed above the cursor.


```
CUSTOMER ID TAGNAME
ENTER PASSWORD: BAA
```

The Field key is used to move the cursor to the next character to be edited.


```
CUSTOMER ID TAGNAME
ENTER PASSWORD: EOS
```

The enter key submits the password for approval.

If the password was entered correctly, the following screen will be displayed for about a second before the operations screen is displayed:

```
Password Accepted
VER 2.XXX    : 1
```

ROM Version # — User Setup Version #

Otherwise, the following message will be displayed for a second and the user will be returned to the password menu:

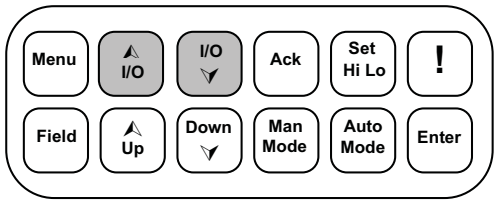
```
Incorrect Password
```

2.4 Operations Screen

After the password has been entered correctly, the operations screen is displayed. The operations screen allows the user to set system parameters and to review the status of all system inputs and outputs.

```
WELL1              OFF
ALARMS SET >MANUAL
```

2.5 I/O Keys



Pressing the I/O Up or I/O Down keys will scroll through the operational I/O points in the system. Data relevant to a particular I/O point will be displayed to right of the point's Tagname.

I/O

```
WELL2                ON
ALARMS SET >MANUAL
```

Forward scroll through I/O points

I/O

```
WELL3                OFF
ALARMS SET >MANUAL
```

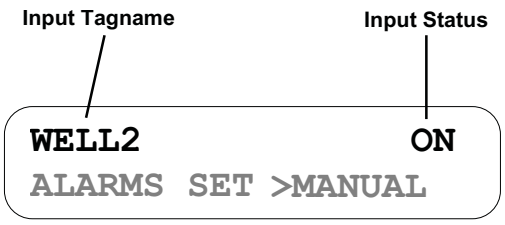
Forward scroll through I/O points

I/O

```
WELL2                ON
ALARMS SET >MANUAL
```

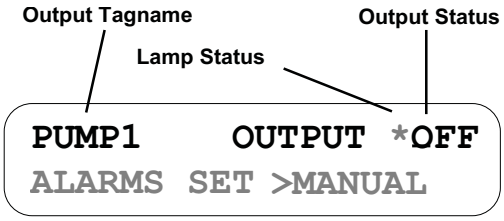
Backward scroll through I/O points

2.6 Digital Input Menu



A digital input displayed in the operations screen will be displayed as shown. When the input is in its Active State "ON" will be displayed in the Input Status area. Otherwise, "OFF" will be displayed.

2.7 Digital Output Menu



A digital output displayed in the operations screen will appear as shown. When the output has been turned on, "ON" will be displayed in the Output Status area. Otherwise, "OFF" will be displayed. The cursor is displayed under the first character in the status field to indicate that it can be changed. The Lamp Status character (*) will be shown for a lamp output if a *lamp test* is running regardless of the output's true state.

Up Down

```
PUMP1     OUTPUT   ON
ALARMS SET >MANUAL
```

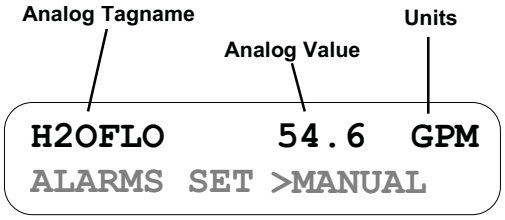
Pressing the Up or Down key will toggle the digital output state and turn the corresponding relay OFF or ON.

Field

```
PUMP1     OUTPUT   ON
ALARMS SET >MANUAL
```

Pressing the Field key will move the cursor to the Menu selection field.

2.8 Analog Input Menu



An analog input displayed in the operations screen will be displayed as shown to the left. The value of the analog input will be shown along with the dimensional units. In the case of a pulse accumulator (totalizer only), you will see only TOT where units is normally displayed.

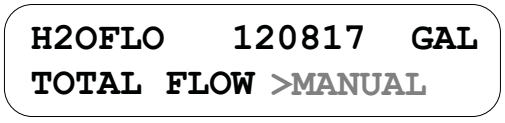
Set Hi Lo

Use the Set Hi Lo key to set the low alarm limit.

Set Hi Lo

Press the Set Hi Lo key again to set the high alarm limit.

Set Hi Lo



Press the Set Hi Lo key again to see the total flow on a flow type input, and once more to return.

Up Down

The Up and Down keys are used to change the value of the current character, as denoted by the cursor.

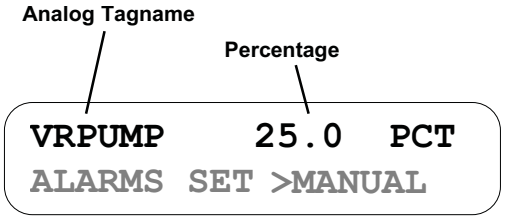
Field

The Field key is used to move to the next character to be edited.

Enter

To save the low alarm limit changes, press the enter key.

2.9 Analog Output Menu

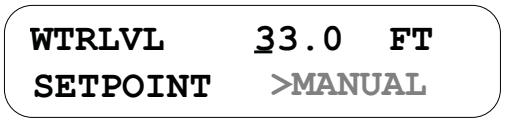


An analog output displayed in the operations screen will be displayed as shown to the left. The percentage of full scale output will be displayed as well.

Set Hi Lo

The Set Hi Lo key can be used to set the output percentage.

Set Hi Lo



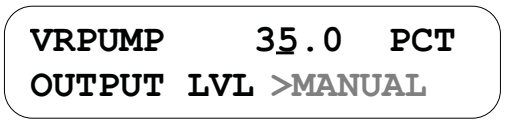
Press the Set Hi Lo key again to declare the SetPoint of an associated analog input. The SetPoint is used only if a PID control loop is in use as an analog output process.

Pressing Set Hi Lo again returns to the original menu.

Up Down

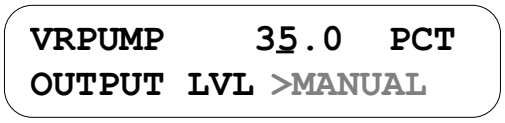
The Up and Down keys are used to change the value of the current character, as denoted by the cursor.

Field



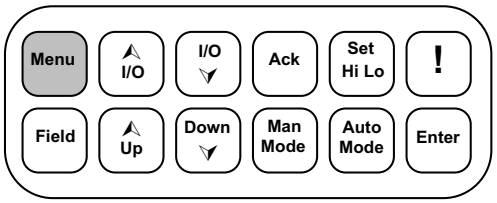
The Field key is used to move to the next character to be edited.

Enter



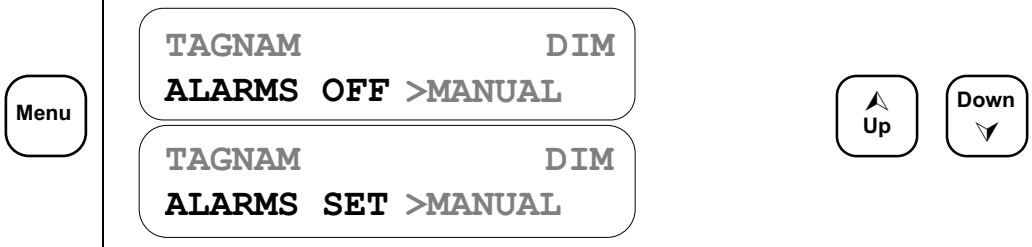
To save the output level changes, press the enter key.

2.10 Menu Key

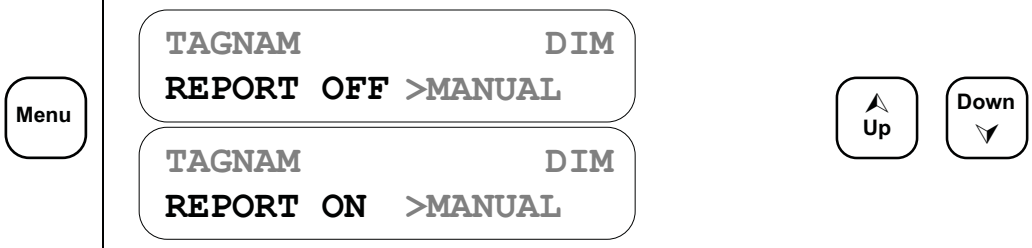


When pressed, the Menu key will scroll through a series of items which allow the user to configure various aspects of system behavior. A description of these items appear in a 10 character field at the bottom left of the display. Either the Up and Down keys or the Enter key is used to change the item.

ALARMS Use the Up and Down keys to enable or disable Alarms.



REPORT Use the Up and Down keys to enable or disable the unit's reporting capabilities (fax or page).



FAX NOW Use the Enter key to send a FAX report immediately.

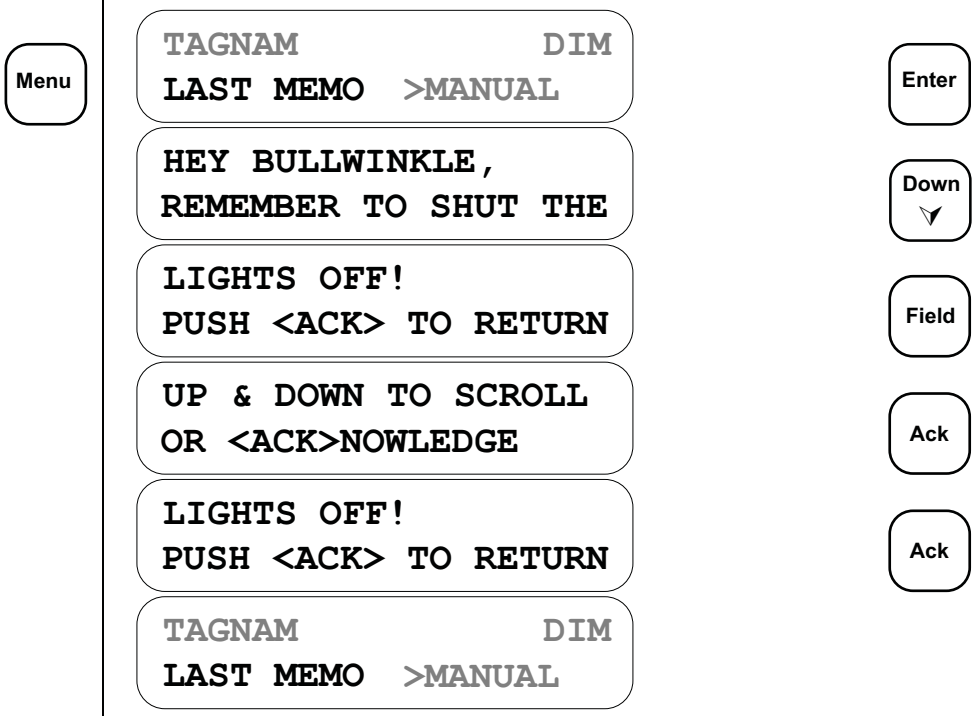
STARTUP Use the Enter key to run the Startup Sequence.

SHUTDOWN Use the Enter key to run the Shutdown Sequence.

LAST SHUTDOWN This display item shows what input or output caused the last shutdown.

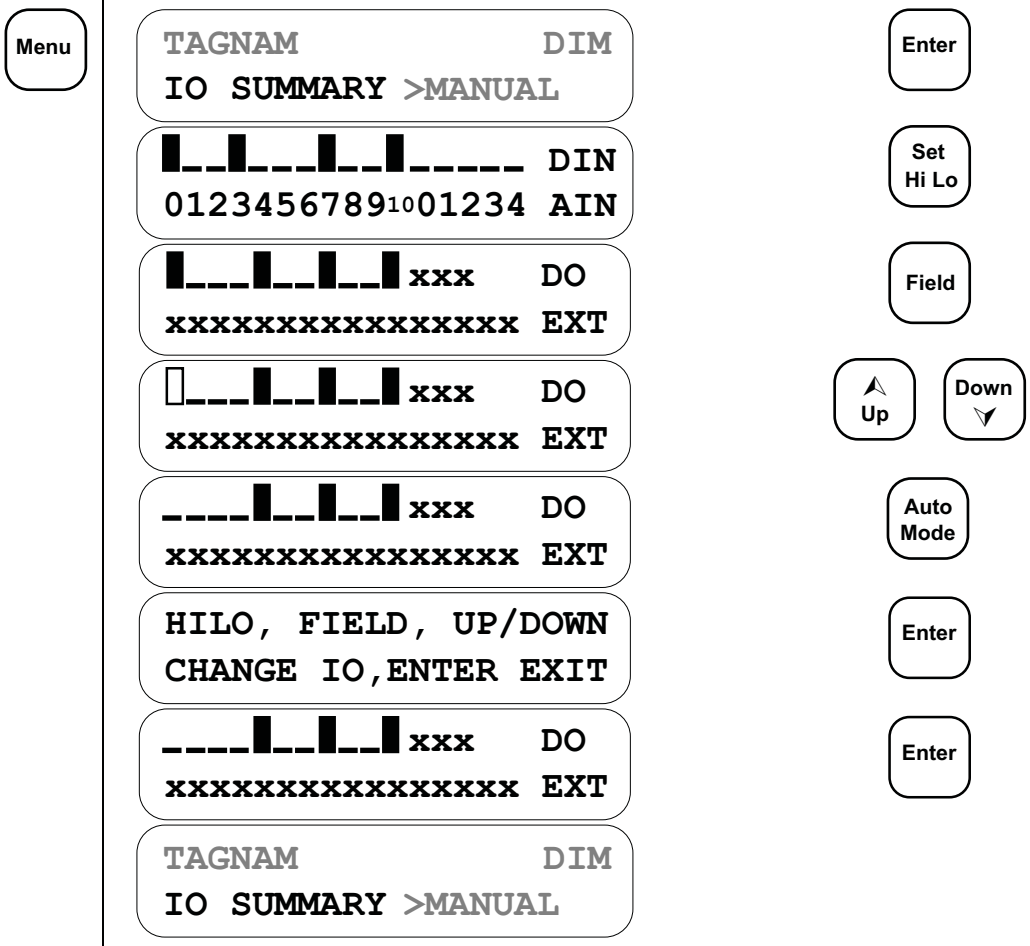
LOG OFF Use the Enter key to Log Off the system and return to the password menu.

LAST MEMO Use the Enter key to see the last memo sent from the remote ProView user. Up and Down are used to scroll through the message, and Ack is used to return to the ProControl menus. If you hit any other key you will see an informative message telling you which keys are valid. The message will be displayed for 3 seconds if no keys are pressed, but can be acknowledged before the 3-second period by pressing either the Ack or Enter keys.

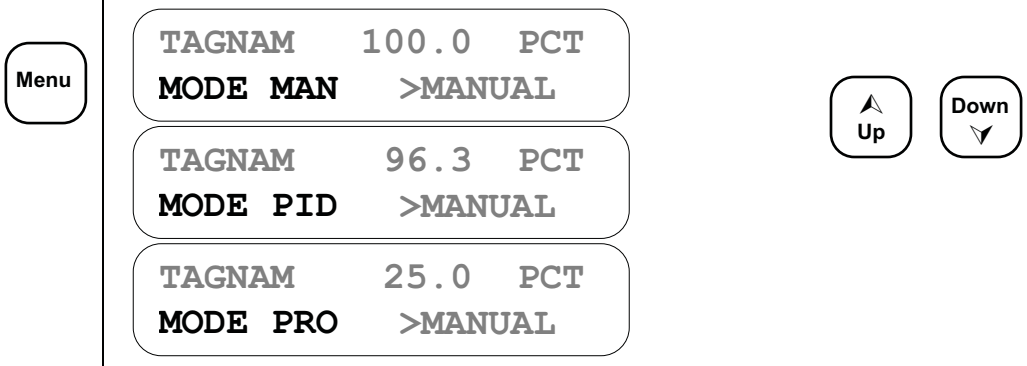


IO SUMMARY

Use the Enter key to enter the I/O summary. The analog input values 0-10 represent a percentage of full scale (i.e. 0 ≅ 4 mA, 5 ≅ 12 mA). Set HiLo is used to toggle between input/output summaries. An underscore represents an open input or an unswitched output. A block indicates a closed input or a switched output. An **x** or **X** is displayed when an output is not enabled and is unswitched or switched, respectively. An asterisk (*****) will be displayed if an output is declared as a lamp and a lamp test is currently being performed. The Field key can be used to move the blinking cursor through the outputs. The Up/Down keys can be used to toggle the state of the output whose position is covered by the blinking cursor. The Enter key will return the ProControl back to its standard menus. If you press any other keys you will see an informative message telling you which keys are valid. The message will be displayed for 3 seconds if no keys are pressed, but can be interrupted before the 3-second period by pressing the Enter key.

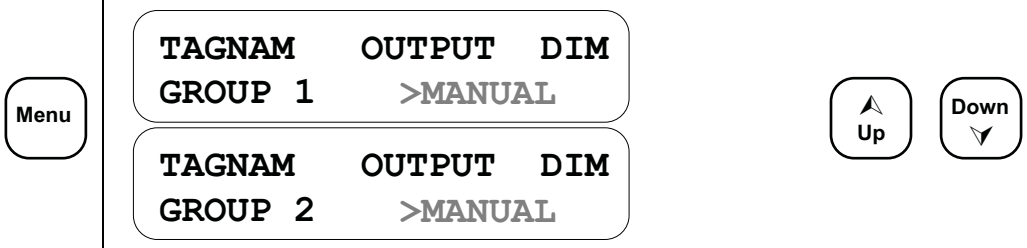


MODES Use the Up and Down keys to toggle an Analog Output from Manual control to PID control or Proportional control, depending on which analog output process is being used. This selection will only appear if an analog output tagname is displayed and the analog output is part of an analog output process.



GROUP The ProControl allows outputs to be assigned to different *Groups* to allow greater process control flexibility. In some cases, you may wish to be able to specify alternate process tasks for a given output. For instance, you can have the operation of a pump be controlled by a series of level switches in a tank, or alternately, the pump can be run on a timed cycle. By selecting the appropriate process Group, you can change the control strategy for that piece of equipment. EOS Research will configure the groups for you according to your specifications

Use the Up and Down keys to select a Group for the displayed output. This menu item is displayed only for outputs that have been configured by EOS to have alternate process Groups.



2.11 LED Indicators

Your ProControl unit has three status LEDs to the left of the keypad, which are used to indicate the following:

System Status: Normally ON when unit is powered.
One blink - The system has internally reset.
Two blinks - An internal error has occurred.

Connect: ON if user is remotely or locally connected.
ON if system is faxing or paging.
Slow blink - last fax or page failed, press ACK to clear.
Fast blink - local connect cable inadvertantly left plugged in, press ACK to clear.

Network: Rapid blinking indicates an active network connection.

3.0 REPORTING FEATURES

3.1 Fax Report

The ProControl unit will keep you informed of your system's operations with facsimile status reports. With the supplied ProView software you can configure the unit to send fax reports to up to two different numbers. You can also have these reports sent on a daily basis, at regular intervals during the day, or when triggered by specific process tasks. You can send one at any time by using the *Fax Now* option either from the menu on the ProControl's display, or through the ProView software.

The fax report you receive will contain several fields, each denoted by a shadow box. The number of fields will depend on the configuration of your system. For instance, you would not see a field indicating *Analog Outputs* if your system does not contain any of these.

The fields as you will see them are shown below. All information enclosed in brackets is variable and depends on your particular system configuration.

To:

```
<FAX RECIPIENT>
```

will indicate the intended fax recipient's name.

From:

```
THE <SYSTEM NAME>          SYSTEM IN <SITE LOCATION>    AT <TIME> ON <DATE>
SETUP VERSION X       :    ROM VERSION 2.x          :   MODEL B1
```

will indicate the name and location of your system, the date and time at which the fax report was initiated, your current ProView setup version, and the current on-board software version 2.X.


```
<MODE><PXX>  :   LAST SHUTDOWN AT <TIME> ON <DATE> BY <SHUTDOWN CAUSE>
                 FAX REPORT INITIATED BY <FAX CAUSE>
```

will indicate the current <MODE> of the controller and associated process. For example, if the controller is running the startup or shutdown sequence, you would see either START or SHUTD followed by the current algorithm. Similarly, in auto mode, you would see AUTO followed by the last successfully completed process task.

The LAST SHUTDOWN indicates when the system last initiated the shutdown sequence and what caused it to happen. For example, if the shutdown sequence were initiated by a key press, the cause you would see would be KEYPAD. Similarly, if the shutdown sequence were caused by a process task such as a high pressure sensor whose tagname was HIPRES, you would see HIPRES as the <SHUTDOWN CAUSE>. If multiple inputs or outputs caused the shutdown (i.e. a process task was dependent on more than one input being in the active state and/or multiple outputs being ON), the most recent one which changed will appear as the cause.

Similarly, the FAX REPORT INITIATED BY line will indicate the tagname of the I/O point which caused the fax to be sent, provided there was only one I/O point responsible. If multiple I/O points were responsible, the process itself will be indicated. Consider, for example, a process task where a shutdown was caused by HIPRES and BLOWER, and a fax was also generated. The <FAX CAUSE> would be PROCESS XX, where *XX* is the number from 1 - 64 of this process task. In the case where *Fax Now* was selected from the menu option on the LCD, the <FAX CAUSE> would be KEYPAD. The <FAX CAUSE> from a ProView generated *Fax Now* command would be REMOTE. This line will <u>not</u> appear on daily or interval scheduled fax reports.

Discrete Inputs:

```
<TAGNAME> is <STATE>   <TAGNAME> is <STATE> ...
```

will indicate the status of all of the digital inputs in four columns. Inputs which are in the active state will appear as ON and those which are in their normal state will appear as OFF.

Discrete Outputs:

```
<TAGNAME> is <STATE>   <TAGNAME> is <STATE> ...
```

will indicate the status of all of the digital outputs in four columns.

Analog Inputs:

```
<TAGNAME> is <VALUE> <DIM> LIMITS are L: <LO-LIM> <DIM> H: <HI-LIM> <DIM>
<TAGNAME> is <VALUE> <DIM> TOTAL FLOW is <FLOW>   <DIM>
<TAGNAME>                  TOTAL FLOW is <FLOW>   <DIM>
...
```

will indicate the current value, dimensional units, low alarm limit, and high alarm limit for all analog inputs which are not flow-type inputs. The precision of the values displayed can be selected through ProView. Any flow-type analog input which is responsible for maintaining a total flow will display that flow in place of the alarm limits. Any pulse-type digital input used for a digital flow meter will appear here since the information being obtained by that type of flow meter is analog in nature. In addition, pulse accumulators (volume totalizers) will appear here.

Analog Outputs:

```
<TAGNAME>   <PCT>  PCT  <MODE>      <TAGNAME>   <PCT>  PCT  <MODE>
...
```

will indicate the output percentage and mode of operation of all analog outputs. The precision is fixed to one decimal place and will range from 0.0 to 100.0, expressed as a percentage. The <MODE> of operation will be PID if the analog output is currently being used in a PID loop, or PRO if the analog output is currently being used in a Proportional scheme, otherwise it will be MAN indicating that the analog output is under manual control.

The next two pages contain examples of scheduled and alarm fax reports.

ProControl Series II+

EOS Research Ltd.

Fax Report

To:

BULLWINKLE J MOOSE

From:

THE NORTH WATER SUPPLY SYSTEM IN MAYBERRY USA @ 09:44:00 ON 12/10/1999
SETUP VERSION 1 : ROM VERSION 2.156 : MODEL B2

System Status:

AUTO P04 : NO PREVIOUS SHUTDOWN

Discrete Inputs:

WEL1LO is OFF	WEL2LO is OFF	TWR_HH is OFF	TNK_HH is OFF
RESET is OFF			

Discrete Outputs:

WLPMP1 is ON	WLPMP2 is ON	FINPMP is ON	CHLMET is ON
NAOMET is ON	PH_ALM is ON	CL_ALM is ON	TWRALM is OFF
WL1ALM is OFF	WL2ALM is OFF	TNKALM is OFF	

Analog Inputs:

TWRLVL is 59.2	FT	LIMITS are	L: 8.0	FT	H: 70.0	FT
TNKLVL is 0.00	FT	LIMITS are	L: 8.00	FT	H: 12.00	FT
FINFLO is 501.3	GPM	TOTAL FLOW is	14794	GAL		
FLOW_2 is 399.3	GPM	TOTAL FLOW is	12561	GAL		
FLOW_1 is 0.0	GPM	TOTAL FLOW is	0	GAL		
FIN_PH is 0.00	PH	LIMITS are	L: 6.00	PH	H: 8.00	PH
FIN_CL is 0.00	PPM	LIMITS are	L: 0.75	PPM	H: 2.00	PPM

Analog Outputs:

VSPMP1	86.8 PCT	PID	VSPMP2	100.0 PCT	PID
NAOHFD	100.0 PCT	PID	CHLRFD	20.0 PCT	PRO

ALARM Fax Report

EOS Research Ltd. — ProControl Series II+

To:

BULLWINKLE J MOOSE

From:

THE NORTH WATER SUPPLY SYSTEM IN MAYBERRY USA @ 09:34:12 ON 12/10/1999
SETUP VERSION 1 : ROM VERSION 2.156 : MODEL B2

System Status:

AUTO P04 : NO PREVIOUS SHUTDOWN
FAX REPORT INITIATED BY REMOTE

Discrete Inputs:

WEL1LO is OFF	WEL2LO is OFF	TWR_HH is OFF	TNK_HH is OFF
RESET is OFF			

Discrete Outputs:

WLPMP1 is ON	WLPMP2 is ON	FINPMP is ON	CHLMET is ON
NAOMET is ON	PH_ALM is ON	CL_ALM is ON	TWRALM is OFF
WL1ALM is OFF	WL2ALM is OFF	TNKALM is OFF	

Analog Inputs:

TWRLVL is 59.1	FT	LIMITS are	L: 8.0	FT	H: 70.0	FT
TNKLVL is 0.00	FT	LIMITS are	L: 8.00	FT	H: 12.00	FT
FINFLO is 203.5	GPM	TOTAL FLOW is	11348	GAL		
FLOW_2 is 399.6	GPM	TOTAL FLOW is	8671	GAL		
FLOW_1 is 0.0	GPM	TOTAL FLOW is	0	GAL		
FIN_PH is 0.00	PH	LIMITS are	L: 6.00	PH	H: 8.00	PH
FIN_CL is 0.00	PPM	LIMITS are	L: 0.75	PPM	H: 2.00	PPM

Analog Outputs:

VSPMP1	37.4 PCT	PID	VSPMP2	100.0 PCT	PID
NAOHFD	100.0 PCT	PID	CHLRFD	20.0 PCT	PRO

3.2 Page Alerts

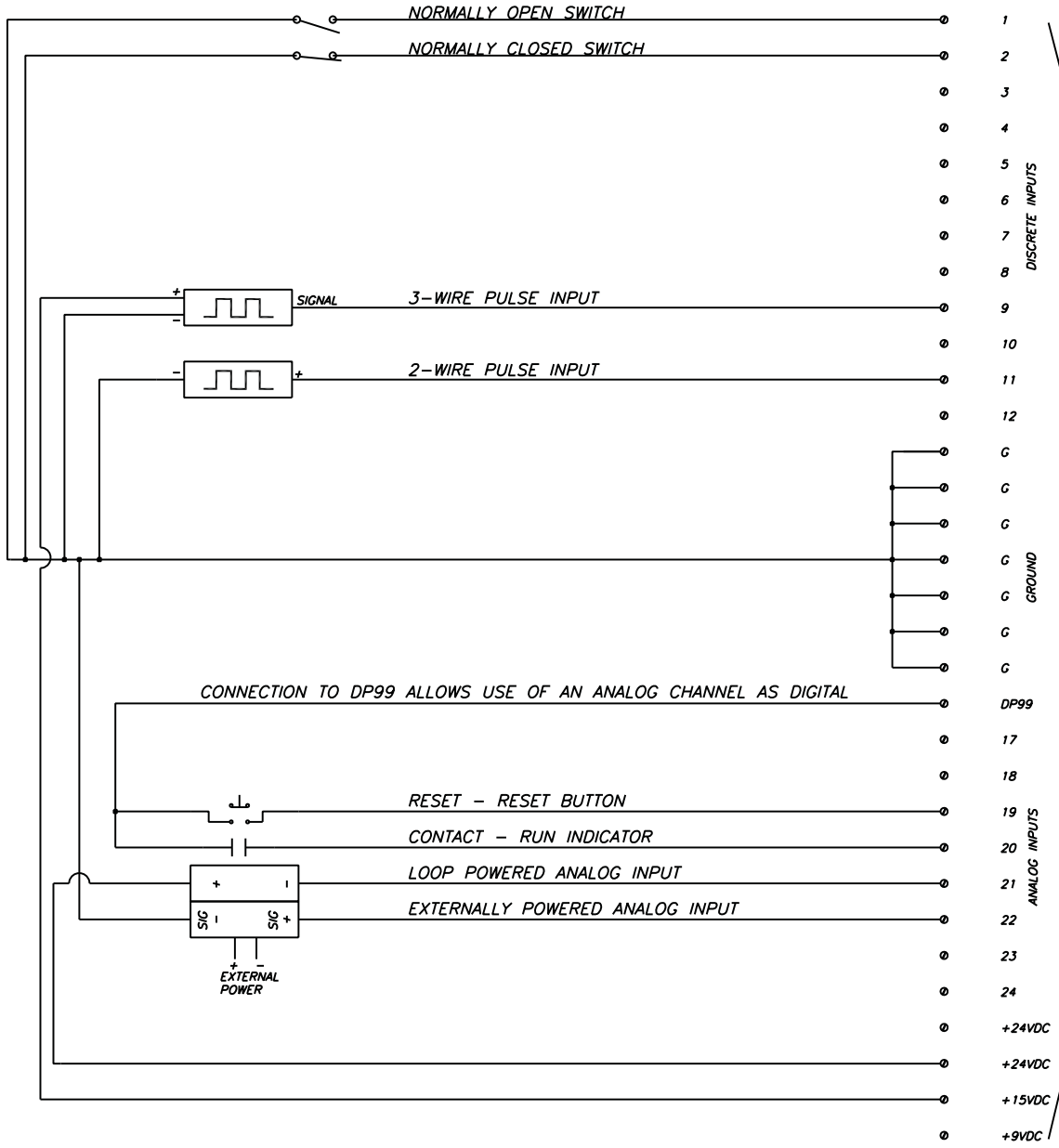
The ProControl unit can alert you to important conditions at your site via a page alert. Any system that is not in manual mode, that is, executing process tasks or the startup or shutdown sequences, can send a message up to eighty characters in length to an alphanumeric pager or up to nineteen digits in length to a numeric pager. If you are out of the office and away from a fax machine, you will still be alerted to any trouble at your site. With ProView you can select up to two pager numbers to be called. Each process task or startup/shutdown algorithm is capable of sending a message to either or both of these pagers. The pager messages are configured by EOS Research according to your specifications.

An example message for an alphanumeric pager would be:

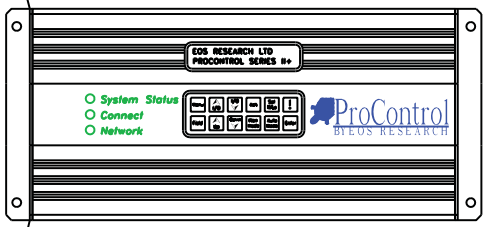
```
ANYTOWN SITE
High water level EQ Tank
System shut down!
Call Fred to fix: 555-6789
```

APPENDIX A

EXAMPLE WIRING DIAGRAM



SERIES 2*plus* Type B1-B2, A1-A2



NOTES:
1. FOR ANALOG INPUTS, MAINTAIN VOLTAGE AND TOTAL LOOP RESISTANCE PER MFG. SPECIFICATIONS.
2. INPUT IMPEDANCE FOR SERIES 2Plus ANALOG INPUTS IS 135 OHMS.
3. ACTIVE DISCRETE INPUTS WILL SOURCE 1mA WHEN GROUNDED.
4. THE ProControl SOURCES 5VDC FOR DISCRETE INPUTS.
5. DISTRIBUTE ANALOG INSTRUMENTS EVENLY ACROSS +24VDC TERMINALS.

E O S
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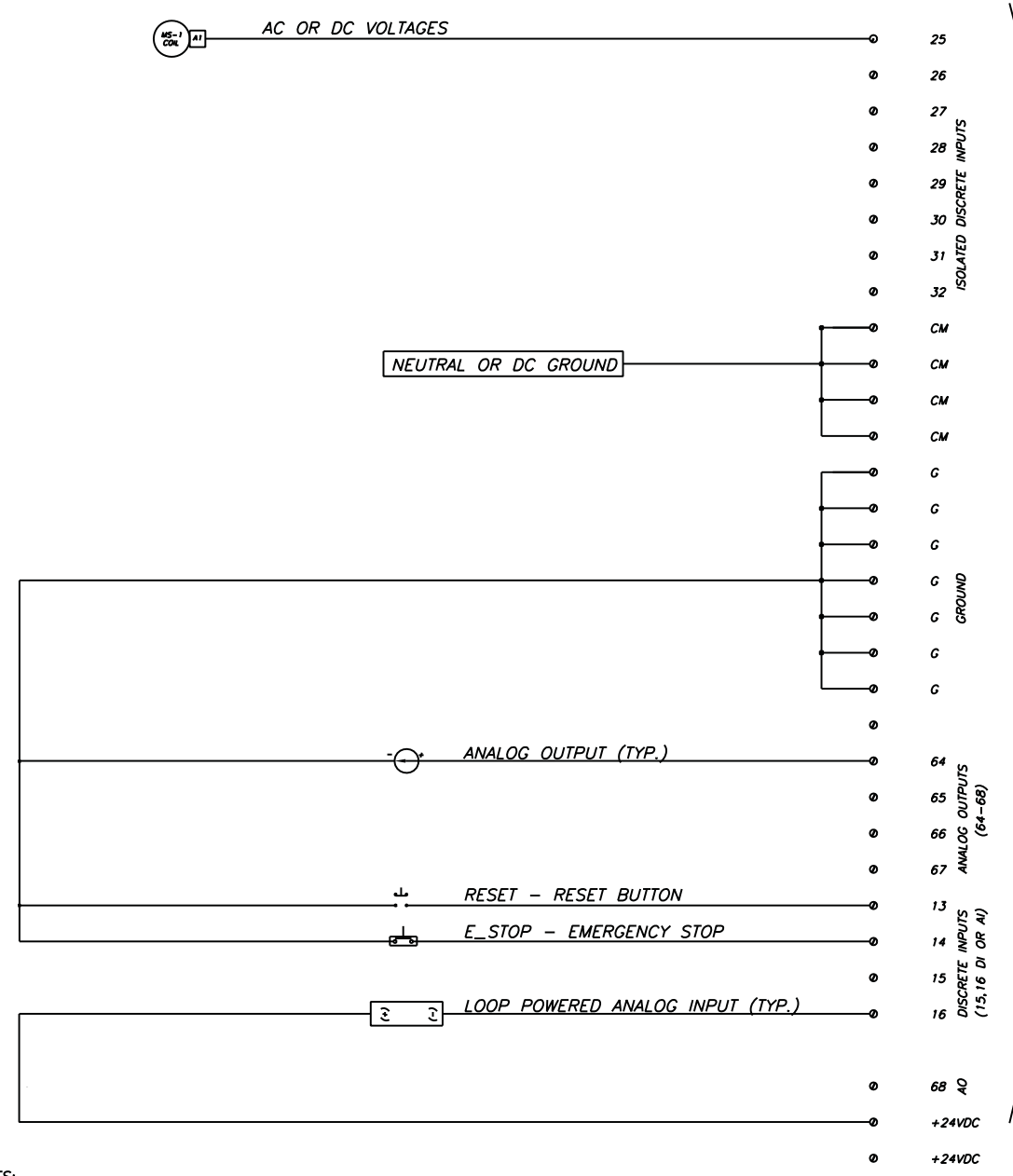
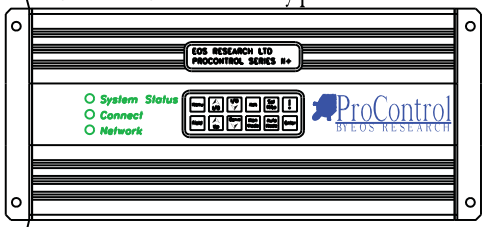
159 Walnut Street, Rochester, NH

TYPICAL ProControl WIRING
DIGITAL & ANALOG INPUTS - BOTTOM LEFT SIDE

EXAMPLE WIRING DIAGRAM



SERIES 2*plus* Type B2 ONLY

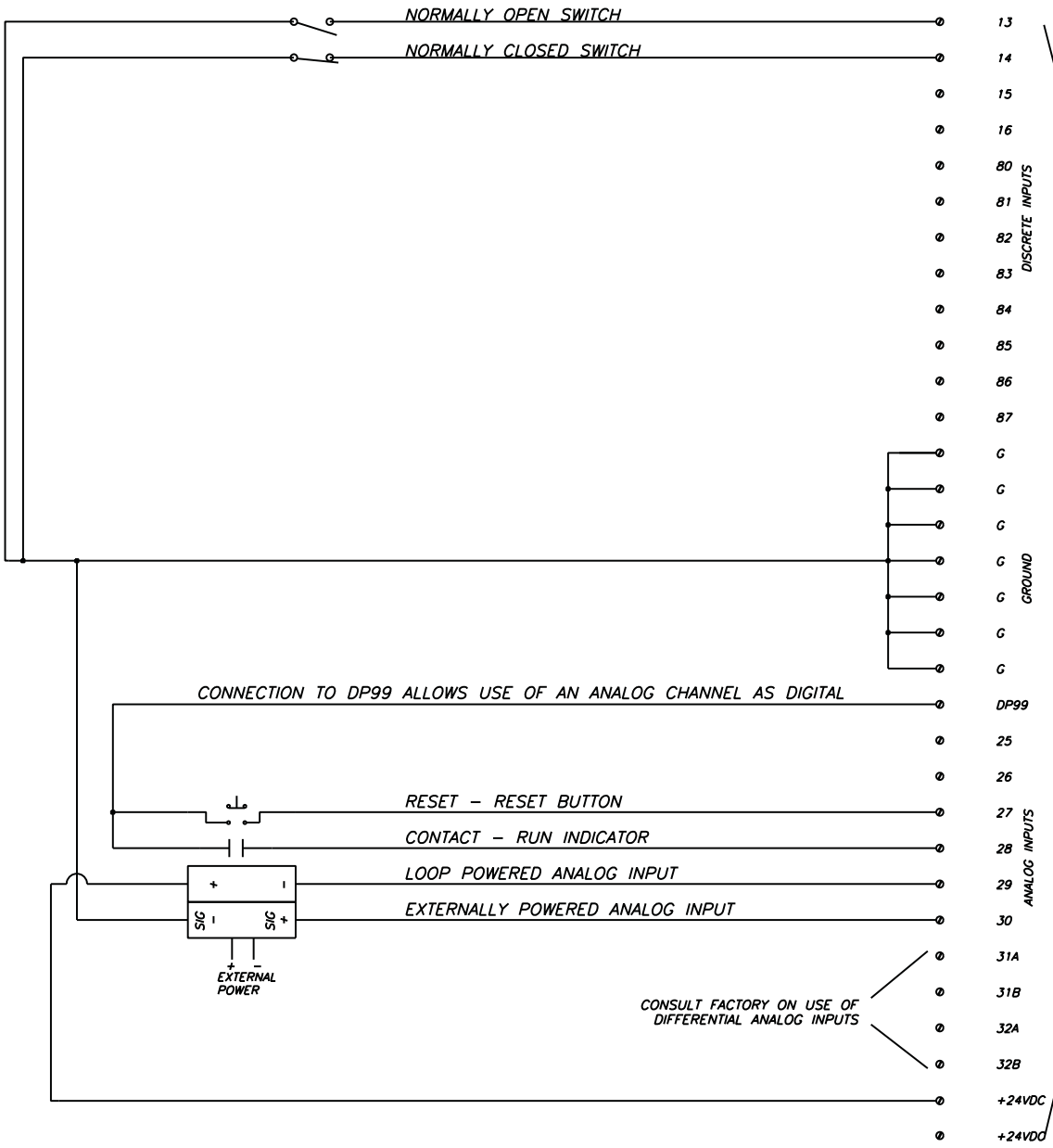


NOTES:
1. FOR ANALOG INPUTS, MAINTAIN VOLTAGE AND TOTAL LOOP RESISTANCE PER MFG. SPECIFICATIONS.
2. INPUT IMPEDANCE FOR SERIES 2Plus ANALOG INPUTS IS 135 OHMS.
3. MAXIMUM ISOLATED DISCRETE INPUT VOLTAGE 120V. ALL INPUTS MUST BE SAME VOLTAGE AND SHARE THE SAME COMMON OR NEUTRAL!
4. CM REPRESENTS COMMON FOR INPUTS 25–32. (ie. 120VAC, CM=NEUTRAL/ 24VDC, CM=DC GROUND)

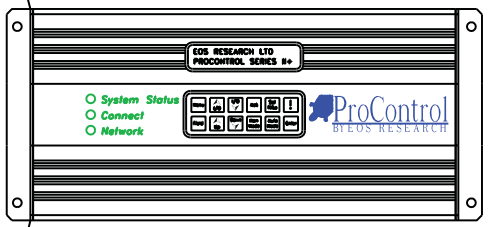
E O S
research
159 Walnut Street, Rochester, NH

TYPICAL ProControl WIRING
DIGITAL INPUTS & ANALOG OUTPUTS
TYPE B2 - TOP LEFT SIDE

EXAMPLE WIRING DIAGRAM



SERIES 2*plus* Type A1-A2



NOTES:
1. FOR ANALOG INPUTS, MAINTAIN VOLTAGE AND TOTAL LOOP RESISTANCE PER MFG. SPECIFICATIONS.
2. INPUT IMPEDANCE FOR SERIES 2Plus ANALOG INPUTS IS 135 OHMS.
3. ACTIVE DISCRETE INPUTS WILL SOURCE 1mA WHEN GROUNDED.
4. THE ProControl SOURCES 5VDC FOR DISCRETE INPUTS.
5. DISTRIBUTE ANALOG INSTRUMENTS EVENLY ACROSS +24VDC TERMINALS.

E O S
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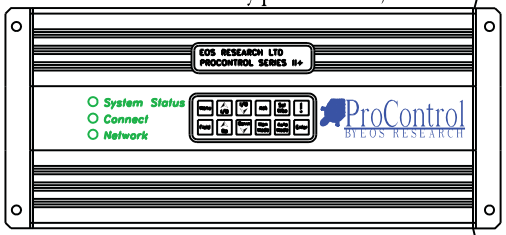
159 Walnut Street, Rochester, NH

TYPICAL ProControl WIRING DIGITAL & ANALOG INPUTS - TYPE A - TOP LEFT SIDE

EXAMPLE WIRING DIAGRAM

SERIES 2*plus* Type B1-B2, A1-A2



RS-232/SERIAL RJ-45 LOCAL CONNECTION PORT

TEL./RS-485 RJ-11 TELEPHONE/NETWORKING PORT

NEUTRAL LINE GROUND +24VDC

DISCRETE OUTPUTS

46
45 SLNVLV - SOLENOID VALVE
44 AIRCMP - AIR COMPRESSOR — MS-2 COIL
43 DISPMP - DISCHARGE PUMP — MS-1 COIL
42
41
40
CM2 COMMON FOR 40-46
39
38
37
36
35 VACALM - HIGH VACUUM ALARM — R
34 PRSALM - LOW PRESSURE ALARM — R
33 SMPALM - HIGH LEVEL ALARM — R
CM1 COMMON FOR 33-39

INPUT POWER 10VAC

10VAC TRANSFORMER SUPPLIED WITH ProControl UNIT. (REV 4 AND ABOVE)

NOTE: 20VAC-CT TRANSFORMER SUPPLIED PRIOR TO REV 4. DO NOT USE 20VAC TRANSFORMER ON REV 4 AND ABOVE!!

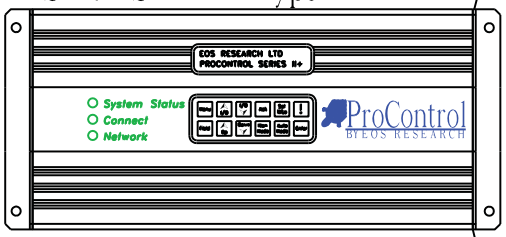
NOTES:
1. OUTPUT RELAYS RATED AT 125VAC/0.5A, 24VDC/0.5A
   UNITS SHIPPED AFTER 12/1/99 RATED AT 125VAC/1.0A, 24VDC/1.0A
2. CM1 IS SWITCHED TO 33-39 AND CM2 IS SWITCHED TO 40-46 WHEN OUTPUT IS ACTIVE.
3. DO NOT USE +24VDC FROM ProControl TO DRIVE OUTPUTS. FOR TRANSDUCER POWER ONLY.

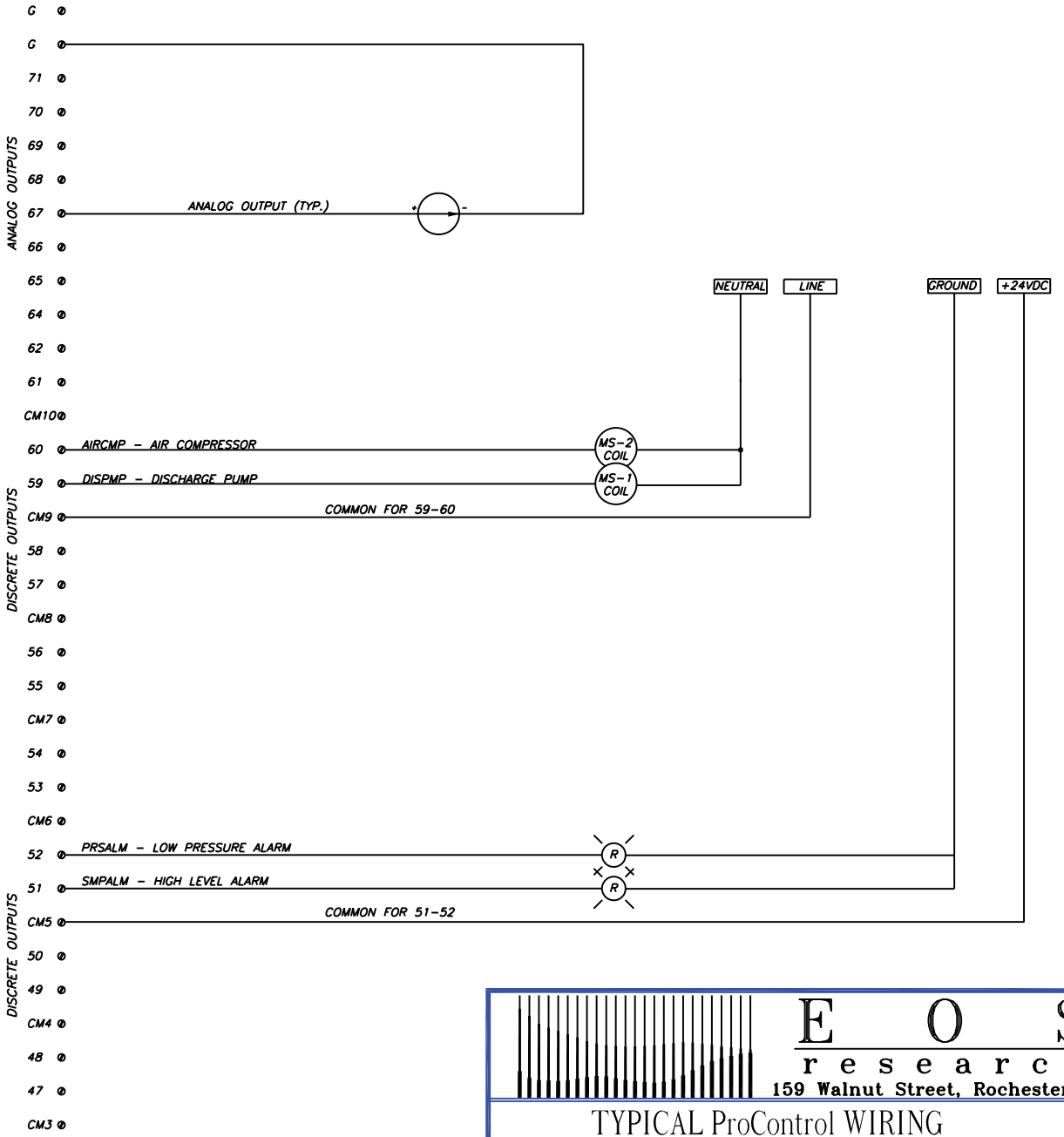
E O S research
159 Walnut Street, Rochester, NH

TYPICAL ProControl WIRING
DIGITAL OUTPUTS - RIGHT SIDE

EXAMPLE WIRING DIAGRAM

SERIES 2*plus* Type A1-A2





NOTES:
1. OUTPUT RELAYS ARE RATED AT 125VAC/0.5A, 24VDC/0.5A
2. CM3 IS SWITCHED TO 47-48, CM4 IS SWITCHED TO 49-50, ETC. WHEN OUTPUT IS ACTIVE.
3. DO NOT USE +24VDC FROM ProControl TO DRIVE OUTPUTS. FOR TRANSDUCER POWER ONLY.

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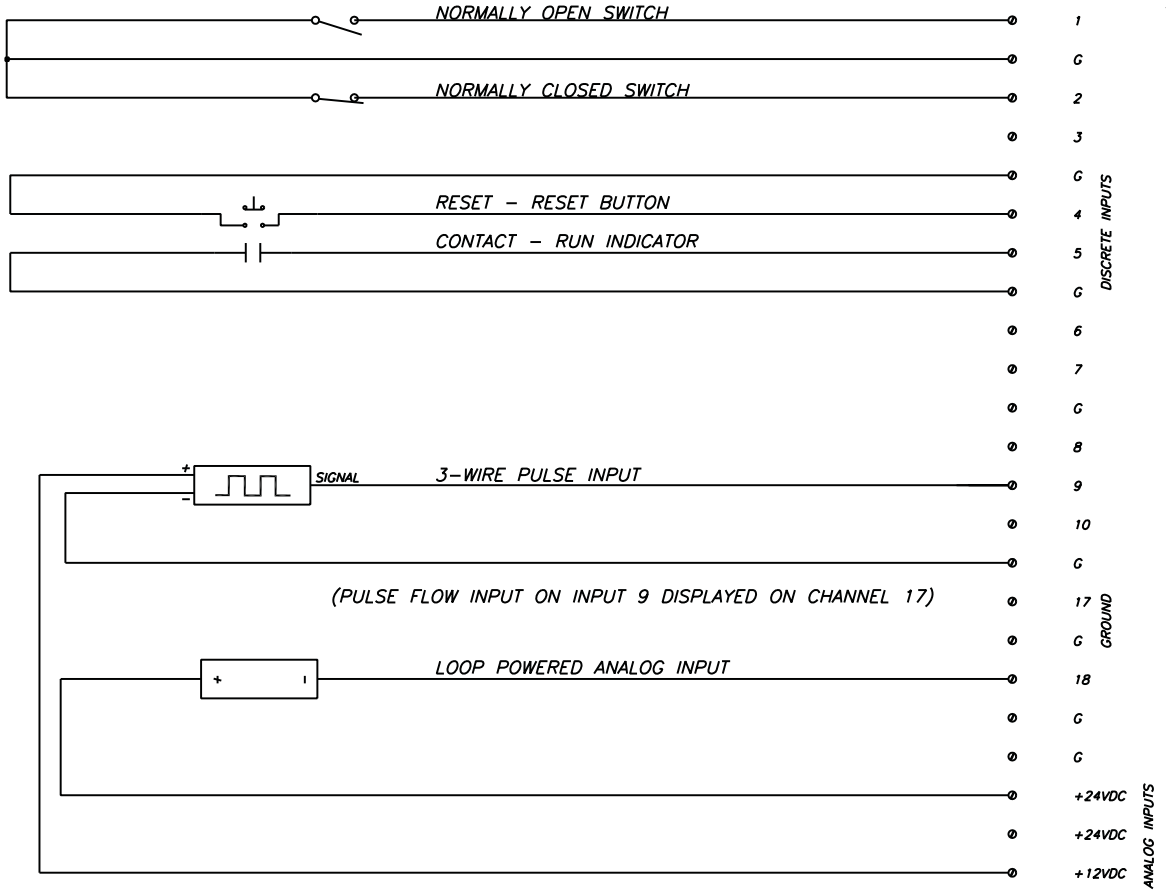
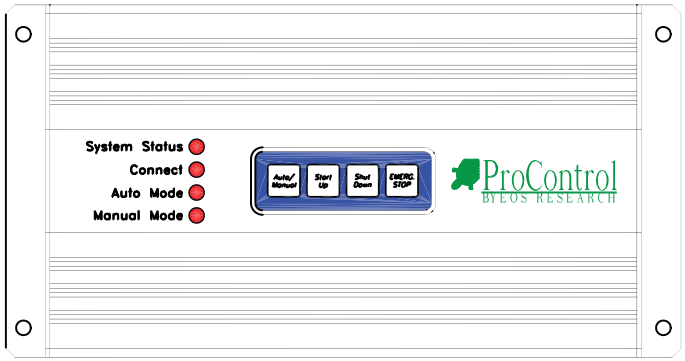
TYPICAL ProControl WIRING
DIGITAL & ANALOG OUTPUTS
TYPE A - TOP RIGHT SIDE

EXAMPLE WIRING DIAGRAM



SERIES 2*plus* Type C1



NOTES:
1. FOR ANALOG INPUTS, MAINTAIN VOLTAGE AND TOTAL LOOP RESISTANCE PER MFG. SPECIFICATIONS.
2. INPUT IMPEDANCE FOR SERIES 2Plus ANALOG INPUTS IS 135 OHMS.
3. ACTIVE DISCRETE INPUTS WILL SOURCE 1mA WHEN GROUNDED.
4. THE ProControl SOURCES 5VDC FOR DISCRETE INPUTS.
5. DISTRIBUTE ANALOG INSTRUMENTS EVENLY ACROSS +24VDC TERMINALS.

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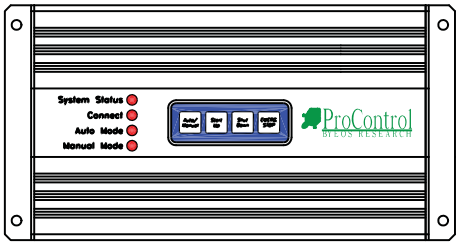
TYPICAL ProControl Type C1 WIRING
DIGITAL & ANALOG INPUTS - BOTTOM LEFT SIDE

EXAMPLE WIRING DIAGRAM



RS-232/SERIAL RJ-45 LOCAL CONNECTION PORT

TEL./RS-485 RJ-11 TELEPHONE/NETWORKING PORT

GROUND +24VDC NEUTRAL LINE

DISCRETE OUTPUTS

40 PRSALM - LOW PRESSURE ALARM (R)

39 SMPALM - HIGH LEVEL ALARM (R)

CM4 COMMON FOR 39-40

38

37

CM3 COMMON FOR 37-38

36

35 SLNVLV - SOLENOD VALVE (CR-1 COIL)

CM2 COMMON FOR 35-36

34 AIRCMP - AIR COMPRESSOR (MS-2 COIL)

33 RW_PMP - RECOVERY WELL PUMP (MS-1 COIL)

CM1 COMMON FOR 33-34

INPUT POWER 10VAC

10VAC TRANSFORMER SUPPLIED WITH ProControl UNIT.

NOTES:
1. OUTPUT RELAYS RATED AT 125VAC/1.0A, 24VDC/1.0A
2. CM1 IS SWITCHED TO 33-34 AND CM2 IS SWITCHED TO 35-36, CM3 IS SWITCHED TO 37-38, CM4 IS SWITCHED TO 39-40 WHEN OUTPUT IS ACTIVE.
3. DO NOT USE +24VDC FROM ProControl TO DRIVE OUTPUTS. FOR TRANSDUCER POWER ONLY.

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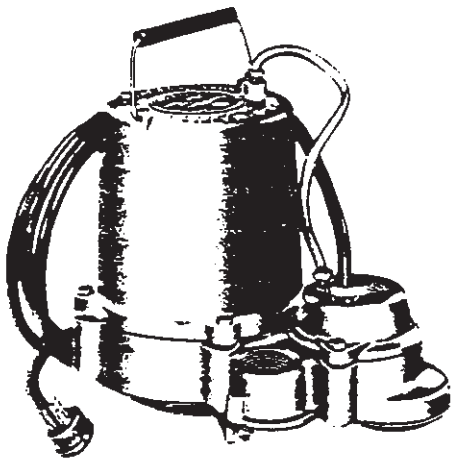
TYPICAL ProControl TYPE C WIRING
DIGITAL OUTPUTS - RIGHT SIDE

Submersible Manhole Sump Pumps

(Deep Well: P-1; Shallow Well: P-2)

Hydromatic Model OSP-33

INFLUENT PUMPS



OSP33 Submersible Pump for Residential and Industrial Effluent Service

HYDROMATIC PUMPS
A Marley Pump Company

Outstanding Features:

- Completely submersible. Oil-filled, ball bearing motor provides long life and quiet operation. Motor is ⅓ HP single phase, 115 V, 1750 rpm with built-in automatic reset overload protection.
- Non-clogging 5-inch diameter bronze impeller threaded to stainless steel shaft operates with higher capacities and heads. Capable of handling 5/8-inch spherical solids and lint without clogging.
- Water level is controlled by proven diaphragm type pressure switch. Solids cannot affect operation, even if exposed diaphragm is punctured, because switch is sealed into watertight housing. Standard switch setting is 6 inches but models can be furnished for levels up to 40 inches.
- Pump case and motor cap are heavy cast iron with metallic paint for corrosion resistance. All exposed parts are high grade bronze, cast iron, steel and stainless steel. All bronze model available.
- Mechanical shaft seal, ceramic and carbon faced, super lapped for perfect sealing. Buna N rubber, brass and stainless steel used in seal parts.
- Field serviceable.

Applications

- Septic tank effluent
- Flood control units
- Air conditioning condensate
- Industrial circulators
- Transfer tanks
- Basement sumps
- Elevator pits
- Water coolers

Capabilities

Specifications	1/3 HP
Capacity to	60 GPM
Electrical to	115, 230 Volt
Discharge	1-1/4" NPT
Solids Handling	5/8"
Pump Cord	10' Std., 20' Opt.
Controls	Auto & Manual
Construction	Cast Iron Std., Bronze Available

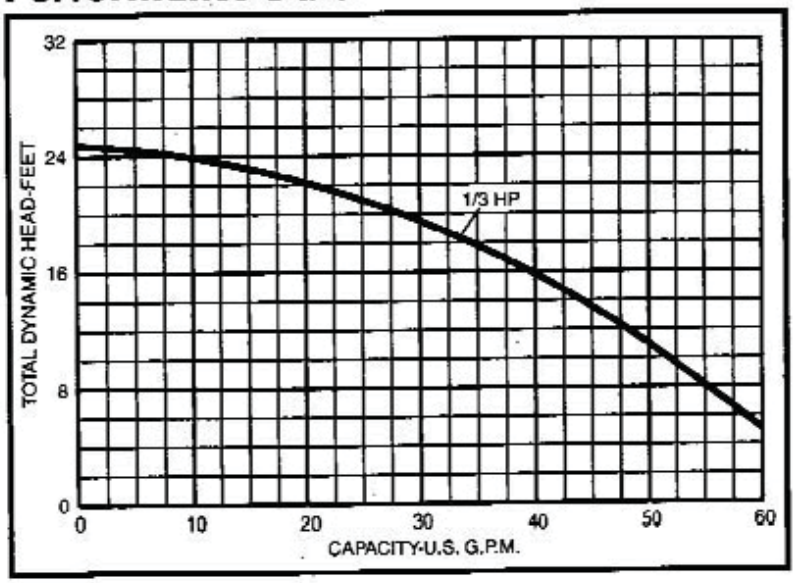
OSP33 - Submersible Effluent Pump

DETAILS

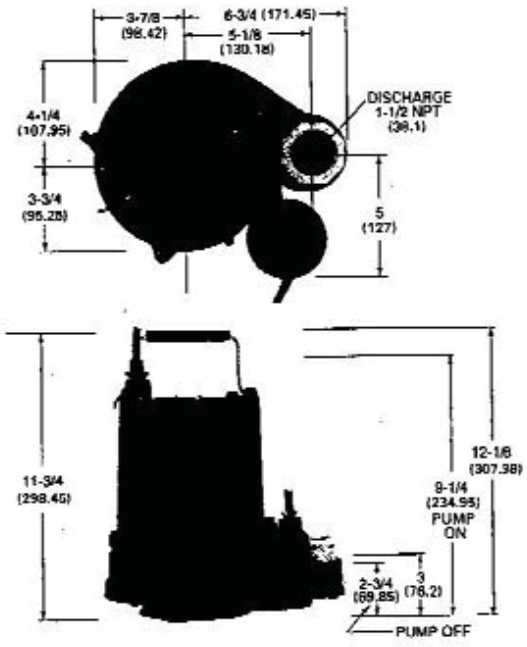
Pump Characteristics

Pump/Motor Unit	Submersible	
Manual Models	OSP33MI	OSP33M2
Automatic Models	OSP33AI	OSP33A2
Horsepower	1/3	
Full Load Amps	7.8	4.6
Motor Type	Split Phase	
R.P.M.	1750	
Phase Ø	1	
Voltage	115	230
Hertz	60	
Operation	Intermittent	
Temperature	140°F Ambient	
NEMA Design	B	
Insulation	Class F	
Discharge Size	1-1/2" NPT	
Solids Handling	5/8"	
Unit Weight	50 lbs.	
Power Cord	18/3, SJTW, 10' std. (20 opt.)	18/3, SJTW 20' std.

Performance Data



Dimensional Data



All dimensions in inches. Metric for international use. Component dimensions may vary ± 1/8 inch. Dimensional data not for construction purpose unless certified. Dimensions and weights are approximate. On/Off level adjustable. We reserve the right to make revisions to our product and their specifications without notice.

Materials of Construction

Handle	Steel
Lubricating Oil	Dielectric Oil
Motor Housing	Cast Iron
Pump Casing	Cast Iron
Shaft	Steel
Mechanical Shaft Seal	Seal Faces: Carbon/Ceramic Seal Body: Brass, Spring: Stainless Steel Bellows: Buna-N
Impeller	Bronze
Upper Bearing	Single Row Ball Bearing
Lower Bearing	Single Row Ball Bearing
Base	Cast Iron
Fasteners	Stainless Steel

HYDROMATIC®
Pentair Pump Group

USA
1840 Boney Road Ashland, Ohio 44805
Tel: 419-289-3042 Fax: 419-281-4087

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Item #: W-02-6220 4/01 3M

Float-Type Level Switches

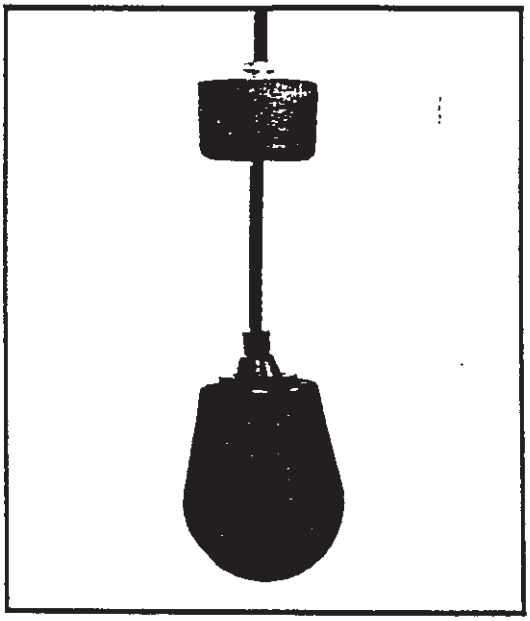
(Manhole Level Controls; Filter Feed Tank; Recharge (Floor) Sump)

Hydromatic Model 3900

Bulletin Q-102
Float Switch Level Control

HYDROMATIC PUMPS
A Marley Pump Company

FLOAT SWITCH LEVEL CONTROL
MODEL 3900



- Most trouble-free control ever designed.
- For use in sewage and practically all chemical solutions.
- Designed for over 250,000 cycles of operation.
- Weight outside float holds switch at any desired height in sump.
- Weighted cords prevent the floats from hanging up on rails, ladders and other obstructions under turbulent wet well conditions.

3900 Specifications

GENERAL: Designed for operating sewage pumps to control liquid level in sumps. Can also be used to operate alarms to indicate high water conditions in sumps or tanks.

TYPES: 3900 Controls can be supplied with open or normally closed contacts.

Two normally open controls are used to control operation of a single pump. One control is set for turn off level and one control is set for turn on level. A magnetic starter contactor with a holding contact holds the circuit in after level drops below turn on control.

For two-pump operation 3 controls are used; one for turn off, one for turn on one pump, and one for turn on two pumps. An electric alternator is supplied to alternate pumps.

Normally closed switches can be supplied for pump up applications such as filling surface or elevated tanks. Normally closed switches are color coded yellow.

SWITCH SPECIFICATION: Switch has a recommended operating temperature range of 32°F to 160°F and has a rating of 13 AMPS at 115 or 230 Volts, A.C.

POWER CORD: Is 2-conductor #16 flexible cord type SJOW oil-resistant, 300-Volt.

FLOAT: The switch is sealed in a solid polypropylene float that is leakproof, shookproof and corrosion resistant to sewage and most chemicals. Consult factory for use with chemicals.

WEIGHT: The lead weight holds switch in sump at desired height. Height can be easily adjusted from the surface by raising or lowering the cord in the cord snubber. Weights of special materials can be supplied for use in chemicals.

SUPPORT BRACKET: A special support bracket is bolted to the junction box (if used), otherwise it bolts to the discharge pipe. Bracket has plastic cord snubber that holds the switches at the required height. Cords are spaced apart to prevent tangling.

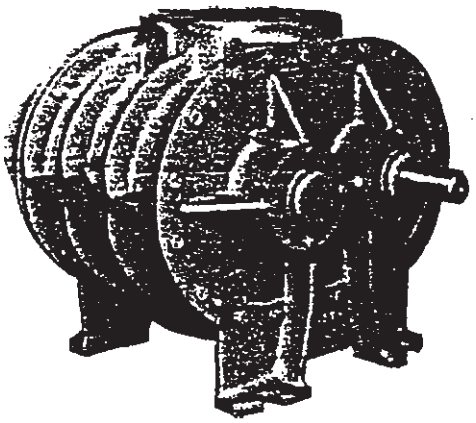
Aeration System Blowers

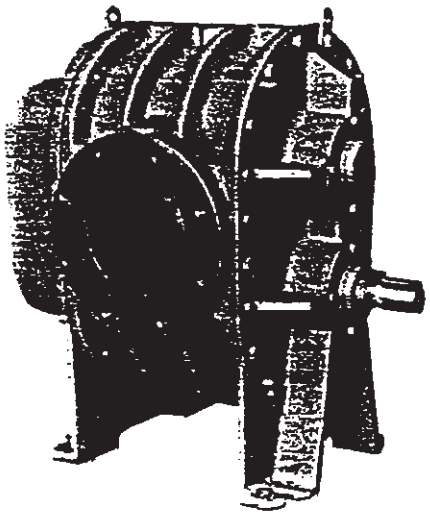
(B-1 & B-2)

Sutorbilt California Series F, Model 3HV

BULLETIN 5-55Y

SUTOR





CALIFORNIA SERIES F

ADVANTAGES OF SUTORBILT UNITS

A METERED QUANTITY OF AIR

The Sutorbilt blower or gas pump is a positive displacement, constant volume machine designed to operate against varying pressures. There is no guesswork as to the quantity of delivered air or gas from a Sutorbilt blower. With each revolution, the blower delivers a metered amount of air measured at inlet conditions. Operating at a constant speed against a constant pressure, the blower delivers a constant amount of air. Increasing the blower speed against a constant pressure increases the volume by an amount equal to the displacement of the blower times the increased number of revolutions.

JOB ENGINEERED HORSEPOWER

Should on-the-job pressure requirements be less than originally calculated, the Sutorbilt rotary positive blower automatically adjusts to the operating job pressure. There is no horsepower sacrificed because of overestimated pressure needs. A rotary positive blower need not be ported for a specific pressure. The only restriction it has to overcome is the actual line pressure. It adapts itself immediately to changes in operating conditions avoiding costly generation of unnecessarily high pressures.

HIGH VOLUMETRIC EFFICIENCY AND LOW MECHANICAL FRICTION

Sutorbilt rotary positive blowers are built to the closest tolerances by highly skilled personnel operating the finest of modern machine tools. Since rotary positive blowers require no internal lubrication or seal, the volumetric efficiency is a direct function of good castings, highly accurate machining and the best in assembly methods. The only mechanical friction encountered in a rotary positive blower is in the timing gears and bearings. This friction is minimized by the use of anti-friction bearings and wide face precision timing gears.

ANTI-FRICTION BEARINGS

All Sutorbilt rotary positive blowers are equipped with heavy duty, anti-friction bearings. These bearings are over-sized for longer life and low mechanical friction. Anti-friction bearings allow reversible shaft rotation for extra versatility. This feature is especially important in tunnel ventilation, allowing the blower to be used both to supply ventilation air to the face of the tunnel and to exhaust blasting fumes by simply reversing the rotation of the blower. Anti-friction bearings have an advantage over the older sleeve type bearings in that they do not wear allowing the impeller clearances to change as a result of this wear. A Sutorbilt blower retains factory clearances at all times.

FLEXIBILITY

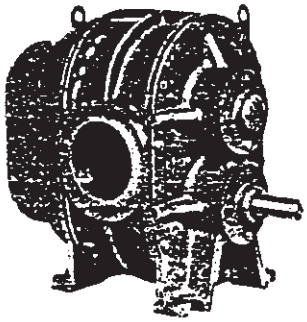
Sutorbilt rotary positive blowers are available in a complete range of sizes and types to give the customer the most compact and economical unit possible. Although cast iron is standard, blowers and pumps constructed of other metals are available for applications in which cast iron is unsuitable. The drive shaft is extended for direct connection to the motor, or gear reducer, or to accommodate a multiple V-drive. Units may be assembled with either right or left hand shaft extension. Vertical units with the shafts parallel in a vertical plane are available to facilitate piping and drive lay-out.

CLEAN AIR

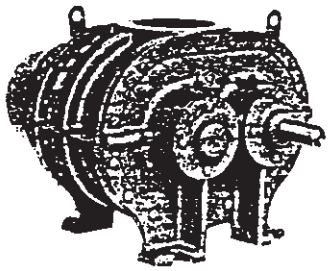
One of the principal advantages of the rotary positive blower and gas pump is that the absence of friction in the impeller chamber makes internal lubrication unnecessary. This permits the delivery of gas or air free from contaminating lubricants. It is an especially valuable feature in chemical processing and material agitation applications that require minimum contamination.

MANUFACTURING

Sutorbilt blowers are engineered and manufactured by capable and experienced personnel in a modern plant with the latest tooling and equipment. Production is controlled by close inspection, test and attention to the smallest detail. Reliable field service is maintained by factory trained personnel. Conveniently located repair shops are available with an inventory of spare parts. Sutorbilt blowers and vacuum pumps range in capacity up to 32863 cfm. You are invited to request information on sizes not covered in this bulletin.



Vertical Style



Horizontal Style

SUTORBILT CALIFORNIA "F" SERIES

OPERATING PRINCIPLE

The Sutorbilt blower has two figure eight impellers rotating in opposite directions. As each lobe of an impeller passes the blower inlet, it traps a quantity of air equal to exactly one-fourth the displacement of the blower. This entrapment occurs four times per revolution, moving the entrained air around the case to the blower outlet. Timing gears accurately position the impellers in relation to each other, maintaining the minute clearances so vital to the high volumetric efficiency of the rotary positive blower.

SUTORBILT FEATURES

Like all Sutorbilt equipment, California Series F blowers are precision-engineered for maximum effectiveness and well built for long, trouble-free service. This series is designed for continuous service to deliver air at pressures up to 12 psi within each gear size, and 15 psi in 6″, 7″, and 8″ gear sizes.

Impellers are machined from cast iron to an exact involute shape and are permanently fastened to steel shafts. They are balanced to operate without vibration.

Headplates are machined from cast iron and ground on the interior surface to exact operating tolerances. Bearing fits are machined into the headplates to assure exact bearing positioning.

Impeller cases are machined from cast iron, heavily ribbed to prevent distortion. Inlet and discharge ports are integral parts of the impeller case.

Anti-friction Bearings are used exclusively. Smaller sizes are fitted with single row ball bearings; larger sizes are equipped with double row ball bearings and spherical roller bearings for greater overhung load capacity.

Timing gears are accurately cut from alloy steel and bolted to timing hubs in sizes 6″ through 8″ gear diameters. Gears mounted directly on shafts are used on smaller size units.

Lubrication

Timing gears and gear-end bearings are splash oil lubricated from an oil tight housing enclosing the timing gears. Drive-end bearings are grease lubricated through fittings. Lip type seals prevent oil and grease from entering the impeller chamber.

Drive Shaft

The drive shaft is extended for V-belt drive or direct connection. A thrust control arrangement is standard on all units. Vertical and horizontal shaft arrangement is available in all sizes.

PRESSURE PERFORMANCE DATA - SUTORBILT SERIES F BLOWERS

Capacities and Horsepower Based on Standard Air at Inlet

LOW PRESSURE UNITS

SIZE	DIA. INLET & OUTLET	DISP. CU. FT. REV.	RPM	.5 PSI		1 PSI		2 PSI		3 PSI		4 PSI		5 PSI	
				CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP
2LF 2LVF	2"-S	.035	2905	91	.4	86	.7	79	1.2	74	1.8	70	2.1		
			3320	105	.5	100	.8	94	1.3	88	1.9	85	2.4		
			3735	120	.5	115	.8	108	1.4	103	2.1	99	2.7		
			4150	134	.5	130	.9	123	1.6	118	2.3	114	3.0		
3LF 3LVF	2½"-S	.104	2295	222	.8	215	1.3	206	2.5	197	3.6	191	4.7		
			2620	256	.8	249	1.5	239	2.8	231	4.1	225	5.2		
			2950	290	.9	283	1.7	273	3.1	265	4.6	259	5.8		
			3275	324	1.0	317	1.8	307	3.4	299	5.0	293	6.5		
4LF 4LVF	3"-S	.170	2005	318	1.0	304	1.8	289	3.4	278	5.0	268	6.5		
			2290	363	1.1	353	2.0	338	3.9	326	5.8	316	7.4		
			2575	412	1.2	401	2.3	386	4.3	374	6.2	365	8.3		
			2860	460	1.4	450	2.5	435	4.8	423	6.9	413	9.2		
5LF 5LVF	4"-S	.350	1610	533	1.5	520	2.9	502	5.3	488	8.0	476	10.7		
			1840	613	1.7	600	3.3	582	6.1	568	9.2	557	12.2		
			2070	694	1.9	681	3.6	663	6.9	649	10.3	637	13.7		
			2300	774	2.1	761	4.0	743	7.6	729	11.4	718	15.3		
6LF 6LVF	6"-F	.718	1470	1005	2.7	984	5.0	954	10.0	931	15.0	912	20.0	895	25.0
			1680	1156	3.1	1135	5.7	1106	11.4	1082	17.2	1063	22.9	1046	28.6
			1890	1306	3.4	1285	6.4	1256	12.9	1233	19.3	1214	25.7	1197	32.2
			2100	1457	3.8	1436	7.1	1406	14.3	1384	21.4	1364	28.6	1347	35.7
7LF 7LVF	8"-F	1.20	1260	1448	3.8	1422	7.2	1385	14.3	1356	21.5	1332	28.7	1311	35.8
			1440	1664	4.3	1638	8.2	1601	16.4	1572	24.6	1548	32.8	1527	41.0
			1620	1880	4.8	1854	9.2	1817	18.4	1788	27.6	1764	36.9	1743	46.1
			1800	2086	5.1	2070	10.2	2033	20.5	2004	30.7	1980	41.0	1959	51.2
8LF 8LVF	10"-F	1.74	1105	1640	4.8	1606	9.1	1758	18.2	1721	27.3	1690	36.5	1662	45.6
			1260	2110	5.2	2076	10.4	2028	20.8	1991	31.2	1959	41.6	1932	52.0
			1420	2388	5.8	2364	11.7	2308	23.4	2269	35.1	2238	46.8	2210	58.6
			1575	2658	6.5	2624	13.0	2576	26.0	2539	39.0	2508	52.0	2480	64.9

MEDIUM PRESSURE UNITS

SIZE	DIA. INLET & OUTLET	DISP. CU. FT. REV.	RPM	4 PSI		5 PSI		6 PSI		7 PSI		8 PSI		9 PSI	
				CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP
2MF 2MVF	1"-S	.017	2905	32	1.0	30	1.3	29	1.5	27	1.7				
			3320	39	1.2	37	1.4	36	1.7	34	2.0				
			3715	47	1.3	45	1.6	43	1.9	41	2.2				
			4150	54	1.4	52	1.8	50	2.1	48	2.4				
3MF 3MVF	2"-S	.060	2295	107	2.7	103	3.4	100	4.0	96	4.7				
			2620	126	3.1	122	3.8	119	4.6	116	5.2				
			2950	146	3.5	142	4.3	139	5.0	136	5.9				
			3275	165	3.8	162	4.8	158	5.6	155	6.5				
4MF 4MVF	2½"-S	.117	2005	182	4.5	176	5.6	170	6.7	165	7.8				
			2290	215	5.1	209	6.3	204	7.6	198	8.9				
			2575	249	5.7	242	7.1	237	8.6	232	10.0				
			2860	282	6.3	276	7.9	270	9.5	265	11.1				
5MF 5MVF	4"-S	.210	1610	279	6.4	272	8.0	266	9.6	260	11.2				
			1840	328	7.3	321	9.2	314	11.0	309	12.8				
			2070	376	8.2	369	10.3	363	12.4	357	14.4				
			2300	424	9.2	417	11.4	411	13.7	405	16.0				
6MF 6MVF	6"-S	.383	1470	475	10.7	466	13.3	456	16.0	447	18.7	439	21.3	431	24.0
			1680	555	12.2	545	15.2	536	18.3	527	21.3	519	24.4	511	27.4
			1890	636	13.7	625	17.2	616	20.6	607	24.0	599	27.4	592	30.9
			2100	716	15.2	706	19.1	697	22.9	688	26.7	680	30.5	672	34.3
7MF 7MVF	8"-F	.733	1260	799	17.5	784	21.9	771	26.3	759	30.6	748	35.0	737	39.4
			1440	931	20.0	916	25.0	903	30.0	891	35.0	879	40.0	869	46.0
			1620	1063	22.5	1048	28.1	1035	33.8	1023	39.4	1011	45.0	1001	50.7
			1800	1195	25.0	1180	31.3	1167	37.5	1155	43.8	1143	50.0	1133	56.3
8MF 8MVF	8"-F	1.04	1105	993	21.8	975	27.2	958	32.7	943	38.1	929	43.6	915	49.0
			1260	1155	24.8	1136	31.1	1120	37.3	1104	43.5	1090	49.7	1077	55.9
			1420	1321	28.0	1303	35.0	1288	42.0	1271	49.0	1256	56.0	1243	63.0
			1575	1482	31.1	1464	38.8	1447	46.6	1432	54.3	1418	62.1	1404	69.9

HIGH PRESSURE UNITS

SIZE	DIA. INLET & OUTLET	DISP. CU. FT. REV.	RPM	7 PSI		8 PSI		9 PSI		10 PSI		12 PSI		15 PSI	
				CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP
3HF 3HVF	1¼"-S	.048	2295	70	3.4	68	3.9	66	4.4	63	4.9	–	–		
			2620	85	3.8	82	4.5	80	5.0	78	5.6	74	6.7		
			2950	99	4.4	97	5.0	95	5.7	93	6.3	89	7.6		
			3275	114	4.9	112	5.6	110	6.3	108	7.0	104	8.4		
4HF 4HVF	1¼"-S	.069	2005	92	4.6	89	5.2	86	5.9	83	6.6	–	–		
			2290	111	5.2	108	6.0	105	6.7	102	7.5	97	9.0		
			2575	131	5.9	128	6.7	125	7.6	122	8.4	117	10.1		
			2860	151	6.5	148	7.5	145	8.4	142	9.4	136	11.2		
5HF 5HVF	2½"-S	.140	1610	170	7.5	166	8.5	162	9.6	158	10.7	153	12.8		
			1840	202	8.5	198	9.8	195	11.0	191	12.2	185	14.7		
			2070	234	9.6	230	11.0	227	12.4	223	13.7	217	16.5		
			2300	266	10.7	263	12.2	259	13.7	256	15.3	249	18.3		
6HF 6HVF	3"-S	.227	1470	256	11.1	250	12.7	245	14.2	240	15.8	232	19.0	–	–
			1680	303	12.7	296	14.5	293	16.3	288	18.1	278	21.7	267	27.1
			1890	351	14.2	346	16.3	341	18.3	336	20.3	327	24.4	315	30.5
			2100	399	15.8	393	18.1	388	20.3	383	22.6	375	27.1	363	33.9
7HF 7HVF	4"-S	.367	1260	386	15.3	359	17.5	382	19.7	346	21.9	336	26.3	320	32.9
			1440	431	17.5	425	20.0	418	22.5	413	25.0	401	30.1	386	37.6
			1620	498	19.7	491	22.5	485	25.4	479	28.2	468	33.8	453	42.3
			1800	564	21.9	557	25.0	551	28.2	546	31.3	534	37.6	519	47.0
8HF 8HVF	4"-S	.566	1105	491	20.8	481	23.7	473	26.7	464	29.6	449	35.6	428	44.5
			1260	579	23.7	569	27.0	560	30.4	552	33.8	537	40.6	516	50.7
			1420	668	26.7	660	30.5	651	34.3	643	38.1	627	45.7	607	57.1
			1575	757	29.6	747	33.8	739	38.0	731	42.3	715	50.7	694	63.4

"S" indicates screwed, "F" indicates flanged connections.
Capacities and Horsepower based on standard inlet conditions: 14.7 psia, 70° F, 1.0 Specific Gravity

VACUUM PERFORMANCE DATA — SUTORBILT SERIES F BLOWERS

Capacities and Horsepower based on Vacuum at inlet, Discharge at Standard Ambient.

LOW VACUUM UNITS

SIZE	DIA. INLET & OUTLET	DISP. CU. FT. REV.	RPM	2" HG		4" HG		6" HG		8" HG		10" HG	
				CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP
2LF 2LVF	2"-S	.035	2905	86	.7	78	1.1	71	1.6	65	2.1		
			3320	100	.7	93	1.3	86	1.8	80	2.4		
			3735	115	.8	107	1.4	101	2.0	94	2.6		
			4150	129	.9	122	1.6	115	2.2	109	2.9		
3LF 3LVF	2½"-S	.104	2296	214	1.3	203	2.4	193	3.5	183	4.6		
			2620	248	1.5	236	2.7	227	4.0	217	5.1		
			2950	282	1.6	271	3.1	261	4.5	251	5.7		
			3275	316	1.8	305	3.4	295	5.0	285	6.3		
4LF 4LVF	3"-S	.170	2005	303	1.8	286	3.4	271	5.0	256	6.3		
			2290	352	2.0	334	3.8	319	5.4	305	7.3		
			2575	400	2.2	383	4.3	368	6.1	353	8.2		
			2860	449	2.5	431	4.7	416	6.8	402	9.1		
5LF 5LVF	4"-S	.350	1610	519	2.8	498	5.2	480	7.9	462	10.5		
			1840	599	3.2	578	6.0	560	9.0	543	12.0		
			2070	680	3.8	659	6.7	641	10.1	623	13.5		
			2300	760	3.9	739	7.5	721	11.2	704	15.0		
6LF 6LVF	6"-F	.718	1470	982	5.1	947	9.8	916	14.7	886	19.7	881	24.6
			1680	1133	5.6	1098	11.2	1069	16.9	1040	22.5	1011	28.1
			1890	1283	6.3	1249	12.6	1219	19.0	1191	25.3	1162	31.6
			2100	1434	7.0	1400	14.0	1370	21.1	1342	28.1	1313	35.1
7LF 7LVF	8"-F	1.20	1260	1420	7.0	1377	14.1	1339	21.1	1304	28.2	1268	35.2
			1440	1636	8.0	1593	16.1	1555	24.1	1520	32.2	1484	40.2
			1620	1852	9.1	1809	18.1	1771	27.2	1736	36.2	1700	45.3
			1800	2068	10.1	2025	20.1	1987	30.2	1952	40.2	1916	50.3
8LF 8LVF	10"-F	1.74	1105	1803	9.0	1747	17.9	1699	26.9	1653	35.8	1606	44.8
			1260	2073	10.2	2017	20.4	1968	30.6	1923	40.8	1878	51.0
			1420	2351	11.5	2295	23.0	2247	34.5	2201	46.0	2154	57.5
			1575	2621	12.8	2565	25.5	2517	38.3	2471	51.0	2424	63.8

MEDIUM VACUUM UNITS

SIZE	DIA. INLET & OUTLET	DISP. CU. FT. REV.	RPM	6" HG		8" HG		10" HG		12" HG		14" HG	
				CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP
2MF 2MVF	1"-S	.017	2905	33	.8	30	1.0	26	1.2	—	—		
			3320	40	.9	37	1.2	33	1.4	—	—		
			3735	47	1.0	44	1.3	40	1.6	37	1.9		
			4150	54	1.1	51	1.4	47	1.7	44	2.1		
3MF 3MVF	2"-S	.060	2295	108	2.0	102	2.7	95	3.3	89	3.9	—	—
			2620	127	2.3	121	3.0	115	3.8	108	4.5	—	—
			2950	147	2.6	141	3.4	135	4.2	128	5.0	121	5.8
			3275	167	2.8	160	3.8	154	4.7	148	5.5	140	6.4
4MF 4MVF	2½"-S	.117	2005	184	3.4	174	4.5	163	5.5	152	6.6	—	—
			2290	217	3.8	207	5.1	196	6.2	185	7.5	—	—
			2575	251	4.3	240	5.6	230	7.0	219	8.4	207	9.8
			2860	284	4.8	274	6.2	263	7.8	252	9.3	240	10.9
5MF 5MVF	4"-S	.210	1610	282	4.8	270	6.3	258	7.9	246	9.4	232	11.0
			1840	330	5.4	318	7.2	307	9.0	294	10.8	281	12.6
			2070	378	6.1	367	8.1	355	10.1	343	12.1	329	14.2
			2300	427	6.7	415	9.0	403	11.2	391	13.5	377	15.7
6MF 6MVF	5"-S	.383	1470	479	7.9	461	10.5	443	13.1	425	15.7	405	18.4
			1680	559	9.0	542	12.0	524	15.0	505	18.0	485	21.0
			1890	639	10.1	622	13.5	604	16.9	586	20.2	566	23.6
			2100	720	11.2	702	15.0	685	18.7	666	22.5	646	26.2
7MF 7MVF	6"-F	.733	1260	804	12.9	779	17.2	754	21.5	728	25.8	700	30.1
			1440	936	14.7	911	19.7	886	24.6	860	29.5	832	34.4
			1620	1068	16.6	1043	22.1	1016	27.8	992	33.2	964	38.7
			1800	1200	18.4	1175	24.6	1150	30.7	1124	36.9	1096	43.0
8MF 8MVF	8"-F	1.04	1105	1000	16.1	969	21.4	938	26.8	905	32.1	869	37.5
			1260	1161	18.3	1130	24.4	1099	30.5	1066	36.6	1030	42.7
			1420	1327	20.6	1296	27.5	1265	34.4	1232	41.3	1197	48.1
			1575	1488	22.9	1458	30.5	1426	38.1	1394	45.8	1358	53.4

HIGHER VACUUM UNITS

SIZE	DIA. INLET & OUTLET	DISP. CU. FT. REV.	RPM	6" HG		8" HG		10" HG		12" HG		14" HG	
				CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP
3HF 3HVF	1½"-S	.045	2295	79	1.4	74	1.9	69	2.4	64	2.9	—	—
			2620	94	1.6	89	2.2	84	2.7	78	3.3	73	3.8
			2950	109	1.9	104	2.5	99	3.1	93	3.7	87	4.3
			3275	123	2.1	118	2.7	113	3.4	108	4.1	102	4.8
4HF 4HVF	1½"-S	.068	2005	105	1.9	96	2.5	91	3.2	83	3.9	—	—
			2290	124	2.2	117	2.9	110	3.7	103	4.4	96	5.2
			2575	144	2.5	137	3.3	130	4.1	123	5.0	114	5.8
			2860	164	2.8	157	3.7	150	4.6	142	5.5	134	6.4
5HF 5HVF	2½"-S	.140	1610	185	3.1	177	4.2	168	5.2	160	6.3	150	7.3
			1840	217	3.8	209	4.8	201	6.0	192	7.2	182	8.4
			2070	250	4.0	241	5.4	233	6.7	224	8.1	214	9.4
			2300	282	4.5	273	6.0	265	7.5	256	9.0	247	10.5
6HF 6HVF	3"-S	.227	1470	277	4.7	265	6.2	254	7.8	241	9.3	228	10.9
			1680	325	5.3	313	7.1	301	8.9	289	10.7	275	12.4
			1890	372	6.0	361	8.0	349	10.0	337	12.0	323	14.0
			2100	420	6.7	408	8.9	397	11.1	384	13.3	371	15.5
7HF 7HVF	4"-S	.357	1260	392	6.5	377	8.6	363	10.8	347	12.9	331	15.1
			1440	458	7.4	444	9.8	429	12.3	413	14.8	397	17.2
			1620	524	8.3	510	11.1	495	13.8	480	16.6	463	19.4
			1800	590	9.2	576	12.3	561	15.4	546	18.5	529	21.5
8HF 8HVF	6"-S	.566	1105	528	8.7	508	11.6	487	14.6	466	17.5	442	20.4
			1260	615	10.0	595	13.3	575	16.6	553	19.9	530	23.2
			1420	706	11.2	686	15.0	666	18.7	644	22.5	621	26.2
			1575	794	12.5	774	16.6	753	20.8	732	24.9	706	29.1

"S" indicates screwed, "F" indicates flanged connection

6", 7" and 8" units in "M" and "H" case lengths may be operated at vacuum levels greater than 14" Hg. in certain applications. Factory approval is required.

SUTORBILT
CALIFORNIA "F" SERIES
Horizontal Blowers

DIMENSIONS

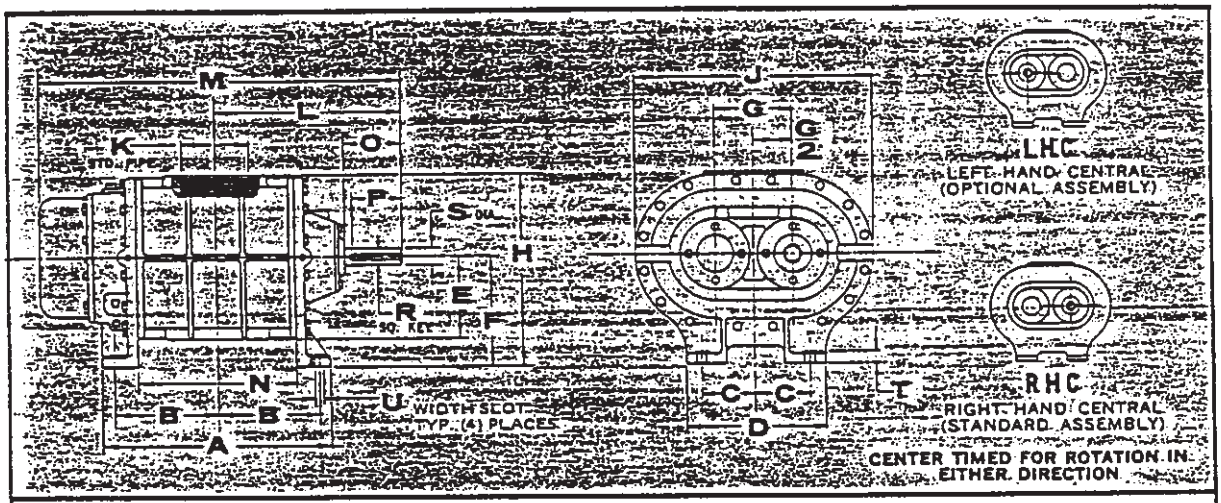
3HV Base dimensions

OAL - ~~32 5/8~~ 36"

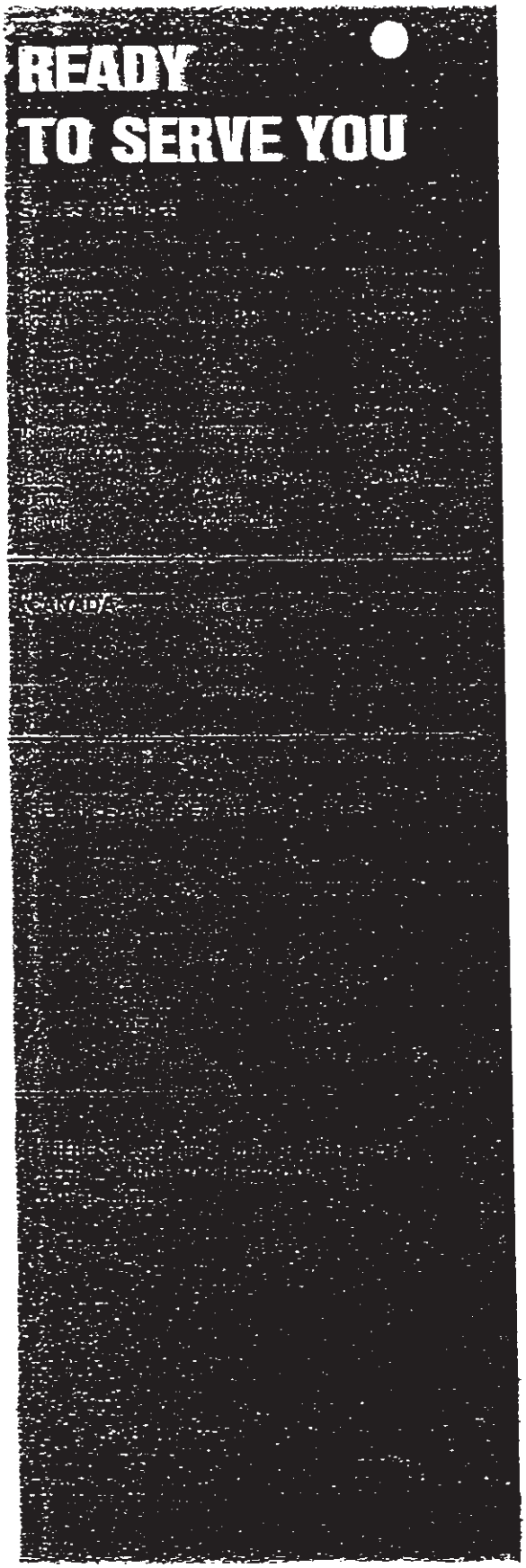
OAW 21 5/8

OAH ~~15~~ 16"

2" after silencer



SIZE	CONNEC-TIONS	A	B	C	D	E	F	G	H	J	K	L	M	N	O	P	R	S	T	U
2MF	S	5	2	2	5½	3	3¾	2¾	6¾	8¾	1	5 3/32	9¾	2	2⅜	1⅜	3/16	.625	⅜	7/16
2LF	S	7	3	2	5½	3	3¾	2¾	6¾	8¾	2	6 3/32	11¾	4	2⅜	1⅜	3/16	.625	⅜	7/16
3HF	S	6¾	2⅜	2⅞	7¼	3 13/16	5	3½	8 13/16	11⅛	1¼	5 13/16	11 13/16	2¾	2 7/16	1⅜	3/16	.750	7/16	½
3MF	S	7⅝	3 1/16	2⅞	7¼	3 13/16	5	3½	8 13/16	11⅛	2	6¼	12 13/16	3⅝	2 7/16	1⅜	3/16	.750	7/16	½
3LF	S	10¼	4⅜	2⅞	7¼	3 13/16	5	3½	8 13/16	11⅛	2½	7 9/16	14 13/16	6¼	2 7/16	1⅜	3/16	.750	7/16	½
4HF	S	7¼	3	3	7½	4 3/16	6¼	4	10 7/16	12⅜	1½	6⅞	13⅝	3¼	2 7/16	1⅜	3/16	.875	½	½
4MF	S	9½	4⅛	3	7½	4 3/16	6¼	4	10 7/16	12⅜	2½	8	15⅞	5½	2 7/16	1⅜	3/16	.875	½	½
4LF	S	12	5⅜	3	7½	4 3/16	6¼	4	10 7/16	12⅜	3	9¼	18⅞	8	2 7/16	1⅜	3/16	.875	½	½
5HF	S	8½	3½	3½	9	5⅛	7	5	12⅛	15¼	2½	8 9/16	16⅞	4	2¾	1 13/16	¼	1.125	⅝	⅝
5MF	S	10½	4½	3½	9	5⅛	7	5	12⅛	15¼	4	9 9/16	18⅞	6	2¾	1 13/16	¼	1.125	⅝	⅝
5LF	S	14½	6½	3½	9	5⅛	7	5	12⅛	15¼	4	11 9/16	22⅞	10	2¾	1 13/16	¼	1.125	⅝	⅝
6HF	S	9¾	3⅞	4	11	6	8¾	6	14¾	18	3	9 9/16	18⅝	4¾	3	2	5/16	1.375	¾	¾
6MF	S	13	5½	4	11	6	8¾	6	14¾	18	5	10 13/16	21⅞	8	3	2	5/16	1.375	¾	¾
6LF	F	20	9	4	11	7½	8¾	6	16¼	18	6	14 9/16	28⅞	15	3	2	5/16	1.375	¾	¾
7HF	S	11¼	4⅝	5½	15	9 11/16	11	7	20 11/16	22	4	10	20 9/16	5½	3½	2½	⅜	1.562	9/16	¾
7MF	F	16¾	7⅜	5½	15	8½	11	7	19½	22	6	12¾	25⅛	11	3½	2½	⅜	1.562	9/16	¾
7LF	F	23¾	10⅞	5½	15	8½	11	7	19½	22	8	16¼	32⅛	18	3½	2½	⅜	1.562	9/16	¾
8HF	S	13½	5¾	6	16	10	12½	8	22½	25¼	4	11 11/16	23⅝	6½	3 15/16	2 13/16	⅜	1.750	1	¾
8MF	F	19	8½	6	16	10	12½	8	22½	25¼	8	14 7/16	29⅛	12	3 15/16	2 13/16	⅜	1.750	1	¾
8LF	F	27	12½	6	16	10	12½	8	22½	25¼	10	18 7/16	37⅛	20	3 15/16	2 13/16	⅜	1.750	1	¾



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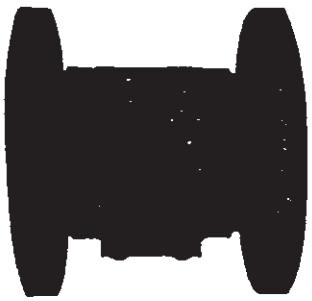
SUTORBILT® FLEXIBLE CONNECTORS



The SUTORBILT Flexible Connector effectively isolates the unit from intake and discharge piping. This prevents introduction of pipe strain on the impeller case and also permits normal thermal movement in the piping system without interfering with the close internal clearances of the unit.

These connectors are available in standard pipe sizes from 1" through 5" with male threaded pipe ends and 4" through 16" with standard ASA 125# flange drilling

The connector consists of a flexible rubber tube mounted over two pipe nipples and held in place bt two heavy duty thumb screw type clamps.

Good practice calls for a flexible connector on inlet and discharge of all units.

Flexible connectors should always be placed between restrained or supported areas of the piping system for added safety.

The flexible member in the SUTORBILT connector is covered with a metal wrap in 3" through 10" to reduce noise emission and pipe ring often associated with flexible connectors.

The connector is essentially maintenance free with only an occasional inspection required to check for cracks or leaks in the flexible member.

All prices subject to change without notice
All prices are F.O.B. Compton, California

S	No. 99711-1C Eff 1-2-79 Sup. 99711-1B

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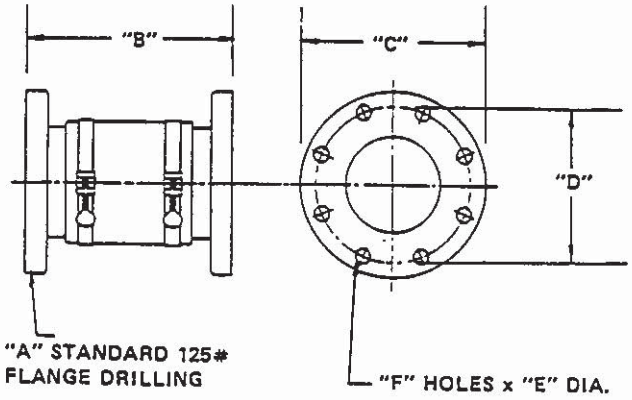
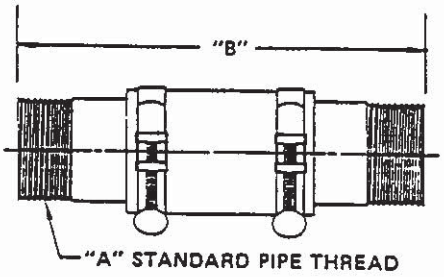
SUTORBILT® FLEXIBLE CONNECTORS



FLANGED CONNECTORS



THREADED CONNECTORS

DIMENSIONS

FLANGED

NOMINAL SIZE INCHES	DIMENSIONS (INCHES)						
	A	B	C	D	E	F	WT.
4	4	9½	9	7½	¾	8	40#
6	6	9½	11	9½	⅞	8	60
8	8	10½	13½	11¾	⅞	8	80
10	10	12	16	14¼	1	12	105
12	12	8	19	17	1	12	160
14	14	8	21	18¾	1⅛	12	215
16	16	8	23½	21¼	1⅛	16	215

THREADED

NOMINAL SIZE INCHES	DIMENSIONS (INCHES)		
	A	B	WT.
1	1	6	1#
1¼	1¼	7½	2
1½	1½	7½	2
2	2	9	3
2½	2½	9	5
3	3	9	7
4	4	9½	9
5	5	12	16

All prices subject to change without notice
All prices are F.O.B. Compton, California

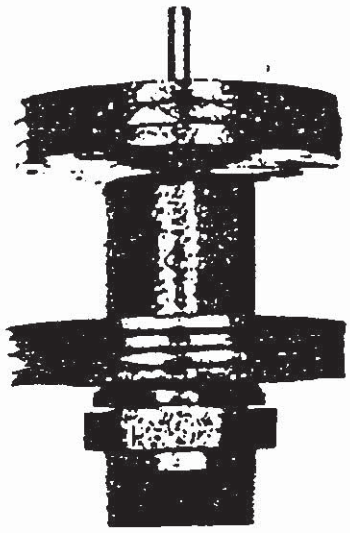
S	No. 99711-2C Eff. 7-25-78 Sup.99711-2B

COOPER INDUSTRIES

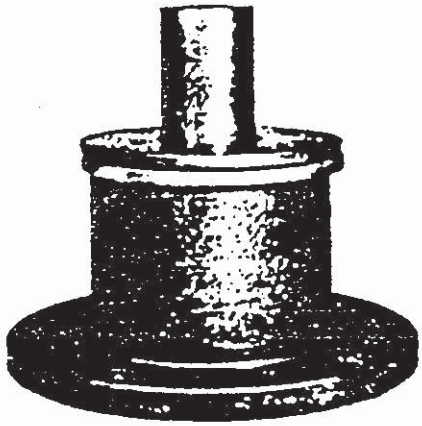
SUTORBILT®
2966 E. VICTORIA STREET
COMPTON, CALIFORNIA 90224
TEL.: (213) 639-7600 • TELEX: 24-4337 SUT

SUTORBILT® WEIGHT LOADED PRESSURE RELIEF VALVES

THREADED – 1" thru 4"



FLANGED 125# ASA – 6" and 8"



The SUTORBILT® weight loaded pressure relief valve offers inexpensive safety relief capacity in a sturdy, trouble free design in 1" through 8" sizes.

Sizes 1" through 4" have standard male threaded connections. Sizes 6" and 8" have standard 125# ASA flange drillings.

Removable weights have been carefully designed to permit accurate pressure settings in ¼ and ½ pound increments in the 1" through 4" size and ½ and 1 pound increments in 6" and 8" size.

The operation of the relief valve is simple. As the service line air pressure reaches the pressure setting, the weight loaded cap is forced upwards off the valve seat. As pressure increases, the cap rises to expose the discharge ports. The flow-through capacity of the valve is such that no damage can be caused to the blower or related systems.

The valve automatically reseats itself as line pressure is reduced.

Since the opening and closing of the valve is essentially sliding of a piston in a cylinder, the valve is virtually chatter-free.

The body and cap of the valve are made of cast iron with close tolerance machined surfaces in the operating areas. The weights are cut from uniform steel plate or uniformly cast to give accurate pressure adjustment.

Application of light oil to the mating surfaces of the cap and body periodically is all the maintenance required on this valve.

The SUTORBILT weight loaded relief valve was engineered to provide long life and dependable protection for your SUTORBILT blower and associated systems by its simplicity of design.

For proper operation, the valve must be mounted in exact upright position.

Use only FULL FLANGE gasket.

F	No. 90912-B Eff. 10-25-69 Sup. 90910-1

All prices subject to change without notice
All prices are F.O.B. Compton, California

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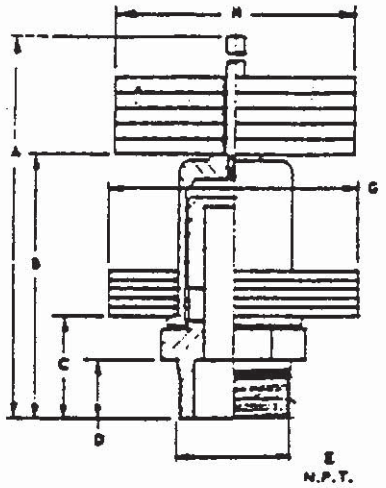
SUTORBILT® WEIGHT LOADED PRESSURE RELIEF VALVES

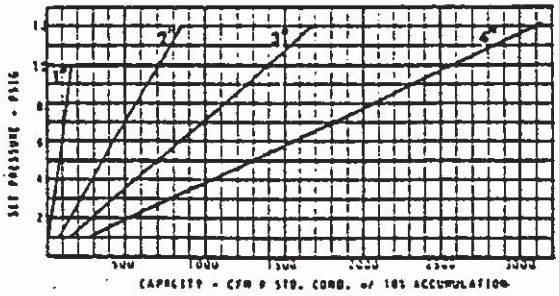
THREADED CONNECTION – 1", 2", 3" AND 4"



DIMENSION CHART

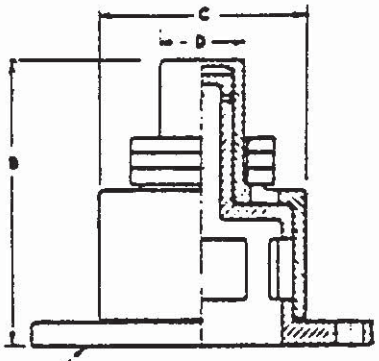
VALVE SIZE	A	B	C	D	E — N.P.T.	G	H
1 INCH	8	5-3/8	1-7/8	1-1/2	1	3-1/2	3-1/4
2 INCH	11	5-3/8	2-1/16	1-3/16	2	3-3/16	5
3 INCH	15-9/16	6-7/16	2-3/4	1-1/2	3	4-3/8	6-13/16
4 INCH	14-1/2	9-1/2	3-1/8	1-3/4	4	5-3/8	5-3/8

CAPACITY CHART



NOTE: 1" Valve is not recommended to relieve pressures over 10 psig.

FLANGED CONNECTION – 6" AND 8"

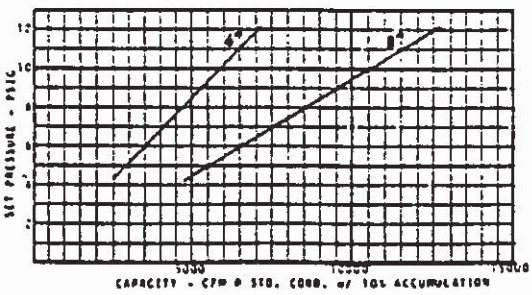


A, MOUNTING FLANGE, ASA 125# DRILLING
USE ONLY FULL FLANGE GASKET.

DIMENSION CHART

VALVE SIZE	DIMENSIONS – INCHES			
	A	B	C	D
6"	6	9-5/8	6-1/2	2-5/8
8"	8	11-1/4	9-1/4	2-3/4

CAPACITY CHART



NOTE: Valves not recommended to relive at set pressures under 4 psig.

All prices subject to change without notice
All prices are F.O.B. Compton, California

F	No. 90910-D Eff. 6-15-82 Sup. 90910-C

Metering Pumps w/Safety Data Sheets

(Sternpac; Redux)

Liquid Metronics Model A161-61 & D131-25HV

Material Safety Data Sheet

LA4875
Sternpac

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Id: LA4875
Product Name: Sternpac
Synonyms: Polyaluminum chloride, polyhydroxosulphatoaluminum chloride.
Chemical Family: Polynuclear inorganic salt
Application: Coagulant for portable water treatment.

Distributed By:
Univar Canada Ltd.
9800 Van Horne Way
Richmond, BC
V6X 1W5

Prepared By: The Environment, Health and Safety Department of Univar Canada Ltd.
Preparation date of MSDS: 24/Apr/2014
Telephone number of preparer: 1-866-686-4827

24-Hour Emergency Telephone Number (CANUTEC): (613) 996-6666

2. HAZARDS IDENTIFICATION

Potential Acute Health Effects:
Eye Contact: Causes moderate eye irritation. Will cause painful burning or stinging or eyes and lids, watering of eyes and inflammation of conjunctiva.
Skin Contact: May cause skin irritation.
Inhalation: Overexposure to vapors may cause irritation of the respiratory tract.
Ingestion: May be harmful if swallowed.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Ingredients	Percentage (W/W)	LD50s and LC50s Route & Species:
Aluminum Chloride Hydroxide Sulphate 39290-78-3	15-40	Acute Oral LD50 :12800mg/kg

Note: No additional remark.

4. FIRST AID MEASURES

Eye Contact: In case of contact, or suspected contact, immediately flush eyes with plenty of water for at least 15 minutes and get medical attention immediately after flushing.
Skin Contact: In case of contact, immediately flush skin with plenty of water for at least 15 minutes. Get medical attention. Remove contaminated clothing and launder before reuse.
Inhalation: Remove person to fresh air. If not breathing, give artificial respiration. If breathing is difficult, get immediate medical attention.
Ingestion: Do NOT induce vomiting. Never give anything by mouth to an unconscious or convulsing person. Seek immediate medical attention. If vomiting occurs spontaneously, keep head below hips to prevent aspiration of liquid into the lungs.
Notes to Physician: Treatment based on sound judgment of physician and individual reactions of patient.

5. FIRE FIGHTING MEASURES

Flash Point: Not applicable.
Flash Point Method: Not applicable.
Autoignition Temperature: Not available.
Flammable Limits in Air (%): Not Available.
Extinguishing Media: Use extinguishing media appropriate for surrounding fire.
Special Exposure Hazards: Use water spray to cool fire-exposed containers and structures.
Hazardous Decomposition/Combustion Materials (under fire conditions): Hydrogen chloride. Aluminum oxides. Oxides of sulphur.
Special Protective Equipment: Fire fighters should wear full protective clothing, including self-contained breathing equipment.
NFPA RATINGS FOR THIS PRODUCT ARE: HEALTH 2, FLAMMABILITY 0, INSTABILITY 1
HMIS RATINGS FOR THIS PRODUCT ARE: HEALTH 2, FLAMMABILITY 0, REACTIVITY 1

6. ACCIDENTAL RELEASE MEASURES

Personal Precautionary Measures: Wear appropriate protective equipment.
Environmental Precautionary Measures: Prevent from entering into soil, ditches, sewers, waterways and/or groundwater. Consult local authorities.
Procedure for Clean Up: Isolate hazard area and restrict access. Ventilate area. Dike area to prevent spill from spreading. Neutralize with lime slurry, limestone, or soda ash. Absorb with an inert dry material and place in an appropriate waste disposal container. Flush area with water to remove trace residue. This will generate carbon dioxide, so additional ventilation may be necessary.

7. HANDLING AND STORAGE

Handling: Ensure all containers are labeled. Treat as any dilute acid. Avoid contact with metals Avoid contact with eyes, skin and clothing. Keep the containers closed when not in use. Wear all protective equipment.
Storage: Store in dry rubber-lined, plastic or FRP vessels. Keep containers tightly closed. Store in original container. Do not store in metal containers. Store between 10°C - 30°C. Reason: Quality.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls:

Utilize a closed system process where feasible. Where this material is not used in a closed system, good enclosure and local exhaust ventilation should be provided to control exposure.
Respiratory Protection: If exposure exceeds occupational exposure limits, use an appropriate NIOSH-approved respirator. Use a NIOSH approved organic vapor / acid gas cartridge respirator.
Gloves:

Appropriate chemical resistant gloves should be worn. Neoprene gloves.
Skin Protection: Wear chemical resistant pants and jackets, preferably butyl or nitrile rubber. Rubber boots.
Eyes: Chemical goggles; also wear a face shield if splashing hazard exists.
Other Personal Protection Data: Ensure that eyewash stations and safety showers are proximal to the work-station location.

Ingredients	Exposure Limit - ACGIH	Exposure Limit - OSHA	Immediately Dangerous to Life or Health - IDLH
Aluminum Chloride Hydroxide Sulphate	Not available.	Not available.	Not Available.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State: Liquid
Color: Clear amber - colorless.
Odor: Slight
pH 1.8 - 3.4
Specific Gravity: 1.16 - 1.30
Boiling Point: 102°C /215.6°F
Freezing/Melting Point: -12°C / 10.39 °F(+/-2)
Vapor Pressure: 17 mmHg @ 20°C
Vapor Density: 1.3
% Volatile by Volume: Not Available.
Evaporation Rate: Not Available.
Solubility: Soluble in water.
VOCs: Not Available.
Viscosity: Not Available.
Molecular Weight: Not Available.
Other: Not Available.

10. STABILITY AND REACTIVITY

Chemical Stability: Stable.
Hazardous Polymerization: Will not occur.
Conditions to Avoid: High temperatures.
Materials to Avoid: Mineral acids. Bases. Metals such as iron or steel which are subject to corrosion. Carbon steel, aluminum, carbon, brasses and nylon.
Hazardous Decomposition Products: Oxides of sulphur. Oxides of aluminum. Hydrogen chloride.
Additional Information:

No additional remark.

11. TOXICOLOGICAL INFORMATION

Principle Routes of Exposure

Ingestion: May be harmful if swallowed.
Skin Contact: May cause skin irritation.
Inhalation: Overexposure to vapors may cause irritation of the respiratory tract.
Eye Contact: Causes moderate eye irritation. Will cause painful burning or stinging or eyes and lids, watering of eyes and inflammation of conjunctiva.

Additional Information: No additional information available.

Acute Test of Product:

Acute Oral LD50: > 5000 mg/kg (Rat)
Acute Dermal LD50: Not Available.
Acute Inhalation LC50: Not Available.

Carcinogenicity:

Ingredients	IARC - Carcinogens	ACGIH - Carcinogens
Aluminum Chloride Hydroxide Sulphate	Not listed.	Not listed.

Carcinogenicity Comment: No additional information available.

Reproductive Toxicity/ Teratogenicity/ Embryotoxicity/ Mutagenicity: Not Available.

12. ECOLOGICAL INFORMATION

Ecotoxicological Information:

Ingredients	Ecotoxicity - Fish Species Data	Acute Crustaceans Toxicity:	Ecotoxicity - Freshwater Algae Data
Aluminum Chloride Hydroxide Sulphate	1460 - 1500 mg/L LC50 (Leuciscus idus melanotus) 48 h static	Not Available.	Not Available.

Other Information:
No additional remark.

13. DISPOSAL CONSIDERATIONS

Disposal of Waste Method: Disposal of all wastes must be done in accordance with municipal, provincial and federal regulations.
Contaminated Packaging: Empty containers should be recycled or disposed of through an approved waste management facility.

14. TRANSPORT INFORMATION

DOT (U.S.):
DOT Shipping Name: CORROSIVE LIQUID, ACIDIC, INORGANIC, N.O.S. (ALUMINUM CHLORIDE HYDROXIDE SULPHATE)
DOT Hazardous Class 8
DOT UN Number: UN3264
DOT Packing Group: III
DOT Reportable Quantity (lbs): Not Available.
Note: No additional remark.
Marine Pollutant: No.

TDG (Canada):
TDG Shipping Name: CORROSIVE LIQUID, ACIDIC, INORGANIC, N.O.S. (ALUMINUM CHLORIDE HYDROXIDE SULPHATE)
Hazard Class: 8
UN Number: UN3264
Packing Group: III
Note: No additional remark.
Marine Pollutant: No.

15. REGULATORY INFORMATION

U.S. TSCA Inventory Status: All components of this product are either on the Toxic Substances Control Act (TSCA) Inventory List or exempt.

Canadian DSL Inventory Status: All components of this product are either on the Domestic Substances List (DSL), the Non-Domestic Substances List (NDSL) or exempt.

Note: Not available.

U.S. Regulatory Rules

Ingredients	CERCLA/SARA - Section 302:	SARA (311, 312) Hazard Class:	CERCLA/SARA - Section 313:
Aluminum Chloride Hydroxide Sulphate	Not Listed.	Not Listed.	Not Listed.

California Proposition 65: Not Listed.
MA Right to Know List: Not Listed.
New Jersey Right-to-Know List: Not Listed.
Pennsylvania Right to Know List: Not Listed.

WHMIS Hazardous Class:
E CORROSIVE MATERIAL

16. OTHER INFORMATION

Additional Information: This product has been classified in accordance with the hazard criteria of the Canadian Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR.

Disclaimer: NOTICE TO READER:
Univar, expressly disclaims all express or implied warranties of merchantability and fitness for a particular purpose, with respect to the product or information provided herein, and shall under no circumstances be liable for incidental or consequential damages.

Do not use ingredient information and/or ingredient percentages in this MSDS as a product specification. For product specification information refer to a Product Specification Sheet and/or a Certificate of Analysis. These can be obtained from your local Univar Sales Office.

All information appearing herein is based upon data obtained from the manufacturer and/or recognized technical sources. While the information is believed to be accurate, Univar makes no representations as to its accuracy or sufficiency. Conditions of use are beyond Univar's control and therefore users are responsible to verify this data under their own operating conditions to determine whether the product is suitable for their particular purposes and they assume all risks of their use, handling, and disposal of the product, or from the publication or use of, or reliance upon, information contained herein. This information relates only to the product designated herein, and does not relate to its use in combination with any other material or in any other process.

*****END OF MSDS*****

REDUX TECHNOLOGY®
Division of Azure Water Services, LLC

Redux 390 Deposit Control Agent

PRODUCT APPLICATION:

Redux 390 is a concentrated blend of sequestering agents and polymers specifically designed to prevent the precipitation and deposition of calcium and other hardness salts and limited metal oxide concentrations in groundwater recovery and treatment systems. By maintaining clean treatment system surfaces, use of the product helps to increase mass transfer rates, improve circulation and, perhaps most importantly, reduce instances of highly destructive under-deposit corrosion. When used on a continuous basis, or as part of a coordinated clean-up program, Redux 390 can also help to remove existing deposits from the system.

Redux 390 is easy to use in that the product is environmentally safe, does not promote microbiological contamination, is active over a broad pH range and is compatible with all other water treatment compounds. The product is also chlorine-stable, does not contribute to foaming problems and is non-corrosive to metal surfaces.

PRODUCT DESCRIPTION:

Appearance:	Clear, pale yellow liquid
Specific Gravity:	1.0 - 1.1 @ 25 degrees C
Density:	8.61 pounds per gallon
pH:	Approximately 2.5
Freeze Point:	~28 degrees F

PRODUCT DOSAGE:

As product feed rates are highly dependent upon makeup water characteristics and system operating conditions, your sales representative should be consulted for specific dosage recommendations. Typically, however, Redux 390 is dosed to the system at a rate of 25 - 200 ppm (as product). The recommended feed method is continuously feed into the treatment system influent line.

PRODUCT SAFETY:

As with any industrial chemical, Redux 390 should be handled with appropriate care. Therefore, please have all supervisory personnel and operating employees review the Material Safety Data Sheet (MSDS) to obtain recommended application, storage and disposal procedures before using the product in your facility.

PRODUCT PACKAGING:

Redux-380 is available in 55 and 30 gallon drums, 15 gallon containers, 6 gallon pails and bulk containers of various sizes.

280 Callegari Drive, West Haven, Connecticut 06516
Phone: 203-933-9071 Fax: 203-933-1751 www.reduxtech.com

REDUX TECHNOLOGY®

Division of Azure Water Services, LLC

Material Safety Data Sheet

Product Name: Redux 390 **Effective date: 9/15/2013**
MSDS #: 36 **Page** 1 of 6

SECTION 1 -- CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

IDENTIFICATION

Product Name Redux 390
Chemical Name Aqueous Blended Deposit Control Agent
Chemical Family
Formula
Synonym

COMPANY IDENTIFICATION

Redux Technology
Division of Azure Water Services, LLC
280 Callegari Drive
West Haven, CT 06516
Phone: 203-933-9071
Fax: 203-933-1751
Email: info@reduxtech.com

EMERGENCY TELEPHONE NUMBER

24 hours a day: CHEMTREC 1-800-424-9300.
Number for non-emergency questions concerning MSDS: 203-933-9071

SECTION 2 -- COMPOSITION / INFORMATION ON INGREDIENTS

Component	CAS #	Amount (%W/W)
Water	7732-18-5	~90.0%
PolyCarboxylic Acid	Non Hazardous	~6.0%
Organophosphorous Compound	Proprietary	~4.0%

SECTION 3 -- HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW	**Eye and skin irritant. Material may cause burns on exposed tissues. Eye contact may cause corneal injury, which may result in permanent impairment of vision, or even blindness. Prolonged or repeated skin may cause irritation or even a burn.**

POTENTIAL HEALTH EFFECTS	
INGESTION.....	Mildly corrosive.Can cause severe and permanent damages to mouth throat and stomach. May be fatal if swallowed.
INHALATION.....	Damages airways and lungs, depending upon amount and duration of exposure. Effects can vary from irritation to bronchitis or pneumonia.
EYE CONTACT.....	Corrosive to the eyes, and may cause permanent damage, including blindness.
SKIN CONTACT.....	Mildy corrosive; causes skin burns. Harmful contact may not cause immediate pain.

SECTION 4 -- FIRST AID MEASURES

INGESTION	If swallowed, DO NOT induce vomiting. Immediately drink a large quantity of water. If available, give large quantities of milk. Never give anything by mouth to an unconscious person. **Get medical attention immediately.** If vomiting occurs spontaneously, keep airway clear.
INHALATION	Get person out of contaminated area to fresh air. If breathing has stopped, resuscitate and administer oxygen if readily available. **Get medical attention immediately.**
EYE CONTACT	Immediately flush eye with plenty of cool, running water. Remove contact lenses if applicable and continue flushing for at least 15 minutes, holding eyelids apart to ensure thorough rinsing of the entire eye. **Get medical attention immediately.**
SKIN CONTACT	Immediately flush skin with plenty of cool running water for at least 15 minutes. Wash with soap and water. If irritation develops or persists, get medical attention. Remove contaminated clothing and shoes; wash before reuse.
NOTE TO PHYSICIAN	Information pertaining to ingestion toxicology, therapy, symptomatology and treatment can be found in Clinical Toxicology of Commercial Products, authored by Gosselin, Smith and Hodge and published by Williams & Wilkins, Baltimore, Maryland.

SECTION 5 -- FIRE FIGHTING MEASURES

FLASH POINT / METHOD	None / N.A.	FLAMMABLE LIMITS	Not flammable or combustible
EXTINGUISHING MEDIA	Use extinguishing media appropriate for surrounding fire.		
SPECIAL FIRE FIGHTING PROCEDURES	Pressure demand self-contained respiratory protection and protective clothing should be worn by fire fighters.		
FIRE AND EXPLOSION HAZARDS	Not a fire or explosion hazard		

SECTION 6 -- ACCIDENTAL RELEASE MEASURES

RESPONSE TO SPILLS	Absorb with inert material such as vermiculite, shovel into closeable container for disposal. Thoroughly flush residual with water.

SECTION 7 -- HANDLING AND STORAGE

HANDLING PRECAUTIONS	Wear proper safety equipment. Mix only with water. Follow appropriate tank entry procedures (ANSI Z117) and OSHA Confined Space Regulations.
STORAGE PRECAUTIONS	Store in a cool, dry and well-ventilated place. Keep from freezing. Keep container tightly closed when not in use.

SECTION 8 -- EXPOSURE CONTROLS / PERSONAL PROTECTION

HYGIENIC PRACTICES	Observe label precautions; use personal protective equipment. Avoid breathing mists or vapors of this product.
ENGINEERING CONTROLS	**Facilities using this product must be equipped with an eyewash station.** Local Exhaust: None

PERSONAL PROTECTIVE EQUIPMENT

X	**RESPIRATOR**	NIOSH/MSHA approved respirator where mists or sprays may be generated.
X	**GOGGLES / FACE SHIELD**	Chemical splash goggles required; also use face shield if exposure is severe
X	**APRON**	Required; PVC, Neoprene or Vinyl acceptable
X	**GLOVES**	Required; use PVC, Neoprene or Nitrile with long gauntlet or protective cuff
X	**BOOTS**	Rubber

SECTION 9 -- PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE	Clear pale yellow liquid	BOILING POINT	> 212^{o} F
ODOR	Slight Odor	FREEZING POINT	< 32^{o} F
pH	Approx. 6.0	VAPOR PRESSURE	Similar to water
SPECIFIC GRAVITY	1.03	VAPOR DENSITY	Similar to water
SOLUBILITY IN WATER	Complete	EVAPORATION RATE	Similar to water

SECTION 10 -- STABILITY AND REACTIVITY

CHEMICAL STABILITY		**STABLE**	X		**UNSTABLE**	
CONDITIONS TO AVOID	Do not mix with anything but water.					
INCOMPATIBILITY	Do not mix with quaternay amines, acids, sulfides and strong oxidizers.					
HAZARDOUS PRODUCTS OF DECOMPOSITION	Carbon dioxide and carbon monoxide.					
POLYMERIZATION		**WILL NOT OCCUR**	X		**MAY OCCUR**	
CONDITIONS TO AVOID	Not applicable					

SECTION 11 -- TOXICOLOGICAL INFORMATION

Oral: Rat LD50 = >13,000 mg/kg
Eye Irritation: Corrosive
Skin irritation Mild Irritant

CARCINOGENICITY

	THIS PRODUCT CONTAINS A KNOWN OR SUSPECTED CARCINOGEN
X	**THIS PRODUCT DOES NOT CONTAIN ANY KNOWN OR ANTICIPATED CARCINOGENS ACCORDING TO THE CRITERIA OF THE NTP ANNUAL REPORT ON CARCINOGENS AND OSHA 29 CFR 1910, Z**

OTHER EFFECTS

ACUTE	May be corrosive to all body tissues which it comes in contact.
CHRONIC	The chronic local effect may consist of multiple areas of superficial destruction of the skin or of primary irritant dermatitis. Similarly, inhalation of dust, spray, or mist may result in varying degrees of irritation or damage to the respiratory tract tissues and an increased susceptibility to respiratory illness.

SECTION 12 -- ECOLOGICAL INFORMATION

BIODEGRADABILITY		**CONSIDERED BIODEGRADABLE**	X		**NOT BIODEGRADABLE**	
BOD / COD VALUE	Not established					
ECOTOXICITY	Ceriodaphnia: 48 hr LD50 = 5,800 mg/l NOAEL = 4,000 mg/l Fathead Minnow: 96 hr LD50 = 11,400 mg/l NOAEL = 4,000 mg/l Rainbow Trout: 96 hr LD50 = 12,500 mg/l					

SECTION 13 -- DISPOSAL CONSIDERATIONS

WASTE DISPOSAL METHOD	Product that cannot be used according to the label must be disposed of as a hazardous waste at an approved hazardous waste management facility. Empty containers may be triple rinsed, then offered for recycling or reconditioning; or puncture and dispose of in a sanitary landfill.									
RCRA CLASSIFICATION	Non-Hazardous									
RECYCLE CONTAINER		**YES**	X		**CODE**	2 - HDPE		**NO**		

SECTION 14 -- TRANSPORT INFORMATION

DOT CLASSIFICATION		**HAZARDOUS**			**NOT HAZARDOUS**	X
DESCRIPTION						

SECTION 15 -- REGULATORY INFORMATION

REGULATORY STATUS

	EPA REGISTERED (UNDER FIFRA)	
	FDA REGULATED	
	KOSHER	
	SARA TITLE III MATERIAL	
	USDA AUTHORIZED	
	NSF APPROVAL	

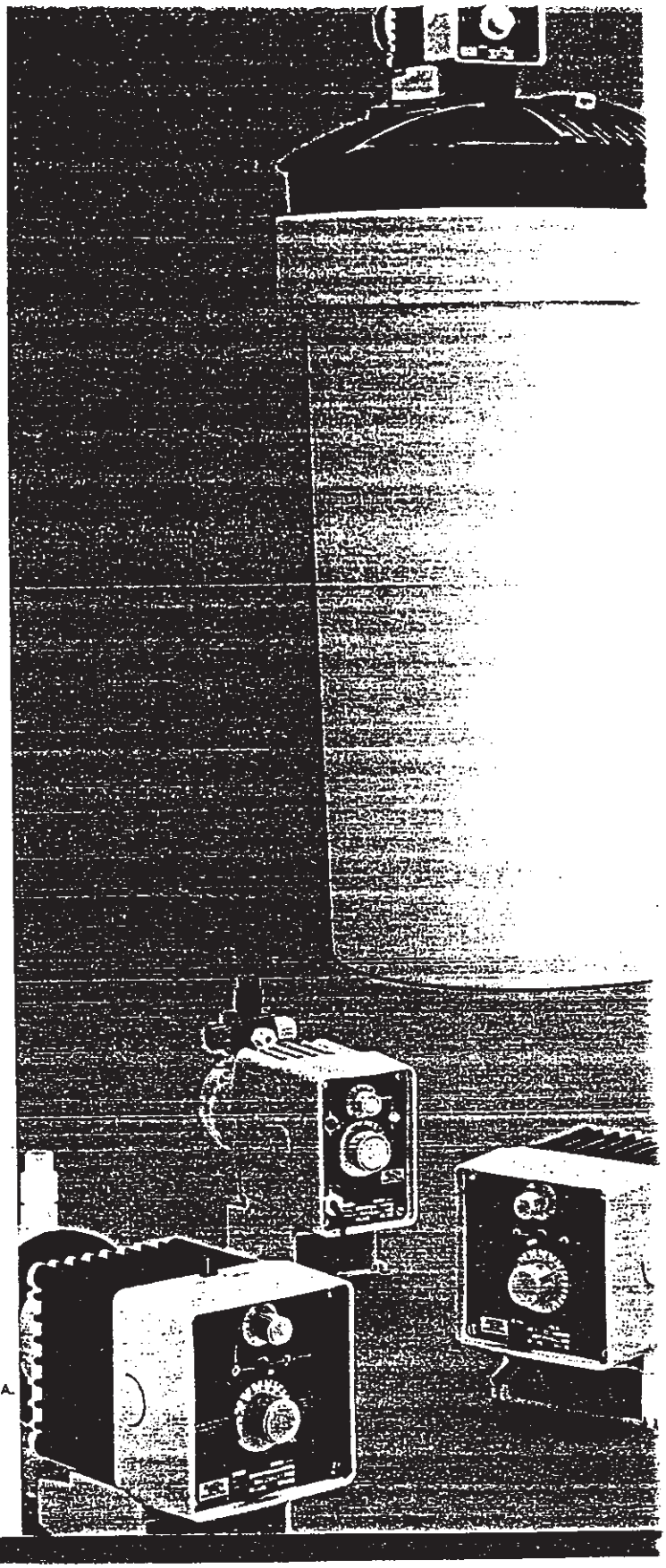
SECTION 16 -- OTHER INFORMATION

NFPA CLASSIFICATION

2	**BLUE**	HEALTH HAZARD
0	**RED**	FLAMMABILITY
1	**YELLOW**	REACTIVITY
C	**WHITE**	SPECIAL HAZARD

Versatility in chemical metering pumps

- Four series covering output ranges from 0.002 to 70 GPH (.008 to 265 liters/hour)
- Corrosion proof housings of glass fiber reinforced polypropylene
- Solid state encapsulated electronics
- Thermostatic power coil protection
- Built-in anti-syphon valve
- Automatic pressure limitation prevents damage to pump or system

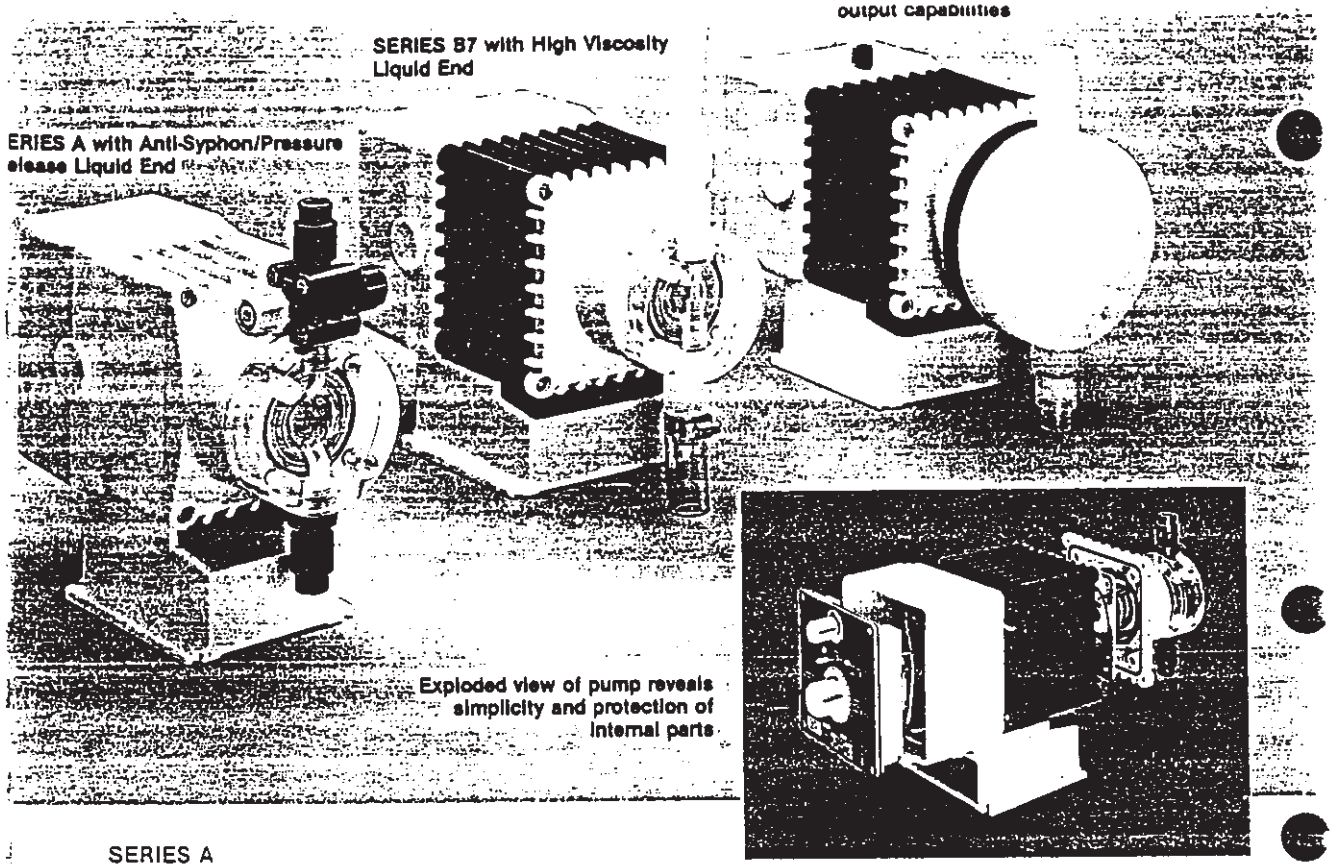


ARIES CHEMICAL, INC.
R.D. 1 Box 171A
Castorland NY 13620
315 346-1489

LIQUID METRONICS INCORPORATED
19 Craig Road, Acton, MA 01720-5495 U.S.A.

Bulletin Sec. 1.0, pg. 1000
Replaces Same of 7/86

output capabilities



SERIES 87 with High Viscosity Liquid End

ERIES A with Anti-Syphon/Pressure elease Liquid End

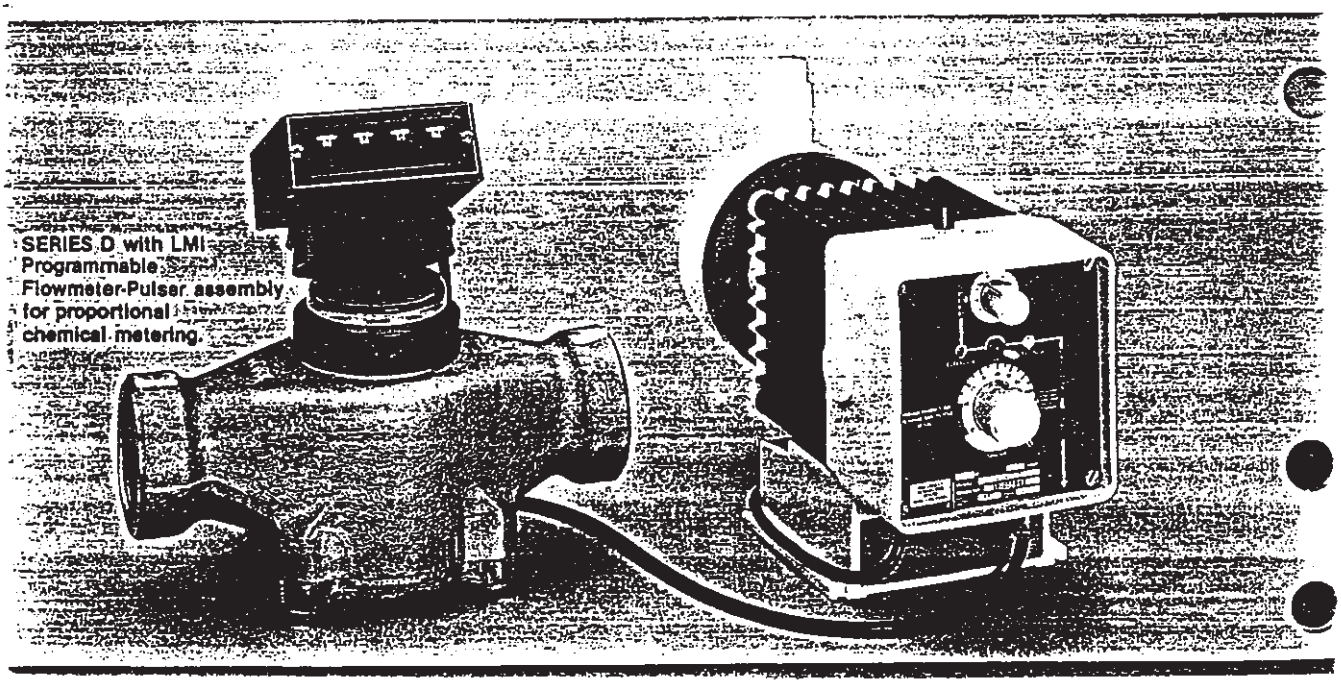
Exploded view of pump reveals simplicity and protection of internal parts

SERIES A

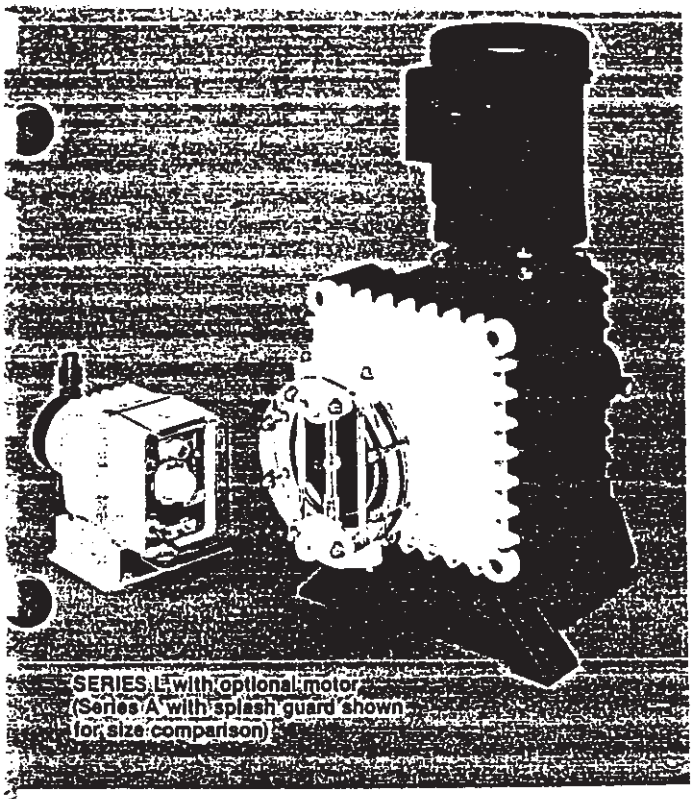
Safety and reliability unavailable in pumps of this size and type until now. Adjust both stroke length and stroke frequency for 100:1 output range. Feed viscous polymers, corrosive acids or caustics with confidence. Series A pumps are also capable of responding to external switch closures.

SERIES B & D

The same safety, reliability and dual output controls as on the A Series but with greater power, 200:1 output range and higher output/pressure ratings. In addition, B & D Series pumps can respond to external switch closures for easy adaptability to automatic controls.



SERIES D with LMI Programmable Flowmeter-Pulser assembly for proportional chemical metering.



SERIES L with optional motor (Series A with splash guard shown for size comparison)

Why LMI?

Because LMI pumps are a major advance in the state of the metering pump art. Features include:

- Outstanding safety and electromagnetic pressure limitation
- Corrosion proof housing of glass fiber reinforced polypropylene
- Solid state encapsulated electronics
- Thermostatic power coil protection
- Minimal power consumption, 22 watts maximum for A14 Series
- No lubrication required
- Independently adjustable stroke length and frequency for wide output rangeability
- Solid Ceramic ball valves with Teflon or Polyprel™ seats handle most chemicals

SERIES L

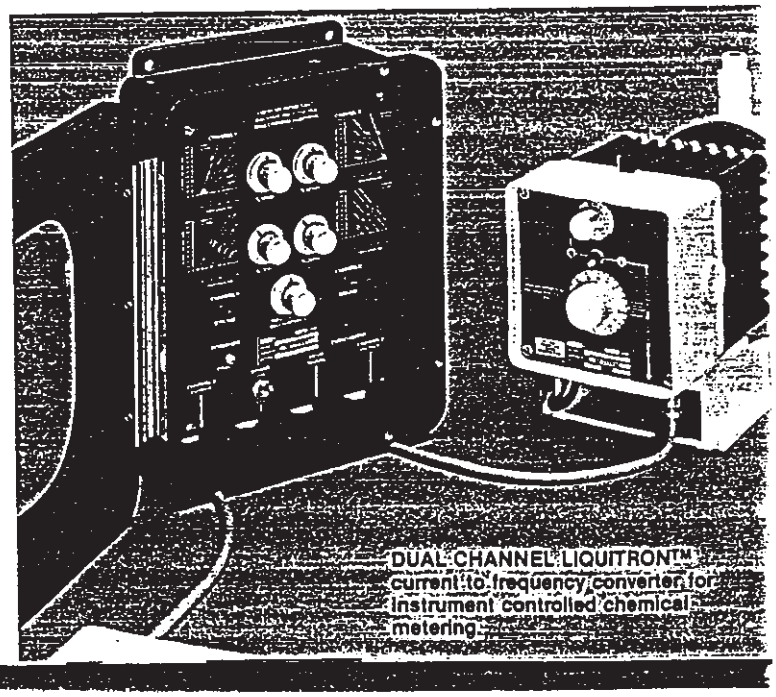
LMI's newest line of metering pumps are mechanically driven, and can be used with a number of different motors (available as options). Depending on the motor speed, maximum output is 35 or 70 GPH, 60 Hz, and 110 or 220 LPH, 50 Hz. Adjustment is by stroke length while in operation. In addition, the L Series features a totally enclosed gear reduction drive in an oil bath.

ACCESSORIES

LMI pumps can be supplied with a wide variety of accessories that include:

- Corporation Stop and Nozzle Assembly
- Fluoride Saturator
- Liquid Level Switch
- Splash Guard
- Anti-Syphon/Pressure Release Valve
- and more!

50 GALLON POLYETHYLENE TANK and rigid pump support cover. For corrosive and non-corrosive chemical solutions. Self-supporting tapered sides with U.S. gallon and liter graduations.



DUAL CHANNEL LIQUITRON™ current to frequency converter for instrument controlled chemical metering

Output Capacity	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
Gallons per hour	0.006	0.58	0.002	0.58	0.002	0.42	0.01	1.0	0.02	2.0	0.006	0.42	0.011	0.75	3.5	35	7.0	70.0
Liters per hour	0.023	2.19	0.008	2.19	0.008	1.57	0.038	3.79	0.076	7.57	0.023	1.57	0.043	2.84	13.25	132.5	26.5	265.0
ML or CC per min	0.40	38.0	0.13	38.0	0.13	26.3	0.63	63.0	1.26	126.0	0.40	26.3	0.72	47.3	221	2208	442	4416
Output per stroke ML or CC	0.08	.38	.08	.38	.07	.26	0.13	0.63	0.26	1.26	.07	.26	.14	47	—	—	—	—
Strokes per minute (Adjustable)	5	100	1.7	100	1.7	100	5	100	5	100	5	100	5	100	—	—	—	—
Stroke Length (0-100% adjustable) Recommended min	20%		20%		30%		20%		20%		30%		30%		10%		10%	
Maximum Injection Pressure	250 psi (17.3 bar)		250 psi (17.3 bar)		140 psi (9.7 bar)		110 psi (7.6 bar)		50 psi (3.5 bar)		140 psi (9.7 bar)		80 psi (5.5 bar)		125 psi (8.6 bar)		125 psi (8.6 bar)	
Peak Input Power	110 watts		110 watts		75 watts		150 watts		150 watts		75 watts		75 watts		¼ H.P.		½ H.P.	
Average Input Power @ maximum speed	22 watts		22 watts		11 watts		22 watts		22 watts		11 watts		11 watts		N/A		N/A	
Height; max.	8" (203 mm)		8" (203 mm)		8" (203 mm)		8" (203 mm)		8" (203 mm)		8" (203 mm)		8" (203 mm)		24"** (610 mm)		24"** (610 mm)	
Length; max.	9.25" (235 mm)		9.25" (235 mm)		9.25" (235 mm)		9.25" (235 mm)		9.25" (235 mm)		9.25" (235 mm)		9.25" (235 mm)		19" (483 mm)		19" (483 mm)	
Width; max. (Facing head)	4.05" (103 mm)		4.05" (103 mm)		4.05" (103 mm)		4.05" (103 mm)		4.05" (103 mm)		4.05" (103 mm)		4.05" (103 mm)		12" (305 mm)		12" (305 mm)	
Shipping weight	10 lbs. (4.55 kg)		10 lbs. (4.55 kg)		10 lbs. (4.55 kg)		10 lbs. (4.55 kg)		10 lbs. (4.55 kg)		10 lbs. (4.55 kg)		10 lbs. (4.55 kg)		85 lbs. (38.6 kg)		85 lbs. (38.6 kg)	

Voltage: 115 Volts AC 50/60 Hz, single phase.
200-240 Volts AC 50/60 Hz, single phase available.

**14.25" (362 mm) without optional motor.
† 62 lbs. (28.2 kg) without optional motor.

Specifications B & D*

SERIES	B11 B71		B12 B72		B13 B73		D10 D70		D11 D71		D12 D72		D13 D73		D14 D74	
Output Capacity	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
Gallons per hour	0.008	1.6	0.012	2.5	0.022	4.5	0.006	1.3	0.012	2.5	0.02	4.0	.04	8.0	0.1	20.0
Liters per hour	0.03	6.0	0.05	9.5	0.085	17.0	0.024	4.9	0.047	9.5	.076	15.2	.15	30.3	0.3785	76.0
ML or CC per min	0.5	100	0.79	158	1.42	284.0	0.41	81.75	0.79	157.5	1.28	252	2.51	504.75	6.30	1260
Output per stroke ML or CC	0.10	1.0	0.16	1.58	0.28	2.84	0.11	1.09	0.21	2.10	0.34	3.36	0.67	6.73	1.68	16.8
Strokes per minute (Adjustable)	5	100	5	100	5	100	3.75	75	3.75	75	3.75	75	3.75	75	3.75	75
Stroke Length (0-100% adjustable) Recommended min	15%		10%		10%		10%		10%		10%		10%		10%	
Maximum Injection Pressure	150 psi (10.3 bar)		100 psi (6.9 bar)		50 psi (3.5 bar)		300 psi (20.7 bar)		150 psi (10.3 bar)		100 psi (6.9 bar)		60 psi (4.1 bar)		20 psi (1.4 bar)	
Peak Input Power	248 watts		248 watts		248 watts		381 watts		381 watts		381 watts		381 watts		381 watts	
Average Input Power @ maximum speed	29 watts		29 watts		29 watts		33 watts		33 watts		33 watts		33 watts		33 watts	
Height; max.	8" (203 mm)		8" (203 mm)		8" (203 mm)		9.25" (235 mm)		9.25" (235 mm)		9.25" (235 mm)		9.25" (235 mm)		9.25" (235 mm)	
Length; max.	10.75" (273 mm)		10.75" (273 mm)		10.75" (273 mm)		10.75" (273 mm)		10.75" (273 mm)		10.75" (273 mm)		11.00" (280 mm)		11.70" (298 mm)	
Width; max. (Facing head)	5.72" (146 mm)		5.72" (146 mm)		5.72" (146 mm)		5.72" (146 mm)		5.72" (146 mm)		5.72" (146 mm)		5.72" (146 mm)		5.72" (146 mm)	
Shipping weight	15 lbs. (6.9 kg)		15 lbs. (6.9 kg)		15 lbs. (6.9 kg)		19 lbs. (8.7 kg)		19 lbs. (8.7 kg)		19 lbs. (8.7 kg)		19 lbs. (8.7 kg)		19 lbs. (8.7 kg)	

Voltage: 115 Volts AC, 50/60 Hz, single phase. 200-240 Volts AC, 50/60 Hz, single phase available.

***For complete ordering information refer to individual product information and specification sheets or Bulletin 9.0.1000 General Price List.**

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Telex: 95-1781
FAX: 617-264-9172

Printed in U.S.A. 30M 12/86 SGM WEA

WARRANTY

Liquid Metronics Incorporated warrants equipment of its manufacture and bearing its identification to be free from defects in workmanship and material. LMI's liability under this warranty extends for a period of one year from the date of delivery from our factory or authorized distributor. It is limited to repairing or replacing any device or part which is returned, transportation prepaid, to the factory within one year of delivery to the original purchaser, and which is proven defective upon examination.

LMI disclaims all liability for damage during transportation, for consequential damage of whatever nature, for damage due to handling, installation or improper operation, and for determining suitability for the use intended by the purchaser. Replaceable elastomeric parts are expendable and are not covered by any warranty either express or implied.

LMI makes no warranties either express or implied other than those stated above. No representative has authority to change or modify this warranty in any respect.

Specifications subject to change without notice.

SERIES	[illegible]		[illegible]		[illegible]		[illegible]		[illegible]		[illegible]		[illegible]	
Output Capacity	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
Gallons per hour	0.006	0.58	0.002	0.58	0.002	0.42	0.01	1.0	0.02	2.0	0.006	0.42	0.011	0.75
Liters per hour	0.023	2.19	0.008	2.19	0.008	1.57	0.038	3.79	0.076	7.57	0.023	1.57	0.043	2.84
ML or CC per min	0.40	38.0	0.13	38.0	0.13	26.3	0.63	63.0	1.26	126.0	0.40	26.3	0.72	47.3
Output per stroke ML or CC	0.08	.38	.08	.38	.07	.26	0.13	0.63	0.26	1.26	.07	.26	.14	.47
Strokes per minute (Adjustable)	5	100	1.7	100	1.7	100	5	100	5	100	5	100	5	100
Stroke Length (0-100% adjustable) Recommended min	20%		20%		30%		20%		20%		30%		30%	
Maximum Injection Pressure	250 psi (17.3 bar)		250 psi (17.3 bar)		140 psi (9.7 bar)		110 psi (7.6 bar)		50 psi (3.5 bar)		140 psi (9.7 bar)		80 psi (5.5 bar)	
Peak Input Power	110 watts		110 watts		75 watts		150 watts		150 watts		75 watts		75 watts	
Average Input Power @ maximum speed	22 watts		22 watts		11 watts		22 watts		22 watts		11 watts		11 watts	
Height; max.	8" (203 mm)		8" (203 mm)		8" (203 mm)		8" (203 mm)		8" (203 mm)		8" (203 mm)		8" (203 mm)	
Length; max.	9.25" (235 mm)		9.25" (235 mm)		9.25" (235 mm)		9.25" (235 mm)		9.25" (235 mm)		9.25" (235 mm)		9.25" (235 mm)	
Width; max. (Facing head)	4.05" (103 mm)		4.05" (103 mm)		4.05" (103 mm)		4.05" (103 mm)		4.05" (103 mm)		4.05" (103 mm)		4.05" (103 mm)	
Shipping weight	10 lbs. (4.55 kg)		10 lbs. (4.55 kg)		10 lbs. (4.55 kg)		10 lbs. (4.55 kg)		10 lbs. (4.55 kg)		10 lbs. (4.55 kg)		10 lbs. (4.55 kg)	

[illegible]		L12	
Min.	Max.	Min.	Max.
3.5	35	7.0	70.0
13.25	132.5	26.5	265.0
221	2208	442	4416
—	—	—	—
—	—	—	—
10%		10%	
125 psi (8.6 bar)		125 psi (8.6 bar)	
¼ H.P.		½ H.P.	
N/A		N/A	
24"** (610 mm)		24"** (610 mm)	
19" (483 mm)		19" (483 mm)	
12" (305 mm)		12" (305 mm)	
85 lbs. (38.6 kg)		85 lbs. (38.6 kg)	

Voltage: 115 Volts AC 50/60 Hz, single phase.
200-240 Volts AC 50/60 Hz, single phase available.

**14.25" (362 mm) without optional motor.
† 62 lbs. (28.2 kg) without optional motor.

Specifications B & D*

SERIES	B11 B71		B12 B72		B13 B73		D10 D70		D11 D71		D12 D72		D13 D73		D14 D74	
Output Capacity	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
Gallons per hour	0.008	1.6	0.012	2.5	0.022	4.5	0.006	1.3	0.012	2.5	0.02	4.0	.04	8.0	0.1	20.0
Liters per hour	0.03	6.0	0.05	9.5	0.085	17.0	0.024	4.9	0.047	9.5	.076	15.2	.15	30.3	0.3785	76.0
ML or CC per min	0.5	100	0.79	158	1.42	284.0	0.41	81.75	0.79	157.5	1.28	252	2.51	504.75	6.30	1260
Output per stroke ML or CC	0.10	1.0	0.16	1.58	0.28	2.84	0.11	1.09	0.21	2.10	0.34	3.36	0.67	6.73	1.68	16.8
Strokes per minute (Adjustable)	5	100	5	100	5	100	3.75	75	3.75	75	3.75	75	3.75	75	3.75	75
Stroke Length (0-100% adjustable) Recommended min	15%		10%		10%		10%		10%		10%		10%		10%	
Maximum Injection Pressure	150 psi (10.3 bar)		100 psi (6.9 bar)		50 psi (3.5 bar)		300 psi (20.7 bar)		150 psi (10.3 bar)		100 psi (6.9 bar)		60 psi (4.1 bar)		20 psi (1.4 bar)	
Peak Input Power	248 watts		248 watts		248 watts		381 watts		381 watts		381 watts		381 watts		381 watts	
Average Input Power @ maximum speed	29 watts		29 watts		29 watts		33 watts		33 watts		33 watts		33 watts		33 watts	
Height; max.	8" (203 mm)		8" (203 mm)		8" (203 mm)		9.25" (235 mm)		9.25" (235 mm)		9.25" (235 mm)		9.25" (235 mm)		9.25" (235 mm)	
Length; max.	10.75" (273 mm)		10.75" (273 mm)		10.75" (273 mm)		10.75" (273 mm)		10.75" (273 mm)		10.75" (273 mm)		11.00" (280 mm)		11.70" (298 mm)	
Width; max. (Facing head)	5.72" (146 mm)		5.72" (146 mm)		5.72" (146 mm)		5.72" (146 mm)		5.72" (146 mm)		5.72" (146 mm)		5.72" (146 mm)		5.72" (146 mm)	
Shipping weight	15 lbs. (6.9 kg)		15 lbs. (6.9 kg)		15 lbs. (6.9 kg)		19 lbs. (8.7 kg)		19 lbs. (8.7 kg)		19 lbs. (8.7 kg)		19 lbs. (8.7 kg)		19 lbs. (8.7 kg)	

Voltage: 115 Volts AC, 50/60 Hz, single phase. 200-240 Volts AC, 50/60 Hz, single phase available.

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Printed in U.S.A. 30M 12/86 SGM WEA

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LMI disclaims all liability for damage during transportation, for consequential damage of whatever nature, for damage due to handling, installation or improper operation, and for determining suitability for the use intended by the purchaser. Replaceable elastomeric parts are expendable and are not covered by any warranty either express or implied.

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Specifications subject to change without notice.

SERIES A14,A15,A16,A17,A18 METERING PUMPS

INSTRUCTIONS
MAINTENANCE
SERVICE

For file reference, please record the following data:

Model No.: _____

Serial No.: _____

Installation Date: _____

Installation Location: _____

_____

When ordering replacement parts for your LMI Metering Pump or accessory, please include complete model number and serial number of your unit.

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Bulletin Sec. 6.0, pg. 1000
Replaces same of 3/88

INSTALLATION

I. UNPACKING

A. Remove tubing, injection check and foot valve from the small cardboard carton included in the pump carton. Notify delivery carrier immediately if there are any signs of damage to the metering pump or parts.

II. LOCATION AND MOUNTING

CAUTION

When pumping chemicals make certain that all tubing is securely attached to the fittings. It is recommended that tubing or pipe lines be shielded to prevent possible injury in case of rupture or accidental damage. Always wear protective face shield and clothing when working on or near a chemical metering pump.

A. Locate the pump in an area that is convenient to both chemical injection point and electrical supply. LMI chemical metering pumps have corrosion resistant housings, but should not be subjected to continuous high temperature (over 122°F or 50°C).

B. Mount pump on a shelf directly above chemical tank. Secure pump by putting size no. 10 (3/16") or 5 mm diameter screws through the four slots at the edge of the pump base.

C. Pump may also be mounted on top of molded chemical tank cover provided the cover has a recess for pump mounting to prevent pump from sliding. A molded cover for this purpose is included with LMI tank and cover assembly, in 10, 35 and 50 gallon size.

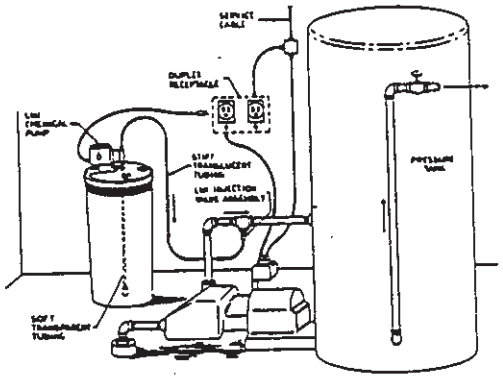
D. Diagrams (below and on the following page) show typical chemical pump installation methods. Note location of **injection check valve** which is most important. Refer to **separate Liquid Handling Assembly Instructions** Section A regarding installation of injection check valve.

E. BACK PRESSURE REQUIREMENTS—All electronically controlled magnetically driven pumps maintain maximum velocity on the discharge portion of their stroke regardless of the stroke frequency setting. If there is little or no resistance (back pressure) the velocity of the pumped fluid will be so great as to cause over-pumping. Because of this characteristic, back pressure equal to approximately 25 psi must be supplied by an anti-syphon/back pressure valve if the system pressure at the injection point is not high enough to provide the needed back pressure.

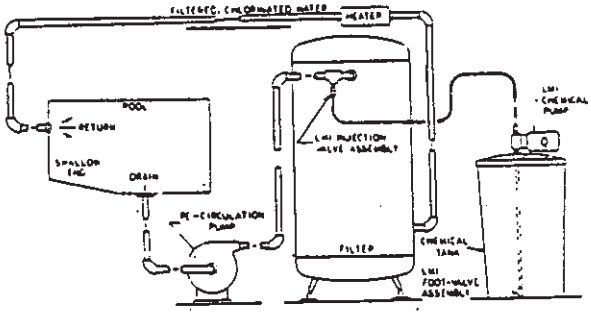
CAUTION

Be sure installation does not constitute a cross connection. Check local plumbing code.

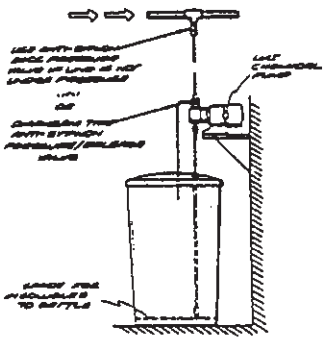
HYDROPNEUMATIC SYSTEMS



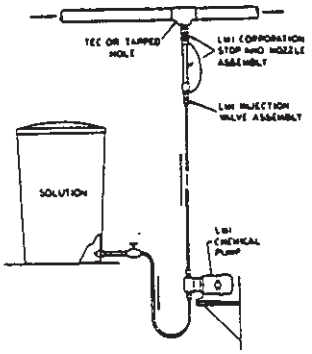
TREATMENT OF SWIMMING POOLS



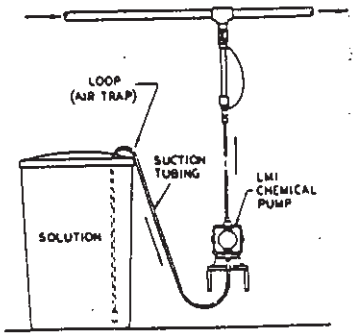
SUCTION LIFT INSTALLATION



FLOODED SUCTION INSTALLATION
helpful when pumping at very low rate

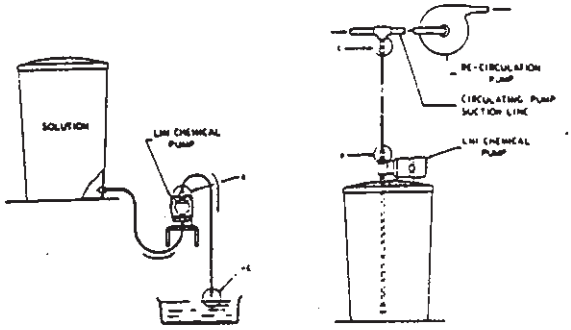


AVOID THIS TYPE OF "FALSE" FLOODED SUCTION INSTALLATION
The loop at the top of the tank forms a neat air trap. In time, air and gases can bubble out, accumulate, and cause loss of prime.



PREVENT SYPHONING WHEN PUMPING

"Downhill" or into pump suction. Always use anti-syphon/ back pressure valve at pump discharge (a) or at injection point (c).



III. ELECTRICAL

A. Chemical metering pump should be plugged into a 3-prong grounded electrical outlet with ratings conforming to data on the pump control panel.

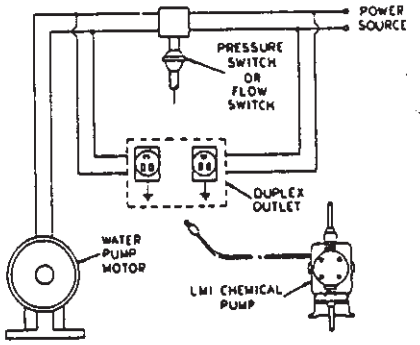
NOTE: All wiring must be approved under local electrical code.

B. It is extremely important that ground prong of the 3-prong plug is connected to a good ground. Do NOT use adapters.

C. Diagram (below) is example of wiring scheme commonly used.

WIRING DIAGRAM

PRESSURE OR FLOW SWITCH SYSTEM



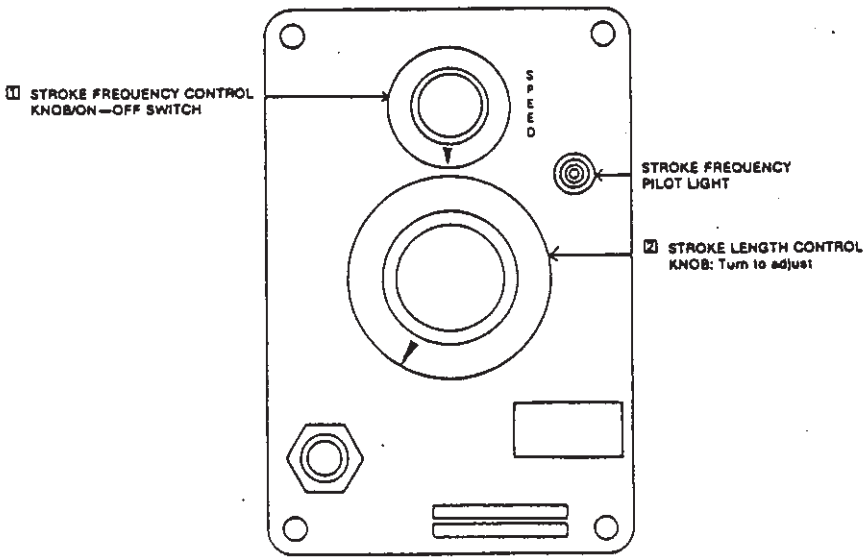
OUTPUT ADJUSTMENT

I. INITIAL APPROXIMATION

A. Stroke frequency adjustment knob is the uppermost of the two knobs on the control panel. Speed control dial is graduated in approximate strokes per minute. Turning this knob clockwise ↻ increases pumping frequency.

Output Estimate—Total output of pump may be estimated by multiplying stroke frequency (percent of maximum) by stroke length setting (percent of maximum).

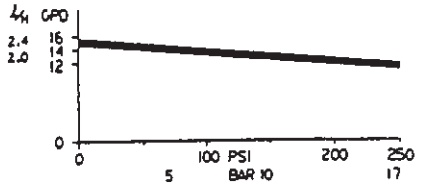
For example, if the stroke length knob is set at 100% of maximum and the stroke frequency is 20% of maximum, total pump output will be approximately 20%; if the stroke length knob is set at 30% of maximum and stroke frequency is 20% of maximum total output of pump will be approximately 6% of the pump's maximum rating. That is, .2 x .3 = .06 or 6%.



B. To determine exact frequency in strokes per minute at any speed knob setting, count number of flashes of stroke frequency pilot light for one minute.

C. Stroke length adjustment knob is the lower of two control panel knobs. Adjust by rotating to desired setting, while pump is stroking.

OUTPUT CURVE—A14



II. SETTING (See diagram on preceding page)

A. Maximum output—Turn Knob No. 1 (upper, stroke frequency control knob) clockwise ↻ to a setting of 100 on its dial.

Turn Knob No. 2 (central, stroke length control knob) clockwise ↻ to a setting of 100 on its dial.

B. Reduced output—Turn Knob No. 1 counter-clockwise ↺ to a setting representing the desired percentage of the pump's total output capability.

For maximum volumetric efficiency leave Knob No. 2 (stroke length control knob) at its maximum setting (100) unless it is impossible to reduce the pump's output sufficiently by turning Knob No. 1. If Knob No. 2 must be adjusted in order to reduce pump output, avoid turning it into the dial's red zone: doing so reduces the length of the stroke so much that volumetric efficiency is lost.

C. After installation is complete and an initial approximation setting has been made, the pump should be calibrated and the stroke frequency and/or stroke length settings adjusted.

III. CALIBRATION PROCEDURE—ON-SITE VOLUMETRIC CALIBRATION

A. With pump primed and discharge tubing connected to the injection point as it would be in normal service, place foot valve and strainer assembly in a graduated container with a volume of 500 ml or more (so that the volume displaced by tubing and foot valve assembly is minimal in relation to volume of solution in the container).

B. Switch pump on, and pump until air is exhausted from the suction line and pump head.

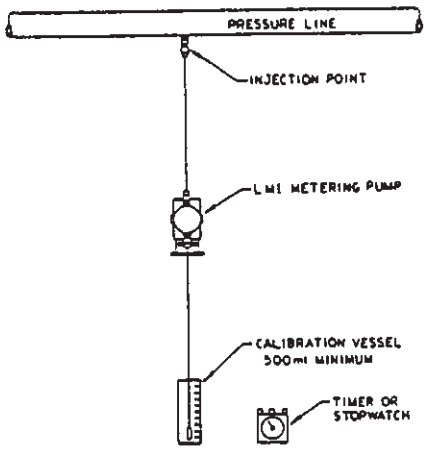
C. Switch pump off, note the solution level in the graduate. Refill graduate if necessary.

D. Switch pump on, and permit it to pump for a measured time. Be sure time is long enough to accumulate an adequate number (minimum 50) pump strokes. In general, the longer the calibration period, the more confidence you can have in accuracy of results.

E. Switch off pump at the end of the calibration period, note volume pumped during the calibration period, and calculate volume of chemical pumped in time unit you choose (minute, hour, day, etc.).

F. Adjust stroke frequency and/or stroke length knobs to your best estimate of required correction, and repeat calibration measurement as a check.

This calibration adjustment should always be made with pumping conditions identical to conditions of normal pumping service. This means that factors such as injection pressure, fluid viscosity, suction lift and others will automatically be accounted for in making final adjustment of the pump.



CALIBRATION TEST

TROUBLE SHOOTING—LIQUID END

I. LOW PUMP OUTPUT:

Low pump output can be caused by many things. Some of the more common ones are:

- Very low stroke setting, i.e. red (or black) zone setting of knob
- Trapped air in pump head (trapped air in discharge tubing has no effect)
- Air leak through valve seal rings
- Ruptured pumping Liquifram™ (diaphragm)
- Clogged Liquid End, or injection point connection
- Injection into pressure within 25 psi of pump's maximum pressure rating with back pressure spring in place (if so supplied)
- Injection into pressure in excess of pump rating—see chart

Pressure Ratings:	PSI	bar
A14	250	17.3
A15	110	7.6
A16	55	3.8

A. Very low stroke setting—check position of stroke length knob (lower knob) by rotating it counter-clockwise ↺ until pumping diaphragm (Liquifram™) stops moving with the pump operating. The pumping diaphragm should not stop reciprocating (moving or clicking) until the knob points to zero. If it stops before zero, reset knob by removing yellow cap and loosening hex nut with 8mm (or 5/16") nut driver setting the knob to point to zero and retightening hex nut.

Rotate knob clockwise ↻ and operate pump with stroke length setting above the dial's red (or black) zone.

B. Trapped air in pump head—May be caused by leaks in the suction line, where the suction line joins the suction fitting, or at the seal ring between suction fitting and pump head. It may also be caused by air or gases coming out of the solution. Trapped air or bubbles in the discharge line have no effect on the pump's operation. They may be ignored.

To remove trapped air from the pump head, operate the pump with both stroke frequency knob and stroke length knob set at 100.

It may be necessary to disconnect the discharge tubing from the injection point temporarily in order to relieve the pressure on the pump discharge or pull on both knobs of "Anti-Syphon/Pressure Release Assembly" if so equipped. Follow "Priming" instructions in the Liquid Handling Assembly sheet inserted in this instruction book and operate the pump for a few minutes to purge the head and valves of air or gas.

C. Air leak through valve seal rings—usually caused by worn or damaged seal rings or loose fittings. Tighten fittings by hand until they are very snug. If there is no improvement, replace both seal rings in pump head. See enclosed Liquid Handling Assembly sheet.

D. Ruptured pumping Liquifram™ (diaphragm)—If rupture is severe, and pump is injecting into pressure, chemical leak will be obvious through the 3/16" (5 mm) diameter hole at the bottom of the spacer directly behind the pump head. Replace pumping Liquifram™ (diaphragm). If rupture is a small pin hole, there may be oozing of solution through the 3/16" (5 mm) diameter hole described above. Replacement of pumping Liquifram™ (diaphragm) will be necessary.

E. Clogged Liquid End—will cause low pump output. Disassemble Liquid End. Clean individual parts with water and detergent or appropriate cleaning solution.

F. Injection into excessive pressure—If discharge pressure is within 25 psi of maximum pump rating, remove spring in injection check valve, if so supplied.

II. CHANGING LIQUIFRAM™

A. Make sure size code markings on top of disk and replacement Liquifram™ are the same. Liquifram™ and disk size code must match in order for pump to function.

Always wear protective clothing, gloves and face shield when working on or near chemical metering pumps.

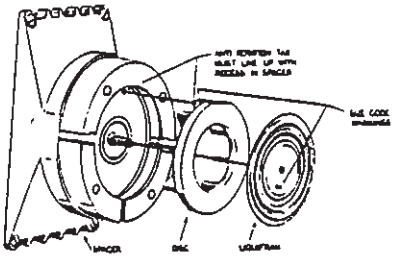
B. Move foot valve from chemical solution into a container of water or appropriate flushing or neutralizing solution. Pump until head assembly is flushed, then lift foot valve and pump until air enters pump head. Remove pump head. If water or neutralizing solution cannot be pumped, remove head carefully and immerse in water or neutralizing solution.

C. Set stroke length knob (lower knob) to zero by rotating it counter-clockwise ↺ with the pump running, then stop the pump by turning speed knob to off.

D. Grasp outer edge of Liquifram™ with your fingers or, if Liquifram™ is not to be used again, pierce it with a pointed tool, and rotate it counter-clockwise ↺ to unscrew it.

E. Before installing new Liquifram,™ restart pump and rotate stroke length control knob to 90. With pump stroking, screw on new Liquifram™ until the center begins to buckle inwards during the latter half of the stroke. Stop pump and check Liquifram™ position with a pencil or similar straight edge held firmly against the spacer (take care not to scratch sealing flange of Teflon-faced Liquifram™). Center of Liquifram™ should be flush with outer edges of spacer. See illustration below.

F. Reinstall pump head and tighten head mounting screws in criss-cross pattern. Do not overtighten.

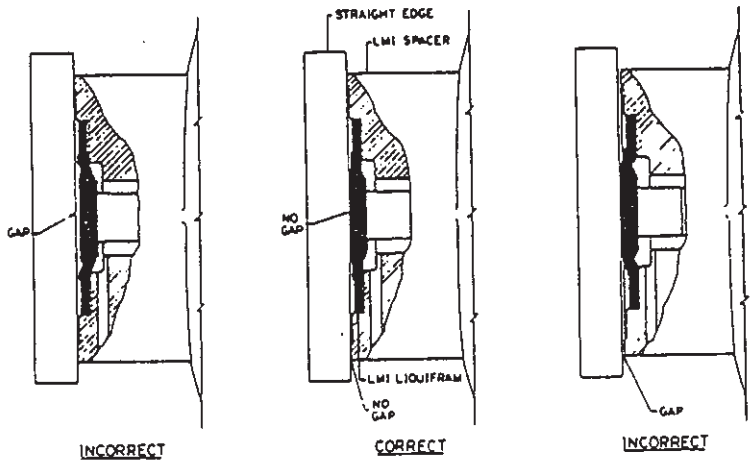


III. EXCESSIVE PUMP OUTPUT:

A. Syphoning—will cause excessive pump output. Check to be sure back pressure spring is in place in the injection check valve, and that the seal ring is in good condition. However, for service within 25 psi below pump pressure rating back pressure spring must be removed. Liquid Ends with a suffix "S" have a diaphragm type anti-syphon valve which prevents syphoning and over-pumping but does not affect pump pressure rating.

B. Incorrect knob setting—check stroke length knob (lower knob) by rotating it counter-clockwise ↺ to zero position. The pumping diaphragm should stop reciprocating. If it does not, continue counter-clockwise ↺ rotation until motion stops. Remove yellow cap and loosen hex nut with 8mm (or 5/16") nut driver, reset knob by setting the knob to point to zero, and retightening hex nut.

NOTE: This Illustration For All "A" Series Pumps



TROUBLE SHOOTING—ELECTRICAL
SERIES A

NOTE: All tests should be conducted with pump head and Liquiftam™ installed. If pump head is removed it is normal for Liquiftam™ shaft to hang forward and not pulsate if speed is at or near maximum.

I. Plug power cord into appropriate outlet.
A. Set speed knob (upper knob) to 100.
B. Set stroke knob (lower knob) to 100.

II. Listen for pulsation.
A. If pump pulses according to number on table below, electronic pulser module is working correctly.
B. If pilot light stays on, go to step III.
C. If pilot light stays off, go to step IV.
D. If pump pulses faster than maximum allowable per table below, pulser module is defective and should be replaced.
E. If pump pulses slower than minimum allowable per table below, go to step V.

III. Unplug power cord and remove control panel from housing. The control panel is secured by a screw in each corner. In addition the stroke length knob must be removed by removing yellow cap and loosening hex nut with 8mm (or 5/16") nut driver. Check that all electrical connections are tight and correspond to the wiring diagram. Also check that no corrosion has formed around the connections. If the wiring is all OK, proceed as follows:

A. Disconnect yellow EPU wires from pulser terminal 3 (YEL EPU + Light) and pulser terminal 5 (YEL EPU − Light).

B. Measure the resistance across the EPU wires. Resistance readings should be in accordance to the table below. If resistance reads infinity, remove spacer assembly and check resistance across EPU leads at EPU coil. If resistance is incorrect, EPU is bad and should be replaced. If resistance is okay check for blown fuses and replace if necessary. (Blown fuse may be caused by either faulty EPU or faulty pulser.) If resistance readings are according to table, the problem then is the pulser module which should be replaced.

C. Cold (18°C-22°C or 64°F-75°F). Coil resistances other than the table indicates that the EPU is defective and should be replaced.

Pump Drive No.	EPU Resistance	EPU Assembly Part No.	Allowable Pulses (blinks) At Top Speed	
A141—	65 to 93 ohms	28085	110	95
A142—, A143— A145—, A146—	260 to 300 ohms	28086	110	95
A151—	65 to 93 ohms	27465	110	95
A152—, A153— A155—, A156—	260 to 300 ohms	27466	110	95
A161—	65 to 93 ohms	27467	110	95
A162—, A163— A165—, A166—	260 to 300 ohms	27468	110	95

IV. Check line voltage at outlet. 115 to 120 VAC or 220 to 250 VAC is normal (depending upon model). If line voltage is OK proceed as follows:

A. Plug in power cord and observe pilot light.

B. If pump does not operate at all unplug power cord, remove control panel and check wiring as in step III above.

C. If wiring is OK, carefully plug power cord into outlet. USING EXTREME CAUTION measure voltage between pulser terminal 1 (BLK) and pulser terminal 2 (WHT). If it reads zero volts, cord is defective.

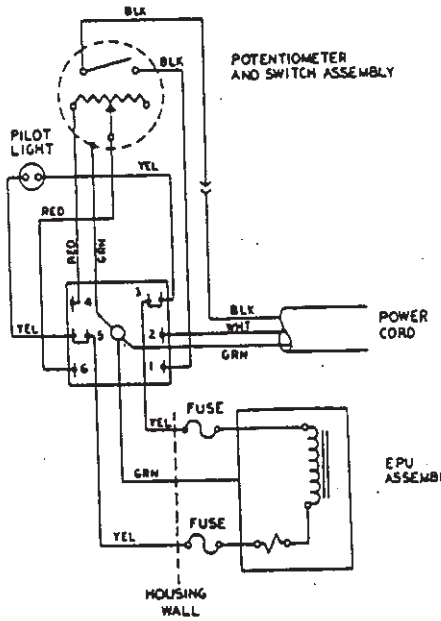
D. If terminals 1 and 2 (BLK and WHT) of pulser are getting proper voltage and EPU is clicking, pilot light is defective and should be replaced.

E. If EPU is not clicking, unplug power cord. Remove red speed control wires from terminals labeled RED POT (4 and 6) of pulser. Measure resistance across these wires making sure speed knob is set fully clockwise. ↶ It should read less than 100 Ohms. Turn speed knob fully counterclockwise ↷ and the resistance should read 1,000,000 Ohms (1 MegOhm ± 20%). If the resistance is not correct replace the potentiometer and switch assembly. If the resistance checks out OK, the pulser is defective and should be replaced.

V. A. Unplug unit, remove control panel from housing, and check wiring as in step III. If wiring is OK go to step IV E.

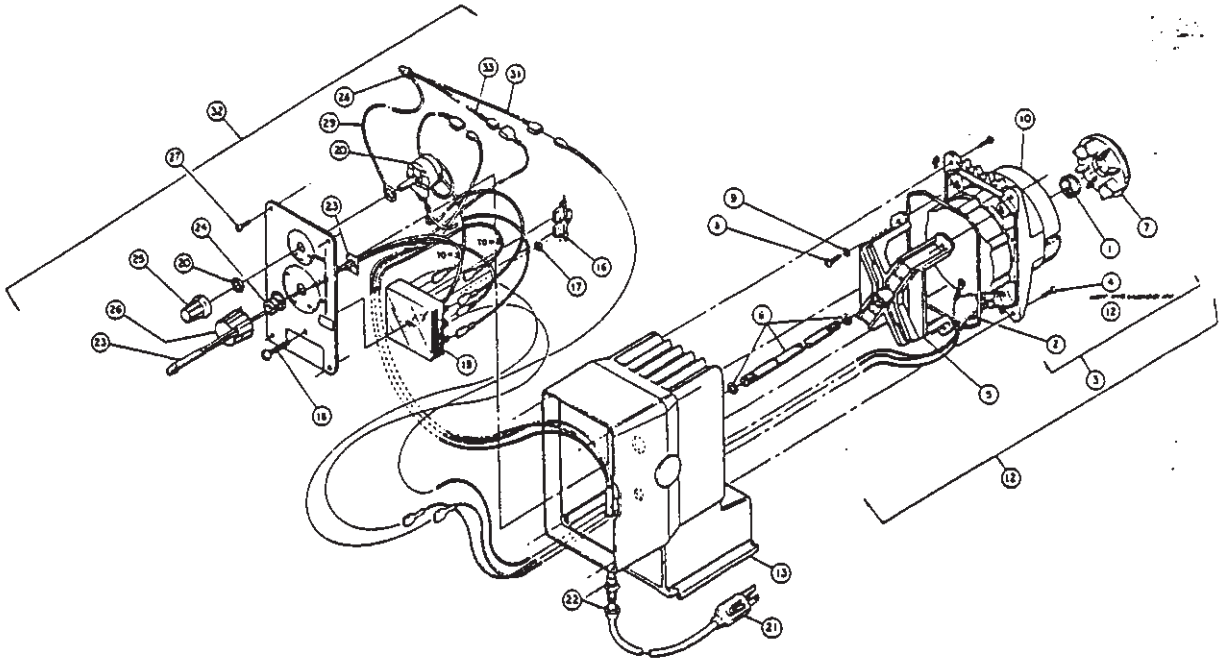
B. When replacing potentiometer and switch assembly or the pulser, be sure to re-connect the appropriate ground wires.

WIRING DIAGRAM
A14, A15, A16, A17, A18 SERIES



PULSER TERMINALS		
No.	Label	Function
1	BLK	AC HOT (SWITCHED) + MOV
2	WHT	AC NEUTRAL + MOV
3	EPU + YEL • LIGHT	DC + EPU/SOLENOID + PILOT LIGHT
4	RED • POT	SPEED CONTROL
5	EPU − YEL • LIGHT	DC − EPU/SOLENOID + PILOT LIGHT
6	RED • POT	SPEED CONTROL

SERIES A14, A15, A16, A17, A18 DRIVE ASSEMBLY PARTS LIST



SERIES A14, A15, A16, A17, A18 DRIVE ASSEMBLY PARTS LIST

Key No.	Model Series	Part No.	Description		Quantity
1	A14, A15, A16, A17, A18	10973	Seal		1
2	A14, A15, A16, A17, A18	10166	O-Ring		1
3	A141	28085	EPU and Spacer Assembly, 115 V	W/Disk	1
3	A142 A143 A145 A146 A147	28086	EPU and Spacer Assembly, 230 V	W/Disk	1
3	A151	27465	EPU and Spacer Assembly, 115 V	W/Disk	1
3	A152, A153, A155, A156, A157	27466	EPU and Spacer Assembly, 230 V	W/Disk	1
3	A161	27467	EPU and Spacer Assembly, 115 V	W/Disk	1
3	A162, A163, A165, A166, A167	27468	EPU and Spacer Assembly, 230 V	W/Disk	1
3	A171	29272	EPU and Spacer Assembly, 115 V	W/Disk	1
3	A172 A173 A175 A176 A177	29273	EPU and Spacer Assembly, 230 V	W/Disk	1
3	A181	29274	EPU and Spacer Assembly, 115 V	W/Disk	1
3	A182, A183, A185, A186, A187	29275	EPU and Spacer Assembly, 230 V	W/Disk	1
4	A14, A15, A16, A17, A18	10168	Screw, 10—24 x 7/16" PH S.S.		4
5	A14, A15, A16, A17, A18	26838	Bracket		1
6	A14, A15, A16, A17, A18	27298	Adjustment Shaft Assembly		1
7	A14, A17	29445	Disk		1
7	A15, A18	29437	Disk		1
7	A16	29442	Disk		1
8	A14, A15, A16, A17, A18	10598	Screw		4
9	A14, A15, A16, A17, A18	10415	Washer		4
10	A141, A151	30123	EPU and Spacer Assembly, 115 V		1
10	A142, A152 A143, A153 A145, A155 A146, A156 A147, A157	30124	EPU and Spacer Assembly, 230 V		1
10	A161	30128	EPU and Spacer Assembly, 115 V		1
10	A162, A163 A165, A166 A167	30129	EPU and Spacer Assembly, 230 V		1
10	A171, A181	30100	EPU and Spacer Assembly, 115 V		1
10	A172, A182 A173, A183 A175, A185 A176, A186 A177, A187	30101	EPU and Spacer Assembly, 230 V		1

SERIES A14, A15, A16, A17, A18 DRIVE ASSEMBLY PARTS LIST

Key No.	Model Series	Part No.	Description		Quantity
12	A141	28088	EPU and Spacer Assembly With Stroke Adjustment, 115 V	W/Disk	1
12	A142 A143 A145 A146 A147	28089	EPU and Spacer Assembly With Stroke Adjustment, 230 V	W/Disk	1
12	A151	27689	EPU and Spacer Assembly With Stroke Adjustment, 115 V	W/Disk	1
12	A152, A153, A155, A156, A157	27690	EPU and Spacer Assembly With Stroke Adjustment, 230 V	W/Disk	1
12	A161	27691	EPU and Spacer Assembly With Stroke Adjustment, 115 V	W/Disk	1
12	A162, A163, A165, A166, A167	27692	EPU and Spacer Assembly With Stroke Adjustment, 230 V	W/Disk	1
12	A171	29308	EPU and Spacer Assembly With Stroke Adjustment, 115 V	W/Disk	1
12	A172 A173 A175 A176 A177	29309	EPU and Spacer Assembly With Stroke Adjustment, 230 V	W/Disk	1
12	A181	29310	EPU and Spacer Assembly With Stroke Adjustment, 115 V	W/Disk	1
12	A182, A183, A185, A186, A187	29311	EPU and Spacer Assembly With Stroke Adjustment, 230 V	W/Disk	1
13	A14, A15, A16, A17, A18	10200—7	Housing		1
16	A141, A151, A161, A171, A181	10626	MOV Assembly, 130 V		1
16	A142, A152, A162, A172, A182	10627 25268	MOV Assembly, 230 V		1
16	A143, A153, A163, A173, A183 A145, A155, A165, A175, A185 A146, A156, A166, A176, A186 A147, A157, A167, A177, A187	10627	MOV Assembly, 250 V		1
17	A14, A15, A16, A17, A18	10199	Nut, 1/4—20, Nylon		1
18	A14, A15, A16, A17, A18	10198	Screw, 1/4—20, Nylon		1
19	A141, A151, A161, A171, A181	10150	Pulser, 115 V		1
19	A142, A152, A162, A172, A182 A143, A153, A163, A173, A183 A145, A155, A165, A175, A185 A146, A156, A166, A176, A186 A147, A157, A167, A177, A187	10268	Pulser, 230 V		1
20	A14, A15, A16, A17, A18	27718	Potentiometer Assembly		1
21	A141, A151, A161, A171, A181	27719	Power Cord Assembly, 115 V		1
21	A142, A152, A162, A172, A182	27720	Power Cord Assembly, 230 V		1
21	A143, A153, A163, A173, A183	27721	Power Cord Assembly, 230 V, DIN Plug		1
21	A145, A155, A165, A175, A185	27722	Power Cord Assembly, 230 V, British (U.K.) Plug		1
21	A146, A156, A166, A176, A186	27723	Power Cord Assembly, 230 V Australian/NZ Plug		1
21	A147, A157, A167, A177, A187	27724	Power Cord Assembly, 230 V Swiss Plug		1
22	A14, A15, A16, A17, A18	25957	Connector		1
23	A141, A151, A161, A171, A181	10181—G	Pilot Light, 115 V		1
23	A142, A152, A162, A172, A182 A143, A153, A163, A173, A183 A145, A155, A165, A175, A185 A146, A156, A166, A176, A186 A147, A157, A167, A177, A187	10423—B	Pilot Light, 230 V		1
24	A14, A15, A16, A17, A18	10486	Grommet		1
25	A14, A15, A16, A17, A18	25889	Knob		1
26	A14, A15, A16, A17, A18	29099	Knob		1
27	A14, A15, A16, A17, A18	30306	Screw, 10—24 x 3/4" PH S.S.		4
28	A14, A15, A16, A17, A18	25038	Wire Connector		1
29	A14, A15, A16, A17, A18	26285	Wire Assembly		1
31	A14, A15, A16, A17, A18	26286	Wire Assembly		1
32	A141	28207	Control Panel Assembly, 115 V		1
32	A142	28208	Control Panel Assembly, 230 V		1
32	A143	28209	Control Panel Assembly, 230 V		1
32	A145	28210	Control Panel Assembly, 240—250 V		1
32	A146	28211	Control Panel Assembly, 240—250 V		1
32	A151, A161	27726	Control Panel Assembly, 115 V		1
32	A152, A162	27727	Control Panel Assembly, 230 V		1
32	A153, A163	27728	Control Panel Assembly, 230 V		1
32	A155, A165	27729	Control Panel Assembly, 240—250 V		1
32	A156, A166	27730	Control Panel Assembly, 240—250 V		1
33	A14, A15, A16, A17, A18	25878	Wire Assembly		1

LE 61 LE 62 LE 65

LIQUID HANDLING ASSEMBLIES with 1.8 Liquifram™

CAUTION

When pumping chemicals make certain that all tubing is securely attached to the fittings. It is recommended that tubing or pipe lines be shielded to prevent possible injury in case of rupture or accidental damage. Always wear protective clothing when working on or near chemical metering pump.

MATERIALS			
	LE-61	LE-62	LE-65
Fittings	Polypropylene	Polypropylene	GFR Polypropylene
Seal Rings	Polyprel™	Polyprel™	Teflon
Balls	Ceramic	Ceramic	Ceramic
Head	Acrylic	PVC	Polypropylene
Liquifram	PFA	PFA	Teflon
Suction	.375" OD Vinyl	.375" OD Polyethylene	.375" Polyethylene
Discharge	.375" OD Polyethylene	.375" OD Polyethylene	.375" Polyethylene

A. INSTALLING INJECTION CHECK VALVE

1. The injection check valve should always be installed as close as possible to the point of chemical injection, at the very end of the tubing run.
2. Purpose of the injection check/back pressure valve is to prevent backflow from treated line and to prevent syphoning or overpumping of chemical.
3. A ½" NPT female fitting with sufficient depth will accept the injection check/back pressure valve.
4. In order to insure correct seating of the ball inside the check valve, the injection check/back pressure valve should be installed upwards.

B. CONNECTING DISCHARGE TUBING

Note: Cut tubing to length needed for discharge line.

1. Route tubing from injection check valve to chemical metering pump making sure it does not touch hot surfaces, sharp surfaces, or is bent so sharply that it kinks.
2. Slide small end of coupling nut onto tubing.
3. Slide clamp ring onto tubing.
4. Push tubing over tapered nozzle of discharge valve housing so that tubing flares out and reaches the shoulder. (If tubing is stiff from cold, dip end in hot water.)
5. Slide down the coupling nut until threads are engaged. Tighten by hand until tubing is held securely in place.

Excessive force will crack or distort fittings. DO NOT USE PIPE WRENCH.

6. Follow the same procedure for connecting tubing to injection valve.

C. CONNECTING SUCTION TUBING

1. Cut suction tubing to a length such that the foot valve hangs just above the bottom of the chemical container. Maximum recommended vertical suction lift is 5 feet (1.5m).
2. Follow same procedure (see B) in connecting suction tubing to suction valve and foot valve.
3. If a suction tube straightener is desired, one may be fabricated from a 3 ft. (1m) piece of ½" schedule SDR 13.5 (thin wall type) PVC pipe.
4. Dip end of PVC pipe in hot water for at least 1 minute.
5. Push pipe over small end of coupling

D. PRIMING

1. Temporarily remove tubing from injection check/back pressure valve and hold the end of the tubing so it is above pump level.
2. Set pump at 80% speed 100% stroke and pump.
3. As soon as chemical is visible through transparent discharge tubing just past the discharge valve, stop the pump.
4. Pump is now primed.
5. Reconnect tubing to injection check/back pressure valve.

Note:

(a.) Pump is normally self-priming if suction lift is no more than 5 feet (1.5m), valves in the pump are wet with water (pump is shipped from factory with water in pumping head) and the above steps (D1 thru D3) are followed.

(b.) If the pump does not self prime, remove discharge valve housing and ball and pour water or chemical slowly into discharge port until it is filled. Follow steps D2 thru D5 thereafter.

LIQUID METRONICS INCORPORATED

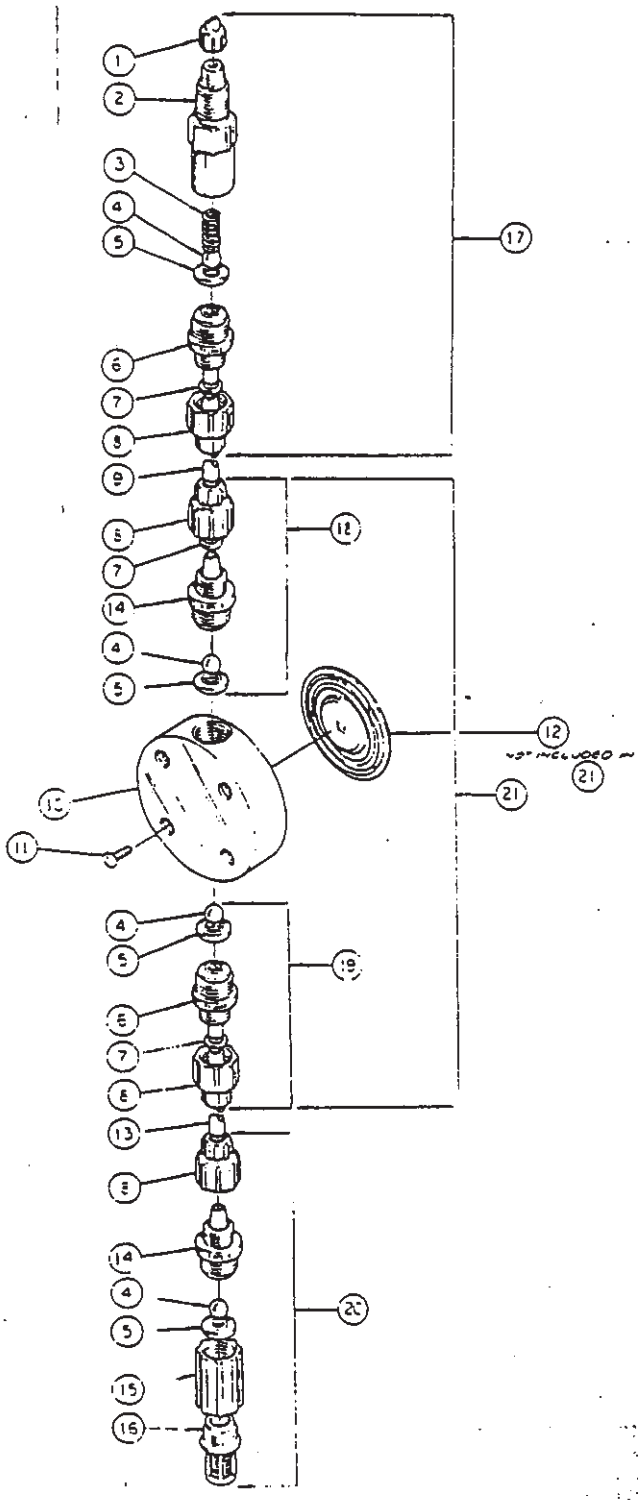
19 CRAIG ROAD - ACTON, MA - 01720-5495 - USA

TEL: (508) 263-9800 FAX: (508) 264-9172 TLX: 95-1781

Bulletin Sec. 4.0 pg. 2970
Replaces same of 2/87
1329.C 7/88 2AG

KEY NO.	PART NO.	DESCRIPTION	QUANTITY		
			LE-61	LE-62	LE-65
1	27352	FLAPPER VALVE	1	1	0
2	29960	INJECTOR FITTING	1	1	0
2	10394	INJECTOR FITTING	0	0	1
3	29339#	SPRING	1	0	0
3	10339*+	SPRING	0	1	1
4	10338*+#	BALL, CERAMIC	4	4	4
5	29443#	SEAL RING, POLYPREL	4	0	0
5	30334*	SEAL RING, POLYPREL	0	4	0
5	10407+	SEAL RING, TEFLON	0	0	4
6	10292	VALVE SEAT	2	2	0
6	10392	VALVE SEAT	0	0	2
7	26136	CLAMP RING	3	3	3
8	10299	COUPLING NUT	4	4	4
9	10342-10	TUBING, .375" OD POLYETHYLENE	1	0	0
9	10342-16	TUBING, .375" OD POLYETHYLENE	0	1	1
10	10104	HEAD	1	0	0
10	10204	HEAD	0	1	0
10	10304	HEAD	0	0	1
11	10340	SCREW, 10-24 X 3/4" SS	4	4	4
12	28928*#	LIQUIFRAM	1	1	0
12	10305+	LIQUIFRAM	0	0	1
13	10469-06	TUBING, .375" OD VINYL	1	0	0
14	10293	VALVE HOUSING	2	2	0
14	10393	VALVE HOUSING	0	0	2
15	10978	FOOT VALVE SEAT	1	1	1
16	10123	STRAINER, POLYPROPYLENE	1	1	1
17	27600	INJ CHECK/BACK PRESS VALVE ASM	1	0	0
17	27608	INJ CHECK/BACK PRESS VALVE ASM	0	1	0
17	25073	INJ CHECK/BACK PRESS VALVE ASM	0	0	1
18	27601	DISCHARGE VALVE ASM	1	1	0
18	25074	DISCHARGE VALVE ASM	0	0	1
19	27602	SUCTION VALVE ASM	1	1	0
19	25075	SUCTION VALVE ASM	0	0	1
20	27603	FOOT VALVE ASM	1	1	0
20	30377	FOOT VALVE ASM	0	0	1
21	29283	HEAD ASM	1	0	0
21	29289	HEAD ASM	0	1	0
21	29294	HEAD ASM	0	0	1
	10322**	WEIGHT, CERAMIC (NOT SHOWN)	1	1	1

* Parts included in Spare Parts Kit No. Sp-U10.
\+ Parts included in Spare Parts Kit No. Sp-U2.
** PN 10322 Ceramic Weight keeps Foot Valve Asm. at tank bottom. Install weight over suction tubing.
\# Parts included in Spare Parts Kit No. Sp-U12.



1. Maximum pump pressure rating is reduced by 25 psi (1.7 bar) with back pressure spring (Item 3 on exploded view) installed.
2. Do not remove back pressure spring if pressure at injection point is less than 20 psi (1.4 bar).

NOTE:
Threaded connections into pump head are ¾"-16 straight threads. Do not use Teflon tape. These joints are sealed by seat ring valve seats (Item 5 on exploded view).

Flocculation Tank Mixer

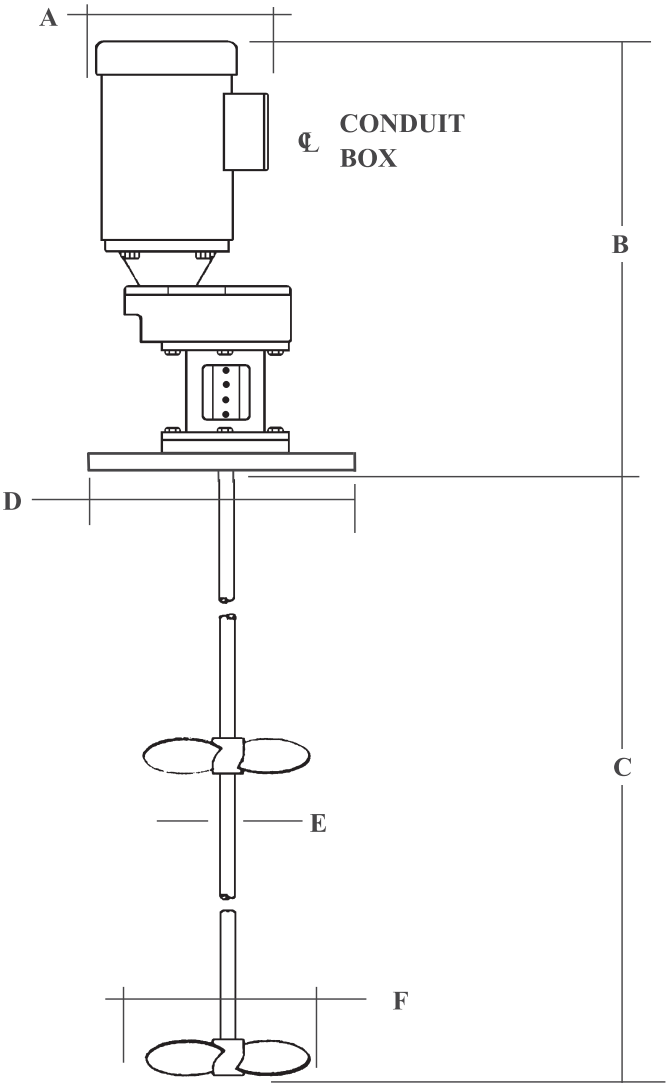
Grovhac Model 700-1000GD

SPECIFICATION SHEET
SERIES 700 GEAR DRIVE

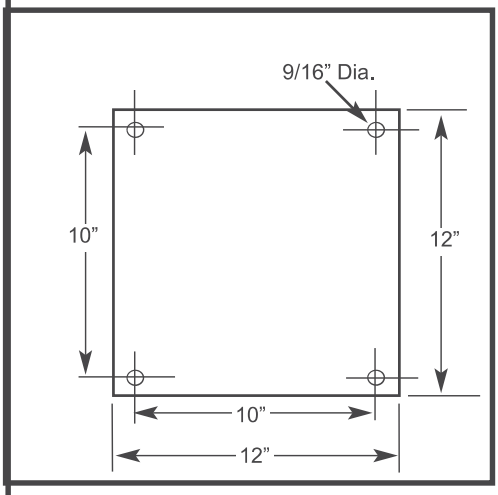
Avail Models: Electric (TEFC), Air, X-proof, Vari-speed

Grovhac Inc.
4310 North 126th Street Brookfield, WI 53005 (U.S.A.)
Phone: 262-781-5020 Fax: 262-781-8120
www.Grovhac.com

OPTIONS INCLUDE:
16" x 16" SQ. Flanges
150# Flanges
Double Mechanical Seal
Stuffing Box
Angle Mount



Mounting Hole Patern



MODEL	H.P.	R.P.M.	* A	* B	* C	D	E	SINGLE G	DUAL G
700-250-GD	.25	425	11.5"	24.8"	36"	12"	1"	9"	8"
700-333-GD	.33	425	11.5"	24.8"	36"	12"	1"	10"	9"
700-500-GD	.50	425	11.5"	24.8"	36"	12"	1"	11"	10"
700-750-GD	.75	425	11.5"	24.8"	36"	12"	1"	12"	11"
700-1000-GD	1.00	425	11.5"	24.8"	36"	12"	1.25"	12"	11"
700-1500-GD	1.50	425	11.5"	25.9"	36"	12"	1.25"	14"	12"
700-2000-GD	2.00	425	11.5"	32.7"	36"	12"	1.25"	15"	14"

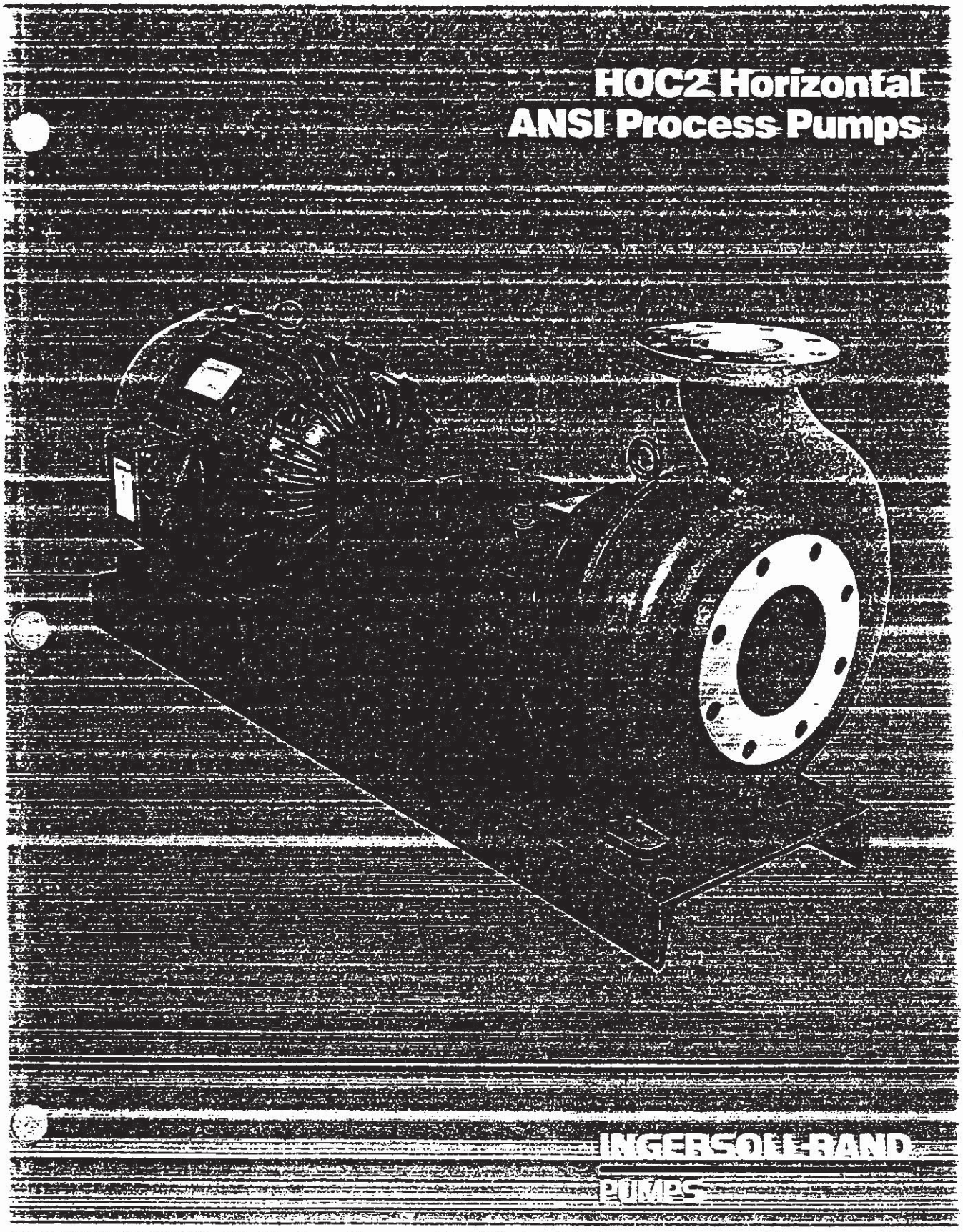
*** MAY VARY WITH PHASE OR ENCLOSURES.**

Clarifier Centrifugal Solids Pump & Filter Feed Pumps

(Clarifier Pump: P-5A; Filter Feed Pumps: P-3 & P-4)

Ingersoll-Rand Model HOC II Single Stage Centrifugal

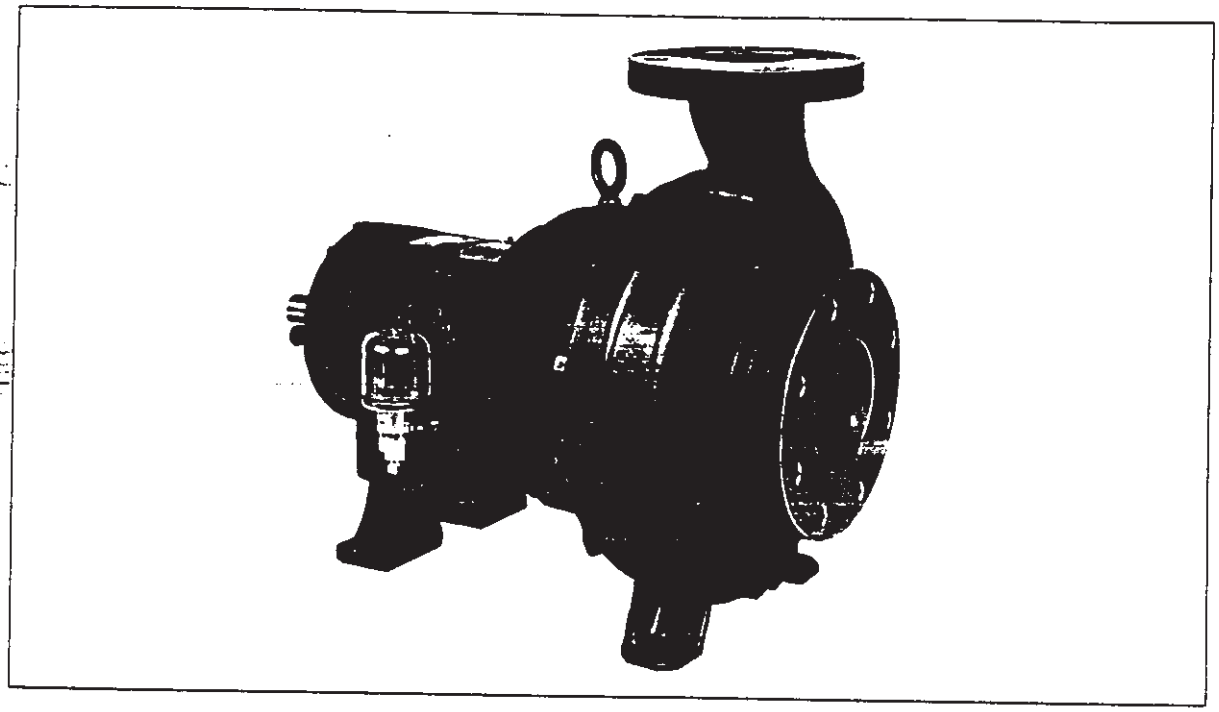
HOC2 Horizontal ANSI Process Pumps



INGERSOLL-RAND

PUMPS

HOC2



General Information

The HOC2 pump is a single stage, end suction, horizontal Centrifugal Pump, designed to ANSI/ASME B73.1M-1984 Standards for Chemical Process Pumps. The pumps are designed with vertical centerline discharge and back pullout construction. These pumps are available in ANSI Group 1, 2 and 3 sizes.

Construction

Casing is high grade ductile iron or 316 stainless steel of the back pull-out design with a fully confined gasket, centerline discharge, and foot mounted. Higher alloy materials are available as standard options depending on the particular application.

Stuffing Box is rabbet fitted to the casing with in and out flush connections. Optional internal drilling is available for internal flushing.

Impellers are precision cast in high grade carbon steel or 316 stainless steel of the semi-open design. They are statically and hydraulically balanced, externally adjustable, threaded to the shaft against rotation and "O" ring sealed. Higher alloy precision cast impellers are available as standard options depending on the application.

Shaft is high quality rigid AISI 4140 steel with a replaceable hook type sleeve and is also available in a sleeveless design. The shaft is ground to a high finish and designed for .002" maximum deflection at the stuffing box.

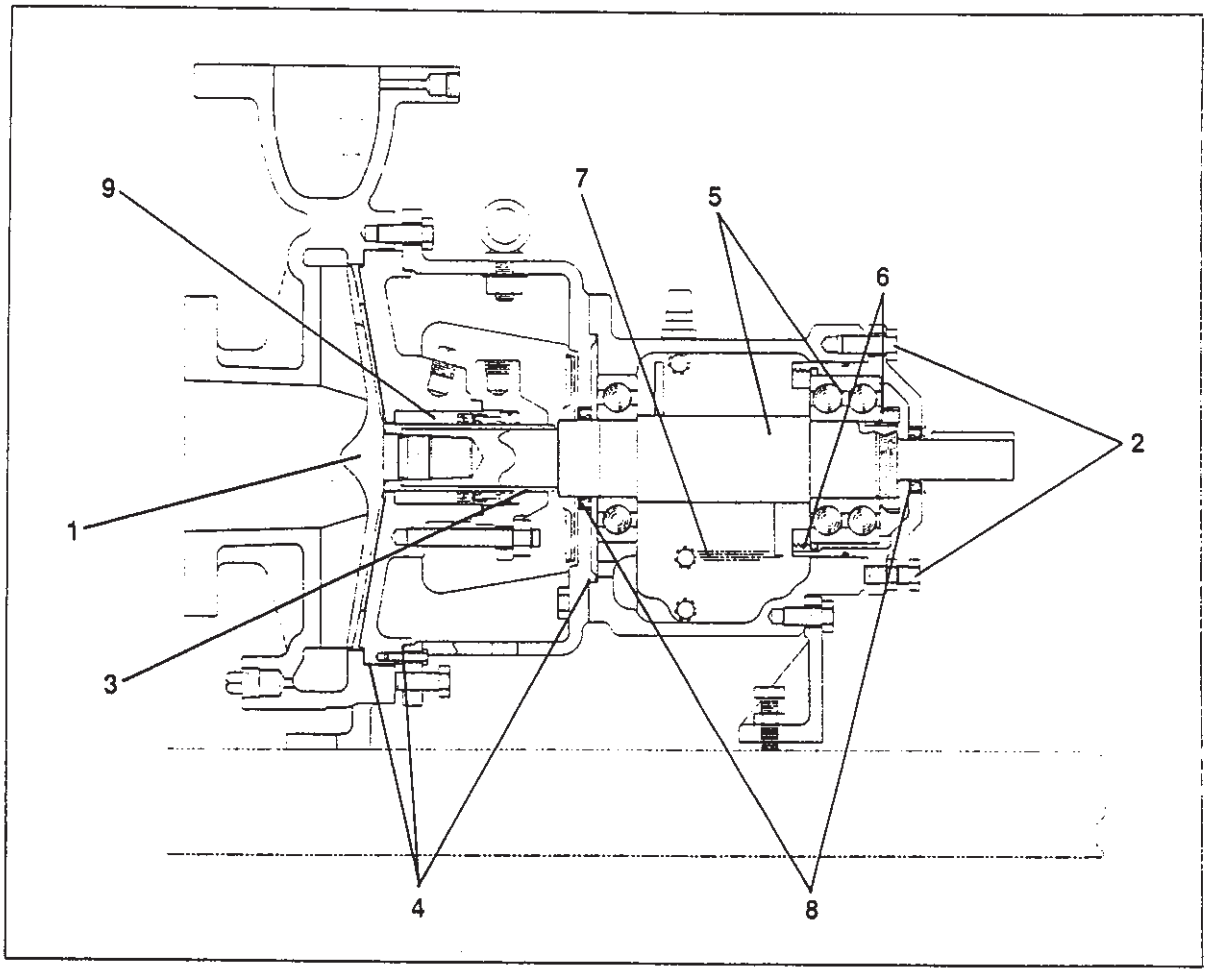
Bearings are oil lubricated with an external oiler, designed for minimum L-10 life of 2 years. The outboard (coupling end) bearing is double row, capable of carrying high thrust loads.

Baseplates are fabricated steel (standard) or optional reinforced fiberglass and are structurally designed to maintain alignment and provide a sound operating foundation. Drip rims, stilt mounting and ungrouted configurations are optionally available.

Couplings are flexible spacer type to permit disassembly and inspection without disturbing the pump piping or driver. Coupling guards are designed to meet OSHA requirements.

Interchangeability is maximized between pump sizes reducing spares inventory requirements.

HOC2



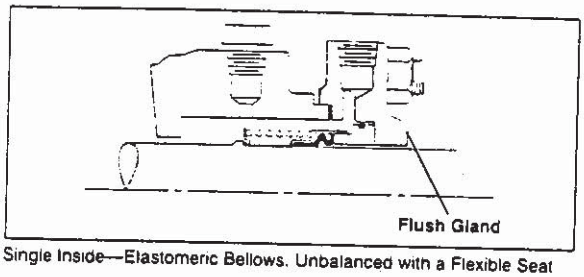
Design Features

1. **Semi-open Precision Cast Impellers** can handle clear liquids, particles, and light slurries with maximum efficiency.
2. **Externally Adjustable Impeller** clearance provides ease of maintenance and maximum efficiency.
3. **Replaceable Hook-Type Sleeve with O-ring** protects shaft and impeller threads from the pumped liquid. This results in lower replacement costs.
4. **Dry Rabbet Fit Construction** provides accurate positive alignment and less down time.
5. **Heavy Duty Shaft System** with a thick shaft, short overhang, and double row bearings, reduces the shaft deflection, thereby extending the bearing life.
6. **Thrust Bearing** is positively locked to the shaft and end cover. No snap rings are used.
7. **Large Capacity Oil Reservoir** with adjustable oiler is standard.
8. **Precision Lip Seals** isolate the oil reservoir from environmental dust and dirt.
9. **Versatile Stuffing Box** accommodates all types of seals, packing, and gland arrangements.
10. **Demanding ANSI/ASME B-73.1M—1984** criteria are met by the complete line of HOC2 pumps.

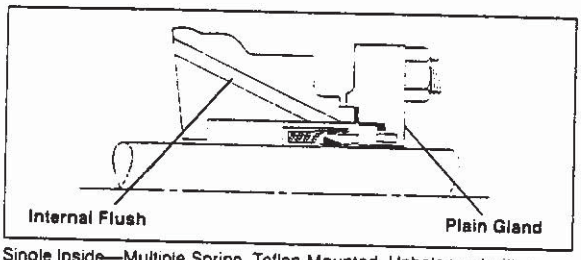
Mechanical Seals

HOC2 accepts a wide range of standard mechanical seals in a variety of stuffing boxes, glands and flush arrangements. This allows the optimum seal and seal environment to be selected to maximize seal life.

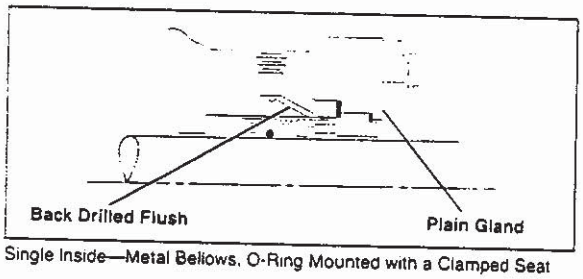
Typical Seal Arrangements:



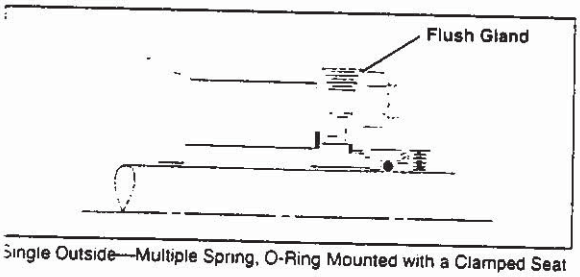
Single Inside—Elastomeric Bellows, Unbalanced with a Flexible Seat



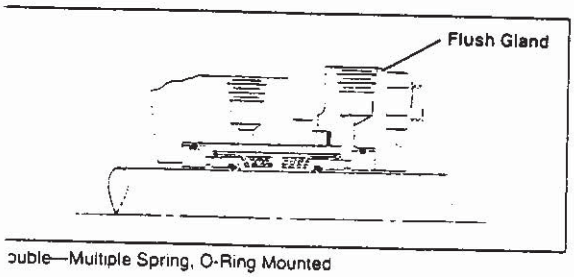
Single Inside—Multiple Spring, Teflon Mounted, Unbalanced with a Flexible Seat



Single Inside—Metal Bellows, O-Ring Mounted with a Clamped Seat

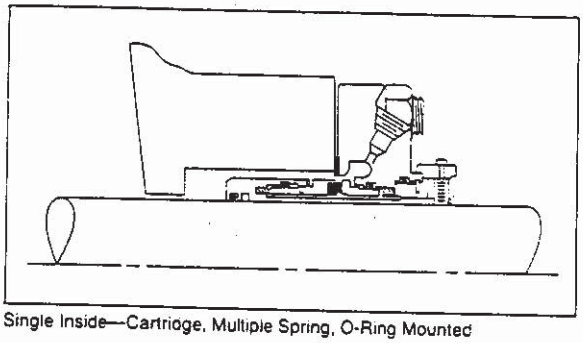


Single Outside—Multiple Spring, O-Ring Mounted with a Clamped Seat

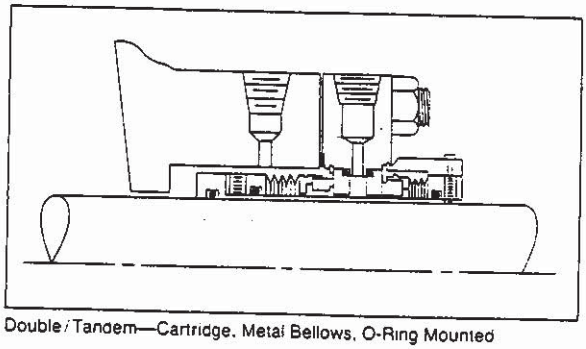


Double—Multiple Spring, O-Ring Mounted

Seal Types	Unbalanced	Balanced
Single Inside with Flexible Seats or Clamped Seats	Single Spring, Elastomeric Bellows	
	Single Spring, O-Ring Mounted	
	Multiple Spring, O-Ring Mounted	
	Multiple Spring, Teflon Mounted	
		Metal Bellows, O-Ring Mounted
		Metal Bellows, Graphite Mounted
Single Outside with Clamped Seats	Multiple Spring, O-Ring Mounted	
	Bellows, O-Ring Mounted	
Double	Friction Drive	
	Multiple Spring, O-Ring Mounted	
	Multiple Spring, Teflon Mounted	
Tandem	Multiple Spring, O-Ring Mounted	
	Multiple Spring, Teflon Mounted	
Single Inside, Cartridge	Single Spring, Elastomeric Bellows	
	Single Spring, O-Ring Mounted	
	Multiple Spring, O-Ring Mounted	
		Metal Bellows, O-Ring Mounted
Double Tandem, Cartridge	Multiple Spring, O-Ring Mounted	
		Metal Bellows, O-Ring Mounted



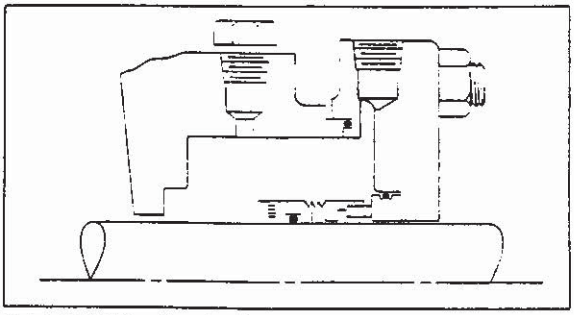
Single Inside—Cartridge, Multiple Spring, O-Ring Mounted



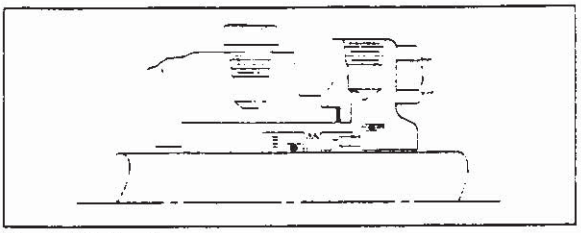
Double / Tandem—Cartridge, Metal Bellows, O-Ring Mounted

Stuffing Boxes

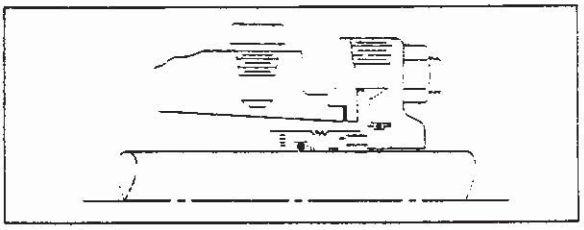
HOC2 is available with three different stuffing boxes to maximize seal life on each application. The Standard Stuffing Box accepts packing and all types of mechanical seals. The Tapered Self Draining Box reduces particle build-up in the box in dirty applications. The Oversized Sealing Chamber Box accepts standard seals while improving seal cooling and lubrication in critical applications.



Oversized Sealing Chamber Box



Standard Stuffing Box

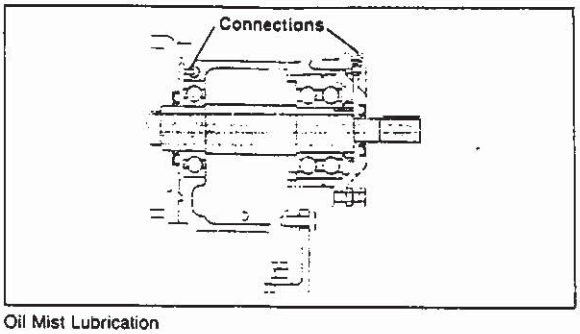


Tapered Self Draining Box

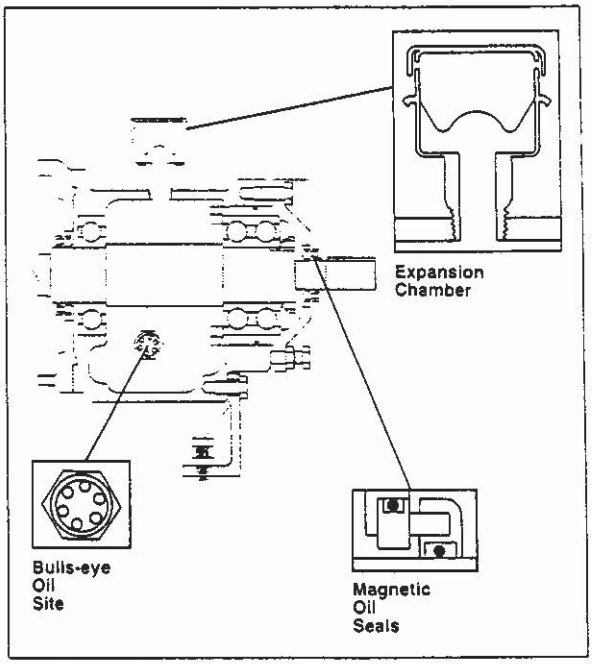
Frame End Options

HOC2 offers several options to maximize bearing life in critical applications and contaminating environments.

Labyrinth Oil Seals



Oil Mist Lubrication



Sealed Bearing Housing Package

Additional Frame End Options

- Group 2A Frame—Oversized Seal and Coupling Shaft Diameters
- Sealed Grease Bearings
- Regreaseable Bearings
- Duplex Thrust Bearings

Bedplate Options

Standard Bedplates	Optional Bedplate Features
Fabricated Steel	316SS Drip Pan Drip Lip Stilts
Fiberglass Bedplate with built-in Drip Pan	Stilts

Materials of Construction

Material Column	DI	S	CD4	R	Hast. C	Hast. B
General Description	Ductile Iron	316 S.S	CD4MCu	Alloy 20	Hastelloy C	Hastelloy B
Casing	Ductile Iron	316 S.S. (Cast)	CD4MCu	Alloy 20 (Cast)	Hastelloy C	Hastelloy B
Casing foot (when used)	Cast Iron					
Casing & Gland Gaskets	Non Asbestos					
Casing Bolting	Carbon Steel (Bolting)	304 S.S. (Bolting)				
Impeller	Carbon Steel (Cast) (1)	316 S.S. (Cast)	CD4MCu	Alloy 20 (Cast)	Hastelloy C	Hastelloy B
"O" Ring, Impeller	Teflon					
Casing Cover (Non-cooled)	Ductile Iron	316 S.S (Cast)	CD4MCu	Alloy 20 (Cast)	Hastelloy C	Hastelloy B
Casing Cover (Cooled)	316 S.S. (Cast)			Alloy 20 (Cast)	Hastelloy C	Hastelloy B
Gland	Ductile Iron	316 S.S.		Alloy 20	Hastelloy C	Hastelloy B
Gland Studs & Nuts	304 S.S. (Bolting)					
Shaft (With Sleeve)	Carbon Steel (Hot rolled)					
Shaft (Less Sleeve)	316 S.S. (Wrought)			Alloy 20 (Wrought)	Hastelloy C	Hastelloy B
Sleeve (Mechanical Seal)	316 S.S. (Wrought)			Alloy 20 (Wrought)	Hastelloy C	Hastelloy B
Sleeve (Packing)	Hardened 416 S.S. (Wrought) or Colmonoy Coated 316 S.S. (Wrought)			As Required		
Coupling Key	Carbon Steel (Key)					
Seal Cage (Lantern Ring)	Teflon					
Stuffing Box Packing	Non Asbestos					
Flinger (except 6 × 4 × 13)	Glass Filled Polypropylene					
Flinger (6 × 4 × 13)	Buna N Rubber					
Support Head or Adapter	Cast Iron					
Bearing Housing	Cast Iron					
Bearing End Cover	Cast Iron					
Bearing Housing Foot	Cast Iron					

Footnote: (1) Ductile Iron in Group 3 pumps.

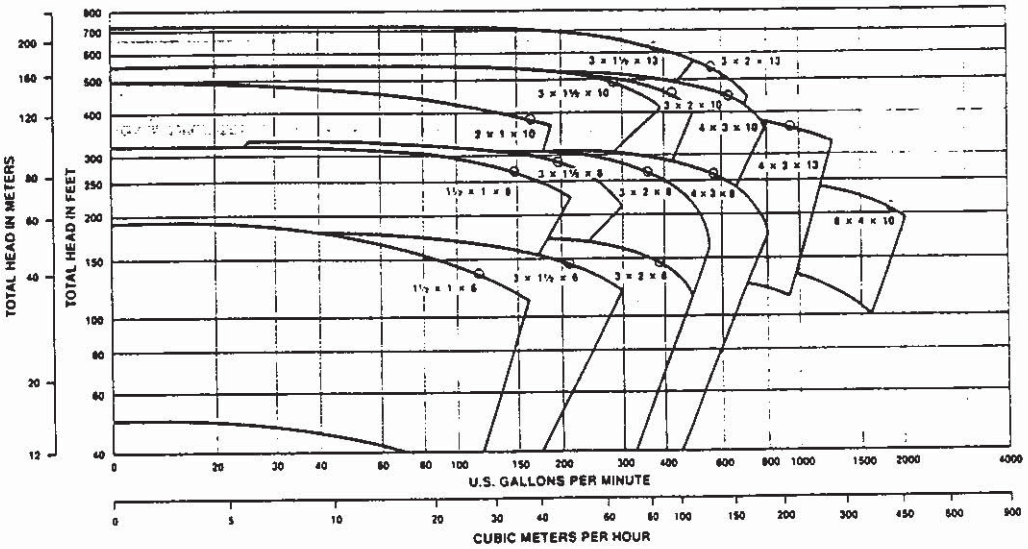
Material Specifications

General Description	Specification	General Description	Specification
Ductile Iron	ASTM A395	304S.S. (Bolting)	ASTM A276 Type 304
316S.S. (Cast)	ASTM A744 CF8M	316S.S. (Wrought)	ASTM A276 Type 316
CD4MCu	ASTM A744 CD4MCu	416S.S. (Wrought)	ASTM A276 Type 416
Alloy 20 (Cast)	ASTM A744 CN7M	Alloy 20 (Wrought)	ASTM B473
Hastalloy C	ASTM A494 CW12MW	Carbon Steel (Bolting)	ASTM A193B7
Hastalloy B	ASTM A494 N12MV	Carbon Steel (Hot rolled)	AISI 4140
Carbon Steel (Cast)	ASTM A216 WCB	Carbon Steel (Key)	AISI C1018
Cast Iron	ASTM A48 Class 30		

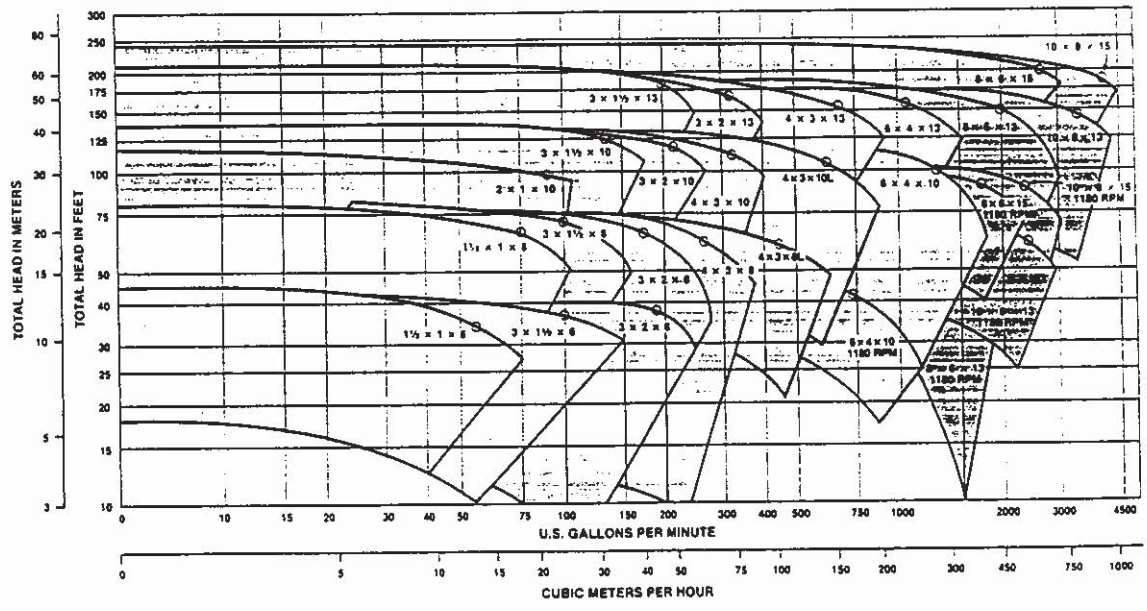
HOC2

Hydraulic Coverage—60 Cycle

3600 RPM

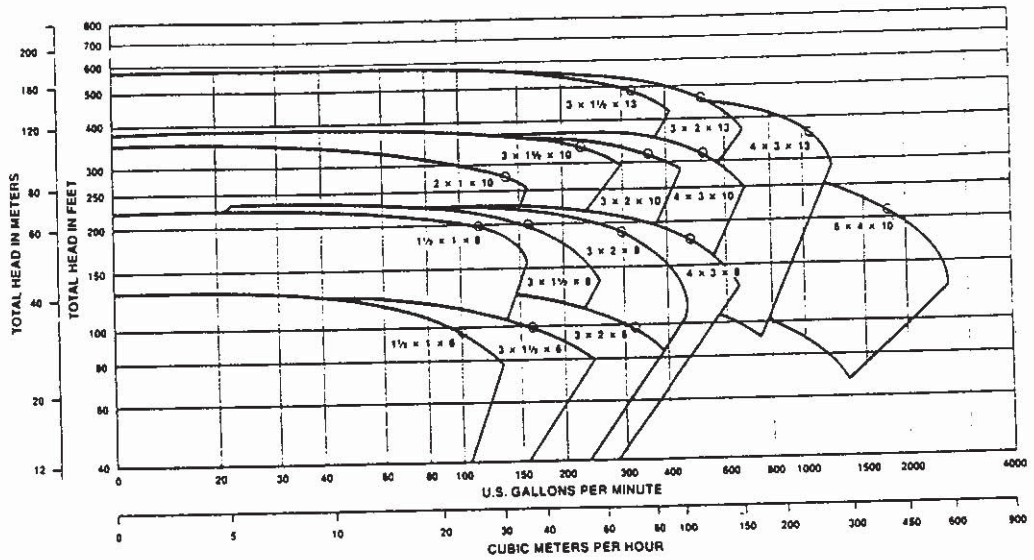


1800 RPM

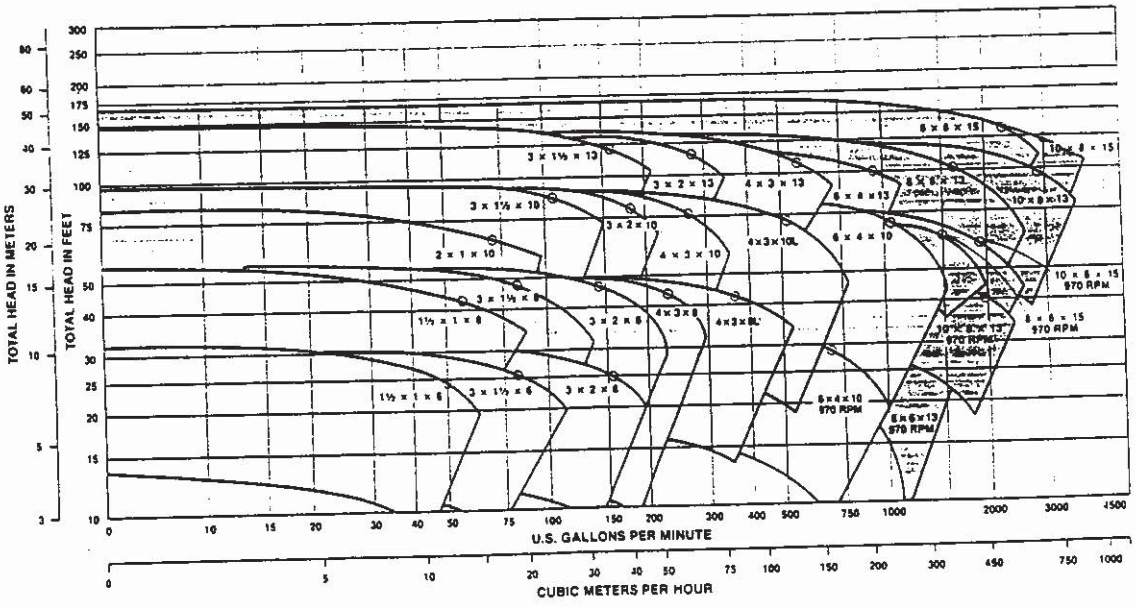


Hydraulic Coverage—50 Cycle

3000 RPM



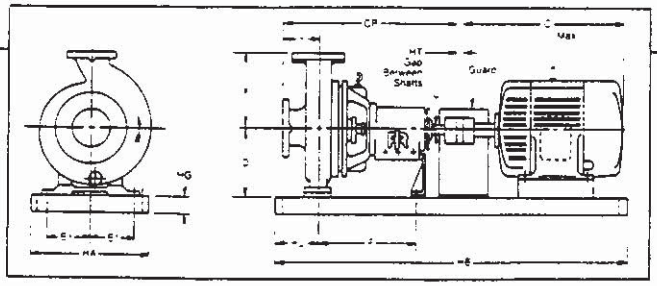
1500 RPM



HOC2

Dimensions And Weights

Approximate—Do not use for construction.



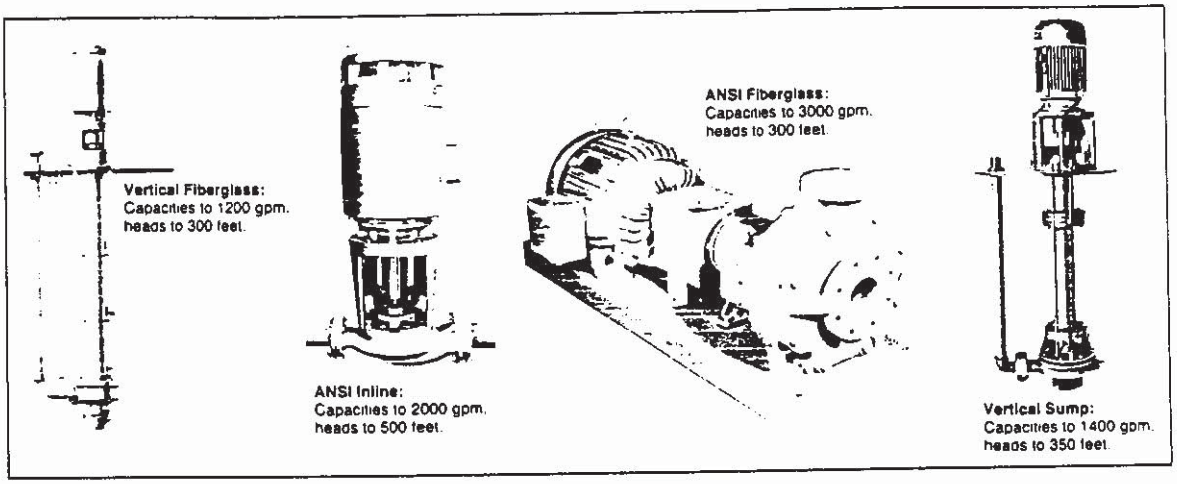
Pump Data																							
Group	Size-Suct. × Discharge × Max. Imp. Dia. (inch)	ANSI Size	X		Y		CP		D		E1		F		U Shaft Diameter		U Keyway Size		Pump Weight	
			in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	lb	kg
1	1.5 × 1 × 6	AA	6.50	165	4.0	102	17.50	445	5.25	133	3.00	76	7.25	184	.875	22.23	.187 × .094	4.76 × 2.38	85	39
	3 × 1.5 × 6	AB																	90	41
	1.5 × 1 × 8	AA																	105	48
2	3 × 2 × 6	A10	8.25	210	4.0	102	23.50	597	8.25	210	4.88	124	12.50	318	1.125	28.58	Standard .250 × .125	6.35 × 3.18	195	88
	3 × 1.5 × 8	A50	9.50	216															210	95
	3 × 2 × 8	A60	9.50	242															215	98
	4 × 3 × 8	A70	11.00	280															230	104
	4 × 3 × 8L	A70	11.00	280															245	111
	2 × 1 × 10	A05	8.50	216															215	98
	3 × 1.5 × 10	A20	10.50	266					10.00	254									230	104
	3 × 2 × 10	A60	9.50	242															235	107
	4 × 3 × 10	A70	11.00	280					8.25	210							Optional .375 × .187	9.53 × 4.76	250	113
	4 × 3 × 10L	A70	11.00	280											1.625	41.28			265	120
	6 × 4 × 10	A80	13.50	343															310	141
	3 × 1.5 × 13	A20	10.50	266					10.00	254									275	125
	3 × 2 × 13	A30	11.50	292															280	127
	4 × 3 × 13	A40	12.50	318															305	138
	6 × 4 × 13	A80	13.50	343							7.25	184							405	184
3	8 × 6 × 13	A90	16.00	406	6.0	152	33.88	860	14.50	368	8.00	203	18.75	476	2.375	60.33	.625 × .312	15.88 × 7.94	615	279
	10 × 8 × 13	A100	18.00	457															660	299
	8 × 6 × 15	A110																	670	304
	10 × 8 × 15	A120	19.00	483															740	336

Bedplate Data																		
Group	ANSI Bed Size	NEMA Motor Frame Sizes	HA		HB		HG		HL		HT		C		Bedplate Weight Steel		Bedplate Weight Fiberglass	
			in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	lb.	kg	lb.	kg
1	1T	56-182	10	254	35	890	2.62	66	4.50	114	3.5	89	14.50	368	45	21	17	8
	2T	184-215	12	305	39	990	3.00	76					19.50	495	68	31	20	9
	2	254-286	15	391	52	1320	3.38	86					27.00	686	147	67	37	17
2	1	143-215	12	305	45	1140	3.00	76	4.50	114	3.5	89	19.50	495	80	36	26	12
	2	254-286	15	391	52	1320	3.38	86					27.00	686	147	67	37	17
	3	324-365	18	467	58	1475	4.00	102					34.00	864	205	93	48	22
	4	404-405	18	467	60	1520	4.00	102					38.50	998	215	97	—	—
	5	444-445	22	559	68	1730	3.00	76					44.50	1130	190	86	90	41
3	5	284-365	22	559	68	1730	3.00	76	6.50	165	5.0	127	34.00	864	185	84	85	39
	6	404-447	22	559	80	2032	3.00	76					46.50	1181	210	95	—	—

Frame End Data								
	Group 1		Group 2		Group 2A		Group 3	
	in.	mm	in.	mm	in.	mm	in.	mm
Sleeve Outside Diameter	1.125	28.6	1.875	47.6	2.125	54.0	2.375	60.3
Standard Stuffing Box —Bore	1.750	44.4	2.625	66.7	2.875	73.0	3.250	82.5
—Radial Gap	.312	7.9	.375	9.5	.375	9.5	.437	11.1
—Depth (Std.)	2.06	52.3	2.44	62.0	2.44	62.0	3.56	90.4
—1st Obstruc. (Std.)	1.91	48.5	2.16	54.9	2.16	54.9	3.69	93.7
—1st Obstruc. (Max.)	2.16	54.9	2.44	62.0	2.44	62.0	4.13	104.9
Packing Size—Square	.312	7.9	.375	9.5	.375	9.5	.437	11.1
Sealing Chamber Box —Bore	2.625	66.7	3.625	92.1	3.625	92.1	4.375	111.1
—Radial Gap	.750	19.0	.875	22.2	.750	19.1	1.000	25.4
—Depth	1.81	46.0	2.16	54.9	2.16	54.9	3.12	79.2
—1st Obstruction	2.16	54.9	2.44	62.0	2.44	62.0	4.13	104.9
Flexible Seal Seat Outer Dia.	1.750	44.4	2.625	66.7	2.875	73.0	3.250	82.5
Bearing—Radial (inboard) Number—Thrust (outboard)	206 5305		311 5311		311 5311		313 5313	

Power Limits								
	Group 1		Group 2		Group 2A		Group 3	
RPM	HP	kw	HP	kw	HP	kw	HP	kw
3550	20	14.9	130	97.0	150	111.9	—	—
2950	16.5	12.3	110	82.1	122	91.0	—	—
1750	10	7.5	65	48.5	75	56.0	220	164.1
1450	8	6.0	53	39.5	61	45.5	179	133.5
1180	7	5.2	43	32.1	50	37.3	146	108.9
880	5	3.7	32	23.9	37	27.6	109	81.3

There's an Ingersoll-Rand process pump that's just right for your needs.



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Your Local Ingersoll-Rand Pump Distributor:

INGERSOLL-RAND
PUMPS

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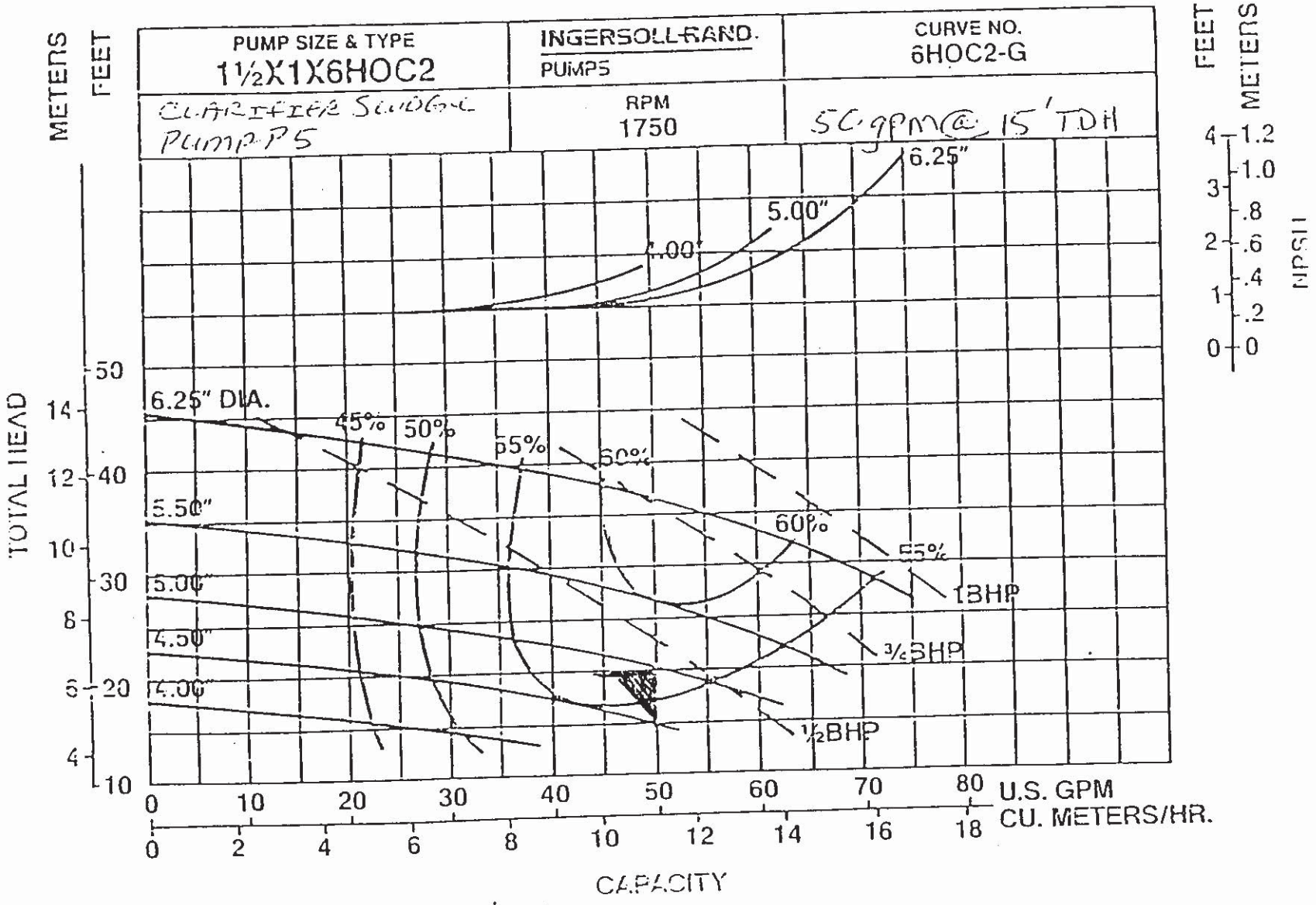
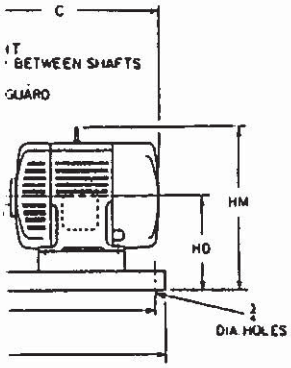
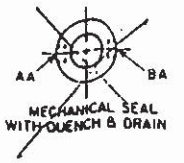
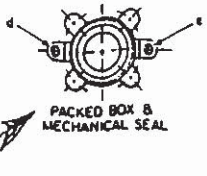
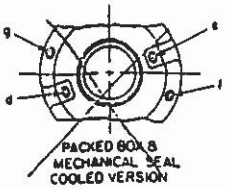

PUMP SIZE & TYPE
1½X1X6HOC2
INGERSOLL-RAND
PUMPS
CURVE NO.
6HOC2-G
CLARIFIER SLUDGE PUMPS
RPM
1750
50 GPM @ 15' TDH
METERS
FEET
TOTAL HEAD
6.25" DIA.
5.50"
5.00"
4.50"
4.00"
6.25"
5.00"
4.00"
45%
50%
55%
60%
60%
55%
1BHP
¾BHP
½BHP
FEET
METERS
NPSH
U.S. GPM
CU. METERS/HR.
CAPACITY

GENERAL ARRANGEMENT – HOC/HEC GROUP 1 PUMPS









PIP	
MECHANICAL S	
Recommended seal piping plan below to be designated in title I "Yes" in title box.	
Fig. No	Piping Plan
1	01 — Internal Circulatio Flushing by pump product thru intern e d Taps plugg
2	11A — Flushing by pump by using piping fr discharge to stuffi e h Taps used d Tap plugged
3	11 — Flushing by pump by using piping fr discharge to flush EA h Taps use d e Taps plugg
4	31 — Flushing by pump thru separator to s h e j Taps us d Tap plugged
5	21 — Flushing by pump thru heat exchang to stuffing box h e Taps used d Tap plugged

AUXILIA	
*a	¼ Bearing
b	½ Casing
*c	Stuffin
*d	⅜ Packed
*e	⅜ Seal Flu
f	½ Cooling
g	½ Cooling
h	⅜ Gage C
j	⅜ Gage C
k	¼ Smothe
m	¼ Smothe
AA	⅜ Mechan
BA	⅜ Mechan
EA	⅜ Mechan
FA	½" Coolin

*Standard – Alway

COUPLING DATA								
FRAME	56	143T	145T	182T	184T	213T	215T	254T
C	14	12½	13⅛	14¾	15¾	17⅞	19¾	21 13/16
WEIGHT	30	30	36	58	69	136	169	252
85								
95	1T-A	1T-A	1T-A	1T-A	2T-B	2T-C	2T-C	2-E
100								

Coupling Letter
Bedplate Number

BEDPLATE DATA							
NO.	WEIGHT	HA	HB	HE	HF	HG	
1T	45	10	35	4	32½	2⅝	
2T	68	12	39	4½	36½	3	
2	147	15	52	6	49½	3⅜	

R. BEDPLATE SETTING AND OVERALL HEIGHT DATA											
184			213-215			254					
HD	HM	HO	HD	HM	HO	HD	HM	HO	HD	HM	HO
8¼	14¾	14¾	8¼	16	14¾						
8¼	14¾	14¾	8¼	16	14¾						
8¼	14¾	14¾	8¼	16	14¾	9⅛	19	16⅛			

COUPLING DATA				
	T.B. WOOD'S	HT	FALK	HT
A	SC4J	3½	20TD31	3½
B	SC5	3½	20TD31	3½
C	SC6	3½	20T-31	3½
D	SC6	3½	30T-31	3½
E	SC7	3½	30T-31	3½

1. CONSULT INST
2. All dimensions gi
3. All pipe taps are s
4. All holes in flange
5. Allow ¼" for vari
6. Foundation bolts equipment.
7. Allow ⅜" under b
8. Recheck alignme
9. "The design of p is the responsibili as an aid, but I-R We recommend foundations, pipi terpret Ingersoll-R bon."

300# A.N.S.I. – STEEL (F.F.)					
O.D. Flange	Thick + 1/16-0	Bolts No.	Bolts Size	Dia. B.C.	
4⅞	11/16	4	⅝	3½	
6⅛	13/16	4	¾	4½	
8¼	1⅛	8	¾	6⅝	

PRELIMINARY – DO NOT USE FOR CONSTRUCTION UNLE

CUSTOMER YOLANA CONSTRUCTION — CUSTO

PROJECT & LOCATION KINGSBURY LAND FILL — CUSTO

I.R. Item No.	Pump	Frame & Enclosure	H.P. / RPM	Flanges	Piping Plan	Cooling Taps
AA	1½x1x6 HOC-II	145T TEFC	1½ / 1750	150#	✓	✓

INGERSOLL RAND COMPANY — CERTIF

ORDER NO. — PER

Solids Collection Tank Pneumatic Transfer Pump

(P-5B)

Wilden P-200 Pneumatic

WILDEN®

Part of Pump Solutions Group

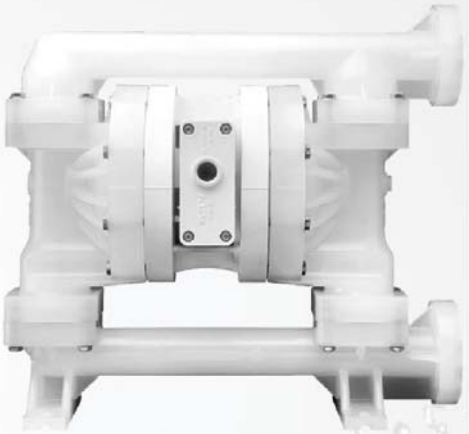
A DOVER COMPANY

EOM

Engineering Operation & Maintenance

P200

Advanced™ Series Plastic Pump



Where Innovation Flows

www.wildenpump.com

PRO-FLO® PROGRESSIVE PUMP TECHNOLOGY

CE

WIL-11070-E-11
REPLACES WIL-11070-E-10

TABLE OF CONTENTS

Member of: Hydraulic INSTITUTE

Class I & II Ozone NON U.S. Clean Air Act Amendments of 1990 USE Depleting Substances

CAUTIONS—READ FIRST!

TEMPERATURE LIMITS*

Polypropylene	0°C to 79°C	32°F to 175°F
PVDF	–12°C to 107°C	10°F to 225°F
PFA	7°C to 107°C	20°F to 225°F
Neoprene	–18°C to 93°C	0°F to 200°F
Buna-N	–12°C to 82°C	10°F to 180°F
EPDM	–51°C to 138°C	–60°F to 280°F
Viton® FKM	–40°C to 177°C	–40°F to 350°F
Wil-Flex™	–40°C to 107°C	–40°F to 225°F
Saniflex™	–29°C to 104°C	–20°F to 220°F
Polyurethane	–12°C to 66°C	10°F to 150°F
Polytetrafluoroethylene (PTFE)[1]	4°C to 104°C	40°F to 220°F
Nordel® EPDM	–51°C to 138°C	–60°F to 280°F
Nylon	–18°C to 93°C	0°F to 200°F
Acetal	–29°C to 82°C	–20°F to 180°F
SIPD PTFE with Neoprene-backed	4°C to 104°C	40°F to 220°F
SIPD PTFE with EPDM-backed	–10°C to 137°C	14°F to 280°F
Polyethylene	0°C to 70°C	32°F to 158°F
Geolast®	–40°C to 82°C	–40°F to 180°F

[1]4°C to 149°C (40°F to 300°F) - 13 mm (1/2") and 25 mm (1") models only.

CAUTION: When choosing pump materials, be sure to check the temperature limits for all wetted components. Example: Viton® has a maximum limit of 177°C (350°F) but polypropylene has a maximum limit of only 79.4°C (175°F).

CAUTION: Maximum temperature limits are based upon mechanical stress only. Certain chemicals will significantly reduce maximum safe operating temperatures. Consult engineering guide for chemical compatibility and temperature limits.

CAUTION: Always wear safety glasses when operating pump. If diaphragm rupture occurs, material being pumped may be forced out of the air exhaust.

WARNING: Prevent static sparking. If static sparking occurs, fire or explosion could result. Proper grounding of pump, valves, and containers is critical when handling flammable fluids or whenever discharge of static electricity is a hazard.

NOTE: Do not exceed 5.2 bar (75 psig) air supply for PFA pumps.

CAUTION: Do not exceed 8.6 bar (125 psig) air supply on polypropylene and PVDF pumps.

CAUTION: Advanced™ series plastic pumps are made with plastic that is not UV-stabilized. Direct sunlight for prolonged periods can cause deterioration of plastics.

CAUTION: Before any maintenance or repair is attempted, the compressed air line to the pump should be disconnected and all air pressure allowed to bleed from pump. Disconnect all intake, discharge and air lines. Drain the pump by turning it upside down and allowing any fluid to flow into a suitable container.

CAUTION: Blow out air line for 10 to 20 seconds before attaching to pump to make sure all pipeline debris is clear. Use an in-line air filter. A 5µ (micron) air filter is recommended.

NOTE: Tighten all bolts prior to installation. Fittings may loosen during transportation. See torque specifications on page 15.

NOTE: When installing polytetrafluoroethylene (PTFE) diaphragms, it is important to tighten outer pistons simultaneously (turning in opposite directions) to ensure tight fit.

CAUTION: Verify the chemical compatibility of the process and cleaning fluid to the pump's component materials in the Chemical Resistance Guide.

CAUTION: When removing the end cap using compressed air, the air valve end cap may come out with considerable force. Hand protection such as a padded glove or rag should be used to capture the end cap.

CAUTION: Do not over-tighten the air inlet reducer bushing. Additionally, too much torque on the muffler may damage the air valve muffler plate. Do not exceed 0.9 N·m (8 in-lb).

NOTE: When reinstalling the outer pistons, apply two (2) drops of Loctite® 246 to the shaft's internal threads before the diaphragm assembly.

P200 ADVANCED™ PLASTIC

25 mm (1") Pump
Maximum Flow Rate:
220 lpm (58 gpm)

Maximum Operating Pressure for PFA is 5.2 bar (75 psig)

LEGEND

P200 / XXXXX / XXX / XX / XXX / *XXXX*

- P200 — MODEL
- XXXXX — WETTED PARTS & OUTER PISTON
- XXX — CENTER SECTION
- XX — AIR VALVE
- XXX — DIAPHRAGMS
- XXX — VALVE BALLS
- XXX — VALVE SEAT
- XXX — O-RINGS
- *XXXX* — SPECIALTY CODE (if applicable)

MATERIAL CODES

WETTED PARTS & OUTER PISTON
KK = PVDF / PVDF
PK = POLYPROPYLENE / PVDF
TT = PTFE / PTFE

CENTER SECTION
PP = POLYPROPYLENE

AIR VALVE
P = POLYPROPYLENE

DIAPHRAGMS
BNS = BUNA-N (Red Dot)
FSS = SANIFLEX™ [Hytrel® (Cream)]
EPS = EPDM (Blue Dot)
NES = NEOPRENE (Green Dot)
PUS = POLYURETHANE (Clear)
TEU = PTFE W/EPDM BACK-UP (White)
TNU = PTFE W/NEOPRENE BACK-UP (White)
TSU = PTFE W/SANIFLEX™ BACK-UP (White)
VTS = VITON® (White Dot)
WFS = WIL-FLEX™ [Santoprene® (Orange Dot)]
TSS = FULL-STROKE PTFE W/SANIFLEX™ BACK-UP
TWS = FULL-STROKE PTFE W/WIL-FLEX™ BACK-UP

VALVE BALLS
BN = BUNA-N (Red Dot)
FS = SANIFLEX™ [Hytrel® (Cream)]
EP = EPDM (Blue Dot)
NE = NEOPRENE (Green Dot)
PU = POLYURETHANE (Brown)
TF = PTFE (White)
VT = VITON® (White Dot)
WF = WIL-FLEX™ [Santoprene® (Orange Dot)]

VALVE SEAT
K = PVDF
P = POLYPROPYLENE
T = PTFE PFA

VALVE SEAT O-RING
BN = BUNA-N
PU = POLYURETHANE (Brown)
TV = PTFE ENCAP. VITON®
WF = WIL-FLEX™ (Santoprene®)

SPECIALTY CODES

0100 Wil-Gard II™ 110V
0102 Wil-Gard II™ sensor wires Only
0103 Wil-Gard II™ 220V
0206 PFA-coated hardware, Wil-Gard II™ sensor wires ONLY
0480 PCM I™ (Sensor & wires only)
0502 PFA-coated hardware
0504 DIN flange
0506 DIN flange, PFA-coated hardware
0603 PFA-coated hardware, Wil-Gard II™ 110V
0604 DIN flange, Wil-Gard II™ 220V
0608 PFA-coated hardware, Wil-Gard II™ 220V

Viton® is a registered trademark of DuPont Dow Elastomers.

The Wilden diaphragm pump is an air-operated, positive displacement, self-priming pump. These drawings show the flow pattern through the pump upon its initial stroke. It is assumed the pump has no fluid in it prior to its initial stroke.

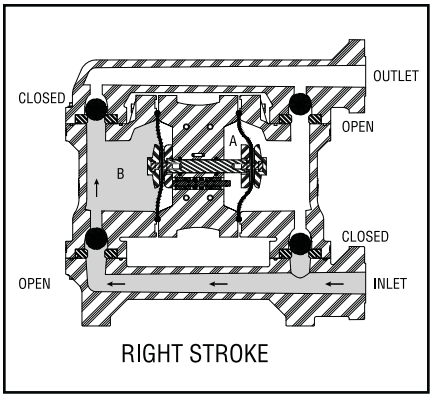


FIGURE 1 The air valve directs pressurized air to the back side of diaphragm A. The compressed air is applied directly to the liquid column separated by elastomeric diaphragms. The diaphragm acts as a separation membrane between the compressed air and liquid, balancing the load and removing mechanical stress from the diaphragm. The compressed air moves the diaphragm away from the center block of the pump. The opposite diaphragm is pulled in by the shaft connected to the pressurized diaphragm. Diaphragm B is on its suction stroke; air behind the diaphragm has been forced out to the atmosphere through the exhaust port of the pump. The movement of diaphragm B toward the center block of the pump creates a vacuum within chamber B. Atmospheric pressure forces fluid into the inlet manifold forcing the inlet valve ball off its seat. Liquid is free to move past the inlet valve ball and fill the liquid chamber (see shaded area).

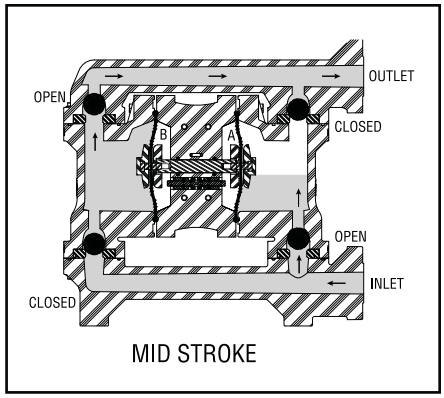


FIGURE 2 When the pressurized diaphragm, diaphragm A, reaches the limit of its discharge stroke, the air valve redirects pressurized air to the back side of diaphragm B. The pressurized air forces diaphragm B away from the center block while pulling diaphragm A to the center block. Diaphragm B is now on its discharge stroke. Diaphragm B forces the inlet valve ball onto its seat due to the hydraulic forces developed in the liquid chamber and manifold of the pump. These same hydraulic forces lift the discharge valve ball off its seat, while the opposite discharge valve ball is forced onto its seat, forcing fluid to flow through the pump discharge. The movement of diaphragm A toward the center block of the pump creates a vacuum within liquid chamber A. Atmospheric pressure forces fluid into the inlet manifold of the pump. The inlet valve ball is forced off its seat allowing the fluid being pumped to fill the liquid chamber.

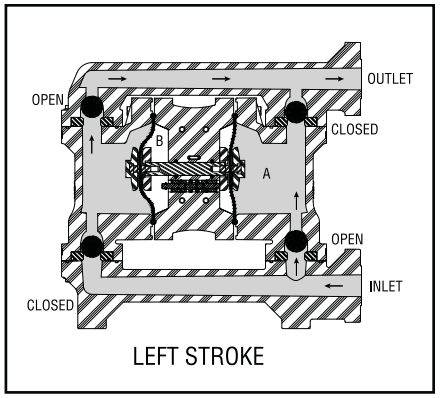
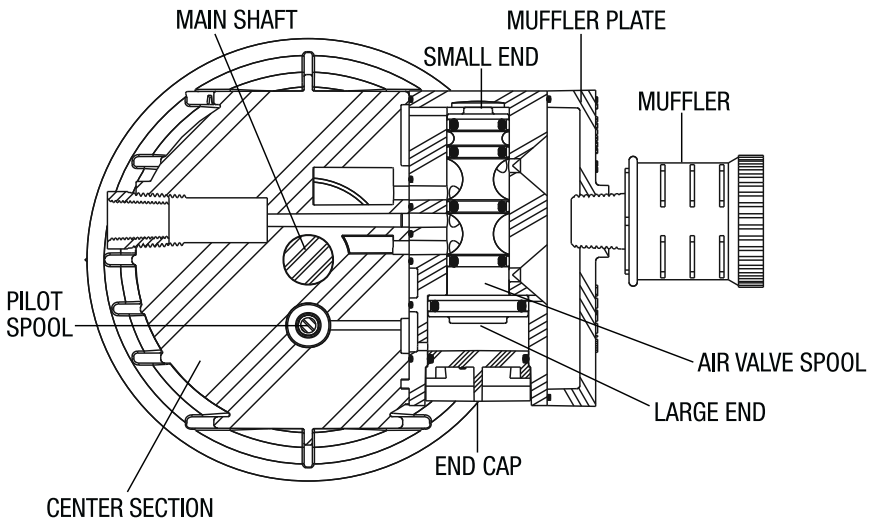


FIGURE 3 At completion of the stroke, the air valve again redirects air to the back side of diaphragm A, which starts diaphragm B on its exhaust stroke. As the pump reaches its original starting point, each diaphragm has gone through one exhaust and one discharge stroke. This constitutes one complete pumping cycle. The pump may take several cycles to completely prime depending on the conditions of the application.

PRO-FLO® PROGRESSIVE PUMP TECHNOLOGY

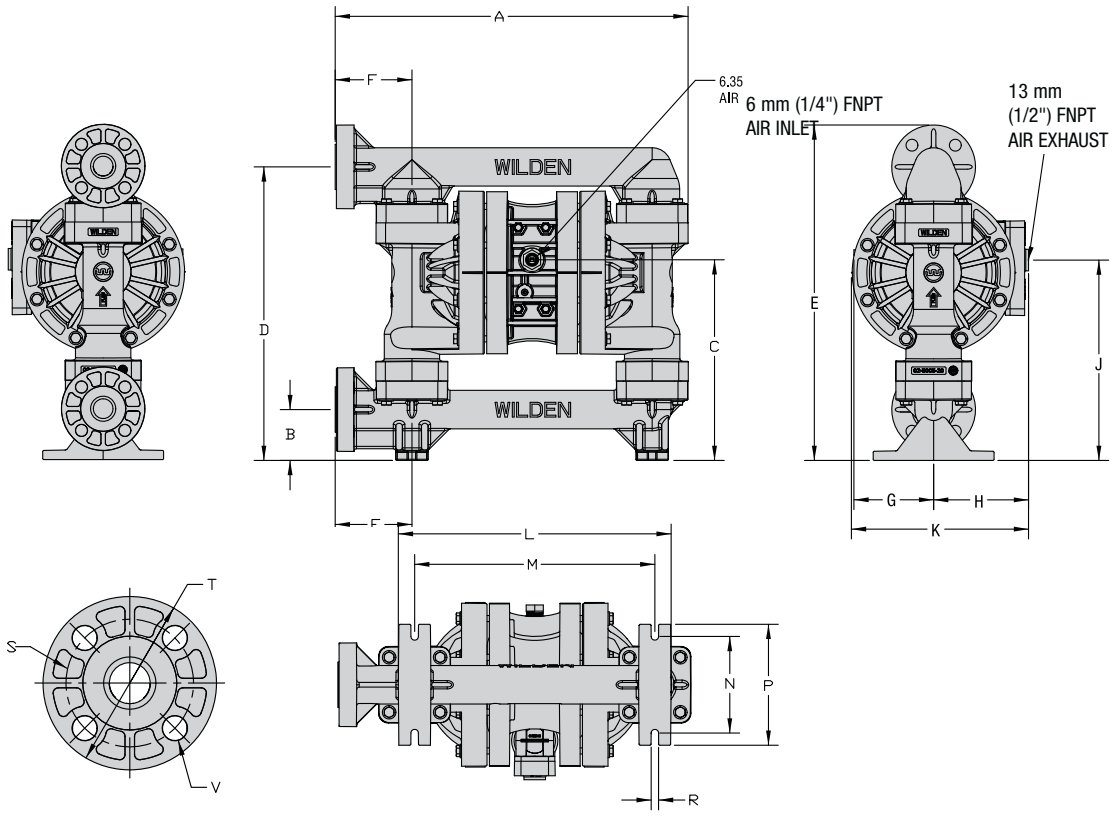
HOW IT WORKS—AIR DISTRIBUTION SYSTEM

Figure A



The Pro-Flo® patented air distribution system incorporates three moving parts: the air valve spool, the pilot spool, and the main shaft/diaphragm assembly. The heart of the system is the air valve spool and air valve. As shown in Figure A, this valve design incorporates an unbalanced spool. The smaller end of the spool is pressurized continuously, while the large end is alternately pressurized then exhausted to move the spool. The spool directs pressurized air to one air chamber while exhausting the other. The air causes the main shaft/diaphragm assembly to shift to one side — discharging liquid on that side and pulling liquid in on the other side. When the shaft reaches the end of its stroke, the inner piston actuates the pilot spool, which pressurizes and exhausts the large end of the air valve spool. The repositioning of the air valve spool routes the air to the other air chamber.

DIMENSIONAL DRAWINGS



DIMENSIONS

ITEM	METRIC (mm)	STANDARD (inch)
A	457	18.0
B	66	2.6
C	259	10.2
D	381	15.0
E	434	17.1
F	99	3.9
G	104	4.1
H	122	4.8
J	259	10.2
K	231	9.1
L	353	13.9
M	310	12.2
N	124	4.9
P	157	6.2
R	10	0.4
	DIN FLANGE	
S	85 DIA.	3.3 DIA.
T	115 DIA.	4.5 DIA.
U	14 DIA.	0.6 DIA.
	ANSI FLANGE	
S	79 DIA.	3.1 DIA.
T	108 DIA.	4.3 DIA.
U	16 DIA.	0.6 DIA.

P200 PLASTIC RUBBER-FITTED

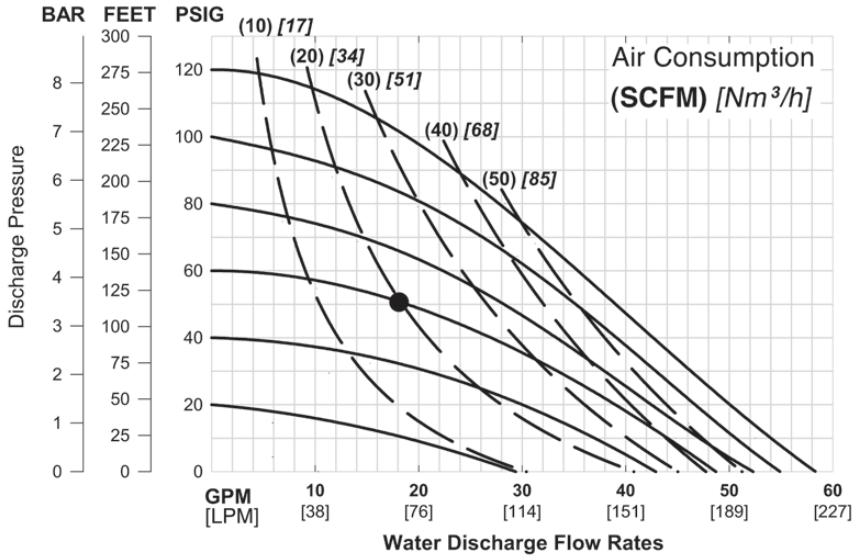
Height.....434 mm (17.1")
Width.....457 mm (18.0")
Depth .....231 mm (9.1")
Est. Ship Weight..... Polypropylene 10 kg (22 lb)
PVDF 15 kg (32 lb) PFA 18 kg (40 lb)
Air Inlet.....6 mm (1/4")
Inlet.....25 mm (1")
Outlet .....25 mm (1")
Suction Lift ..... 3.6 m Dry (11.9')
9.1 m Wet (30.0')
Disp. per Stroke.....0.32 L (0.09 gal)[1]
Max. Flow Rate.....220 lpm (58 gpm)
Max. Size Solids .....4.76 mm (3/16")

[1]Displacement per stroke was calculated at 4.8 bar (70 psig) air inlet pressure against a 2 bar (30 psig) head pressure.

Example: To pump 68 lpm (18 gpm) against a discharge head pressure of 3.4 bar (50 psig) requires 4.1 bar (60 psig) and 34 Nm^3/h (20 scfm) air consumption. (See dot on chart.)

Caution: Do not exceed 5.2 bar (75 psig) air supply pressure on PFA pumps.

Caution: Do not exceed 8.6 bar (125 psig) air supply pressure on polypropylene and PVDF pumps.



Flow rates indicated on chart were determined by pumping water.

For optimum life and performance, pumps should be specified so that daily operation parameters will fall in the center of the pump's performance curve.

P200 PLASTIC TPE-FITTED

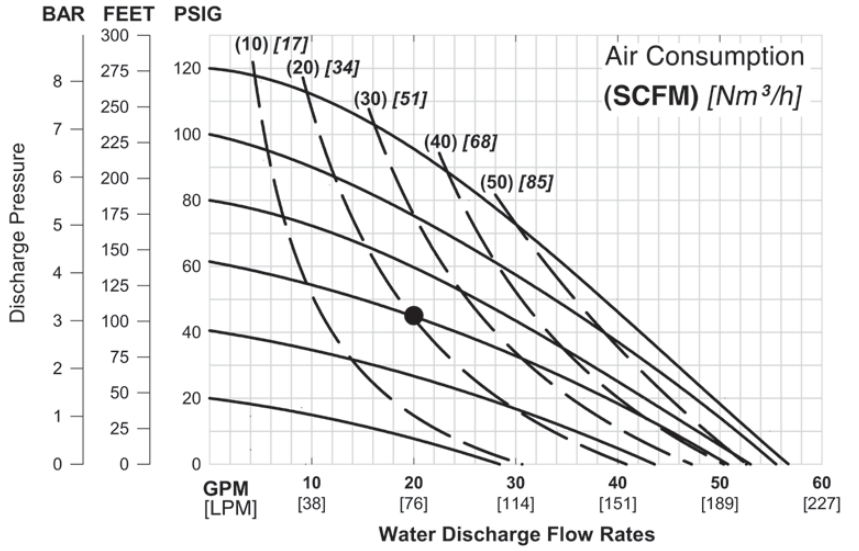
Height.....434 mm (17.1")
Width.....457 mm (18.0")
Depth .....231 mm (9.1")
Est. Ship Weight..... Polypropylene 10 kg (22 lb)
PVDF 15 kg (32 lb) PFA 18 kg (40 lb)
Air Inlet.....6 mm (1/4")
Inlet.....25 mm (1")
Outlet .....25 mm (1")
Suction Lift ..... 3.5 m Dry (11.4')
9.8 m Wet (32.0')
Disp. per Stroke.....0.33 L (0.09 gal)[1]
Max. Flow Rate.....216 lpm (57 gpm)
Max. Size Solids .....4.76 mm (3/16")

[1]Displacement per stroke was calculated at 4.8 bar (70 psig) air inlet pressure against a 2 bar (30 psig) head pressure.

Example: To pump 76 lpm (20 gpm) against a discharge head pressure of 3.1 bar (45 psig) requires 4.1 bar (60 psig) and 34 Nm^3/h (20 scfm) air consumption. (See dot on chart.)

Caution: Do not exceed 5.2 bar (75 psig) air supply pressure on PFA pumps.

Caution: Do not exceed 8.6 bar (125 psig) air supply pressure on polypropylene and PVDF pumps.



Flow rates indicated on chart were determined by pumping water.

For optimum life and performance, pumps should be specified so that daily operation parameters will fall in the center of the pump's performance curve.

P200 PLASTIC
REDUCED-STROKE PTFE-FITTED

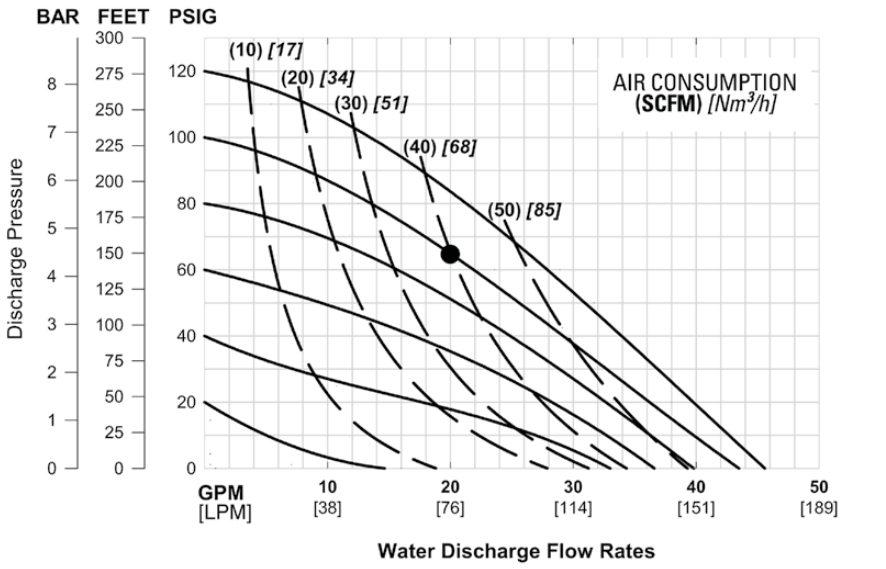
Height.....434 mm (17.1")
Width.....457 mm (18.0")
Depth .....231 mm (9.1")
Est. Ship Weight..... Polypropylene 10 kg (22 lb)
PVDF 15 kg (32 lb) PFA 18 kg (40 lb)
Air Inlet.....6 mm (1/4")
Inlet.....25 mm (1")
Outlet .....25 mm (1")
Suction Lift..... 2.4 m Dry (7.9')
9.4 m Wet (31.0')
Disp. per Stroke.....0.22 L (0.06 gal)[1]
Max. Flow Rate.....174 lpm (46 gpm)
Max. Size Solids .....4.76 mm (3/16")

[1]Displacement per stroke was calculated at 4.8 bar (70 psig) air inlet pressure against a 2.1 bar (30 psig) head pressure.

Example: To pump 76 lpm (20 gpm) against a discharge head pressure of 4.5 bar (65 psig) requires 6.9 bar (100 psig) and 37 Nm^3/h (40 scfm) air consumption. (See dot on chart.)

Caution: Do not exceed 5.2 bar (75 psig) air supply pressure on PFA pumps.

Caution: Do not exceed 8.6 bar (125 psig) air supply pressure on polypropylene and PVDF pumps



Flow rates indicated on chart were determined by pumping water.

For optimum life and performance, pumps should be specified so that daily operation parameters will fall in the center of the pump's performance curve.

P200 PLASTIC
FULL-STROKE PTFE-FITTED

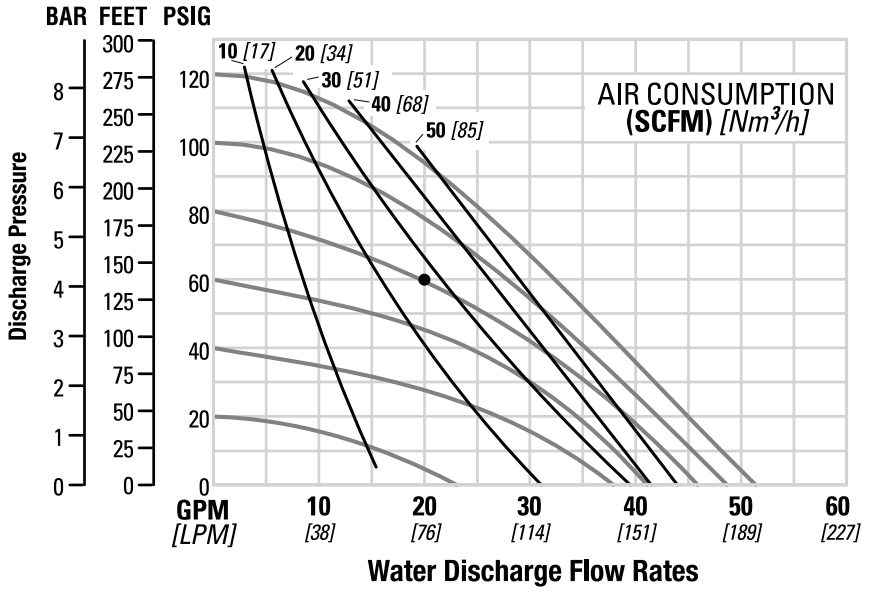
Height.....434 mm (17.1")
Width.....457 mm (18.0")
Depth .....231 mm (9.1")
Ship Weight .....Polypropylene 10 kg (22 lb)
PVDF 15 kg (32 lb)
Air Inlet.....6 mm (1/4")
Inlet.....25 mm (1")
Outlet .....25 mm (1")
Suction Lift..... 3.5 m Dry (11.4')
8.6 m Wet (28.4')
Disp. per Stroke.....0.3 L (0.08 gal)[1]
Max. Flow Rate.....195 lpm (51.4 gpm)
Max. Size Solids .....4.76 mm (3/16")

[1]Displacement per stroke was calculated at 4.8 bar (70 psig) air inlet pressure against a 2.1 bar (30 psig) head pressure

Example: To pump 75.7 lpm (20 gpm) against a discharge head of 4.1 bar (60 psig) requires 5.5 bar (80 psig) and 46.6 Nm^3/h (29 scfm) air consumption.

Caution: Do not exceed 5.2 bar (75 psig) air supply pressure on PFA pumps.

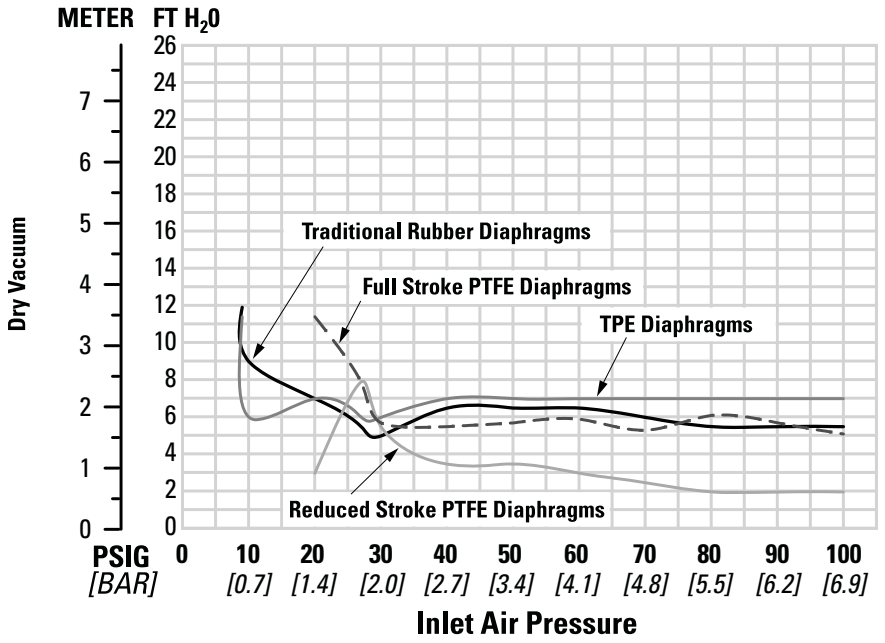
Caution: Do not exceed 8.6 bar (125 psig) air supply pressure on polypropylene and PVDF pumps



Flow rates indicated on chart were determined by pumping water.

For optimum life and performance, pumps should be specified so that daily operation parameters will fall in the center of the pump's performance curve.

P200 PLASTIC SUCTION-LIFT CAPABILITY



Suction-lift curves are calibrated for pumps operating at 305 m (1,000') above sea level. This chart is meant to be a guide only. There are many variables which can affect your pump's operating characteristics. The number of intake and discharge elbows, viscosity of the pumping fluid, elevation (atmospheric pressure) and pipe friction loss all affect the amount of suction lift your pump will attain.

SUGGESTED INSTALLATION

The Pro-Flo® model **P200 Advanced**™ plastic has a 25 mm (1") inlet and 25 mm (1") outlet and is designed for flows to 220 lpm (58 gpm). The **P200 Advanced**™ plastic pump is manufactured with wetted parts of pure, unpigmented Polypropylene or PVDF. The **P200 Advanced**™ plastic pump is constructed with a glass-fiber-filled PP center section. A variety of diaphragms and O-rings are available to satisfy temperature, chemical compatibility, abrasion and flex concerns.

The suction pipe size should be at least 25 mm (1") diameter or larger if highly viscous material is being pumped. The suction hose must be non-collapsible, reinforced type as the **P200 Advanced**™ plastic pump is capable of pulling a high vacuum. Discharge piping should be at least 25 mm (1"); larger diameter can be used to reduce friction losses. It is critical that all fittings and connections are airtight or a reduction or loss of pump suction capability will result.

INSTALLATION: Months of careful planning, study and selection efforts can result in unsatisfactory pump performance if installation details are left to chance.

Premature failure and long-term dissatisfaction can be avoided if reasonable care is exercised throughout the installation process.

LOCATION: Noise, safety and other logistical factors usually dictate where equipment should be situated on the production floor. Multiple installations with conflicting requirements can result in congestion of utility areas, leaving few choices for additional pumps.

Within the framework of these and other existing conditions, every pump should be located in such a way that five key factors are balanced against each other to maximum advantage.

ACCESS: First, the location should be accessible. If it is easy to reach the pump, maintenance personnel will have an easier time carrying out routine inspections and adjustments. Should major repairs become necessary, ease of access can play a key role in speeding the repair process and reducing total downtime.

AIR SUPPLY: Every pump location should have an air line large enough to supply the volume of air necessary to achieve the desired pumping rate (see Section 5). Do not exceed 5.2 bar (75 psig) air supply for PFA pumps. Use air pressure up to a maximum of 8.6 bar (125 psig) for polypropylene and PVDF pumps depending on pumping requirements.

For best results, the pumps should use a 5µ (micron) air filter, needle valve and regulator. The use of an air filter before the pump will insure that the majority of any pipeline contaminants will be eliminated.

SOLENOID OPERATION: When operation is controlled by a solenoid valve in the air line, three-way valves should be used, thus allowing trapped air to bleed off and improving pump performance. Pumping volume can be set by counting the number of strokes per minute and multiplying by displacement per stroke.

SOUND: Sound levels are reduced using the standard Wilden muffler element. Other mufflers can be used, but usually reduce pump performance.

ELEVATION: Selecting a site that is well within the pump's dynamic-lift capability will assure that loss-of-prime troubles will be eliminated. In addition, pump efficiency can be adversely affected if proper attention is not given to site location.

PIPING: Final determination of the pump site should not be made until the potential piping problems of each possible location have been evaluated. The impact of current and future installations should be considered ahead of time to make sure that inadvertent restrictions are not created for any remaining sites.

The best choice possible will be a site involving the shortest and straightest hook-up of suction and discharge piping. Unnecessary elbows, bends and fittings should be avoided. Pipe sizes should be selected to keep friction losses within practical limits. All piping should be supported independently of the pump. In addition, the piping should be aligned to avoid placing stresses on the pump fittings.

Flexible hose can be installed to aid in absorbing the forces created by the natural reciprocating action of the pump. If the pump is to be bolted down to a solid location, a mounting pad placed between the pump and the foundation will assist in minimizing pump vibration. Flexible connections between the pump and rigid piping will also assist in minimizing pump vibration. If quick-closing valves are installed at any point in the discharge system, or if pulsation within a system becomes a problem, a surge suppressor should be installed to protect the pump, piping and gauges from surges and water hammer.

The P200 Advanced™ plastic Pro-Flo® equipped pump can be installed in submersible applications only when both the wetted and non-wetted portions are compatible with the material being pumped. If the pump is to be used in a submersible application, a hose should be attached to the air and pilot spool exhaust ports of the pump. These should then be piped above the liquid level. The exhaust area for the pilot spool is designed to be tapped for a 1/8" NPT fitting.

When pumps are installed in applications involving flooded suction or suction head pressures, a gate valve should be installed in the suction line to permit closing of the line for pump service.

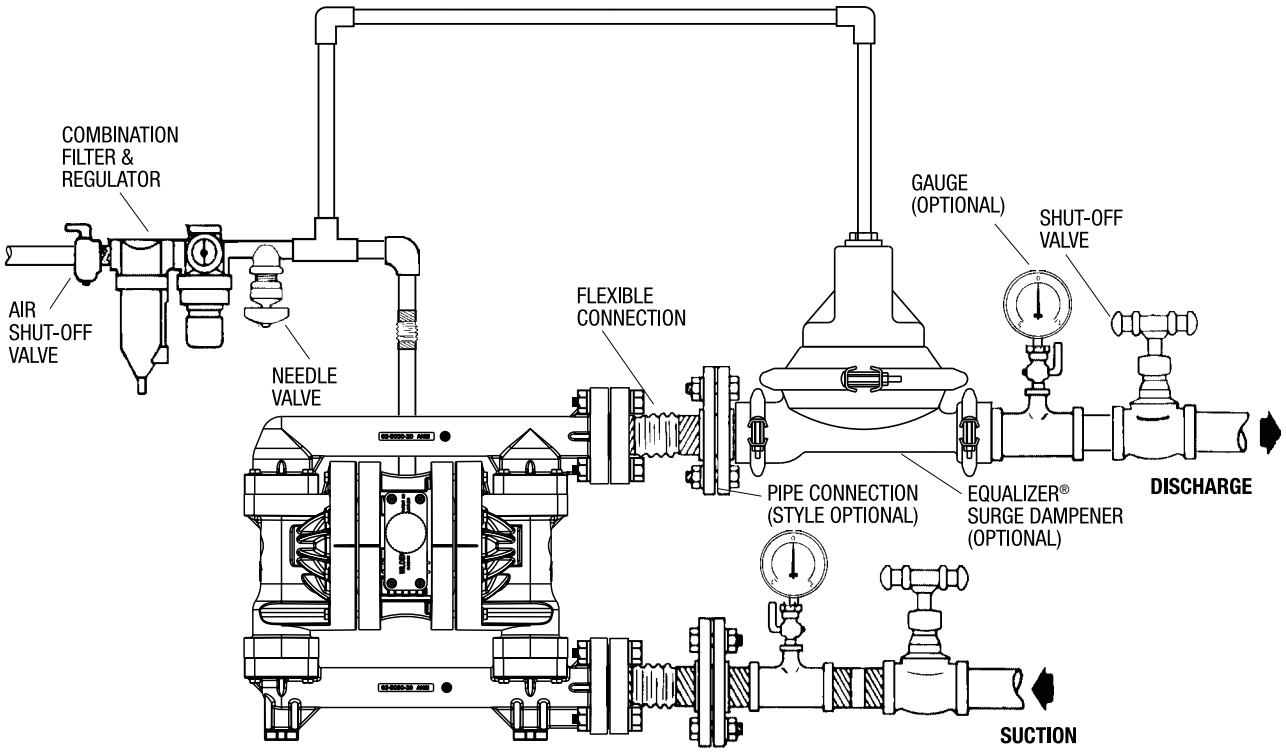
If the pump is to be used in a self-priming application, be sure that all connections are airtight and that the suction-lift is within the ability of the model. **NOTE:** Materials of construction and elastomer material have an effect on suction-lift parameters. Please consult Wilden distributors for specifics.

Pumps in service with a positive suction head are most efficient when inlet pressure is limited to 0.5–0.7 bar (7–10 psig). Premature diaphragm failure may occur if positive suction is 0.7 bar (10 psig) and higher.

THE MODEL P200 ADVANCED™ PLASTIC WILL PASS 4.76 mm (3/16") SOLIDS. WHENEVER THE POSSIBILITY EXISTS THAT LARGER SOLID OBJECTS MAY BE SUCKED INTO THE PUMP, A STRAINER SHOULD BE USED ON THE SUCTION LINE.

CAUTION: DO NOT EXCEED 5.2 BAR (75 PSIG) AIR SUPPLY FOR PFA PUMPS. DO NOT EXCEED 8.6 BAR (125 PSIG) AIR SUPPLY PRESSURE FOR POLYPROPYLENE AND PVDF PUMPS.

SUGGESTED INSTALLATION



AIR-OPERATED PUMPS: To stop the pump from operating in an emergency situation, simply close the "shut-off" valve (user-supplied) installed in the air supply line. A properly functioning valve will stop the air supply to the pump, therefore stopping output. This shut-off valve should be located far enough away from the pumping equipment such that it can be reached safely in an emergency situation.

NOTE: In the event of a power failure, the shut-off valve should be closed, if the restarting of the pump is not desirable once power is regained.

SUGGESTED OPERATION & MAINTENANCE

OPERATION: Pump discharge rate can be controlled by limiting the volume and/or pressure of the air supply to the pump (preferred method). An air regulator is used to regulate air pressure. A needle valve is used to regulate volume. Pump discharge rate can also be controlled by throttling the pump discharge by partially closing a valve in the discharge line of the pump. This action increases friction loss, which reduces flow rate. This is useful when the need exists to control the pump from a remote location. When the pump discharge pressure equals or exceeds the air supply pressure, the pump will stop; no bypass or pressure relief valve is needed, and pump damage will not occur. The pump has been "deadheaded." It can be restarted by reducing the fluid-discharge pressure, or increasing the air inlet pressure. The Wilden P200 Advanced™ plastic pump runs solely on compressed air and does not generate heat, therefore your process fluid temperature will not be affected.

RECORDS: When service is required, a record should be made of all necessary repairs and replacements. Over a period of time, such records can become a valuable tool for predicting and preventing future maintenance problems and unscheduled downtime. In addition, accurate records make it possible to identify pumps that are poorly suited to their applications.

MAINTENANCE AND INSPECTIONS: Since each application is unique, maintenance schedules may be different for every pump. Frequency of use, line pressure, viscosity and abrasiveness of process fluid all affect the parts life of a Wilden pump. Periodic inspections have been found to offer the best means for preventing unscheduled pump downtime. Personnel familiar with the pump's construction and service should be informed of any abnormalities that are detected during operation.

Pump will not run or runs slowly.

1. Ensure that the air inlet pressure is at least 0.35 bar (5 psig) above startup pressure and that the differential pressure (the difference between air inlet and liquid discharge pressures) is not less than 0.7 bar (10 psig).
2. Check air inlet filter for debris (see Suggested Installation).
3. Check for extreme air leakage (blow by) which would indicate worn seals/bores in the air valve, pilot spool, main shaft.
4. Disassemble pump and check for obstructions in the air passageways or objects which would obstruct the movement of internal parts.
5. Check for sticking ball check valves. If material being pumped is not compatible with pump elastomers, swelling may occur. Replace ball check valves and seals with proper elastomers. In addition, valve balls become smaller as the wear. This may cause them to become stuck in the seats. In this case, replace balls and seats.
6. Check for broken inner piston, which will prevent the air valve spool from shifting.
7. Remove plug from pilot spool exhaust, check pilot spool exhaust for blockage.

Pump runs but little or no product flows.

1. Check for pump cavitation; slow pump speed down to allow thick material to flow into liquid chambers.
2. Verify that vacuum required to lift liquid is not greater than the vapor pressure of the material being pumped (cavitation).
3. Check for sticking ball check valves. If material being pumped is not compatible with pump elastomers, swelling may occur. Replace ball check valves and seals with proper elastomers. In addition, valve balls become smaller as the wear. This may cause them to become stuck in the seats. In this case, replace balls and seats.

Pump air valve freezes.

1. Check for excessive moisture in compressed air. Install either a dryer or hot air generator for compressed air. Alternatively, a coalescing filter may be used to remove the water from the compressed air in some applications.

Air bubbles in pump discharge.

1. Check for ruptured diaphragm.
2. Check tightness of outer pistons.
3. Check torque of bolts and integrity of O-rings and seals, especially at intake manifold.
4. Ensure pipe connections are airtight.

Product comes out air exhaust.

1. Check for diaphragm rupture.
2. Check tightness of outer pistons to shaft.

PUMP DISASSEMBLY

CAUTION: Before any maintenance or repair is attempted, the compressed air line to the pump should be disconnected and all air pressure allowed to bleed from the pump. Disconnect all intake, discharge, and air lines. Drain the pump by turning it upside down and allowing any fluid to flow into a suitable container. Be aware of any hazardous effects of contact with your process fluid.

TOOLS REQUIRED:

13 mm (1/2") Box Wrench
2 – 25 mm (1") Sockets or Adjustable Wrench
Adjustable Wrench
Vise equipped with soft jaws (such as plywood, plastic or other suitable material)

NOTE: The model used for these instructions incorporates PTFE diaphragms and balls. Models with rubber diaphragms and balls are the same except where noted.

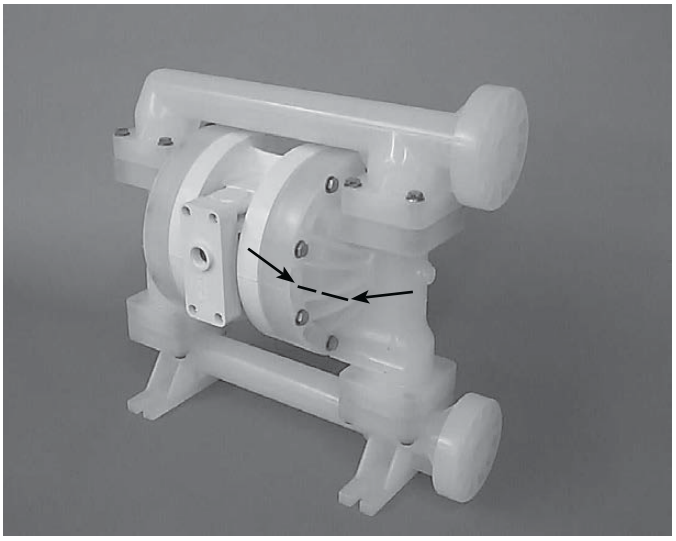
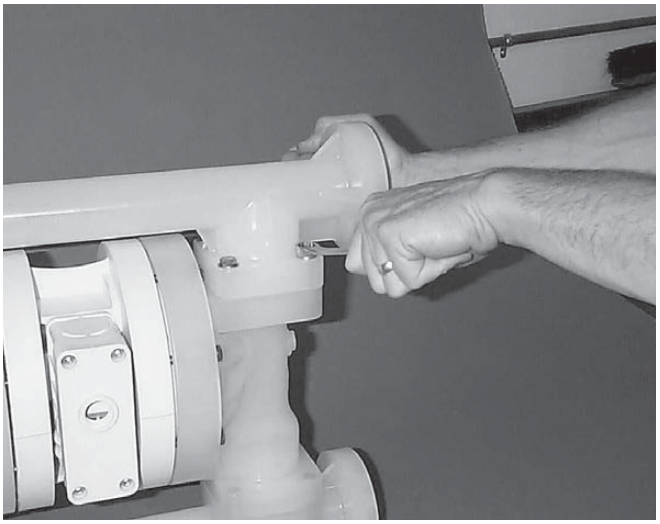


Figure 1

DISASSEMBLY:

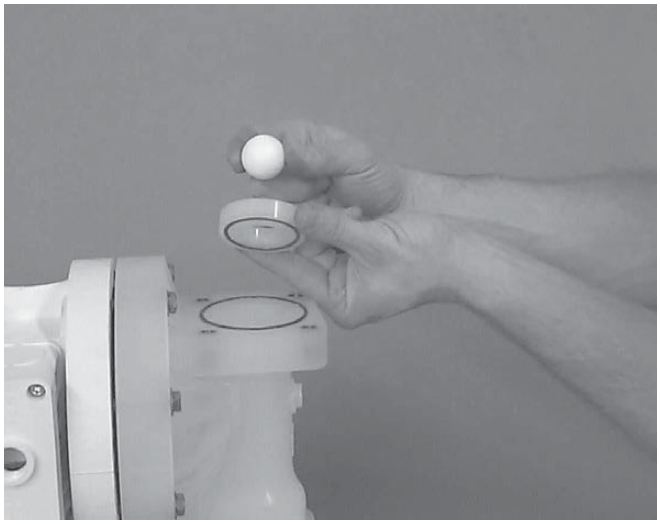
Step 1.

Please see pre-molded alignment marks on the liquid chamber and center section.



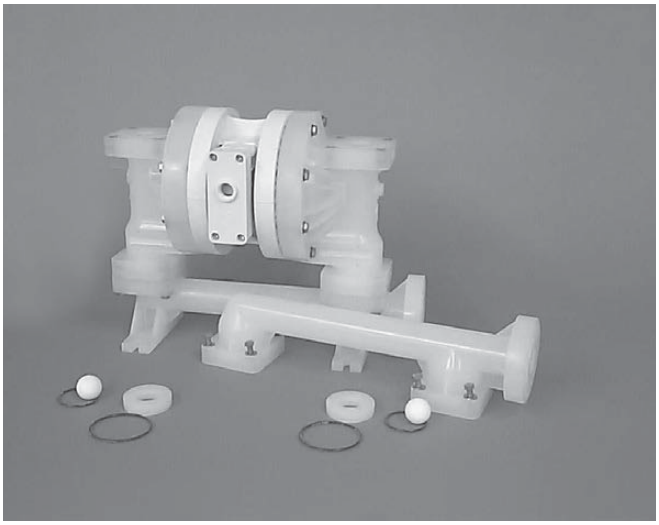
Step 2. *Figure 2*

Using the 13 mm (1/2”) box wrench, loosen the discharge manifold from the liquid chambers.



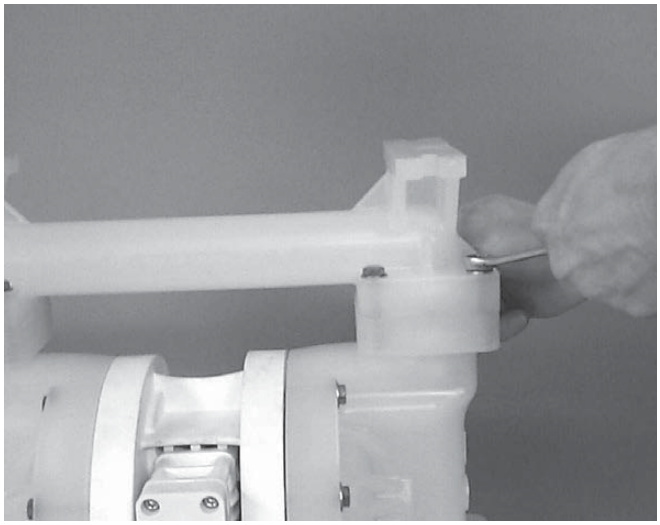
Step 3. *Figure 3*

Remove the discharge manifold to expose the valve balls, valve seats and valve seat O-rings.



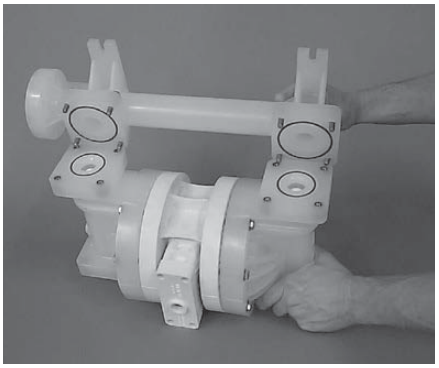
Step 4. *Figure 4*

Remove the discharge valve balls, seats and valve seat O-rings from the discharge manifold and liquid chamber, inspect for nicks, gouges, chemical attack or abrasive wear. Replace worn parts with genuine Wilden parts for reliable performance.



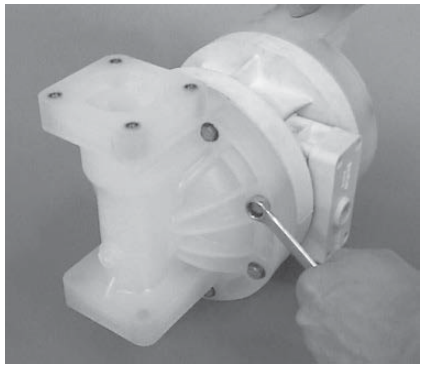
Step 5. *Figure 5*

Using a 13 mm (1/2") box wrench, remove the inlet manifold.



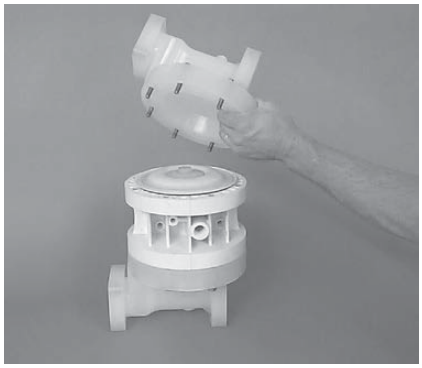
Step 6. *Figure 6*

Remove the inlet valve balls, seats and valve seat O-rings from the liquid chamber and discharge manifold, inspect for nicks, gouges, chemical attack or abrasive wear. Replace worn parts with genuine Wilden parts for reliable performance.



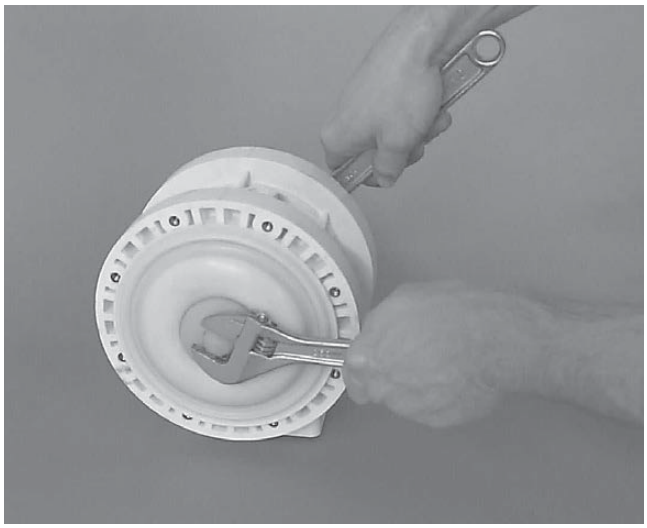
Step 7. *Figure 7*

With a 13 mm (1/2") box wrench, remove the liquid chambers from the center section.



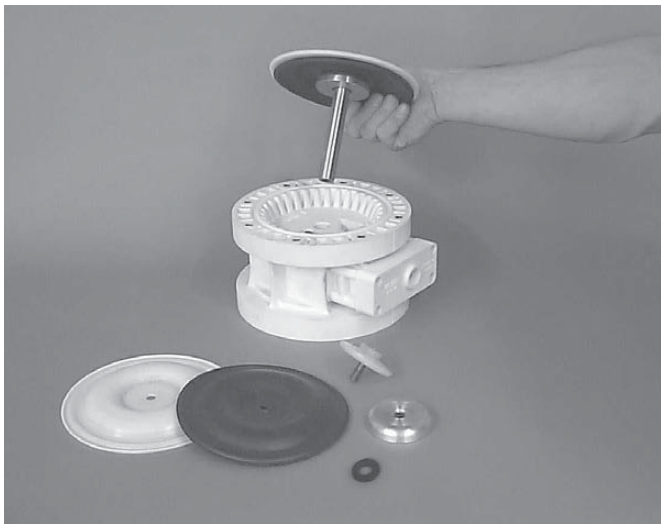
Step 8. *Figure 8*

The liquid chamber should be removed to expose the diaphragm and outer piston. Rotate center section and remove the opposite liquid chamber.



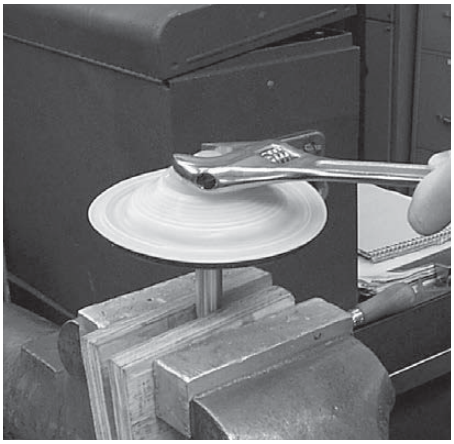
Step 9. *Figure 9*

Using two (2) crescent wrenches or 25 mm (1") sockets, remove diaphragm assembly from center section assembly.



Step 10. *Figure 10*

After loosening and removing the outer piston the diaphragm assembly can be disassembled.



Step 11. *Figure 11*

To remove the remaining diaphragm assembly from the shaft, secure shaft with soft jaws (a vise fitted with plywood or other suitable material) to ensure shaft is not nicked, scratched or gouged. Using an adjustable wrench, remove diaphragm assembly from shaft. Inspect all parts for wear and replace with genuine Wilden parts, if necessary.

Step 12. *Figure 12*

Inspect diaphragms, outer and inner pistons for signs of wear. Replace with genuine Wilden parts, if necessary.

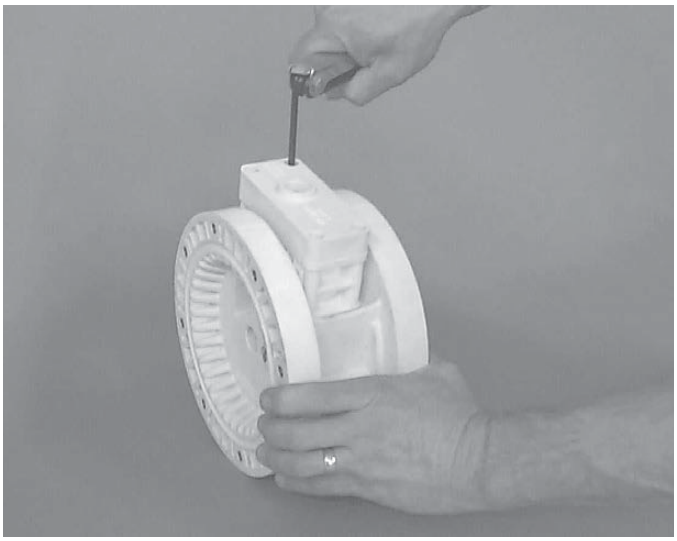
AIR VALVE DISASSEMBLY:

CAUTION: Before any maintenance or repair is attempted, the compressed air line to the pump should be disconnected and all air pressure allowed to bleed from the pump. Disconnect all intake, discharge and air lines. Drain the pump by turning it upside down and allowing any fluid to flow into a suitable container. Be aware of hazardous effects of contact with your process fluid.

The Wilden P200 Advanced™ Plastic Pump utilizes a revolutionary Pro-Flo® air distribution system. A 6 mm (1/4") air inlet connects the air supply to the center section. Proprietary composite seals reduce the coefficient of friction and allow the P200 to run lube-free. Constructed of polypropylene, the Pro-Flo® air distribution system is designed to perform in on/off, non-freezing, non-stalling, tough-duty applications.

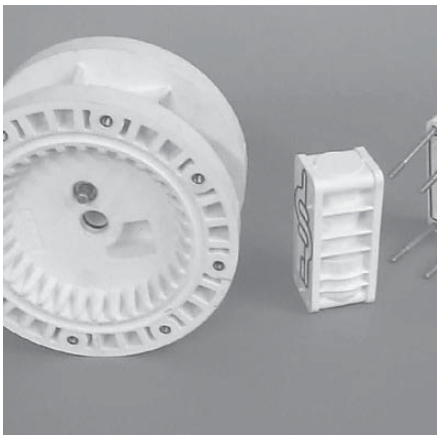
TOOLS REQUIRED:

3/16" Allen Wrench
Snap-Ring Pliers
O-Ring Pick



Step 1. *Figure 1*

Loosen the air valve bolts utilizing a 3/16" Allen wrench.



Step 2. *Figure 2*

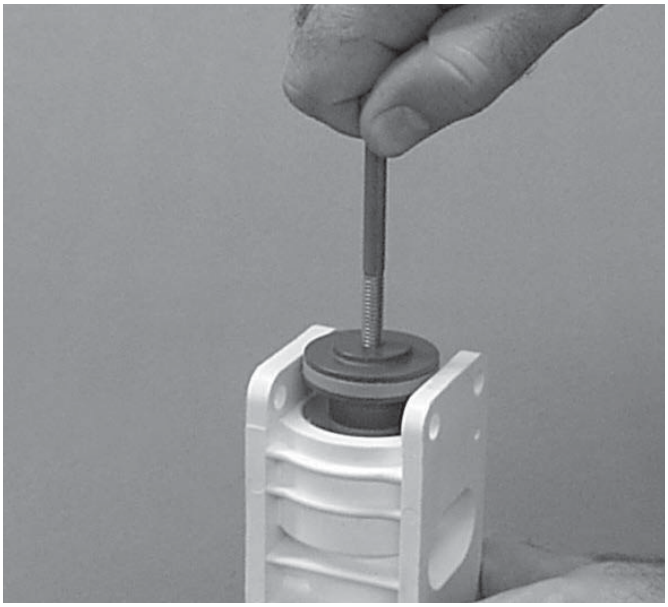
Remove muffler plate and air valve bolts from air valve assembly exposing muffler gasket for inspection. Replace if necessary.

Step 3. *Figure 3*

Lift away air valve assembly and remove air valve gasket for inspection. Replace if necessary.

Step 4. *Figure 4*

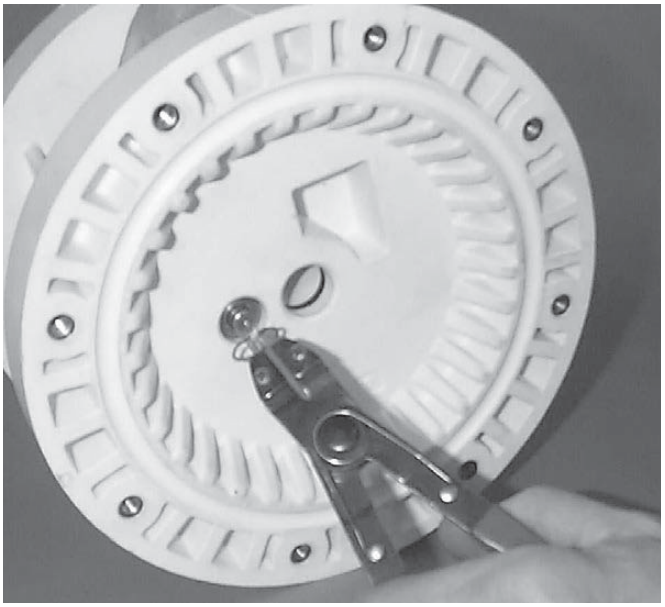
Remove air valve end cap to expose air valve spool by simply lifting up on end cap once air valve bolts are removed.



Step 5. *Figure 5*

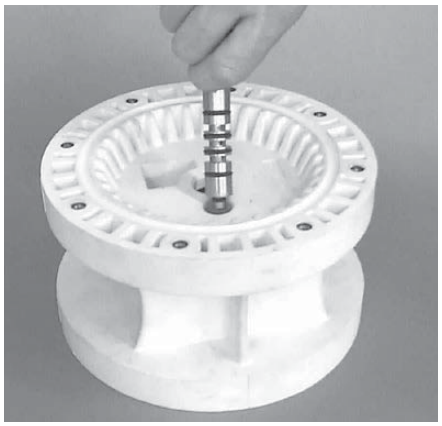
Remove air valve spool from air valve body by threading one air valve bolt into the end of the spool and gently sliding the spool out of the air valve body. Inspect seals for signs of wear and replace entire assembly if necessary. Use caution when handling air valve spool to prevent damaging seals.

NOTE: Seals should not be removed from assembly. Seals are not sold separately.



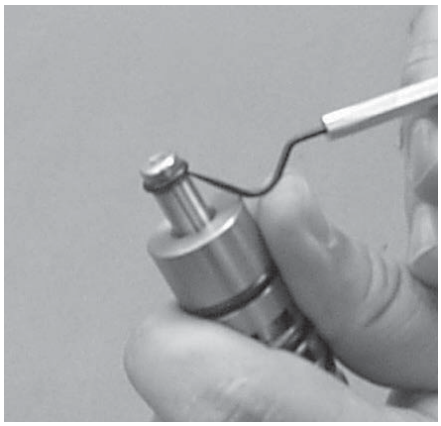
Step 6. *Figure 6*

Remove pilot spool sleeve retaining snap ring on both sides of center section with snap-ring pliers.



Step 7. *Figure 7*

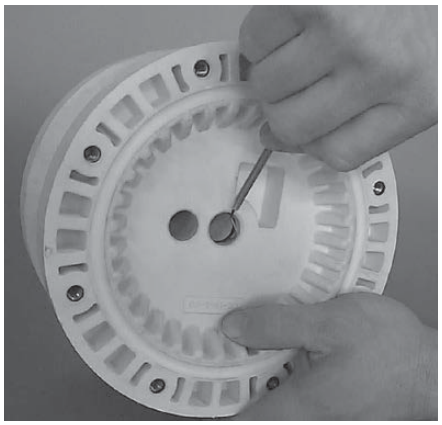
Remove pilot spool sleeve from center section.



Step 8. *Figure 8*

With O-ring pick, gently remove the O-ring from the opposite side of the "center hole" cut on the spool. Gently remove the pilot spool from sleeve and inspect for nicks or gouges and other signs of wear. Replace pilot sleeve assembly or outer sleeve O-rings if necessary. During re-assembly never insert the pilot spool into the sleeve with the "center cut" side first, this end incorporates the urethane O-ring and will be damaged as it slides over the ports cut in the sleeve.

NOTE: Seals should not be removed from pilot spool. Seals are not sold separately.



Step 9. *Figure 9*

Check center section Glyd™ rings for signs of wear. If necessary, remove Glyd™ rings with O-ring pick and replace.

ASSEMBLY:

Upon performing applicable maintenance to the air distribution system, the pump can now be reassembled. Please refer to the disassembly instructions for photos and parts placement. To reassemble the pump, follow the disassembly instructions in reverse order. The air distribution system needs to be assembled first, then the diaphragms and finally the wetted path. Please find the applicable torque specifications on this page. The following tips will assist in the assembly process.

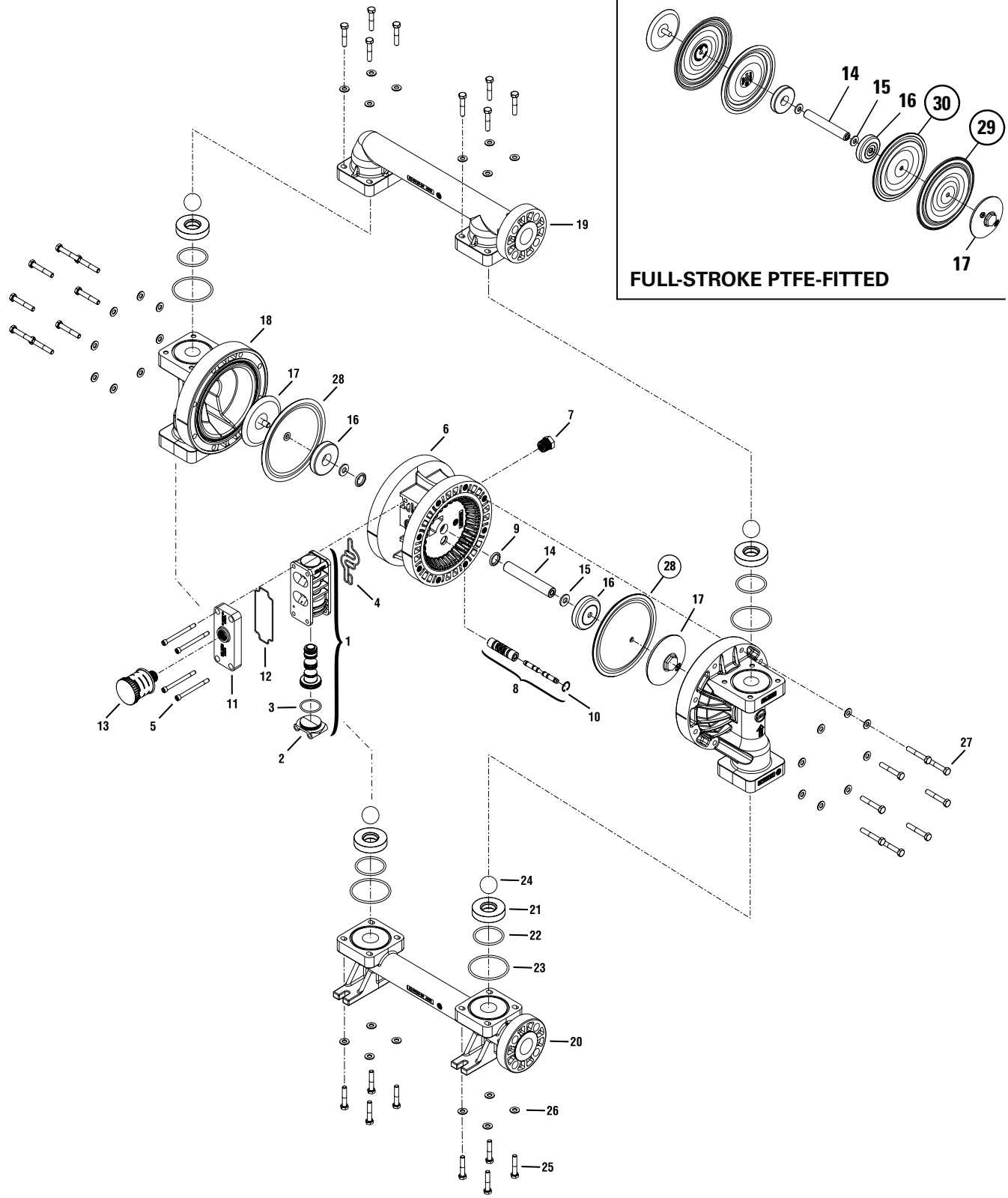
- Clean the inside of the center section shaft bore to ensure no damage is done to new seals.
- Stainless bolts should be lubed to reduce the possibility of seizing during tightening.
- Be sure to tighten outer pistons simultaneously on PTFE-fitted pumps to ensure proper torque values.
- Apply two (2) drops of Loctite® 246 to the shaft internal threads before the diaphragm assembly.
- Concave side of disc spring in diaphragm assembly faces **toward** inner piston.

MAXIMUM TORQUE SPECIFICATIONS

Part Description	Torque
Pro-Flo® Air Valve	3.1 N•m (27 in-lb)
Air Inlet Reducer Bushing	0.9 N•m (8 in-lb)
Outer Piston (rubber, TPE, & PTFE diaphragm fitted)	27.1 N•m (20 ft-lb)
Top & Bottom Manifolds (Poly & PVDF)	5.6 N•m (50 in-lb)
Liquid Chamber (Poly & PVDF)	8.5 N•m (75 in-lb)
Top & Bottom Manifolds (PFA)	3.4 N•m (30 in-lb)
Liquid Chamber (PFA)	5.6 N•m (50 in-lb)

NOTES

P200 PLASTIC | FULL-STROKE DIAPHRAGM-FITTED | EXPLODED VIEW



FULL-STROKE PTFE-FITTED

P200 PLASTIC

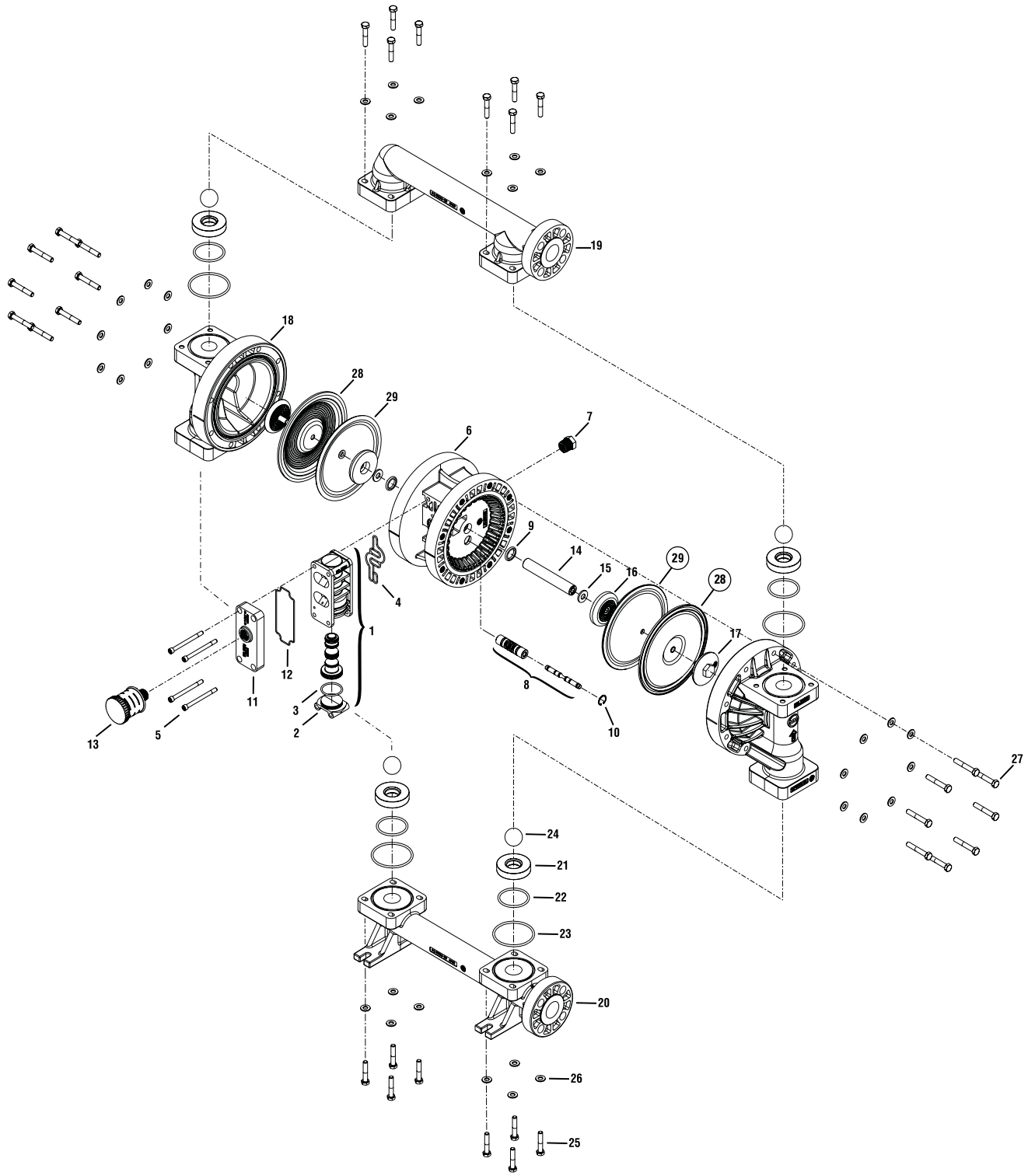
FULL-STROKE DIAPHRAGM-FITTED PARTS LISTING

Item	Part Description	Qty. Per Pump	P200/ PKPPP P/N	P200/ PKPPP/0502 P/N	P200/ KKPPP P/N	P200/ KKPPP/0502 P/N
1	**Pro-Flo® Air Valve Assembly[1]**	**1**	**01-2010-20**	**01-2010-20**	**01-2010-20**	**01-2010-20**
2	End Cap	1	01-2332-20	01-2332-20	01-2332-20	01-2332-20
3	O-Ring, End Cap	1	01-2395-52	01-2395-52	01-2395-52	01-2395-52
4	Gasket, Air Valve	1	01-2615-52	01-2615-52	01-2615-52	01-2615-52
5	Screw, HSHC, Air Valve 1/4-20	4	01-6001-03	01-6001-05	01-6001-03	01-6001-05
6	Center Section	1	02-3142-20	02-3142-20	02-3142-20	02-3142-20
7	Bushing, Reducer	1	01-6950-20	01-6950-20	01-6950-20	01-6950-20
8	Removable Pilot Sleeve Assembly	1	02-3880-99	02-3880-99	02-3880-99	02-3880-99
9	**Glyd™ Ring II**	**2**	**02-3210-55-225**	**02-3210-55-225**	**02-3210-55-225**	**02-3210-55-225**
10	Retaining Ring	2	00-2650-03	00-2650-03	00-2650-03	00-2650-03
11	Muffler Plate	1	01-3181-20	01-3181-20	01-3181-20	01-3181-20
12	Gasket, Muffler Plate	1	01-3505-52	01-3505-52	01-3505-52	01-3505-52
13	Muffler	1	02-3510-99	02-3510-99	02-3510-99	02-3510-99
14	Shaft, Pro-Flo®	1	02-3810-03	02-3810-03	02-3810-03	02-3810-03
15	Disc Spring (Belleville Washer)	2	02-6802-08	02-6802-08	02-6802-08	02-6802-08
16	Inner Piston	2	02-3701-01	02-3701-01	02-3701-01	02-3701-01
17	Outer Piston	2	02-4550-21-500	02-4550-21-500	02-4550-21-500	02-4550-21-500
18	Liquid Chamber	2	02-5005-20	02-5005-20	02-5005-21	02-5005-21
19	Discharge Manifold	1	02-5030-20	02-5030-20	02-5030-21	02-5030-21
20	Inlet Manifold	1	02-5090-20	02-5090-20	02-5090-21	02-5090-21
21	**Valve Seat**	**4**	**02-1125-20**	**02-1125-20**	**02-1125-21**	**02-1125-21**
22	**Valve Seat O-Ring**	**4**	*	*	*	*
23	**Flange O-Ring**	**4**	*	*	*	*
24	**Valve Ball**	**4**	*	*	*	*
25	Flange Bolt	16	02-6181-03	02-6181-05	02-6181-03	02-6181-05
26	Washer	32	02-6731-03	02-6731-05	02-6731-03	02-6731-05
27	Chamber Bolt	16	02-6191-03	02-6191-05	02-6191-03	02-6191-05
28	**Diaphragm**	**2**	*	*	*	*
29	**Diaphragm, Primary Full Stroke PTFE**	**2**	**02-1040-55**	**02-1040-55**	**02-1040-55**	**02-1040-55**
30	**Diaphragm, Backup Full Stroke PTFE**	**2**	*	*	*	*

[1]Air Valve Assembly includes items 2 and 3.
*Refer to corresponding elastomer chart in Section 10.
0502 Specialty Code = PFA Coated, ANSI Flange

All boldface items are primary wear parts.
Consult Factory for DIN Flange.

P200 PLASTIC | REDUCED-STROKE DIAPHRAGM-FITTED | EXPLODED VIEW



P200 PLASTIC

REDUCED-STROKE DIAPHRAGM-FITTED | PARTS LISTING

Item	Part Description	Qty. Per Pump	P200/ PKPPP P/N	P200/ PKPPP/0502 P/N	P200/ KKPPP P/N	P200/ KKPPP/0502 P/N	P200/ TTPPP P/N	P200/ TTPPP/0502 P/N
1	**Pro-Flo® Air Valve Assembly1**	**1**	**01-2010-20**	**01-2010-20**	**01-2010-20**	**01-2010-20**	**01-2010-20**	**01-2010-20**
2	End Cap	1	01-2332-20	01-2332-20	01-2332-20	01-2332-20	01-2332-20	01-2332-20
3	O-Ring, End Cap	1	01-2395-52	01-2395-52	01-2395-52	01-2395-52	01-2395-52	01-2395-52
4	Gasket, Air Valve	1	01-2615-52	01-2615-52	01-2615-52	01-2615-52	01-2615-52	01-2615-52
5	Screw, HSHC, Air Valve 1/4-20	4	01-6001-03	01-6001-05	01-6001-03	01-6001-05	01-6001-03	01-6001-05
6	Center Section	1	02-3142-20	02-3142-20	02-3142-20	02-3142-20	02-3142-20	02-3142-20
7	Bushing, Reducer	1	01-6950-20	01-6950-20	01-6950-20	01-6950-20	01-6950-20	01-6950-20
8	Removable Pilot Sleeve Assembly	1	02-3880-99	02-3880-99	02-3880-99	02-3880-99	02-3880-99	02-3880-99
9	**Glyd™ Ring II**	**2**	**02-3210-55-225**	**02-3210-55-225**	**02-3210-55-225**	**02-3210-55-225**	**02-3210-55-225**	**02-3210-55-225**
10	Retaining Ring	2	00-2650-03	00-2650-03	00-2650-03	00-2650-03	00-2650-03	00-2650-03
11	Muffler Plate	1	01-3181-20	01-3181-20	01-3181-20	01-3181-20	01-3181-20	01-3181-20
12	Gasket, Muffler Plate	1	01-3505-52	01-3505-52	01-3505-52	01-3505-52	01-3505-52	01-3505-52
13	Muffler	1	02-3510-99	02-3510-99	02-3510-99	02-3510-99	02-3510-99	02-3510-99
14	Shaft, Pro-Flo®	1	02-3840-03	02-3840-03	02-3840-03	02-3840-03	02-3840-03	02-3840-03
15	Disc Spring (Belleville Washer)	2	02-6802-08	02-6802-08	02-6802-08	02-6802-08	02-6802-08	02-6802-08
16	Inner Piston	2	02-3751-01	02-3751-01	02-3751-01	02-3751-01	02-3751-01	02-3751-01
17	Outer Piston	2	02-4600-21-500	02-4600-21-500	02-4600-21-500	02-4600-21-500	02-4600-22	02-4600-22
18	Liquid Chamber	2	02-5005-20	02-5005-20	02-5005-21	02-5005-21	02-5005-22	02-5005-22
19	Discharge Manifold	1	02-5030-20	02-5030-20	02-5030-21	02-5030-21	02-5030-22	02-5030-22
20	Inlet Manifold	1	02-5090-20	02-5090-20	02-5090-21	02-5090-21	02-5090-22	02-5090-22
21	**Valve Seat**	**4**	**02-1125-20**	**02-1125-20**	**02-1125-21**	**02-1125-21**	**02-1125-55**	**02-1125-55**
22	**Valve Seat O-Ring**	**4**	**02-1220-60**	**02-1220-60**	**02-1220-60**	**02-1220-60**	**02-1220-60**	**02-1220-60**
23	**Flange O-Ring**	**4**	**04-1300-60-500**	**04-1300-60-500**	**04-1300-60-500**	**04-1300-60-500**	**04-1300-60-500**	**04-1300-60-500**
24	**Valve Ball**	**4**	**02-1085-55**	**02-1085-55**	**02-1085-55**	**02-1085-55**	**02-1085-55**	**02-1085-55**
25	Flange Bolt	16	02-6181-03	02-6181-05	02-6181-03	02-6181-05	02-6181-03	02-6181-05
26	Washer	32	02-6731-03	02-6731-05	02-6731-03	02-6731-05	02-6731-03	02-6731-05
27	Chamber Bolt	16	02-6191-03	02-6191-05	02-6191-03	02-6191-05	02-6191-03	02-6191-05
28	**Diaphragm**	**2**	**02-1010-55**	**02-1010-55**	**02-1010-55**	**02-1010-55**	**02-1010-55**	**02-1010-55**
29	**Backup Diaphragm**	**2**	*	*	*	*	*	*

[1]Air Valve Assembly includes items 2 and 3.
*Refer to corresponding elastomer chart in Section 10.
0502 Specialty Code = PFA Coated, ANSI Flange

All boldface items are primary wear parts.
Consult Factory for DIN Flange.

P200 Advanced Plastic Pumps

Material	Color Code	Diaphragm (2) P/N	Valve Ball (4) P/N	Valve Seat O-Ring (4) P/N	Flange O-Ring (4) P/N	Reduced-Stroke Backup Diaphragm (2) P/N	Full-Stroke Backup Diaphragm (2) P/N
Polyurethane	Natural	02-1010-50	02-1085-50	02-1220-50	04-1300-50-500	N/A	N/A
Buna-N	Red	02-1010-52	02-1085-52	04-2390-52-700	04-1300-52-500	N/A	N/A
PTFE-Encapsulated Viton®	None	N/A	N/A	02-1220-60	04-1300-60-500	N/A	N/A
Neoprene	Green	02-1010-51	02-1085-51	N/A	N/A	02-1060-51	N/A
Viton®	Silver	02-1010-53	02-1085-53	N/A	N/A	N/A	N/A
EPDM	Blue	02-1010-54	02-1085-54	N/A	N/A	02-1060-54[1]	N/A
PTFE - Reduced Stroke	White	02-1010-55	02-1085-55	N/A	N/A	N/A	N/A
Full-Stroke PTFE		02-1040-55	02-1085-55	N/A	N/A	N/A	N/A
Tetra-Flex™ PTFE w/Neoprene	White	02-1010-64	N/A	N/A	N/A	N/A	N/A
Tetra-Flex™ PTFE w/EPDM	White	02-1010-81	N/A	N/A	N/A	N/A	N/A
Saniflex™	Off-White	02-1010-56	02-1085-56	N/A	N/A	02-1060-56[1]	02-1065-56
Wil-Flex™	Orange	02-1010-58	02-1085-58	02-1220-58	02-1370-58	N/A	02-1065-57

[1]Saniflex™ and EPDM back-up diaphragms are available upon request. Please consult your local distributor.
Backup diaphragms for use with PTFE diaphragms only.

NOTES

NOTES

WARRANTY

Each and every product manufactured by Wilden Pump and Engineering, LLC is built to meet the highest standards of quality. Every pump is functionally tested to insure integrity of operation.

Wilden Pump and Engineering, LLC warrants that pumps, accessories and parts manufactured or supplied by it to be free from defects in material and workmanship for a period of five (5) years from date of installation or six (6) years from date of manufacture, whichever comes first. Failure due to normal wear, misapplication, or abuse is, of course, excluded from this warranty.

Since the use of Wilden pumps and parts is beyond our control, we cannot guarantee the suitability of any pump or part for a particular application and Wilden Pump and Engineering, LLC shall not be liable for any consequential damage or expense arising from the use or misuse of its products on any application. Responsibility is limited solely to replacement or repair of defective Wilden pumps and parts.

All decisions as to the cause of failure are the sole determination of Wilden Pump and Engineering, LLC.

Prior approval must be obtained from Wilden for return of any items for warranty consideration and must be accompanied by the appropriate MSDS for the product(s) involved. A Return Goods Tag, obtained from an authorized Wilden distributor, must be included with the items which must be shipped freight prepaid.

The foregoing warranty is exclusive and in lieu of all other warranties expressed or implied (whether written or oral) including all implied warranties of merchantability and fitness for any particular purpose. No distributor or other person is authorized to assume any liability or obligation for Wilden Pump and Engineering, LLC other than expressly provided herein.

PLEASE PRINT OR TYPE AND FAX TO WILDEN

PUMP INFORMATION

Item # _____ Serial # _____

Company Where Purchased _____

YOUR INFORMATION

Company Name _____

Industry _____

Name _____ Title _____

Street Address _____

City _____ State _____ Postal Code _____ Country _____

Telephone _____ Fax _____ E-mail _____ Web Address _____

Number of pumps in facility? _____ Number of Wilden pumps? _____

Types of pumps in facility (check all that apply): ☐ Diaphragm ☐ Centrifugal ☐ Gear ☐ Submersible ☐ Lobe

☐ Other _____

Media being pumped? _____

How did you hear of Wilden Pump? ☐ Trade Journal ☐ Trade Show ☐ Internet/E-mail ☐ Distributor

☐ Other _____

ONCE COMPLETE, FAX TO (909) 783-3440

NOTE: WARRANTY VOID IF PAGE IS NOT FAXED TO WILDEN

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22069 Van Buren St.
Grand Terrace, CA 92313-5607
T: +1 (909) 422-1731
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Authorized PSG Representative:

Soilds (Bag) Filter Housings

(F-1, F-2, F-3 & F-4)

Filter Specialists, Inc. Model FSP35

SINGLE BAG FILTERS

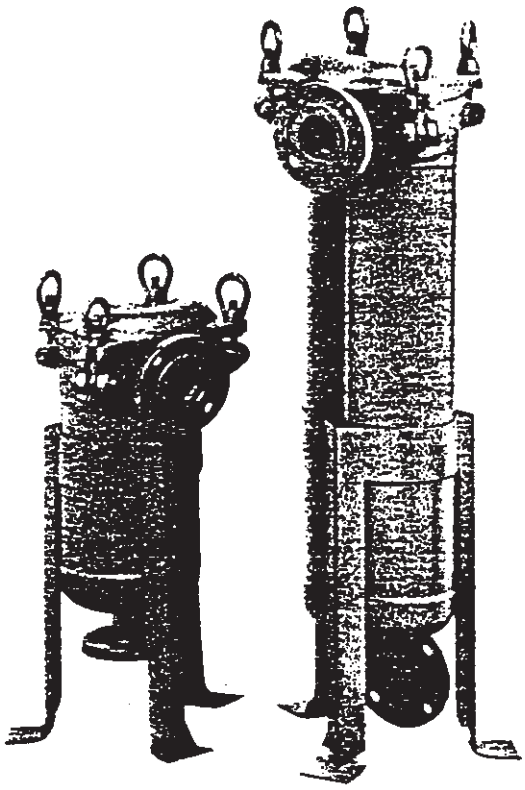
The FS-40 is a filter designed for continuous flows up to 100 GPM. It also handles batch operations in the 200 to 2000 gallon range.

The FS-85 is identical to the FS-40 except for its length. It accommodates a longer bag with more than twice the surface area.

The FS-85 is used for flow rates to 220 GPM or on batch operations of 1500 to 4000 gallons where the use of the FS-40 is not adequate.

The performance of the FS-40 Filter Bag is equal to approximately 6-9 conventional 10" cartridges.

The FS-85 Filter Bag is equal in performance to 12-18 conventional 10" cartridges.



FS-40 FS-85

Model No.	No. of filter bags	Bag Size No.	Surface area per bag, ft.²	Surface area per filter, ft.²	Inlet and Outlet Size	Maximum Flow Rate, GPM
FS-40	1	1	2.0	2.0	2"	100
FS-85	1	2	4.4	4.4	2"	220

FEATURES

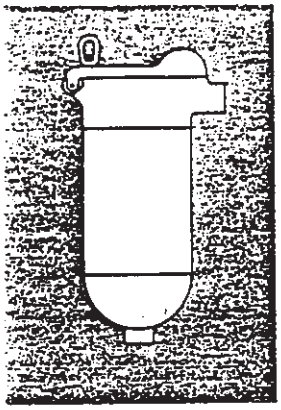
- One gasket seal
- Positive sealing
- 100% cleanable
- Permanent piping
- Heavy duty baskets standard
- Low gasket usage.
- New float evacuation system optional (see Bulletin No. 1735)
- Can be supplied with steam jackets, extra length legs, special size inlet and outlet and 1/16" corrosion allowance

SPECIFICATIONS

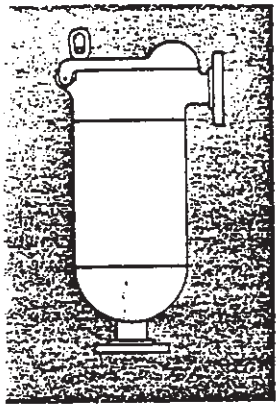
- 2" inlet and outlet
- 3 standard styles
- Stock vessels available in:
  1. carbon steel
  2. nickel coated carbon steel (electrolysis nickel coating .003 thick nominal)
  3. 316 stainless steel
- Standard 150 or 300 PSI ASME code stamp (meets OSHA code)
- Filter bags available rated at 1 to 800 microns (see Bulletin No. 1750)
- Gasket materials include Buna N, Butyl, EPR, Viton, and Teflon

STYLES

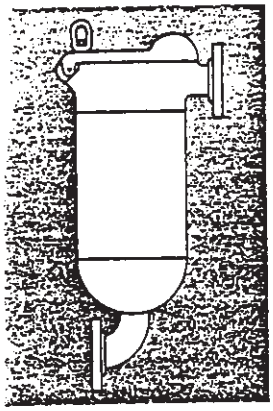
Styles 1 through 3 are shown below (available for both FS-40 and FS-85 Models).



Style No. 1
(2" NPT Fittings)

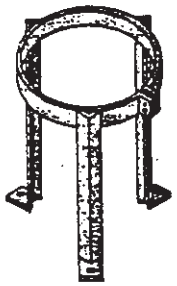


Style No. 2
(2" Flanged Fittings)



Style No. 3
(2" Flanged Fittings with 90° Elbow)

Adjustable legs are available as an option.



FILTER MATERIAL COMPATIBILITY

For recommendations on which bag or filter housing material to use, contact FSI or refer to Technical Bulletin No. 6128.

FLOW RATE — PRESSURE DROP DATA

For complete technical data on pressure drop and flow rates and how to size FSI bag filters, contact FSI or refer to Technical Bulletin No. 6174.

FSI filter specialists, inc.

P.O. BOX 735
MICHIGAN CITY, INDIANA 46360
219/879-3307

DISTRIBUTED BY:

STYLES OF FILTER BAG MEDIA

FELT — A calibrated needled fabric consisting of two layers of fibers which are needled into a supporting scrim. Felt media provides depth filtration and has higher solids loading capabilities then an equivalent mesh fabric.

MULTIFILAMENT MESH — A woven fabric with evenly spaced small holes. Each thread consisting of many smaller diameter threads twisted together.

MONOFILAMENT MESH — A woven fabric with evenly spaced small holes, each thread consisting of a single untwisted thread.

CHART 1

FIBERS AND MICRON RATINGS

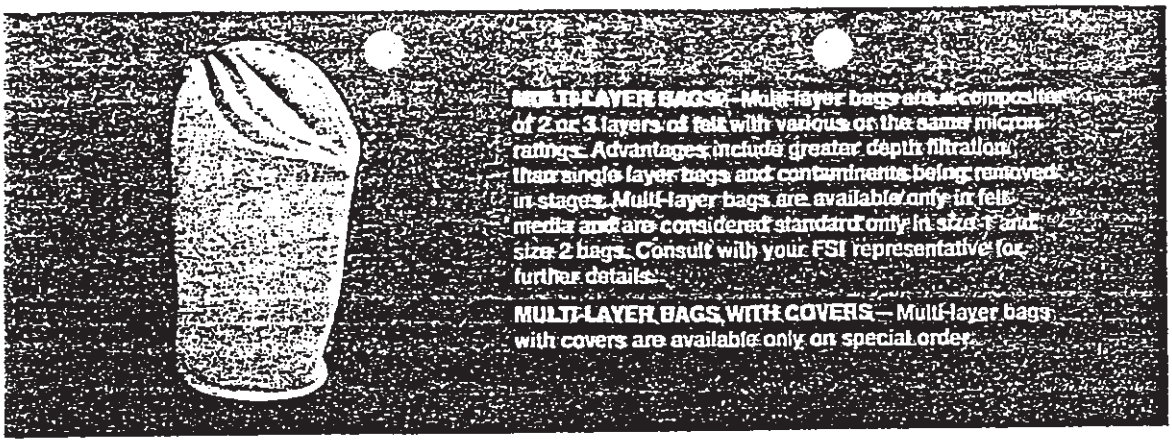
Filter bags to fit FSI filter housings are available in the following standard fibers and micron ratings. Special fibers and micron ratings are available upon request.

FIBER	STYLE OF MEDIA	MICRON RATINGS																				
		1	3	5	10	15	25	35	50	65	75	90	100	125	150	175	200	250	300	400	600	700	800
wool/silk	felt	X																					
rayon-viscose	felt		X	X	X	X	X		X		X		X				X						
nylon	felt			X	X		X		X				X										
nylon	multifilament mesh										X		X	X	X	X	X			X		X	X
nylon	monofilament mesh							X	X	X	X	X	X	X	X	X	X	X	X	X	X		X
nylon	nomex felt			X		X	X		X				X										
polypropylene	felt			X	X		X		X				X										
polypropylene	monofilament mesh																		X		X		
polyester	multifilament mesh										X		X	X	X		X	X					
saran	monofilament mesh																		X		X		X

TYPES OF FILTER BAGS

SINGLE LAYER BAGS—Single layer bags are sewn from a single layer of filter media and are the most common type of filter bag being used. Single layer bags are available in all fibers, styles of media, and micron ratings shown above.

SINGLE LAYER BAGS WITH COVERS—All single layer bags sewn from felt media are available with covers.



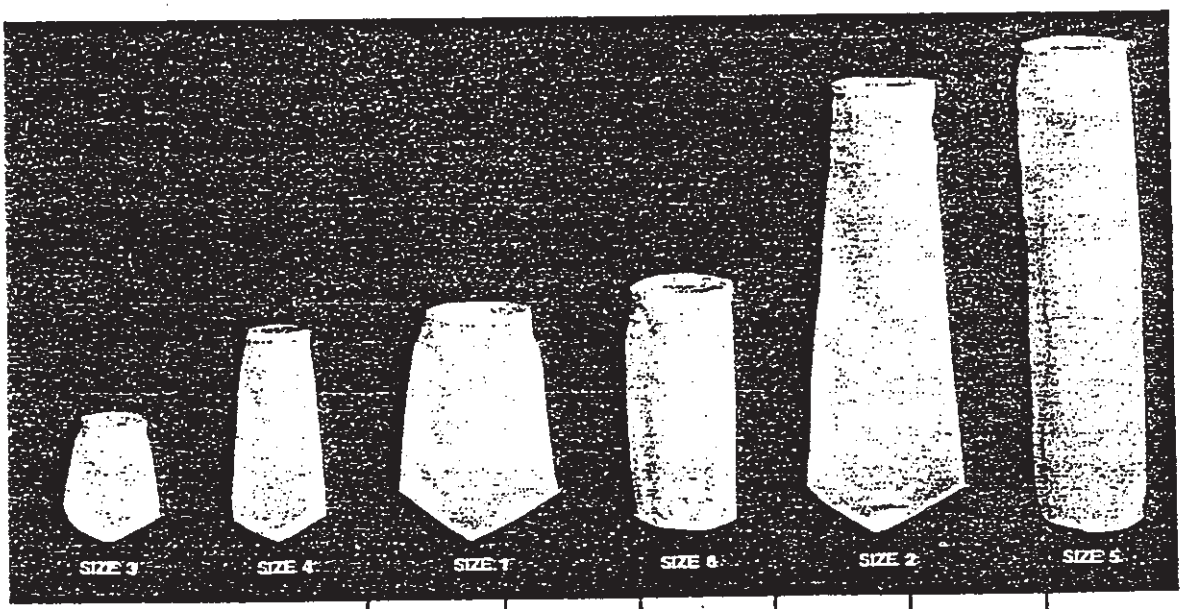
MULTI-LAYER BAGS—Multi-layer bags are a composite of 2 or 3 layers of felt with various or the same micron ratings. Advantages include greater depth filtration than single layer bags and contaminants being removed in stages. Multi-layer bags are available only in felt media and are considered standard only in size 1 and size 2 bags. Consult with your FSI representative for further details.

MULTI-LAYER BAGS WITH COVERS—Multi-layer bags with covers are available only on special order.

CHART 2

BAG SIZES AND CAPACITIES

Shown below are the surface area, bag volume, bag dimensions, and bag size number for all filter bags which are used in FSI filter housings. Also included is a cross reference of the bag size number used in each FSI filter housing.



BAG SIZE NUMBER	3	4	1	8	2	5
SURFACE AREA PER BAG-ft²/m²	0.5/.05	1.0/.09	2.0/.19	2.5/.23	4.4/.41	5.0/.46
VOLUME PER BAG-gal*/l	.37/1.4	.67/2.5	2.1/7.9	2.5/9.3	4.6/17.3	5.3/20.1
BAG DIAMETER-inch/cm	4/10.2	4/10.2	7/17.8	7/17.8	7/17.8	7/17.8
BAG LENGTH-inch/cm	9/22.9	15/38.1	16.5/41.9	15.75/40.0	32/81.3	32.5/82.6
FSI FILTER MODEL NUMBER	FS-15	FS-30 FSP35	FS-40	FS-50 PVC	FS-85 FS-170 FS-1000 FS-1200	FS-90 PVC

*1 Gal = 0.1337 cu. feet = 3.785 x 10⁻³ cu. meters

CHART 3

Replacement Bags

BAG CODES—SINGLE LAYER BAGS

The bag code completely describes the filter bag. The code is comprised of six parts as shown below.

PART 1	PART 2	PART 3	PART 4	PART 5	PART 6
Fiber & Media Style	Micron Rating	Bag Cover	Bag Size Number	Bag Design	Suffix
W—wool/silk felt	1		1—#1 size bag		-SS—316 ss retaining ring
V—rayon-viscose felt	3, 5, 10, 15, 25, 50, 75, 100, 200	P—plain (no cover)	2—#2 size bag		-PVC—PVC coated retaining ring
N—nylon felt	5, 10, 25, 50, 100		3—#3 size bag		-R—reverse collar
NM—nylon multi-filament mesh	75, 100, 125, 150, 175, 200, 400, 700, 800			S—metal retaining ring-snap collar design	
NMO—nylon mono-filament mesh	35, 50, 65, 75, 90, 100, 125, 150, 175, 200, 250, 300, 400, 600, 800	M—muslin cover	4—#4 size bag		-DN—double needle construction
HT—nylon nomex felt	5, 15, 25, 50, 100				
P—polypropylene felt	5, 15, 25, 50, 100	NM—nylon multifilament mesh cover	5—#5 size bag		-TN—triple needle construction
PMO—polypropylene monofilament mesh	300, 600		6—#6 size bag		
PEM—polyester multifilament mesh	75, 100, 125, 150, 200, 250				
S—saran mono-filament mesh	300, 600, 800				
Fiber & Media Style	Micron Rating	Bag Cover	Bag Size Number	Bag Design	Suffix

V200M1S-R

EXAMPLE:

Rayon viscose felt—200 micron—Muslin cover—#1 size bag—Snap collar design—Reverse collar

NOTES:

1. Standard metal ring in bag sizes 1, 2, 3, & 4 is cadium plated carbon steel.
2. Standard metal ring in bag sizes 5 & 6 is PVC coated carbon steel.
3. The -R suffix should only be specified on bags with covers intended for use inside a filter vessel.
4. The -DN and -TN suffixs designates additional stitching for increased strength.
5. More than one suffix may be used i.e. V200M1S -R -SS.

CHART 4

COMPARATIVE PARTICLE SIZE AND FINENESS DATA

PARTICLE SIZE

U.S. MESH	INCHES	MICRONS	MILLIMETERS	U.S. MESH	INCHES	MICRONS	MILIMETERS
3	.265	6730	6.73	40	.0165	420	.42
3½	.223	5660	5.66	45	.0138	354	.35
4	.187	4760	4.76	50	.0117	297	.297
5	.157	4000	4.00	60	.0098	250	.250
6	.132	3360	3.36	70	.0083	210	.210
7	.111	2830	2.83	80	.0070	177	.177
8	.0937	2380	2.38	100	.0059	149	.149
10	.0787	2000	2.00	120	.0049	125	.125
12	.0661	1680	1.68	140	.0041	105	.105
14	.0555	1410	1.41	170	.0035	88	.088
16	.0469	1190	1.19	200	.0029	74	.074
18	.0394	1000	1.00	230	.0024	63	.063
20	.0331	841	.84	270	.0021	53	.053
25	.0280	707	.71	325	.0017	44	.044
30	.0232	595	.59	400	.0015	37	.037
35	.0197	500	.50				

FINENESS DATA

HEGMAN(NS) SCALE	PRODUCTION CLUB SCALE	DEPTH OF WELLS MILS	DEPTH OF WELLS MICRONS	CLOSEST U.S. MESH SIZE
0	0.00	4.0	100.00	140
1	1.25	3.50	87.50	170
2	2.50	3.00	75.00	200
3	3.75	2.50	62.00	230
4	5.00	2.00	50.00	325
5	6.25	1.50	37.50	—
6	7.50	1.00	25.00	400
7	8.75	0.50	12.50	—
7½		0.25	6.25	—
8	10.00	0.00	0.00	—

Primary Carbon Filters

(CF-1 & CF-2)

Siemens PV-1000

PV® Series Liquid Phase Adsorbers

PV-500, PV-1000, PV-2000

Applications

The PV® Series adsorbers are designed for use in a wide range of low/high flow and pressure applications.

- Groundwater remediation
- Wastewater filtration
- Tank rinse water treatment
- Pilot testing
- Underground storage tank clean up
- Leachate treatment
- Dechlorination
- Spill cleanup
- Hydrotesting
- Drinking Water

Installation, Startup and Operation

Siemens can provide a total service package that includes utilizing OSHA trained personnel providing on-site carbon changeouts, packaging and transportation of spent carbon for recycling at our reactivation facilities.

At the time of purchase or rental of the adsorbers, arrangements should be made for the reactivation of the spent carbon. Siemens will provide instructions and assistance on how to obtain acceptance of the spent carbon at our reactivation facilities. Spent carbon cannot be accepted for reactivation until the acceptance process is completed.

Benefits & Design Features

- Durable, carbon steel construction includes internally/externally welded seams.
- SSPC-SP5 sandblasted, NSF-approved baked epoxy interior coating; urethane exterior finish.
- Approved for the transport of hazardous spent carbon.
- Top and side manways permit easy access and inspection of vessels internals and linings.
- Skid-mounted for easy handling and installation.
- Optimized underdrain system for low pressure drop operation.

Piping Manifold (Optional)

- 2"/3" sch 80 PVC piping and valves that allow either adsorber to be used in the lead or lag position (optional carbon steel and stainless steel piping).
- Series or parallel operation.
- Clean utility water connection for manual backflush.
- Sampling ports and pressure gauges.
- Flexible hoses with Kamlock fittings allow easy installation and removal during service exchange operations.
- Available for purchase or rental.

Westates® granular reactivated carbon - AquaCarb® S Series

For Industrial and Remedial Water Treatment

Description

AquaCarb® S Series carbons are produced through thermal reactivation of approved grades of spent carbon at one of our state-of-the-art reactivation facilities. Through careful control of the residence time in the reactivation furnace, reactivation temperature, and reactivation gas composition, adsorbed contaminants on the spent carbon are removed and destroyed, and the carbon's internal pore structure is maintained as close to virgin condition as possible. AquaCarb® S Series reactivated carbons are pooled from a variety of sources, ensuring consistent product properties. The resulting carbon serves as an excellent economic alternative to virgin carbon for the removal of a broad range of organic contaminants from wastewater, process water, and groundwater streams.

Applications

Cost effective AquaCarb® S Series reactivated carbons have been demonstrated to provide excellent performance in a variety of liquid phase treatment applications, including the following:

- Removal of organic contaminants
- Pesticide removal
- Groundwater remediation
- Wastewater treatment
- Industrial process water treatment
- Biological activated carbon support

Quality Control

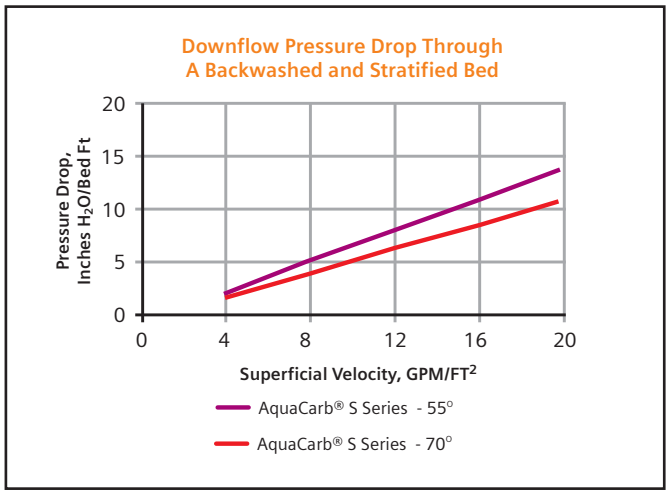
Each lot of reactivated carbon is identified by lot number, sampled, and analyzed in accordance with Siemens Water Technologies' QA/QC program. Siemens' laboratories are fully equipped to provide complete quality control analysis using ASTM standard test methods in order to assure the consistent quality of all Westates® carbons.

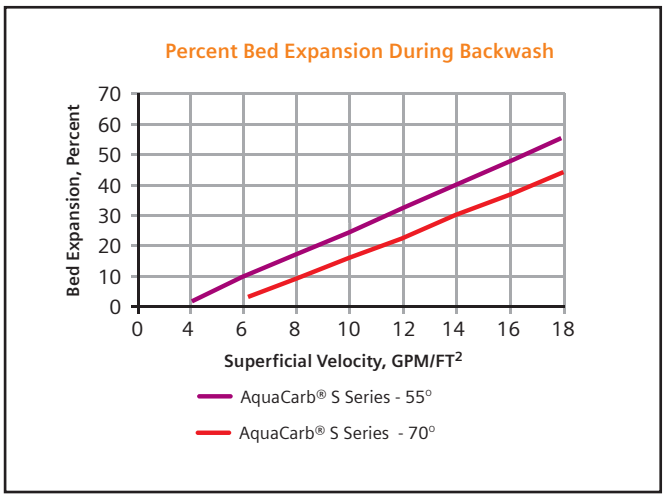
Our technical staff offers hands-on guidance in selecting the most appropriate system, operating conditions and carbon to meet your needs. For more information contact your nearest Siemens representative.

Features and Benefits:

- Reactivated carbons serve as an economical alternative to virgin carbon in many applications
- Use of reactivated carbons reduces the volume of spent carbon sent to landfill and encourages responsible usage of natural resources
- A detailed quality assurance program guarantees consistent quality from lot to lot and shipment to shipment
- Pooled reactivated carbons provide consistent properties and performance

Typical Properties	
Parameter	**AquaCarb® S**
Carbon Type	Reactivated Coconut/Coal
Mesh Size, U.S. Sieve	8 x 30
Iodine No., mg I_2/g	850 - 900
Abrasion Number, Wt. %	75
Apparent Density, g/cc	0.46 - 0.58
Moisture as Packed, Wt. %	3





Safety Note: Under certain conditions, some compounds may oxidize, decompose or polymerize in the presence of activated carbon causing a carbon bed temperature rise that is sufficient to cause ignition. Particular care must be exercised when compounds that have a peroxide-forming tendency are being adsorbed. In addition the adsorption of VOCs will lead to the generation of heat within a carbon bed. These heats of reaction and adsorption need to be properly dissipated in order to fully assure the safe operation of the bed.

Wet activated carbon readily adsorbs atmospheric oxygen. Dangerously low oxygen levels may exist in closed vessels or poorly ventilated storage areas. Workers should follow all applicable state and federal safety guidelines for entering oxygen depleted areas.

All information presented herein is believed reliable and in accordance with accepted engineering practices. Siemens makes no warranties as to the completeness of this information. Users are responsible for evaluating individual product suitability for specific applications. Siemens assumes no liability whatsoever for any special, indirect or consequential damages arising from the sale, resale or misuse of its products.

Siemens
Water Technologies
2430 Rose Place
Roseville, MN 55113
800.525.0658 phone

Totalizing Water Meter

Neptune Model T-10

ARB® UTILITY MANAGEMENT SYSTEMS™

NEPTUNE TECHNOLOGY GROUP

T-10 METER

SIZES: 1 1/2" and 2"

T-10 water meters are warranted for performance, materials, and workmanship.

Every T-10 water meter meets or exceeds the latest AWWA C700 Standard. Its nutating disc, positive displacement principle has been time-proven for accuracy and dependability since 1892, ensuring maximum utility revenue.

CONSTRUCTION

The T-10 water meter consists of three major assemblies: a register, a lead free high copper alloy maincase, and a nutating disc measuring chamber.

The T-10 meter is available with a variety of register types. For reading convenience, the register can be mounted in one of four positions on the meter.

The corrosion-resistant lead free high copper alloy maincase will withstand most service conditions: internal water pressure, rough handling, and in-line piping stress.

The innovative floating chamber design of the nutating disc measuring element protects the chamber from frost damage while the unique chamber seal extends the low flow accuracy by sealing the chamber outlet port to the maincase outlet port. The nutating disc measuring element utilizes corrosion-resistant materials throughout and a thrust roller to minimize wear.

WARRANTY

Neptune provides a limited warranty with respect to its T-10 water meters for performance, materials, and workmanship.

When desired, maintenance is easily accomplished either by replacement of major assemblies or individual components.

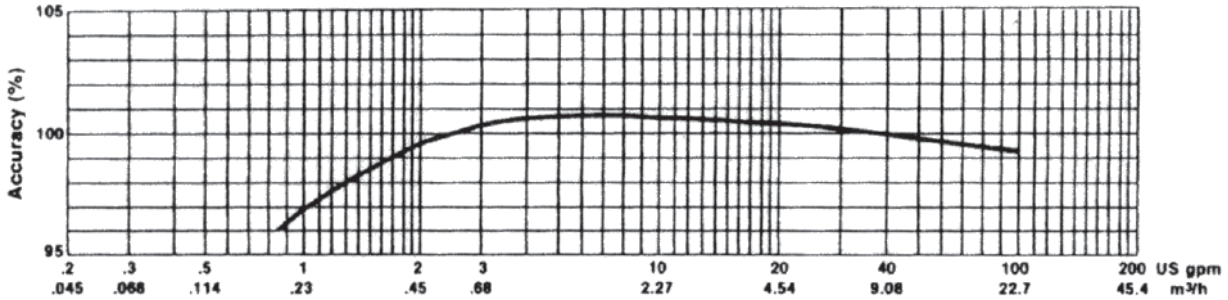
KEY FEATURES

- Register
  - Magnetic drive, low torque registration ensures accuracy
  - Impact-resistant register
  - High resolution, low flow leak detection
  - Bayonet style register mount allows in-line serviceability
  - Tamperproof seal pin deters theft
  - Date of manufacture, size, and model stamped on dial face
- Lead Free Maincase
  - Made from lead free high copper alloy
  - NSF/ANSI 61 Certified, Annex G and Annex F compliant
  - Lifetime guarantee
  - Resists internal pressure stresses and external damage
  - Handles in-line piping variations and stresses
  - Lead free high copper alloy provides residual value vs. plastic
  - Electrical grounding continuity
- Nutating Disc Measuring Chamber
  - Positive displacement
  - Widest effective flow range for maximum revenue
  - Proprietary polymer materials maximize long term accuracy
  - Floating chamber design is unaffected by meter position or in-line piping stresses

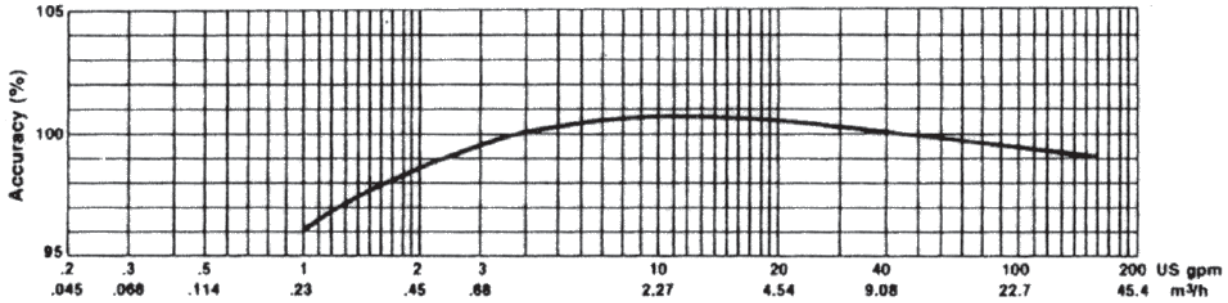
SYSTEMS COMPATIBILITY

Adaptability to all present and future systems for flexibility is available only with Neptune's ARB® Utility Management Systems™.

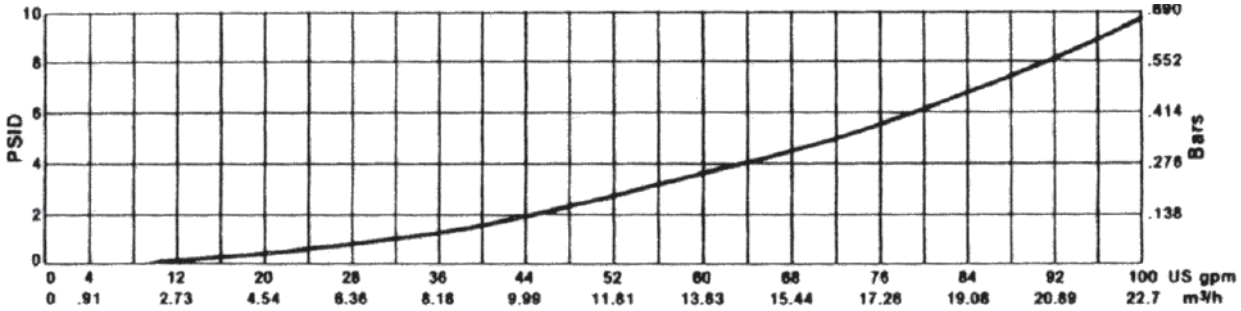
1 1/2" ACCURACY



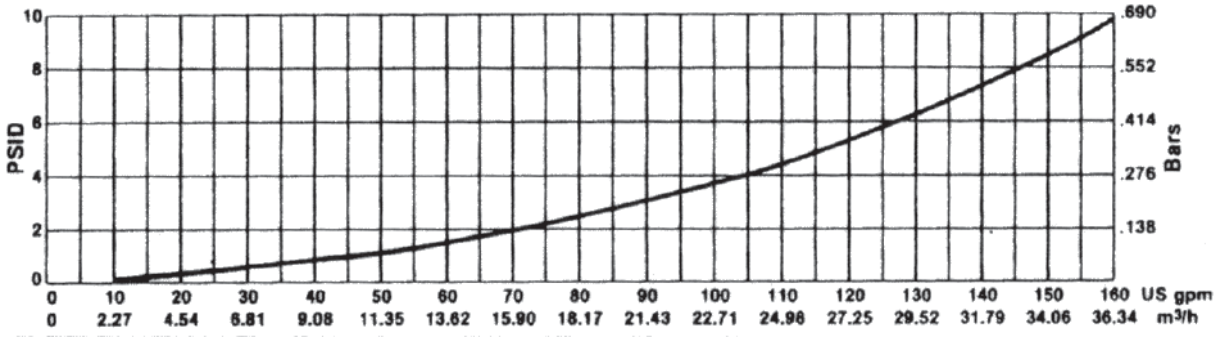
2" ACCURACY



1 1/2" PRESSURE LOSS



2" PRESSURE LOSS



These charts show typical meter performance. Individual results may vary.

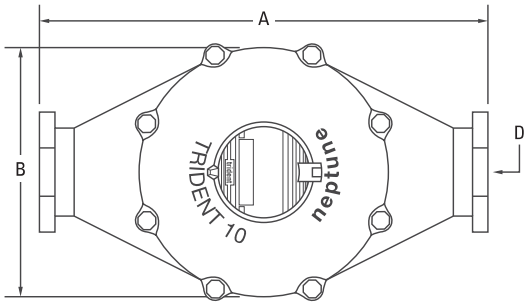
OPERATING CHARACTERISTICS

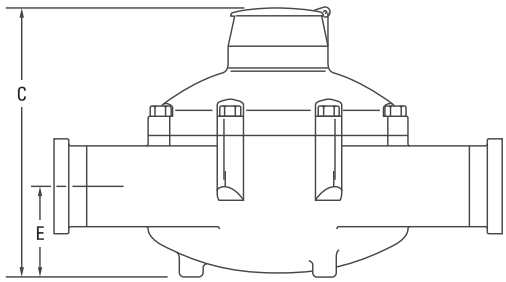
Meter Size	Normal Operating Range @100% Accuracy (±1.5%)	AWWA Standard	Low Flow @ 95% Accuracy
1 1/2"	2 to 100 US gpm	5 to 100 US gpm	3/4 US gpm
	0.46 to 22.73 m^3/h	1.1 to 22.7 m^3/h	0.17 m^3/h
2"	2 1/2 to 160 US gpm	8 to 160 US gpm	1 US gpm
	0.57 to 36.36 m^3/h	1.8 to 36.3 m^3/h	0.23 m^3/h

DIMENSIONS

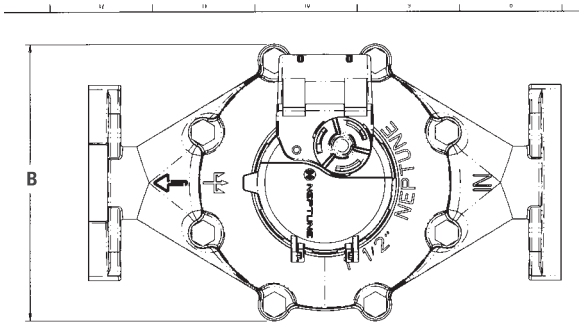
Meter Size	A in/mm	B in/mm	C-Std. in/mm	C-ARB in/mm	C-E-Coder) R900*i*™	D-Threads per inch	D-Thread Type	E in/mm	Weight lbs/kg
1 ½"	12 5/8	8 1/16	8 1/8	8 13/16	10 7/16	11 ½	1 ½	2 3/16	31
Screw End	321	205	206	220.3	225.4		NPT	65	14.1
1 ½"	13	8 1/16	8 1/8	8 13/16	10 7/16	—	—	2 3/16	35
Flanged End	330	205	206	220.3	225.4			65	15.9
2"	15 1/4	9 7/16	9 5/16	9 15/16	11 9/16	11 ½	2"	3 1/8	40
Screw End	387	240	237	248.4	289		NPT	79	18.1
2"	17	9 7/16	9 5/16	9 15/16	11 9/16	—	—	3 1/8	44
Flanged End	432	240	237	248.4	289			79	20.0

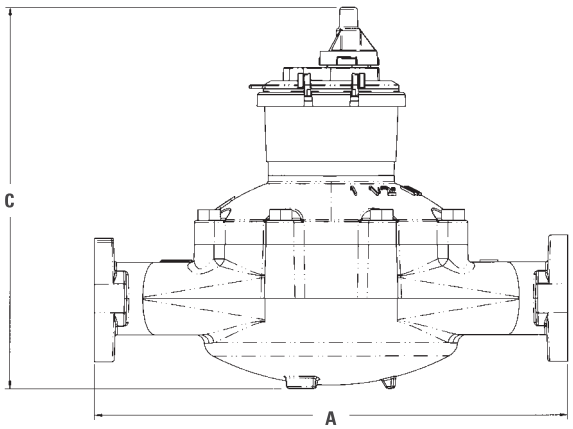
T-10 WITH STANDARD REGISTER





T-10 WITH E-CODER)R900*i* PIT REGISTER





GUARANTEED SYSTEMS COMPATIBILITY

All T-10 meters are guaranteed adaptable to our ARB®V, ProRead™ (ARB VI), E-Coder® (ARB VII), E-Coder)R900*i*™, TRICON®/S, TRICON/E®3, and Neptune ARB Utility Systems without removing the meter from service.

REGISTRATION

ProRead Registration (per sweep hand revolution)		**1 ½"**	**2"**
100	US Gallons	✓	✓
100	Imperial Gallons	✓	✓
10	Cubic Feet	✓	✓
1	Cubic Metre		✓
0.1	Cubic Metre	✓	
Register Capacity ProRead & E-Coder		**1 ½"**	**2"**
100,000,000	US Gallons	✓	✓
100,000,000	Imperial Gallons	✓	✓
10,000,000	Cubic Feet	✓	✓
100,000	Cubic Metres	✓	✓
E-Coder High Resolution (8-digit reading)		**1½"**	**2"**
1	US Gallons	✓	✓
1	Imperial Gallons	✓	✓
.01	Cubic Feet	✓	✓
0.001	Cubic Metres	✓	✓

SPECIFICATIONS

- Certification: NSF/ANSI 61, Annex G and Annex F
- Application: cold water measurement of flow in one direction
- Maximum operating water pressure: 150 psi (1034 kPa)
- Maximum operating water temperature: 80°F
- Measuring chamber: nutating disc technology design made from proprietary synthetic polymer

OPTIONS

- Sizes:
  - 1½" flanged or threaded end
  - 2" flanged or threaded end
- Units of measure: U.S. gallons, imperial gallons, cubic feet, cubic metres
- Register types:
  - Direct reading: Bronze box and cover (standard)
  - Remote reading: ProRead Absolute Encoder, E-Coder, E-Coder)R900*i*, TRICON/S, TRICON/E3
  - Reclaim
- Measuring chamber: synthetic polymer
- Companion flanges: cast iron or lead free high copper alloy
- Environmental Conditions:
  - Operating temperature: 33ºF to 149ºF (0ºC to 65ºC)
  - Storage temperature: 33ºF to 158ºF (0ºC to 70ºC)
- Test Ports: 1"

Neptune engages in ongoing research and development to improve and enhance its products. Therefore, Neptune reserves the right to change product or system specifications without notice.

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NEPTUNE TECHNOLOGY GROUP

neptunetg.com

PS T10INT 05.11

Recharge (Floor) Sump Pump

(P-6)

Hydromatic SP100H

PENTAIR

SPD100H Shown

HYDROMATIC® SPD50H/100H SUBMERSIBLE EFFLUENT PUMP

Septic Tank Effluent • High-Capacity Sump • High-Head Dewatering

SPD50H/100H
Submersible Effluent Pump

SPD100H

The Hydromatic SPD50H/100H submersible pumps are specifically designed to meet the demands of septic tank effluent applications that require a "high-head", dual-seal pump. The SPD50H has a powerful 1/2 horsepower motor, while the SPD100H comes with a 1 horsepower motor. Both pumps are standard 2 inch NPT discharge pumps, with 3 inch versions optional, and available in automatic and manual configurations. The SPD50H can handle capacities up to 110 gallons per minute and heads to 50 feet, while the SPD100H handles capacities up to 140 gallons per minute and heads to 63 feet.

These pumps feature a high-quality cast iron pump volute, motor housing and seal housing construction that help to ensure a long service life. The pump's non-clogging, two-vane, cast iron impeller, which is threaded to a stainless steel shaft, is capable of handling up to 3/4 inch spherical solids – providing long life in demanding applications. A seal-failure sensor probe (for connection to a seal failure alarm) is standard on three-phase units and available as an option on single-phase models. Two carbon- and ceramic-faced mechanical shaft seals are mounted in tandem to provide double protection against water entry for a long, leakproof life.

The SPD50H/100H's oil-filled motor provides superior cooling characteristics, allowing the motor to run cool and quiet for years. This oil-filled design also provides permanent lubrication of the shaft bearings, minimizing maintenance and extending the service life of the pump. In addition, to protect against overheating, the motor windings contain an automatic reset thermal overload protection located in the accessory control panel.

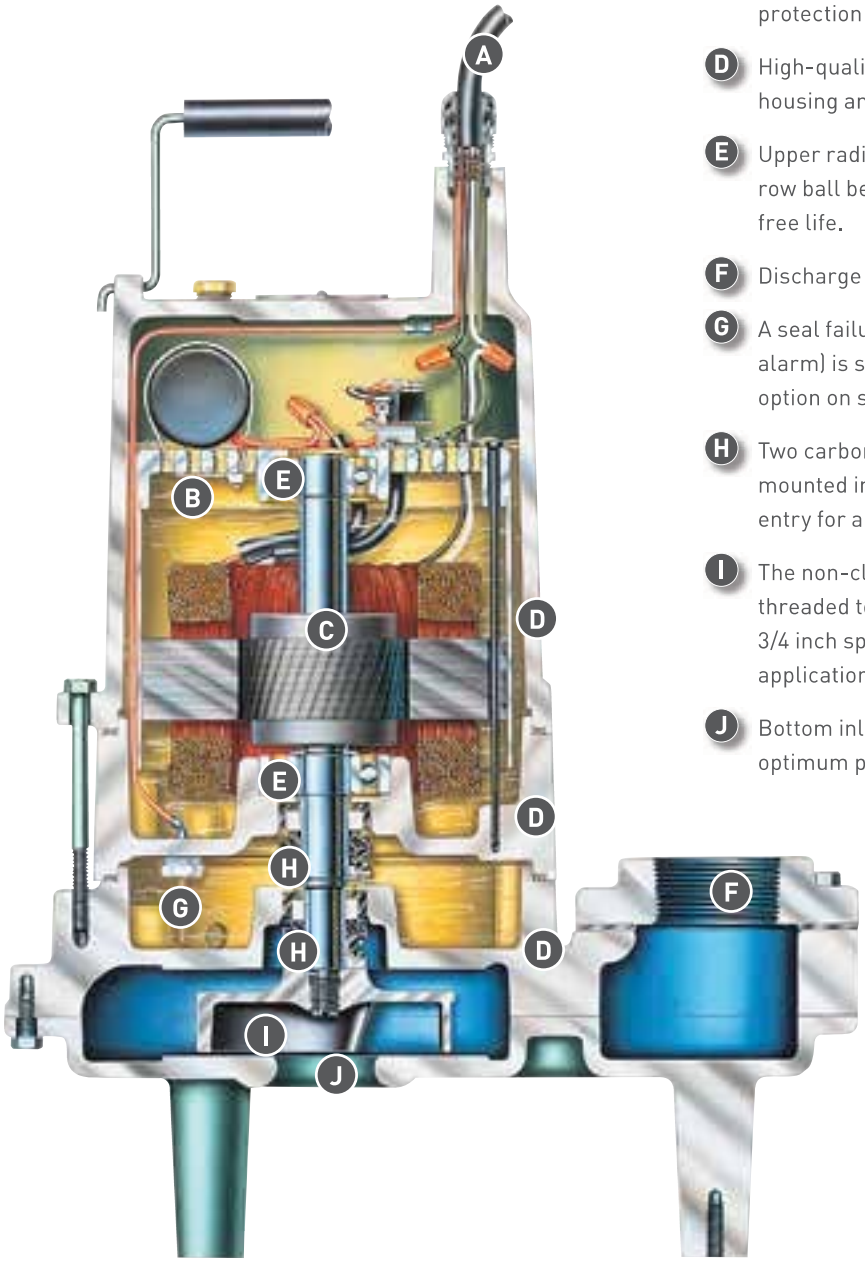
Automatic models (1/2 HP) feature the exclusive Hydromatic diaphragm pressure switch, which provides proven reliability in installations where a float might hang up. It also incorporates a unique piggyback plug arrangement, which allows for simple conversion to manual operation by simply removing the switch plug and inserting the motor plug directly into the electrical outlet.

SPD50H

SPD50H/100H

The SPD50H/100H are completely submersible, "high-head", dual-seal pumps for use in septic tank effluent applications.

Automatic models (1/2 HP) feature the exclusive Hydromatic diaphragm pressure switch with piggyback plug-in arrangement. Proven reliability for automatic operation in installations where a float might hang up. Switch is easily serviced and may be disconnected for manual operation.



- **A** Water-resistant power cord has a compression-fit connection and an epoxy potting for double protection against water entry. Lengths of 10 and 20 feet are available with molded plugs, depending on model variations..
- **B** Oil-filled motor provides superior cooling and permanent lubrication of bearings, minimizing maintenance and extending service life.
- **C** 1/2 or 1 HP capacitor-start motors provide maximum starting torque. Motor windings contain automatic thermal overload protection (1ø).
- **D** High-quality cast iron construction of pump volute, motor housing and seal housing provides long life.
- **E** Upper radial- and lower thrust bearings are heavy-duty, single-row ball bearings that are permanently lubricated for service-free life.
- **F** Discharge is standard 2 inch NPT (3 inch is optional).
- **G** A seal failure sensor probe (for connection to a seal failure alarm) is standard on three-phase units and available as an option on single-phase models.
- **H** Two carbon- and ceramic-faced mechanical shaft seals are mounted in tandem to provide double protection against water entry for a long, leakproof life.
- **I** The non-clogging, two-vane, cast iron impeller, which is threaded to a stainless steel shaft, efficiently handles up to 3/4 inch spherical solids – providing long life in demanding applications.
- **J** Bottom inlet has no screen to become clogged, providing optimum pump performance and minimal maintenance.

SP50

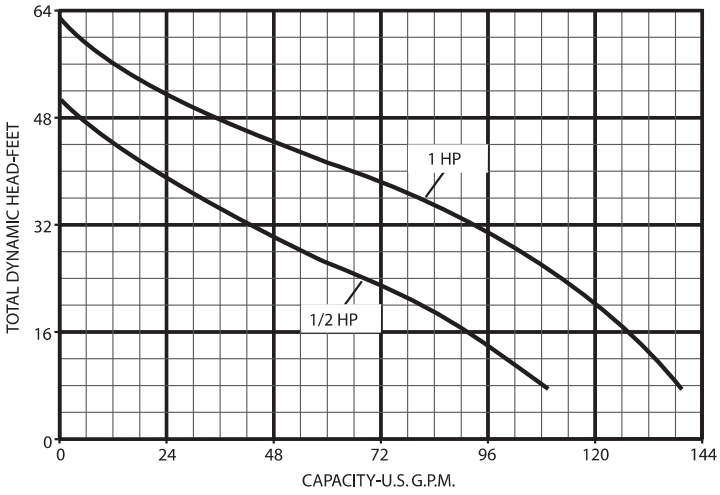
PUMP CHARACTERISTICS

Pump/Motor Unit	Submersible				
Manual Models (50)	MH1	MH2	MH6	MH4	MH5
Automatic Models	AH1	AH2	-	-	-
Horsepower	1/2				
Full Load Amps	14.0	7.0	4.0	1.8	1.5
Motor Type	Capacitor Start			Three-Phase	
R.P.M.	3450				
Phase Ø	1		3		
Voltage	115	230	200	460	575
Manual Models (100)	MH2	MH6	MH3	MH4	M5
Automatic Models	AH2	-	-	-	-
Horsepower	1				
Full Load Amps	9.9	5.5	5.2	2.5	1.5
Motor Type	Cap.	Three-Phase			
R.P.M.	3450				
Phase Ø	1	3			
Voltage	230	200	230	460	575
Hertz	60				
Operation	Intermittent				
Temperature	140°F Max Fluid Temp.				
NEMA Design	B				
Insulation	Class B				
Discharge Size	2" NPT (3" opt.)				
Solids Handling	3/4"				
Unit Weight	73 lbs.				
Power Cord: SPD50H 14/3, SJTW-A, 1ø, 115V=10' std. (20' opt.)-14/4, STW-A, 1ø, 115V=10' (20' opt.)-16/3, STW-A, 1ø, 230V=20' std.-16/4, STW-A, 1ø, 230V=20' std. SPD100H 16/3, STW-A, 1ø, 230V=20' std.-16/4, STW-A, 1ø, 230V=20' std.-18/5, STW-A, 3ø, 200V, 230V, 460V or 575V=20' std.					

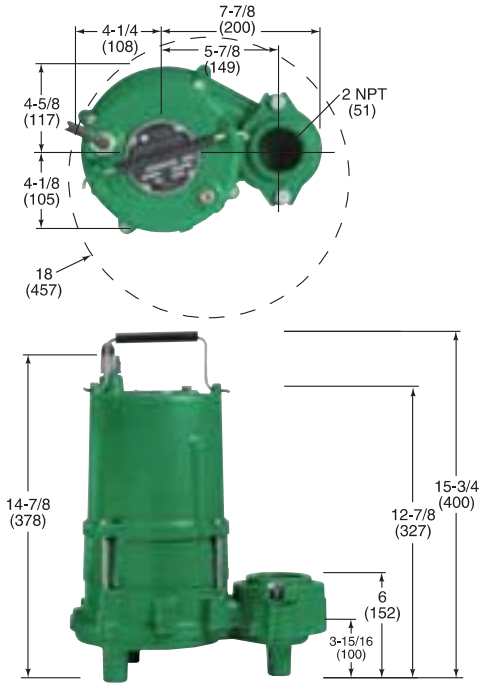
MATERIALS OF CONSTRUCTION

Handle	Steel
Lubricating Oil	Dielectric Oil
Motor Housing	Cast Iron
Seal Housing	Cast Iron
Pump Casing	Cast Iron
Shaft	Stainless Steel
Mechanical Shaft Seal	Seal Faces: Carbon/Ceramic Seal Body: Brass Spring: Stainless Steel Bellows: Buna-N
Impeller	Cast Iron
Upper Bearing	Single Row Ball Bearing
Lower Bearing	Single Row Ball Bearing
Base	Cast Iron
Fastener	Stainless Steel

PERFORMANCE DATA



DIMENSIONAL DATA



All dimensions in inches. Metric for international use. Component dimensions may vary ± 1/8 inch. Dimensional data not for construction purpose unless certified. Dimensions and weights are approximate. On/Off level adjustable.

PENTAIR

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269 TRILLIUM DRIVE, KITCHENER, ONTARIO, CANADA N2G 4W5
PH: 519-896-2163 ORDERS FAX: 519-896-6337

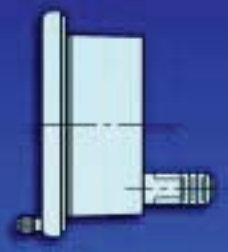
Because we are continuously improving our products and services, Pentair reserves the right to change specifications without prior notice.

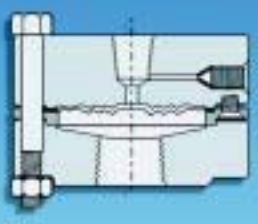
Pressure Gauges

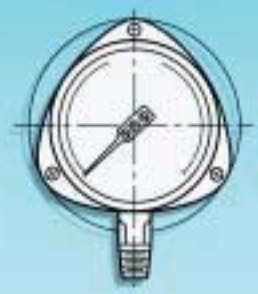
Ametek Series 1900 Solfrunt Gauges

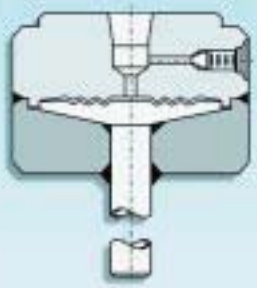
USG
U.S. Gauge

SOLFRUNT PRESSURE GAUGES









AMETEK
U.S. GAUGE

SOLFRUNT® Pressure Gauges for the Process Industries

AMETEK's line of high quality process gauges are specifically designed to meet the demanding needs of the chemical and petroleum processing industries, and are also widely used in industries such as fossil fuel and nuclear power generation, aerospace and marine. The gauge's design and materials of construction provide reliable service in applications where corrosive atmospheres, corrosive media, pressure pulsation, vibration and wide variations in ambient temperatures are present. SOLFRUNT gauge cases feature and integral wall between the measuring element and the window, and a pressure relieving back for increased safety[1]. They are available in various styles and mounting arrangements, and wetted parts are available in bronze, stainless steel, alloy steel and *MONEL*. Recalibration adjustments can be made from the rear of the case without removing the internals. On the 1900 Series the pointer is adjusted by removing the ring and front window. Most SOLFRUNT gauges are factory stock and are readily available through your U.S. Gauge Distributor.

NOTE:

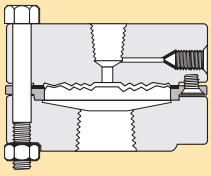
1. It is recommended that users of gauges become familiar with American National Standard ANSI-B40.1-1991 entitled "Gauges, Pressure-Indicating Dial Type-Elastic Element." This specification is available from the American Society of Mechanical Engineers, United Engineering Center, 345 East 47th Street, New York, New York 10017.

2. All dimensions in outline drawings are shown in inches. Tolerance are ± 0.02" on all two place decimals and ± 0.01" on all three place decimals.

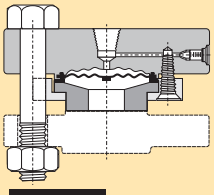
M & G DIAPHRAGM SEALS

Diaphragm seals are designed as protective attachments for pressure sensing elements:

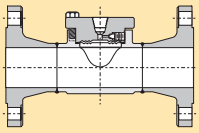
- Where the process medium would corrode the instrument connection and pressure sensing element.
- Where the process medium contains suspended solids or is sufficiently viscous to clog the instrument connection and pressure sensing element.
- Where the process medium might freeze or solidify in the instrument connection and pressure sensing element due to ambient or process temperature change.
- Where changing process medium requires flushing the system to prevent contamination.



1. TYPE RA

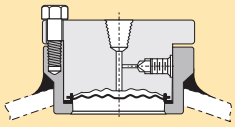


2. TYPE TC



3. TYPE SN

1. ***THREAD ATTACHED—****Diaphragm seal is threaded to process piping.*
2. ***FLANGE ATTACHED—****Diaphragm seal is bolted to a companion flange on process line, reactor, vessel, tank, etc.*
3. ***FLOW-THRU—****Process medium flows through diaphragm seals attached to process lines by threaded, welded, or flanged connections.*
4. ***INLINE—****Saddle type diaphragm seal that is welded into process piping or a vessel.*
5. ***SPECIAL DESIGNS—****Available for socket weld, special threads, tubing and capillary. Metric threads and flange sizes available.*



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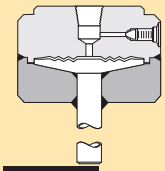


5. TYPE SW

SOLFRUNT® 4-1/2" Standard Gauges

Series 1900 4-1/2″ SOLFRUNT gauges are supplied in 30 vacuum, compound and pressure ranges from 30″ Hg vacuum through 11,600 psi. Any low-connected PET turret case or aluminum back-flanged case gauge can be easily liquid filled in the field using the appropriate conversion kit (see page 6).

Calibration adjustments (scale shape and span) can be accomplished from rear of case without disturbing the gauge internals. Pointer adjustments are easily made by removing ring and window.

STANDARD DIAL RANGES

PRESSURE RANGES (Pounds per Square Inch)

MAXIMUM INDICATIONS	FIGURE INTERVALS	INTERMEDIATE GRADUATIONS	MINOR GRADUATIONS	MATERIAL CODE
15	1	0.5	0.1	APRS
30	5	1	0.2	APRS
60	5	1	0.5	APRS
100	10	5	1	APRS
160	20	5	1	APRS
200	20	10	2	APRS
300	30	10	2	APRS
400	50	25	5	APRS
600	50	25	5	APRS
800	100	50	10	APRS
1,000	100	50	10	APRS
1,500	300	50	10	PRS
2,000	500	100	20	PRS
2,300	500	100	20	PRS
3,000	500	100	20	PRS
3,500	500	100	20	PRS
5,000	1,000	250	50	PRS
6,000	1,000	250	50	PRS
10,000	2,000	500	100	RS
11,600	2,000	500	100	RS

COMPOUND & VACUUM RANGES

(Inches of Mercury—0—Pounds per Square Inch)

RANGE	FIGURE INTERVALS		INTERMEDIATE GRADUATIONS		MINOR GRADUATIONS	
30-0-15	5	3	1	1	0.5	0.2
30-0-30	10	5	5	1	1	0.5
30-0-60	10	10	5	5	1	1
30-0-100	30	10	10	5	2	1
30-0-150	30	25	10	5	5	2
30-0-200	30	20	—	10	5	2
30-0-300	30	30	—	10	5	2
30-0	5		1		0.2	

MODEL SELECTION CHART

MODEL NUMBER	MOUNTING	CASE	RING	BOURDON	SOCKET	CONNECTION*
1980	Surface/Stem	PET Turret	Polypropylene Threaded	Phosphor Bronze	Brass	1/2″ NPT LM
1981	Surface/Stem	PET Turret	Polypropylene Threaded	316 Stainless Steel	316 Stainless Steel	1/2″ NPT LM
1982	Surface/Stem	PET Turret	Polypropylene Threaded	316 Stainless Steel	Alloy Steel	1/2″ NPT LM
1986	Surface/Stem	PET Turret	Polypropylene Threaded	K-MONEL/MONEL	K-MONEL / MONEL	1/2″ NPT LM
1901	Surface/Stem	Aluminum Back Flange	Aluminum Bayonet	Phosphor Bronze	Brass	1/2″ NPT LM
1931	Surface/Stem	Aluminum Back Flange	Aluminum Bayonet	316 Stainless Steel	316 Stainless Steel	1/2″ NPT LM
1911	Surface/Stem	Aluminum Back Flange	Aluminum Bayonet	316 Stainless Steel	Alloy Steel	1/2″ NPT LM
1903	Flush Panel	Cast Aluminum	Hinged Steel	Phosphor Bronze	Brass	1/2″ NPT LBM
1933	Flush Panel	Cast Aluminum	Hinged Steel	316 Stainless Steel	316 Stainless Steel	1/2″ NPT LBM
1913	Flush Panel	Cast Aluminum	Hinged Steel	316 Stainless Steel	Alloy Steel	1/2″ NPT LBM

*1/4″ NPT optional

SPECIFICATIONS

DIAL SIZE: 4-1/2".

CASE & RING:

For Stem or Wall Mounting:

CAST ALUMINUM, BACK-FLANGED CASE with bayonet ring, black finish and stainless steel pressure-relieving back. (Model 1901, 1911, 1931)

PET TURRET CASE (black) with glass-filled polypropylene threaded ring and pressure-relieving back. (Model 1980, 1981, 1982, 1986)

For Panel Mounting:

CAST ALUMINUM, FRONT FLANGED CASE with steel hinged ring, black finish and pressure-relieving back. (Model 1903, 1913, 1933)

WINDOW: High temperature acrylic.

POINTER: Anodized aluminum, micro-adjustable with black finish.

DIAL: Aluminum with baked white background and black markings.

MOVEMENT: Geared *ARC-LOC*® with components of corrosion-resistant 300 series stainless steel. Movement can be removed for examination and cleaning without disturbing span and scale shape adjustments.

BOURDON TUBE: Phosphor bronze/silver brazed; 316 stainless steel/TIG welded; or K MONEL, MONEL/ nicro-brazed.

CONNECTION: Brass, alloy steel, 316 stainless steel or MONEL, 1/2" ANPT, standard (1/4" ANPT, optional).

ACCURACY: ± 0.5% of span (Grade A), except where stainless steel bourdon tubes are used in following ranges: Type 316 from 10,000 to 11,600 psi; accuracy is ± 0.5% on ascending pressure and ± 1.0% on descending pressure.

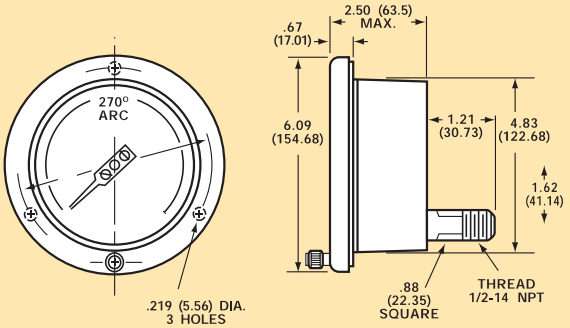
Bourdon and connection assemblies are stamped with the following codes plus the bourdon tube pressure range:

BOURDON TUBE MATERIAL	MATERIAL CODE	CONNECTION MATERIAL	MATERIAL CODE
Phosphor Bronze	C51000	Brass	C36000
316 SST	S31600	316 Stainless Steel	S31600
K Monel	N05500	Alloy Steel	G10180
—	—	MONEL	N04405

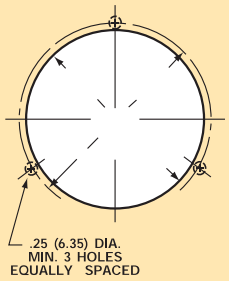
DIMENSIONS

PANEL MOUNTING CASE

IN
(MM)

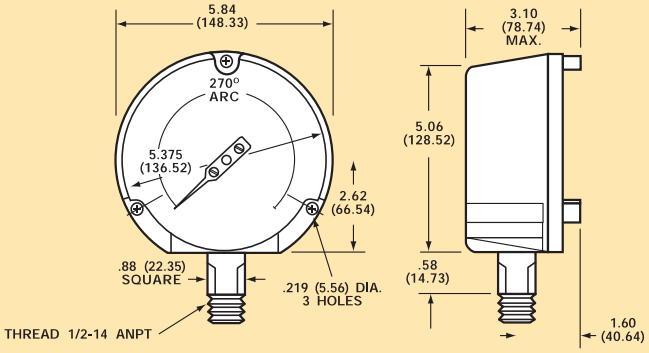


PANEL MOUNTING DIMENSIONS

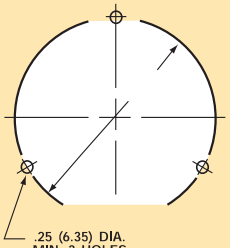


PET TURRET CASE

IN
(MM)

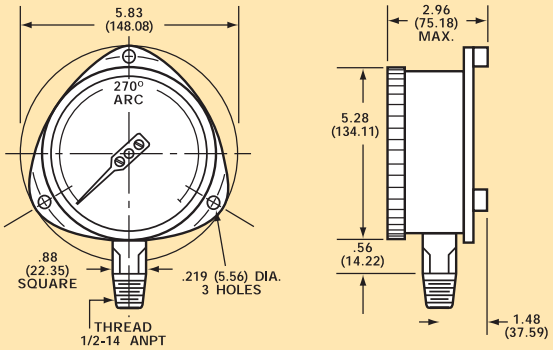


PANEL MOUNTING DIMENSIONS

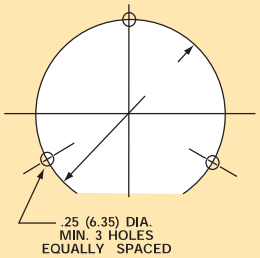


CAST ALUMINUM CASE

IN
(MM)



PANEL MOUNTING DIMENSIONS



Pressure Relief/Reducing Valves & Miscellaneous Associated Controls/Components

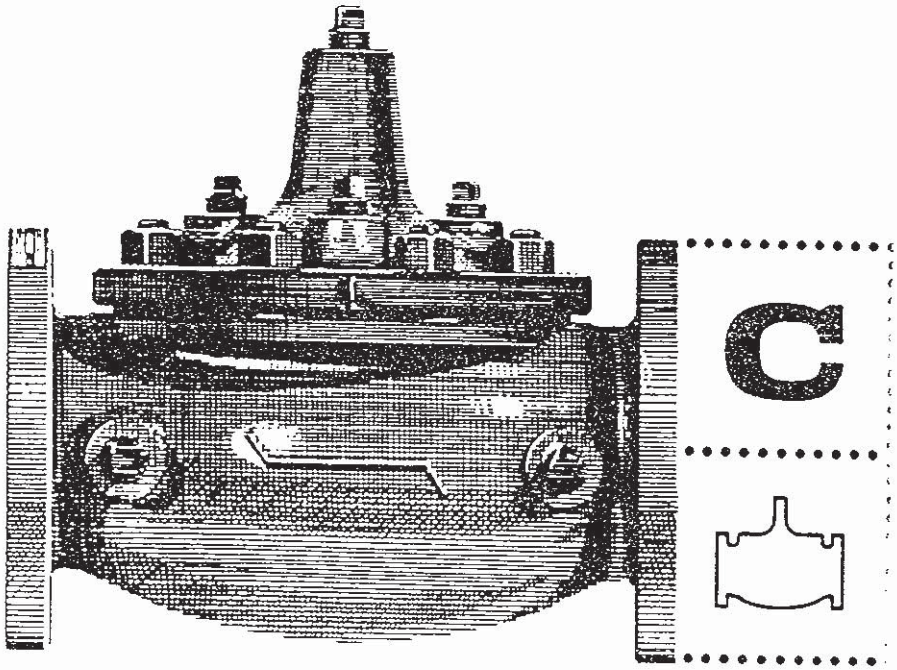
Place this manual with personnel responsible for maintenance of this valve.

Differential Pressure Relief
(Filter Feed & Pumps CV1)

CLAYTON

automatic

VALVES



INSTRUCTION MANUAL

CLA-VAL CANADA, LTD.
4687 Christie Drive
Beamsville, Ontario
L0R 1B0
(416) 563-4963
Fax (416) 563-4040

CVCL 1 ② 3 4 DIST. CODE 002 SHEET 1 OF 3

CLA-VAL CO. NEWPORT BEACH, CALIFORNIA

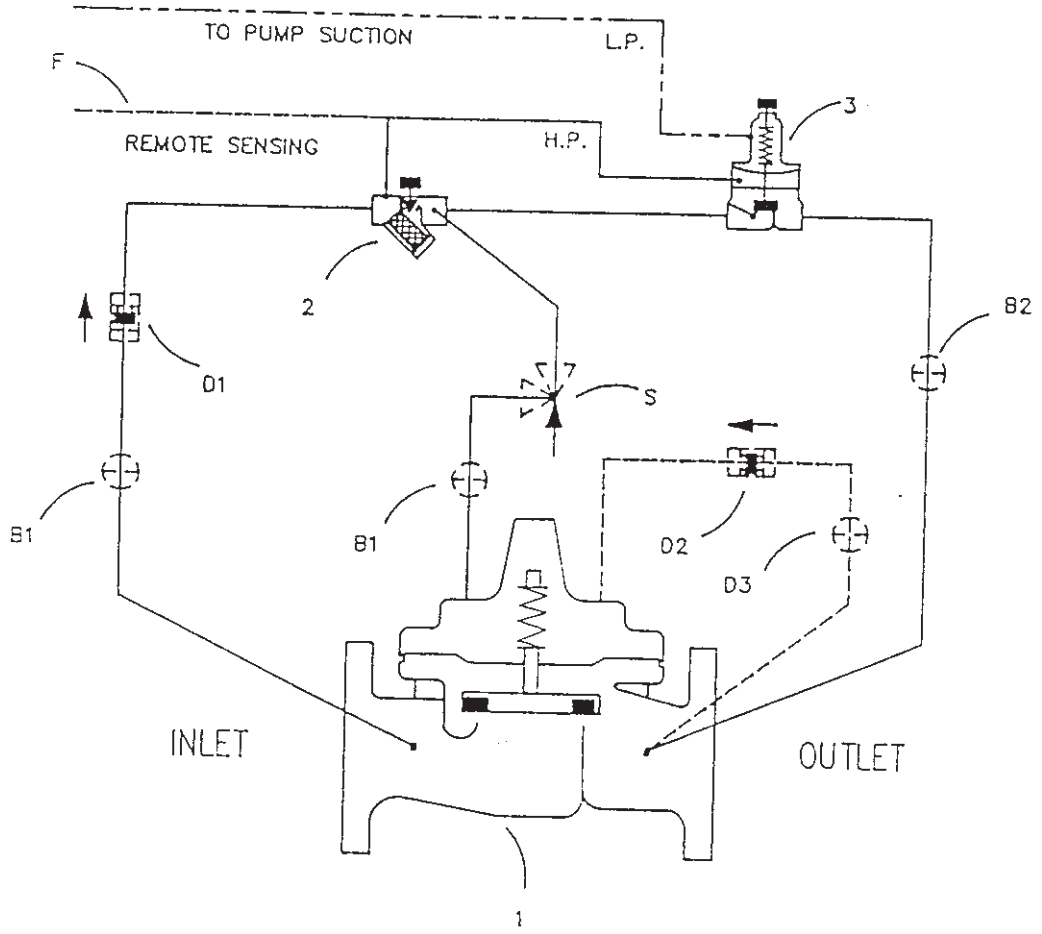
CATALOG NO.	DRAWING NO.	REV.
250-01	89993	C

TYPE OF VALVE AND MAIN FEATURES

DIFFERENTIAL PRESSURE RELIEF VALVE

DESIGN		
DRAW	CH	5-9-75
CHK'D	MF	5-12-75
APV'D	JAS	5-17-75

– – – – NOT FURNISHED BY CLA-VAL CO. ——— OPTIONAL FEATURES



ITEM NO.	BASIC COMPONENTS	QTY
1	100-01 HYTROL (MAIN VALVE)	1
2	X42N-2 STRAINER & NEEDLE VALVE	1
3	CDB-7 DIFFERENTIAL CONTROL	1

OPTIONAL FEATURE SUFFIX		ADDED TO CATALOG NUMBER
B	CK2 COCK (ISOLATION VALVES)	3
D	CHECK VALVES WITH COCK	1
F	REMOTE PILOT SENSING	
S	CV FLOW CONTROL (OPENING)	1

CAD REVISION RECORD - DO NOT REVISE MANUALLY

LTR	DESCRIPTION	BY	DATE
A-B	SEE REVISION FILE		
C	ADDED D OPTIONAL FEATURE & REDRAWN ON CAD (ECO 12050)	TLC	6-27-91

CLA-VAL CO. NEWPORT BEACH, CALIFORNIA

CATALOG NO.	DRAWING NO.	REV.
250-01	89993	C

TYPE OF VALVE AND MAIN FEATURES

DIFFERENTIAL PRESSURE RELIEF VALVE

DESIGN		
DRAWN	CH	5-9-75
CHK'D	ME	5-12-75
APV'D	JAS	5-17-75

CAD REVISION RECORD - DO NOT REVISE MANUALLY

LTR	DESCRIPTION	BY	DATE
	SEE SHEET 1		

OPERATING DATA

I. DIFFERENTIAL RELIEF FEATURE:

DIFFERENTIAL RELIEF CONTROL (3) IS NORMALLY CLOSED AND RESPONDS TO DIFFERENTIAL PRESSURE CHANGES ACROSS THE DIAPHRAGM OF CONTROL (3). AN INCREASE IN DIFFERENTIAL PRESSURE TENDS TO OPEN CONTROL (3) AND A DECREASE IN DIFFERENTIAL PRESSURE TENDS TO CLOSE CONTROL (3). THIS CAUSES MAIN VALVE COVER PRESSURE TO VARY AND THE MAIN VALVE MODULATES (OPENS AND CLOSES) MAINTAINING A RELATIVELY CONSTANT DIFFERENTIAL PRESSURE BETWEEN PUMP SUCTION AND THE MAIN VALVE INLET (PUMP DISCHARGE). WHEN DIFFERENTIAL PRESSURE IS LOWER THAN THE SET POINT OF CONTROL (3), CONTROL (3) CLOSES. THIS PRESSURIZES THE COVER OF THE MAIN VALVE AND THE MAIN VALVE CLOSES. DIFFERENTIAL CONTROL ADJUSTMENT: TURN THE ADJUSTING SCREW CLOCKWISE TO INCREASE THE SETTING.

II. CLOSING SPEED CONTROL:

NEEDLE VALVE (2) CONTROLS THE CLOSING SPEED OF THE MAIN VALVE. TURN THE ADJUSTING STEM CLOCKWISE TO MAKE THE MAIN VALVE CLOSE SLOWER. DO NOT CLOSE VALVE (2) COMPLETELY OR THE MAIN VALVE WILL NOT CLOSE. (SUGGESTED INITIAL SETTING OF NEEDLE VALVE IS 1/4 TO 1/2 TURN OPEN.)

III OPTIONAL FEATURE OPERATING DATA:

SUFFIX B (ISOLATION VALVES)

CK2 COCKS (B1) AND (B2) ARE USED TO ISOLATE THE PILOT SYSTEM FROM MAIN LINE PRESSURE. THESE VALVES MUST BE OPEN DURING NORMAL OPERATION.

SUFFIX D (CHECK VALVES WITH COCK):

WHEN OUTLET PRESSURE IS HIGHER THAN INLET PRESSURE, CHECK VALVE (D2) OPENS AND (D1) CLOSES. THIS DIRECTS THE HIGHER OUTLET PRESSURE INTO THE MAIN VALVE COVER AND THE MAIN VALVE CLOSES.

SUFFIX F (REMOTE PILOT SENSING)

REMOTE SENSING PRESSURE IS OBTAINED FROM A POINT UPSTREAM OF THE MAIN VALVE INLET. [SENSING PRESSURE IS OBTAINED FROM THE MAIN VALVE INLET IF SUFFIX (F) IS NOT SPECIFIED].

CLA-VAL CO. NEWPORT BEACH, CALIFORNIA

CATALOG NO.	DRAWING NO.	REV.
250-01	89993	C

TYPE OF VALVE AND MAIN FEATURES

DIFFERENTIAL PRESSURE RELIEF VALVE

DESIGN		
DRAWN	CH	5-9-75
CHK'D	MF	5-12-75
APV'D	JAS	5-17-75

OPERATING DATA

SUFFIX S (OPENING SPEED CONTROL)
FLOW CONTROL (S) CONTROLS THE OPENING SPEED OF THE MAIN VALVE. TURN THE ADJUSTING STEM CLOCKWISE TO MAKE THE MAIN VALVE OPEN SLOWER.

IV. CHECK LIST FOR PROPER OPERATION:

( ) SYSTEM VALVES OPEN UPSTREAM AND DOWNSTREAM.
( ) AIR REMOVED FROM THE MAIN VALVE COVER AND PILOT SYSTEM AT ALL HIGH POINTS.
( ) CK2 COCKS (B1) & (B2) OPEN (OPTIONAL FEATURE).
( ) PERIODIC CLEANING OF STRAINER (2) IS RECOMMENDED.
( ) VALVE (2) OPEN AT LEAST 1/4 TURN.
( ) DIFFERENTIAL CONTROL (3) TURNED TO THE SET POSITION.

CAD REVISION RECORD - DO NOT REVISE MANUALLY

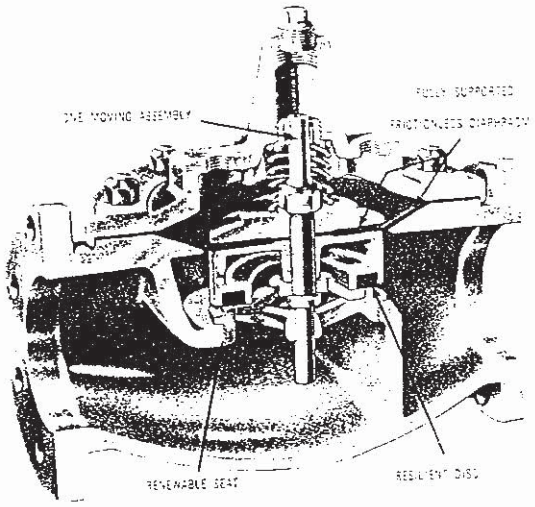
LTR	DESCRIPTION	BY	DATE
	SEE SHEET 1		

CLA-VAL CO. HYTROL (Basic Valve) Model 100-01

)-01 Hytrol valve is a hydraulically operated, e., globe, or angle pattern valve. It consists of three s: the body, diaphragm assembly, and cover. The ly is the only moving part.

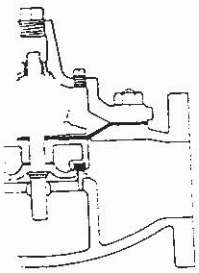
is a removable seat insert. The diaphragm assembly ger) is guided top and bottom by a precision machined diaphragm of nylon fabric bonded with synthetic rub- nthetic rubber disc, contained on three and one-half tainer and disc guide, forms a drip-tight seal with the pressure is applied above the diaphragm. The dia- forms a sealed chamber in the upper portion of the operating pressure from line pressure. The valve's uction and simplicity of design assures a long life of ration.

)1 Hytrol valve is used as the basic valve in almost all ic valves. It is used in many types of piping systems e control, pressure regulation, solenoid operation, rate liquid level control, or check valve operation. It is ous materials and in a full range of sizes, with either ged ends.



Principle of Operation

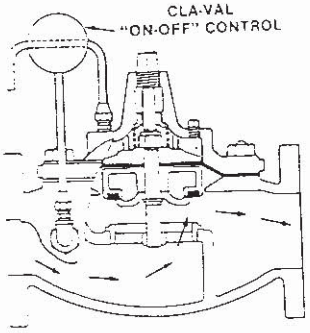
CLA-VAL "ON-OFF" CONTROL



OSING OPERATION

rom the valve inlet (or an pendent operating pressure) is diaphragm chamber the valve t.

CLA-VAL "ON-OFF" CONTROL

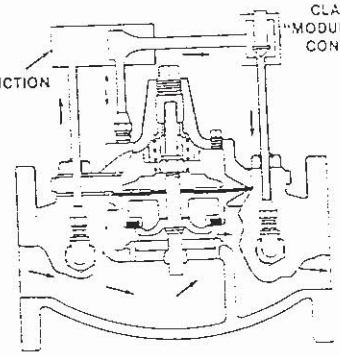


FULL OPEN OPERATION

When pressure in diaphragm chamber is relieved to a zone of lower pressure (usually atmosphere) the line pressure at the valve seat opens the valve. Flow in either direction is permitted.

CLA-VAL "MODULATING" CONTROL

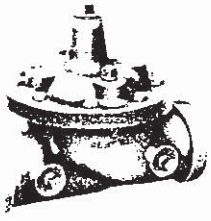
RESTRICTION



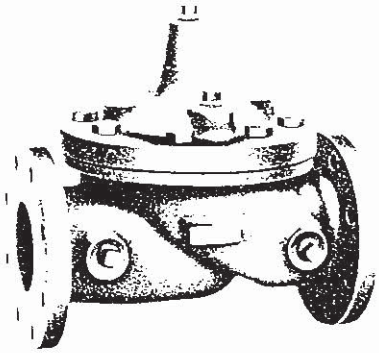
MODULATING ACTION

Valve modulates when diaphragm pressure is held at an intermediate point between inlet and discharge pressure. With the use of a Cla-Val Co., "Modulating" Control, which reacts to line pressure changes, the pressure above the diaphragm is varied, allowing the valve to throttle and compensate for the changes.

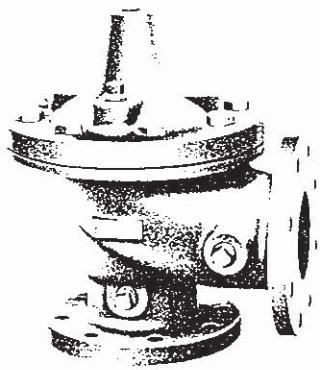
Typical Valves



)BE, SCREWED



4" GLOBE, FLANGED

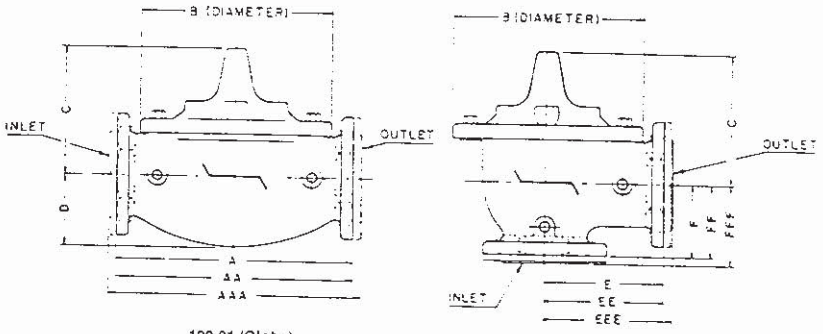


4" ANGLE, FLANGED

Specifications

SIZES	*Globe:* 3/8" - 3" screwed; 1½" - 16" flanged *Angle:* 1½" - 3" screwed; 2" - 16" flanged
END DETAILS	*Flanged:* Cast Iron, 125 & 250 ANSI B16.1 Cast Steel, 150 & 300 ANSI B16.5 Cast Bronze, 150 & 300 ANSI B16.24 *Screwed:* 250 and 300 ANSI B2.1
PRESSURE RATINGS	125 class 175 psi/150 class 275 psi 250 class 300 psi/300 class 400 psi
TEMPERATURES RANGES	Water, Air, to +180°F. Light Petroleum Products −40 to +180°F.
MATERIALS	*Main valve body & cover:* Cast Iron ASTM A48 Cast Steel ASTM A216-WCB Cast Bronze ASTM B62 Cast Aluminum 356-T6 *Main valve trim:* Brass QQ-B-626 Bronze ASTM B61 Stainless Steel 303 *Rubber Parts:* Buna N Synthetic Rubber
OTHER MATERIALS	Available on special order

Dimensions



100-01 (Globe) 100-01 (Angle)

	SIZE	⅜	½-¾	1	1¼-1½	2	2½	3	4	6	8	10	12	14	16
A	Screwed	2 3/4	3 1/2	3 7/8	4 7/8	9 1/8	11	12 1/2							
AA	125 ANSI 150 ANSI	—	—	—	*8 1/2	9 1/8	11	12	15	20	25 1/4	29 1/4	34	39	43 1/2
AAA	250 ANSI 300 ANSI	—	—	—	—	10	11 1/8	13 1/4	15 1/8	21	26 1/4	31 1/8	35 1/2	40 1/2	43 1/2
	B	2 1/2	3 1/8	4 1/2	5 1/8	6 1/8	8	9 1/8	11 1/2	15 1/2	20	23 1/2	28	32 1/4	35 1/2
	C	1 1/2	2 1/8	2 1/2	4 5/16	5 1/4	6 1/2	7 1/2	9 1/8	12 1/2	13 1/2	16 1/2	20	23 1/4	25
	D	1 1/4	1 5/8	1 7/8	2	2 1/2	2 7/8	3 1/8	4 1/2	6	7 5/16	9 1/4	10 1/2	12 5/8	15 1/2
E	Screwed				3 1/4	4 3/4	5 1/2	6 1/4	—	—	—	—	—	—	—
EE	125 ANSI 150 ANSI				—	4 3/4	5 1/2	6	7 1/2	10	12 1/2	14 5/8	17	19 1/2	20 13/16
EEE	250 ANSI 300 ANSI				—	5	5 7/8	6 3/8	7 5/8	10 1/2	13 1/4	15 5/8	17 3/4	20 1/4	21 5/8
F	Screwed				1 1/8	3 1/4	4	4 1/2	—	—	—	—	—	—	—
FF	125 ANSI 150 ANSI				—	3 1/4	4	4	5	6	8	8 5/8	13 3/4	14 5/8	15 5/8
FFF	250 ANSI 300 ANSI				—	3 1/2	4 5/16	4 5/8	5 5/16	6 1/2	8	9 3/8	14 1/2	15 5/8	16 1/2
Cover Tapping N.P.T		1/8	1/8	1/4	1/4	3/8	1/2	1/2	3/4	3/4	1	1	1	1	1
Body Tapping N.P.T		—	1/8	1/4	3/8	3/8	1/2	1/2	3/4	3/4	1	1	1	1	1
Shipping Weight Lbs		3	3	5	15	35	50	70	140	255	500	780	1165	1600	2265

*1½ SIZE ONLY

Purchase Specifications

This valve shall be a hydraulically operated, diaphragm-actuated, globe or angle pattern valve. It shall contain a resilient, synthetic rubber disc, having a rectangular cross-section, contained on three and one-half sides by a disc retainer and disc guide, forming a tight seal against a single removable seat insert. The diaphragm assembly containing a valve stem shall be fully guided at both ends by a bearing in the valve cover and an integral bearing in the valve seat. This diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve, separating operating pressure from line pressure. The diaphragm shall consist of nylon fabric bonded with synthetic rubber and shall not be used as a seating surface. Packing glands and/or stuffing boxes are not permitted and there shall be no pistons operating the valve. All necessary repairs shall be possible without removing the valve from the line.

Valve shall be similar in all respects to the Cla-Val Model 100-01 Hytrol Valve as manufactured by Cla-Val Co., Newport Beach, California, or approved equal.

[illegible]

1. Size.
2. Model 100-01 Hytrol (Globe or Angle)
3. Pressure Class.
4. Temperature and fluid to be handled.
5. Static and flowing line pressure.
6. Operating fluid and pressure (if other than line pressure).
7. Body and trim materials.
8. End Details (screwed or flanged).

VALVE SIZE	Cv FACTOR	FLOW OF WATER — GALLONS PER MINUTE — THRU GLOBE PATTERN VALVE																				
		5	10	15	20	30	40	50	60	80	100	150	200	300	400	600	800	1000	2000	3000	4000	6000	10,000
½	6.0	7	2.7	6.2	11.0																		
¾	8.5	.3	1.4	3.1	5.5	12.5																	
1	13.3	.14	.57	1.3	2.3	5.1	9.1	14.1	20.4														
1¼	30.0		.1	.25	.44	1.0	1.8	2.8	4.0	7.1	11.0												
1½	32.0		.1	.23	.4	.9	1.6	2.4	3.5	6.3	9.8	22.0											
2	54.0				.14	.31	.55	.86	1.23	2.19	3.43	7.72	13.72										
2½	80.0					.14	.25	.4	.6	1.0	1.5	3.5	6.25	14.1									
3	115.0						.12	.19	.27	.48	.76	1.70	3.02	6.81	12.10	27.22							
4	200.0							.06	.09	.16	.25	.56	1.0	2.25	4.0	9.0							
6	500.0										.04	.09	.16	.36	.64	1.44	2.56	4.00	16.00				
8	840.0												.06	.13	.23	.51	.91	1.42	5.67	12.76			
10	1245.0														.10	.23	.41	.65	2.58	5.81	10.32		
12	1725.0															.22	.34	1.34	3.02	5.38	12.10		
14	2300.0																.19	.76	1.70	3.02	6.81	18.90	
16	2940.0																	.46	1.04	1.85	4.16	11.57	
	GPM→	5	10	15	20	30	40	50	60	80	100	150	200	300	400	600	800	1000	2000	3000	4000	6000	10,000

PRESSURE IN P.S.I. (BASED ON WIDE OPEN VALVE)

FLOW CHART — Pressure drop in pounds per square inch for sizes ½" thru 16" Clayton Valves

VALVE SIZE	DISPLACEMENT
⅜"	0.012 Fl. Oz.
½"	0.34 Fl. Oz.
¾"	0.34 Fl. Oz.
1"	0.7 Fl. Oz.
1-¼"	.020 Gals.
1-½"	.020 Gals.
2"	.032 Gals.
2-½"	.043 Gals.
3"	.080 Gals.
4"	.169 Gals.
6"	.531 Gals.
8"	1.26 Gals.
10"	2.51 Gals.
12"	4.0 Gals.
14"	6.50 Gals.
16"	9.57 Gals.

LITHO IN U. S. A

CLA-VAL CO. *Newport Beach, California*

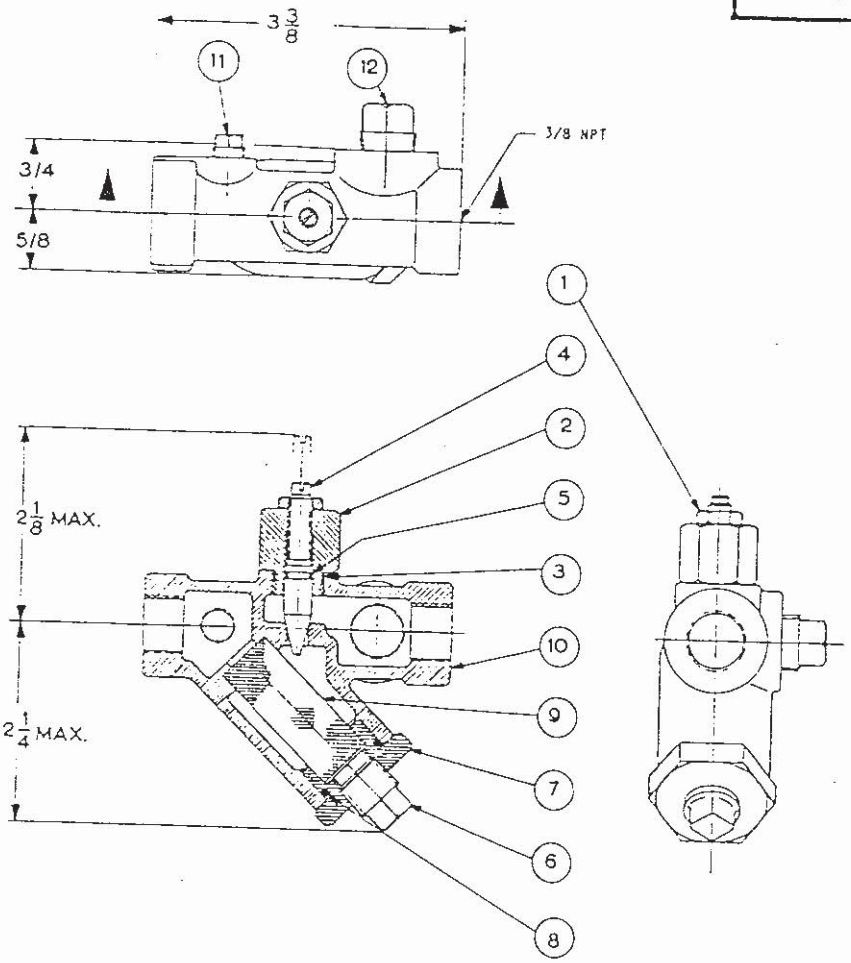
CLAYTON automatic VALVES

PARTS LIST

STRAINER AND NEEDLE VALVE ASSEMBLY

Clayton X-42N-2

SIZE	STOCK NUMBER
⅜" x ⅜"	68372



ITEM	DESCRIPTION	MATERIAL	PART NO.	UNIT PRICE
1	Jam Nut—Hex	Sil Brz	67798-01	
2	Bonnet	S.S.	67910	
3	"O" Ring—Bonnet	Syn Rub	00713	
4	Stem	S.S.	67907	
5	"O" Ring—Stem	Syn Rub	00708	
6	Plug—Pipe 1/4	Brass	67847-02	
7	Strainer Plug	S. S.	67911	
8	"O" Ring—Plug	Syn. Rub.	00751	
9	Screen	Monel	68373	
10	Body	Rd Brs	67905	
11	Plug—Pipe 1/8	Brass	67660-01	
12	Plug—Pipe 3/8	Brass	67660-03	

PRICES SUBJECT TO CHANGE WITHOUT NOTICE • F.O.B. NEWPORT BEACH, CALIFORNIA — EFFECTIVE 4-15-77

When ordering parts specify:
- All nameplate data
- Item Number
- Description
- Material
- Part Number

CLA-VAL CO. *Newport Beach, California*

DIFFERENTIAL CONTROL

Clayton CDB

DESCRIPTION

The Clayton Differential Control is a direct acting, combination spring and pressure loaded, diaphragm-type control.

OPERATION

The Clayton Differential Control is normally held closed by the force of the compression spring and the pressure load above the diaphragm. Control pressure is applied under the diaphragm from a remote sensing point or from a tapping on the discharge end of the main valve.

When the controlling pressure at port A, exceeds the combined load of the spring setting and the pressure load at port B, the disc lifts "off" its seat, permitting flow through the control.

When controlling pressure drops below the combined pressure load and spring setting, the control returns to its normally closed position.

INSTALLATION

The Clayton Differential Control is installed as shown on the schematic group hook-up diagram of complete valve assembly. Be sure to connect control tubing as shown. This control may be installed in any position.

Allow sufficient room to make pressure setting adjustments.

ADJUSTMENT

Pressure adjustment is made by varying the load pressure and by turning the adjusting screw. This will vary the pressure on the diaphragm. As the load, and spring compression is increased, a correspondingly higher pressure is required to open the valve.

DISASSEMBLY

Disassembly of the Clayton Differential Control requires no special tools. The control does not need to be removed from the line. Back out adjustment screw to remove spring tension before removing cover. Refer to Parts Price List CDB

INSPECTION

Check valve disc for scoring, or embedded foreign particles. Inspect diaphragm for excessive wear and other damage. Check all parts for damage, corrosion, excessive wear and mineral deposits.

REPAIR & REPLACEMENT

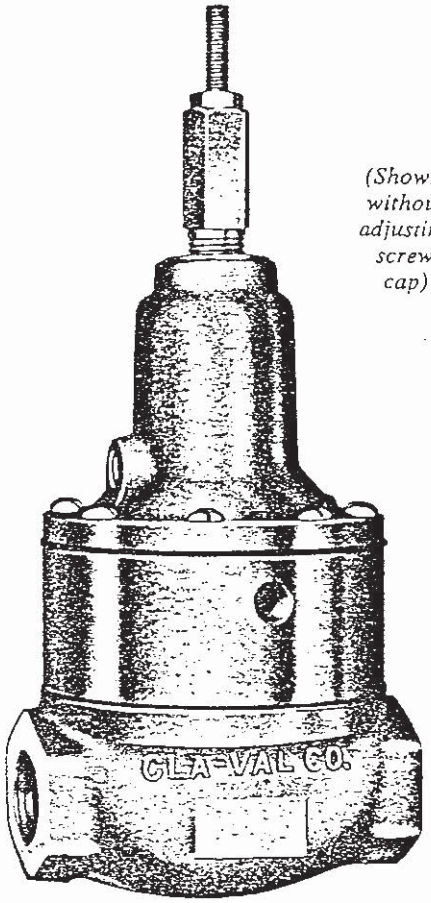
Replace all damaged parts. When ordering replacement parts, be sure to specify catalog number, and all nameplate data.

REASSEMBLY

Reassembly is the reverse of disassembly.

TEST PROCEDURE

No testing of the Differential Control is required prior to reassembly to the Clayton Hytrol Main Valve.



(Shown without adjusting screw cap)

SERVICE SUGGESTIONS

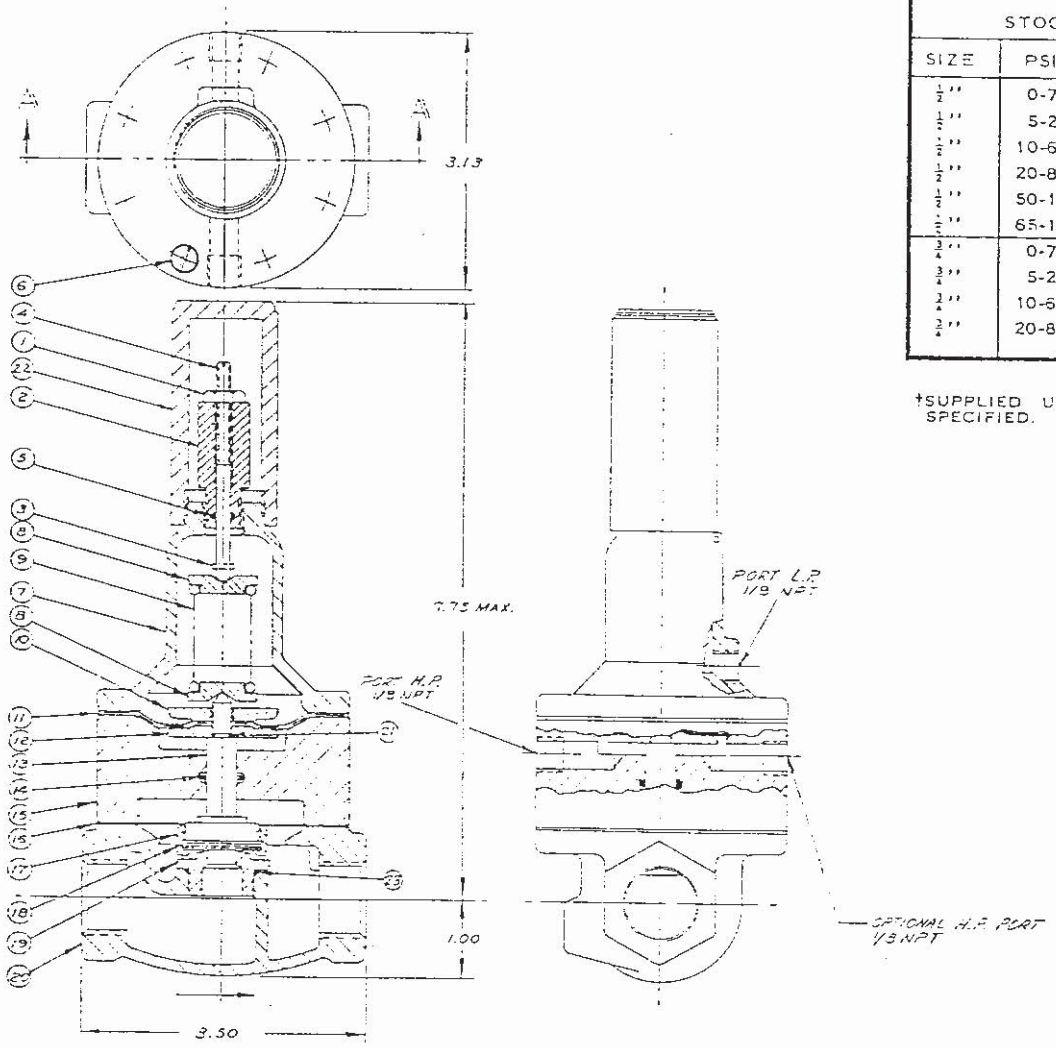
SYMPTOM	PROBABLE CAUSE	REMEDY
Fails to open	Loading pressure too high	Adjust loading pressure to port B on control
	Spring set too high	Back off adjusting screw
Fails to close	Diaphragm damage	Disassemble, replace damaged diaphrag
	Loose diaphragm assembly	Tighten upper diaphragm washer
	No spring compression or load pressure	Re-set pressu adjustments. Check load pressure
Fails to close with spring compressed	Mechanical obstruction	Disassemble, locate, and re move obstruction

CLAYTON *automatic* VALVES

PARTS PRICE LIST

PRESSURE DIFFERENTIAL CONTROL

Clayton CDB



STOCK NUMBERS

SIZE	PSI RANGE	NUMBER
½"	0-7 PSI	37672
½"	5-25 PSI	†31348
½"	10-60 PSI	38715
½"	20-80 PSI	39493
½"	50-150 PSI	41930
½"	65-180 PSI	41934
¾"	0-7 PSI	34681
¾"	5-25 PSI	†34548
¾"	10-60 PSI	35002
¾"	20-80 PSI	36565

†SUPPLIED UNLESS OTHERWISE SPECIFIED.

ITEM	DESCRIPTION	MATERIAL	PART NO.	UNIT PRICE
1-5	ADJ. STEM ASSEMBLY (ITEMS 1 THRU 5)		C-2002	$
1	JAM NUT, ½"-28	BRASS	67798-01	
2	STUFFING BOX	BRASS	C-2004	
3	ROLL PIN 1/16" X 3/8"	S.S.	70989	
4	ADJUSTING STEM	S.S.	C-2003	
* 5	"O"-RING	HYCAR	00508	
6	MACHINE SCREW, 10-32 X 1 7/8" FIL. HD. (8 REQ.)	BRASS	57578-67	
7	COVER	BRASS	C-6657	
8	SPRING GUIDE (2 REQ.)	S.S.	C-1510	
†	SPRING GUIDE (2 REQ.)	S.S.	C-568	
* 9	SPRING			
	PSI RANGE			
†	PSI 0-7	S.S.	C-492	
	PSI 5-25	S.S.	32919	
	PSI 10-60	S.S.	32447	
	PSI 20-80	MUS. WIRE	TV-5695	
	PSI 50-150	MUS. WIRE	C-1124	
	PSI 65-180	MUS. WIRE	TV-6515	

ITEM	DESCRIPTION	MATERIAL	PART NO.	UNIT PRICE
10	DIAPHRAGM WASHER - UPPER	BRASS	TV-6137	$
* 11	DIAPHRAGM	HYCAR	C-3493	
12	DIAPHRAGM WASHER - LOWER	BRASS	TV-6136	
13	STEM	S.S.	C-1508	
* 14	"O" RING	HYCAR	00744	
15	BODY-POWERTROL	BRASS	C-8698	
* 16	GASKET - BODY TO BODY	BUNA-N/CORK	80594-01	
17	DISC RETAINER	BRASS	C-1509	
* 18	DISC ASSEMBLY	SERVINE	C-8839	
19	SEAT	S.S.	C-1507	
20	BODY ½"	BRASS	C-7928	
	BODY ¾"	BRASS	C-9083	
* 21	"O" RING	SYN. RUB.	00902	
22	CAP, ADJ. SCREW	PVC	71000	
* 23	O-RING (SEAT)		00718	

† USE SPRING GUIDE C-568 (2 REQ'D) WITH SPRING C-492 (0-7 PSI) ONLY.

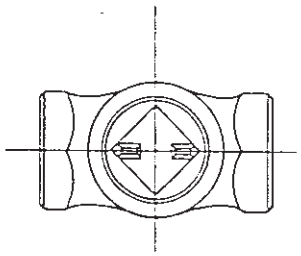
PRICES SUBJECT TO CHANGE WITHOUT NOTICE • *RECOMMENDED SPARE PARTS

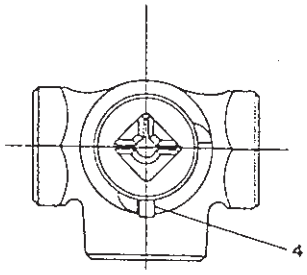
When ordering parts specify: • All nameplate data • Description • Part Number • Item Number • Material

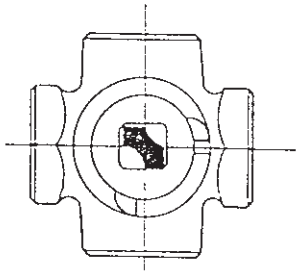
LITHO IN U.S.A.

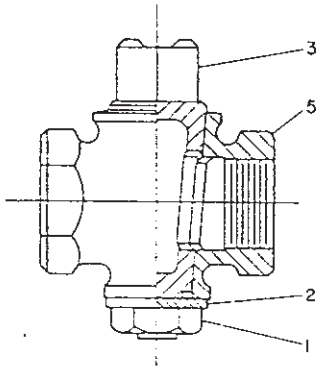
CLA-VAL CO.

C	CLA-VAL CO.	PARTS LIST
	SHUTOFF COCKS	CK SERIES

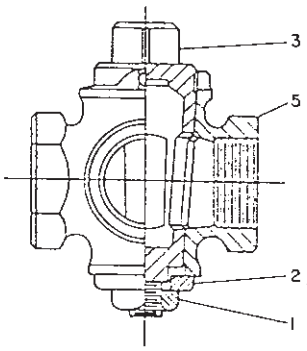




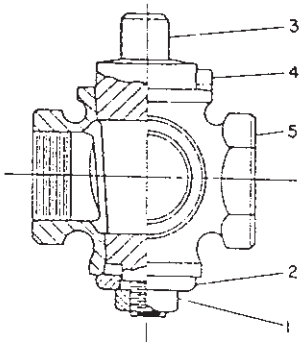




CAT. NO. CK2
(2 WAY)



CAT. NO. CK3
(3 WAY)



CAT. NO. CK4
(4 WAY)

ITEM NO.	DESCRIPTION
1	Nut
2	Washer
3	Plug
4	Stop Pin
5	Body

When ordering parts specify: • All nameplate data • Description • Item Number

CLA-VAL CO. Newport Beach, California U.S.A.
CLA-VAL CANADA LTD. Beamsville, Ontario, Canada

CLA-VAL CO.

FLOW CONTROL

PARTS LIST

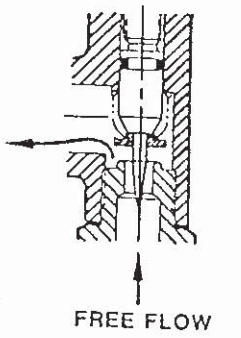
CV 3/8"

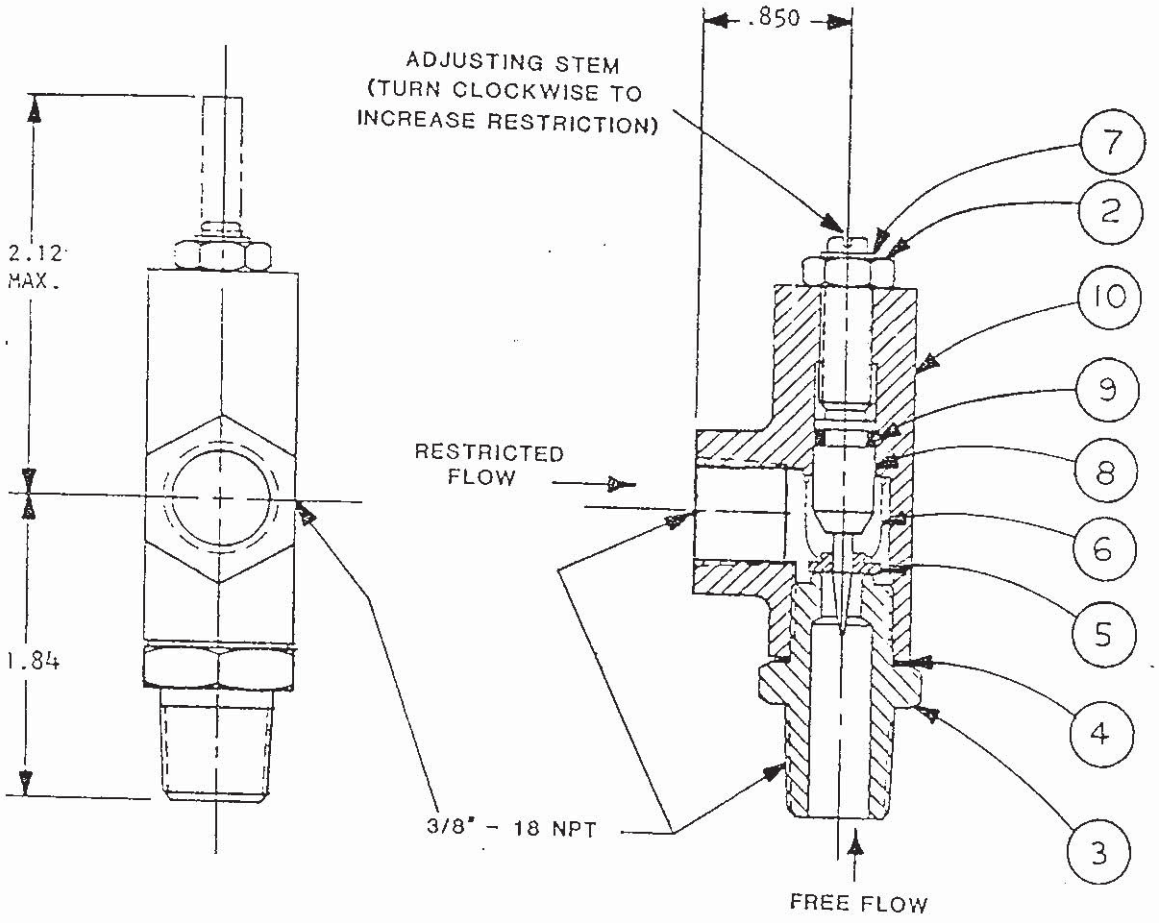
ITEM NO.	DESCRIPTION	QUAN.
2	NUT, JAM	1
3	SEAT	1
4	GASKET	1
5	DISC	1
6	SPRING	1
7	RING, RETAINING	1
8	STEM	1
9	O-RING	1
10	HOUSING	1

STOCK NUMBERS	
SIZE	NUMBER
* 3/8"	01A
3/8"	02J
3/8"	03G
3/8"	04E

* STANDARD

WITH DISC OPEN FOR "FREE FLOW"





When ordering parts specify:

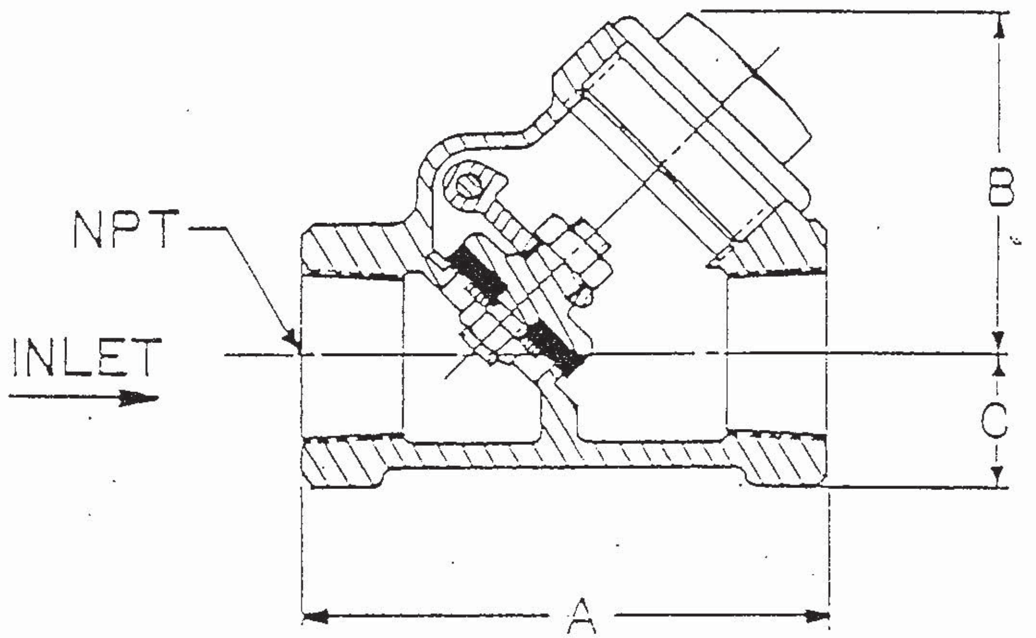
- All nameplate data
- Item Number
- Description
- Material
- Part Number
- Recommended Spare Parts

CLA-VAL CO. Newport Beach, California, U.S.A.
CLA-VAL CANADA LTD. Beamsville, Ontario, Canada
CLA-VAL SA Lausanne, Switzerland

CLA-VAL CO. NEWPORT BEACH, CALIFORNIA	CATALOG NO. CSC	DRAWING NO. 92667

CSC SWING CHECK VALVE

DESIGN		
DRAWN	11-5-76	CH
CHK'D.	11-7-76	M
APP'D.	11-7-76	J.A.
SCALE	DIST. CODE ---	



PIPE SIZE N.P.T.	A	B	C
1/4	2-1/8	1-5/8	1/2
3/8	2-1/8	1-5/8	1/2
1/2	2-7/16	1-11/16	5/8
3/4	2-15/16	1-7/8	3/4
1	3-3/16	2-3/32	15/16

REVISION RECORD

LTR	DESCRIPTION	BY	DATE

92667

CLA-VAL CO. 2 Christie Drive, Beamsville, Ontario

CDC

81353

CHECK VALVE, DISC CHECK TYPE

DESIGN

DRAWN 8-25-71

CHK'D. 8-25-71

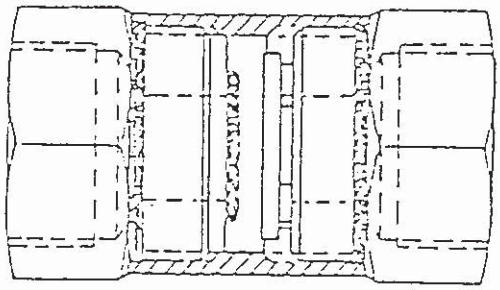
APP'D. 8-25-71

SCALE

NOTE: THIS IS A NON-REPAIRABLE, LOW COST ITEM AND INDIVIDUAL REPLACEMENT PARTS ARE NOT AVAILABLE

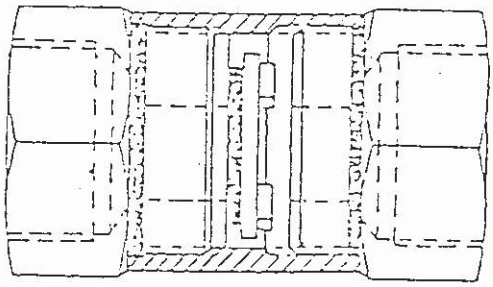
OPERATION

FREE FLOW →



CHECK VALVE OPEN

IN THE FORWARD FLOW DIRECTION, THE FLUID PUSHES THE VALVE DISC AHEAD UNTIL THE LANDS ON THE OPPOSITE SIDE OF THE DISC CONTACT THE END CONNECTOR. THE LANDS PROVIDE A PASSAGE FOR THE FLUID AROUND THE DISC.



CHECK VALVE CLOSED

IN THE REVERSE FLOW DIRECTION, THE FLUID AGAIN PUSHES THE DISC AHEAD OF IT UNTIL THE FACE OF THE DISC COMES IN CONTACT WITH THE SEALING O-RING SHUTTING OFF FLOW. AS THE PRESSURE BUILDS UP, THE O-RING IS COMPRESSED GIVING A BETTER BUBBLE TIGHT SEAL.

REVISION RECORD

DESCRIPTION | BY | DATE

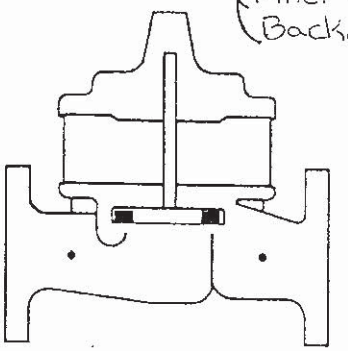
CLA-VAL CO.

AUTOMATIC CONTROL VALVES

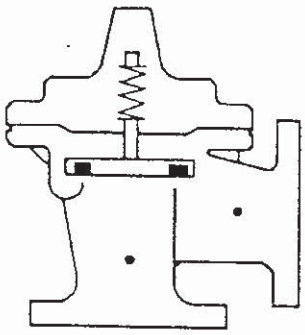
50-01/650-01

Place this manual with personnel responsible for maintenance of this valve.

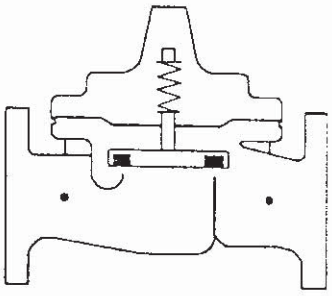
Pressure Relief
(Filter & Feed pumps CV2
Backwash pump CV3)



INSTALLATION



OPERATION



MAINTENANCE

CLA-VAL™ CLA-VAL CO. • P.O. BOX 1325 • Newport Beach, CA 92659-0325 • (714) 722-4800
CLA-VAL CANADA LTD. • 4687 Christie Drive • Beamsville, Ontario, Canada LOR 1B4 • (905) 563-4963

INTRODUCTION

This manual titled the 50-01 Series Pressure Relief Pressure Sustaining or Back Pressure Valve contains information for installation, operation and maintenance of the valve and control system. The Clayton 50-01 is an automatic valve designed to maintain constant upstream pressure to close limits. It is a hydraulically operated, pilot controlled, modulating type valve. It is used where pressure relief pressure sustaining or unloading functions in a bypass system are required.

In operation the valve is actuated by line pressure to a pilot control system, opening fast to maintain steady line pressure but closing gradually to prevent surges. Operation is completely automatic and pressure settings may be easily changed.

INSTALLATION

1. Allow sufficient room around the valve to make adjustments and for disassembly.
2. It is recommended that a gate or block valve be installed above the inlet side of the valve. Straight relief valve applications do not usually require a gate or block valve on the downstream side. This is particularly true if the primary function is surge control or pressure relief where the valve discharges to atmosphere.
3. When a back pressure function is involved in the installation a gate or block valve should also be installed on the downstream side of the valve to facilitate isolating the valve for preventive maintenance.

   NOTE: BEFORE THE VALVE IS INSTALLED, PIPE LINES SHOULD BE FLUSHED OF ALL CHIPS, SCALE AND FOREIGN MATTER.
4. Place the valve in the line with flow through the valve in the direction indicated on the inlet plate or by flow arrows. Check all fittings and hardware for proper makeup and that no apparent damage is evident.
5. Clayton Valves operate with maximum efficiency when mounted in horizontal piping with the cover UP; however, other positions are acceptable. Due to size and weight of cover and internal components of six inch valves and larger, installation with the cover up is advisable. This makes periodic inspection of internal parts readily accessible.

OPERATION AND START-UP

1. Prior to pressurizing the valve assembly make sure the necessary gauges to measure pressure in the system are installed as required by the system engineer. A Clayton X101 Valve Position Indicator may be installed in the center cover port to provide a visual indication of the valve stem position during start-up adjustment.

   CAUTION: During start-up and test a large volume of water may be discharged downstream. Check that the downstream venting is adequate to prevent damage to personnel and equipment. All adjustments in pressure should be made slowly. If the main valve closes too fast it may cause surging in upstream piping.
2. If shutoff cocks (isolation valves) are installed, open cocks (see schematic).
3. Loosen jam nut on strainer valve assembly and turn adjusting stem clockwise until it seats. Turn stem counterclockwise ¼ to ½ turn and tighten jam nut.
4. Remove cap on the CRL Pressure Relief Control, loosen jam nut and turn adjusting screw clockwise until spring is fully compressed. This puts the control in full closed mode and will cause the main valve to close when system is pressurized.
5. If a downstream block valve is installed, slowly open this valve.
6. Partially open upstream block valve. The main valve should close.
7. Carefully loosen tube fittings at highest points and bleed air from system. Carefully loosen the plug at top of cover assembly, or if an Indicator is installed, loosen the pipe plug at top of Indicator. Bleed air from cover and tighten plug. Tighten tube fittings.
8. Open fully the upstream block valve and turn the CRL adjusting screw slowly counterclockwise until you begin to hear a flow through the control. The main valve should start to open. If the pressure is below the required relief setting refer to the spring chart (Drawing No. 47117) and turn the adjusting screw clockwise the number of turns required for the proper setting. Lock the jam nut and replace cover.

   An observation of the pressure relief setting should be made during a usage cycle and the controls readjusted if required.

MAINTENANCE

1. Clayton Valves and Controls require no lubrication or packing and a minimum of maintenance. However, a periodic inspection schedule should be established to determine how the fluid handled is affecting the efficiency of the valve assembly.
2. Repair and adjustment procedures of the main valve and control components are included in separate sections of this manual. Accessory components are listed for reference.
3. Refer to the Service Suggestions Chart to identify operation symptoms.

SERVICE SUGGESTIONS

SYMPTOM	PROBABLE CAUSE	REMEDY
Main valve won't open	Inlet pressure below setting of pilot valve.	Reset pilot valve. If change in setting by tampering, seal cap with wire and lead seal.
	Pilot valve stuck closed. Mineral deposit or foreign material between disc retainer and power unit body.	Disassemble and clean.
	Pilot valve diaphragm ruptured or diaphragm nut loose. Water coming out of the vent hole in cover.	Disassemble and replace diaphragm. Tighten nut.
	Main valve stuck closed. Mineral buildup on stem. Stem damaged.	Disassemble main valve, clean parts and/or replace damaged parts.
Main valve won't close	Inlet pressure above setting of pilot valve.	Reset pilot valve.
	Clogged needle valve.	Disassemble and clean.
	Pilot valve stuck open. Mineral deposit or foreign material under disc retainer or under diaphragm assembly.	Disassemble and clean.
	Main valve stuck open. Mineral buildup on stem. Foreign material between seat and disc assembly.	Disassemble and clean.
	Main valve diaphragm ruptured.	Disassemble and replace.
Valve leaks continuously	Pilot valve disc worn out.	Disassemble and replace.
	Main valve disc worn out or small break in main valve diaphragm.	Disassemble and replace.

CVCL 1 (2) 3 4 DIST. CODE 002 SHEET 1 OF 3

CLA-VAL CO. NEWPORT BEACH, CALIFORNIA

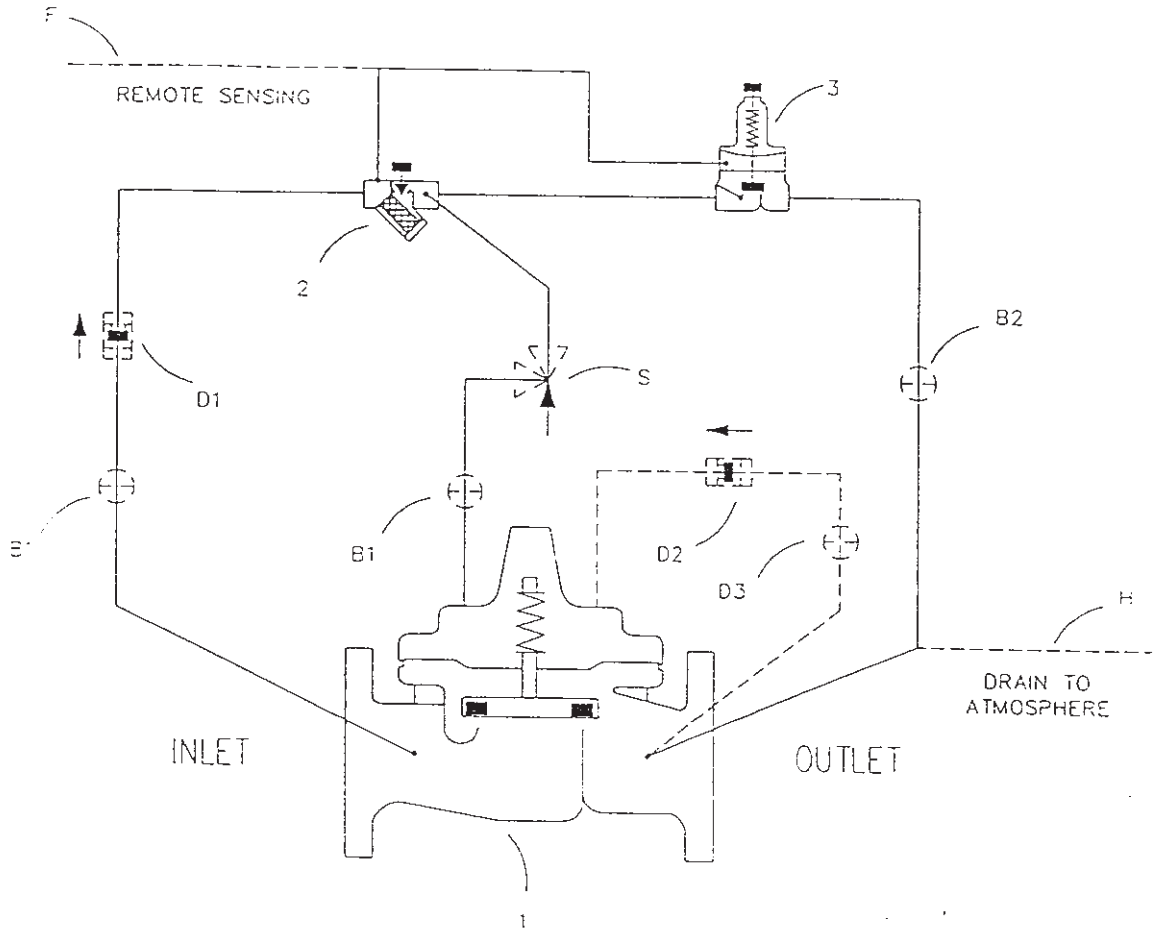
CATALOG NO.	DRAWING NO.	REV.
50-01/650-01	79488	F

TYPE OF VALVE AND MAIN FEATURES

PRESSURE RELIEF VALVE (EQUIPPED WITH CLOSING SPEED CONTROL)

DESIGN		
DRAW	JD	11-30-78
CHK'D	CH	11-30-78
APV'D	WAL	11-30-78

NOT FURNISHED BY CLA-VAL CO. OPTIONAL FEATURES



ITEM NO.	BASIC COMPONENTS	QTY
1	100-01 HYTROL (50-01) MAIN VALVE 100-20 HYTROL (650-01) MAIN VALVE	1
2	X42N-2 STRAINER & NEEDLE VALVE	1
3	CRL PRESSURE RELIEF CONTROL	1

OPTIONAL FEATURE SUFFIX		ADDED TO CATALOG NUMBER
B	CK2 COCK (ISOLATION VALVES)	3
D	CHECK VALVES WITH COCK	1
F	REMOTE PILOT SENSING	
H	DRAIN TO ATMOSPHERE	
S	CV FLOW CONTROL (OPENING)	1

CAD REVISION RECORD - DO NOT REVISE MANUALLY

LTR	DESCRIPTION	BY	DATE
A-D	SEE REVISION FILE		
E	ADDED D OPTIONAL FEATURE & REDRAWN ON CAD (ECO 12040)	TLC	6-13-91
4	TLC	CAT. NO. WAS 50-01; ADDED 100-20 (650-01) TO ITEM 1 (ECO 12835)	

CLA-VAL CO. NEWPORT BEACH, CALIFORNIA

CATALOG NO.	DRAWING NO.	REV.
50-01/650-01	79488	F

TYPE OF VALVE AND MAIN FEATURES

PRESSURE RELIEF VALVE
(EQUIPPED WITH CLOSING SPEED CONTROL)

DESGN		
DRAW	JD	11-30-78
CHKD	CH	11-30-78
APVD	WAL	11-30-78

OPERATING DATA

I. PRESSURE RELIEF FEATURE:

PRESSURE RELIEF CONTROL (3) IS A NORMALLY CLOSED CONTROL THAT RESPONDS TO MAIN VALVE INLET PRESSURE CHANGES. AN INCREASE IN INLET PRESSURE TENDS TO OPEN CONTROL (3) AND A DECREASE IN INLET PRESSURE TENDS TO CLOSE CONTROL (3). THIS CAUSES MAIN VALVE COVER PRESSURE TO VARY AND THE MAIN VALVE MODULATES (OPENS AND CLOSES) MAINTAINING A RELATIVELY CONSTANT PRESSURE AT THE MAIN VALVE INLET. WHEN INLET PRESSURE IS LOWER THAN THE SET POINT OF CONTROL (3), CONTROL (3) CLOSES. THIS PRESSURIZES THE MAIN VALVE COVER CHAMBER AND THE MAIN VALVE CLOSES. PRESSURE RELIEF CONTROL (3) ADJUSTMENT: TURN THE ADJUSTING SCREW CLOCKWISE TO INCREASE THE SETTING.

II. CLOSING SPEED CONTROL:

NEEDLE VALVE (2) CONTROLS THE CLOSING SPEED OF THE MAIN VALVE. TURN THE ADJUSTING STEM CLOCKWISE TO MAKE THE MAIN VALVE CLOSE SLOWER. DO NOT CLOSE VALVE (2) COMPLETELY OR THE MAIN VALVE WILL NOT CLOSE. (SUGGESTED INITIAL SETTING OF NEEDLE VALVE IS 1/4 TO 1/2 TURN OPEN.)

III OPTIONAL FEATURE OPERATING DATA:

SUFFIX B (ISOLATION VALVES)
CK2 COCKS (B1) AND (B2) ARE USED TO ISOLATE THE PILOT SYSTEM FROM MAIN LINE PRESSURE. THESE VALVES MUST BE OPEN DURING NORMAL OPERATION.

SUFFIX D (CHECK VALVES WITH COCK):
WHEN OUTLET PRESSURE IS HIGHER THAN INLET PRESSURE, CHECK VALVE (D2) OPENS AND (D1) CLOSES. THIS DIRECTS THE HIGHER OUTLET PRESSURE INTO THE MAIN VALVE COVER AND THE MAIN VALVE CLOSES.

SUFFIX F (REMOTE PILOT SENSING)
REMOTE SENSING PRESSURE IS OBTAINED FROM A POINT UPSTREAM OF THE MAIN VALVE INLET. [SENSING PRESSURE IS OBTAINED FROM THE MAIN VALVE INLET IF SUFFIX (F) IS NOT SPECIFIED].

SUFFIX H (ATMOSPHERIC DRAIN)
PILOT SYSTEM DRAIN LINE IS DISCHARGED TO ATMOSPHERE. [PILOT SYSTEM DRAIN LINE IS CONNECTED TO THE MAIN VALVE OUTLET BOSS IF SUFFIX (H) IS NOT SPECIFIED.]

CAD REVISION RECORD - DO NOT REVISE MANUALLY

LTR	DESCRIPTION	BY	DATE
	SEE SHEET 1		

CLA-VAL CO. NEWPORT BEACH, CALIFORNIA

CATALOG NO.	DRAWING NO.	REV.
50-01/650-01	79488	F

TYPE OF VALVE AND MAIN FEATURES

PRESSURE RELIEF VALVE
(EQUIPPED WITH CLOSING SPEED CONTROL)

DESIGN		
DRAW	JD	11-30-78
CHK'D	CH	11-30-78
APV'D	WAL	11-30-78

OPERATING DATA

SUFFIX S (OPENING SPEED CONTROL)
FLOW CONTROL (S) CONTROLS THE OPENING SPEED OF THE MAIN VALVE. TURN THE ADJUSTING STEM CLOCKWISE TO MAKE THE MAIN VALVE OPEN SLOWER.

IV. CHECK LIST FOR PROPER OPERATION:

( ) SYSTEM VALVES OPEN UPSTREAM AND DOWNSTREAM.
( ) AIR REMOVED FROM THE MAIN VALVE COVER AND PILOT SYSTEM AT ALL HIGH POINTS.
( ) CK2 COCKS (B1), (B2) & (D3) OPEN (OPTIONAL FEATURE).
( ) PERIODIC CLEANING OF STRAINER (2) IS RECOMMENDED.

CAD REVISION RECORD - DO NOT REVISE MANUALLY

LTR	DESCRIPTION	BY	DATE
	SEE SHEET 1		

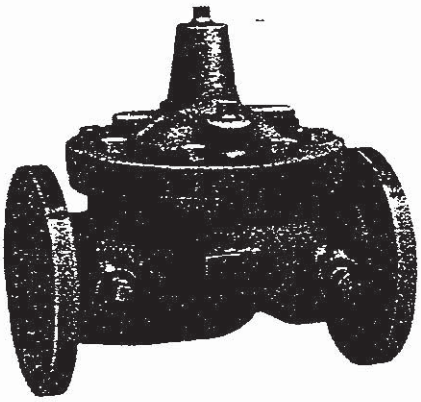
CLA-VAL CO.®

MODEL 100-01
Hytrol Valve

Description

The Cla-Val Model 100-01 Hytrol Valve is a main valve for Cla-Val Automatic Control Valves. It is a hydraulically operated, diaphragm-actuated, globe or angle pattern valve.

This valve consists of three major components; body, diaphragm assembly, and cover. The diaphragm assembly is the only moving part. The diaphragm assembly uses a diaphragm of nylon fabric bonded with synthetic rubber. A synthetic rubber disc, contained on three and one half sides by a disc retainer and disc guide, forms a seal with the valve seat when pressure is applied above the diaphragm. The diaphragm assembly forms a sealed chamber in the upper portion of the valve, separating operating pressure from line pressure.



Installation

1. Before valve is installed, pipe lines should be flushed of all chips, scale and foreign matter.

2. It is recommended that either gate or block valves be installed on both ends of the 100-01 Hytrol Valve to facilitate isolating the valve for preventive maintenance and repairs.

3. Place the valve in the line with flow through the valve in the direction indicated on the inlet nameplate. (See "Flow Direction" Section)

4. Allow sufficient room around valve to make adjustments and for disassembly.

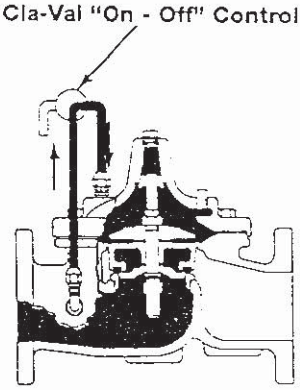
5. Cla-Val Co. 100-01 Hytrol Valves operate with maximum efficiency when mounted in horizontal piping with the cover **UP**, however, other positions are acceptable. Due to size and weight of the cover and internal components of 8 inch and larger valves, installation with the cover **UP** is advisable. This makes internal parts readily accessible for periodic inspection.

6. If a pilot control system is installed on the 100-01 Hytrol Valve, use care to prevent damage. If it is necessary to remove fittings or components, be sure they are kept clean and replaced exactly as they were.

7. After the valve is installed and the system is first pressurized, vent air from the cover chamber and tubing by loosening fittings at all high points.

Principle of Operation

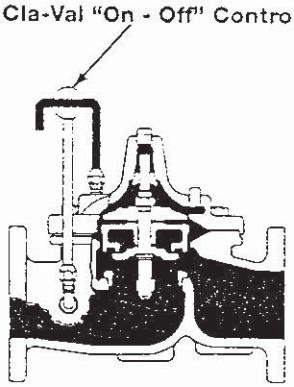
Cla-Val "On - Off" Control



Tight Closing Operation

When pressure from the valve inlet (or an equivalent independent operating pressure) is applied to the diaphragm chamber the valve closes drip-tight.

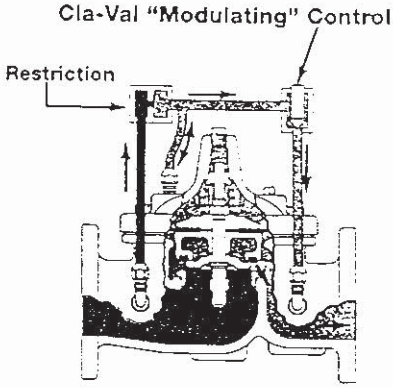
Cla-Val "On - Off" Control



Full Open Operation

When pressure in diaphragm chamber is relieved to a zone of lower pressure (usually atmosphere) the line pressure (5 psi Min.) at the valve seat opens the valve.

Cla-Val "Modulating" Control



Modulating Action

Valve modulates when diaphragm pressure is held at an intermediate point between inlet and discharge pressure. With the use of a Cla-Val Co. "modulating control," which reacts to line pressure changes, the pressure above the diaphragm is varied, allowing the valve to throttle and compensate for the changes.

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Flow Direction

The flow through the 100-01 Hytrol Valve can be in one of two directions. When flow is "up-and-over the seat ", it is in "normal" flow and the valve will fail in the open position. When flow is "over-the seat-and down", it is in "reverse" flow and the valve will fail in the closed position. **The valve must be installed according to nameplate data.**

Recommended Tools

1. Three pressure gauges with ranges suitable to the installation to be put at Hytrol inlet, outlet and cover connections.
2. Cla-Val Model X101 Valve Position Indicator. This provides visual indication of valve position without disassembly of valve.
3. Other items are: suitable hand tools such as screwdrivers, wrenches, etc., soft jawed (brass or aluminum) vise, 400 grit wet or dry sandpaper, and water for cleaning.

Troubleshooting

The following troubleshooting information deals strictly with the Model 100-01 "Hytrol Valve". This assumes that all other components of the pilot control system have been checked out and are in proper working condition. (See appropriate sections in Technical Manual for complete valve) All troubleshooting is possible without removing the valve from the line or removing the cover. It is highly recommended to permanently install a Model X101 Valve Position Indicator and three gauges in unused Hytrol inlet, outlet and cover connections.

SYMPTOM	PROBABLE CAUSE	REMEDY
Fails to Close	Closed cocks in control system, or in main line.	Open Cocks.
	Lack of cover chamber pressure.	Check upstreasm pressure, pilot system, strainer, tubing, cocks, or needle valves for obstruction.
	Diaphragm damaged. (See Diaphragm Check.)	Replace diaphragm.
	Diaphragm assembly inoperative. Corrosion or excessive scale build up on valve stem. (See Freedom of Movement Check)	Clean and polish stem. Inspect and replace any damaged or badly eroded part.
	Mechanical obstruction. Object lodged in valve. (See Freedom of Movement Check)	Remove obstruction.
	Worn disc. (See Tight Sealing Check)	Replace disc.
	Badly scored seat. (See Tight Sealing Check)	Replace seat.
Fails to Open	Closed upstream and/or downstream isolation valves in main line.	Open valves.
	Insufficient line pressure.	Check upstream pressure. (Minimum 5 psi flowing line pressure differential.)
	Diaphragm assembly inoperative. Corrosion or excessive buildup on valve stem. (See Freedom of Movement Check)	Clean and polish stem. Inspect and replace any damaged or badly eroded part.
	Diaphragm damaged. (For valves in "reverse flow" only)	Replace diaphragm.

After checking out probable causes and remedies in shaded portion of above chart, the following three checks can be used to diagnose the nature of the problem before maintenance is started. They must be done in the order shown.

Three Checks

The 100-01 Hytrol Valve has only one moving part (the diaphragm and disc assembly). So, there are only three major types of problems to be considered:

First: Valve is stuck - that is, the diaphragm assembly is not free to move through a full stroke either from open to close or vice versa.

Second: Valve is free to move and can't close because of a worn out diaphragm.

Third: Valve leaks even though it is free to move, and the diaphragm isn't leaking.

CAUTION: Care should be taken when doing these troubleshooting checks on the 100-01 Hytrol Valve. These checks do require the valve to open fully. This will either allow a high flow rate through the valve, or the downstream pressure will quickly increase to the inlet pressure. In some cases, this can be very harmful. Where this is the case, and there are no block valves in the system to protect the downstream piping, it should be realized that **the valve cannot be serviced under pressure.** Steps should be taken to remedy this situation before proceeding any further.

Diaphragm Check (#1)

1. Shut off pressure to the Hytrol Valve by slowly closing upstream and downstream isolation valves. **SEE CAUTION.**

2. Disconnect or close all control lines to the valve cover and leave only one fitting in highest point of cover open to atmosphere.

3. With the cover vented to atmosphere, slowly open upstream isolation valve to allow some pressure into the Hytrol Valve body. Observe the open cover tapping for signs of continuous flow. Volume in Cover Chamber Capacity Chart will be displaced as valve moves to open position. Allow sufficient time for diaphragm assembly to shift positions. If there is no continuous flow, you can be quite certain the diaphragm is sound and the diaphragm assembly is tight. If the fluid appears to flow continuously this is a good reason to believe the diaphragm is either damaged or it is loose on the stem. In either case, this is sufficient cause to remove the valve cover and investigate the leakage. (See "Maintenance" Section for procedure)

COVER CHAMBER CAPACITY
(Liquid Volume displaced when valve opens)

Valve size (inches)	Displacement	
	Gallons	Liters
1 1/4	.020	.07
1 1/2	.020	.07
2	.032	.12
2 1/2	.043	.16
3	.080	.30
4	.169	.64
6	.531	2.0
8	1.26	4.8
10	2.51	9.5
12	4.00	15.1
14	6.50	24.6
16	9.57	36.2

Freedom of Movement Check (# 2)

4. Determining the Hytrol Valve's freedom of movement can be done by one of two methods.

5. For most valves it can be done after completing Diaphragm Check (Steps 1, 2, and 3). **SEE CAUTION.** At the end of step 3 the valve should be fully open.

6. If the valve has a Cla-Val Co. X101 Position Indicator, observe the indicator to see that the valve opens wide. Mark the point of maximum opening.

7. Re-connect enough of the control system to permit the application of inlet pressure to the cover. Open pilot system cock so pressure flows from the inlet into the cover.

8. While pressure is building up in the cover, the valve should close smoothly. There is a hesitation in every Hytrol Valve closure, which can be mistaken for a mechanical bind. The stem will appear to stop moving very briefly before going to the closed position. This slight pause is caused by the diaphragm flexing at a particular point in the valve's travel and is not caused by a mechanical bind.

9. When closed, a mark should be made on the X101 Valve position indicator corresponding to the "closed" position. The distance between the two marks should be approximately the stem travel shown in chart.

STEM TRAVEL
(Fully Open to Fully Closed)

Valve Size (inches)		Travel (inches)	
Inches	MM	Inches	MM
1 1/4	32	0.4	10
1 1/2	40	0.4	10
2	50	0.6	15
2 1/2	65	0.7	18
3	80	0.8	20
4	100	1.1	28
6	150	1.7	43
8	200	2.3	58
10	250	2.8	71
12	300	3.4	86
14	350	4.0	100
16	400	4.5	114

10. If the stroke is different than that shown in stem travel chart this is a good reason to believe something is mechanically restricting the stroke of the valve at one end of its travel. If the flow does not stop through the valve when in the indicated "closed" position, the obstruction probably is between the disc and the seat. If the flow does stop, then the obstruction is more likely in the cover. In either case, the cover must be removed, and the obstruction located and removed. The stem should also be checked for scale build-up. (See "Maintenance" section for procedure.)

11. For valves 6" and smaller, the Hytrol Valve's freedom of movement check can also be done after all pressure is removed from the valve. **SEE CAUTION.** After closing inlet and outlet isolation valves and bleeding pressure from the valve, check that the cover chamber and the body are temporarily vented to atmosphere. Insert fabricated tool into threaded hole in top of valve stem, and lift the diaphragm assembly manually. Note any roughness. The diaphragm assembly should move smoothly throughout entire valve stroke. The tool is fabricated from rod that is threaded on one end to fit valve stem and has a "T" bar handle of some kind on the other end for easy gripping. (See chart in Step 4 of "Disassembly" Section.)

12. Place marks on this diaphragm assembly lifting tool when the valve is closed and when manually positioned open. The distance between the two marks should be approximately the stem travel shown in Stem Travel Chart. If the stroke is different than that shown, there is a good reason to believe something is mechanically restricting the stroke of the valve. The cover must be removed, and the obstruction located and removed. The stem should also be checked for scale build-up. (See "Maintenance" Section for procedure.)

Tight Sealing Check (# 3)

13. Test for seat leakage after completing checks #1 & #2 (Steps 1 to 12). **SEE CAUTION.** Close the isolation valve downstream of the Hytrol Valve. Apply inlet pressure to the cover of the valve, wait until it closes. Install a pressure gauge between the two closed valves. Watch the pressure gauge. If the pressure begins to climb, then either the downstream isolation valve is permitting pressure to creep back, or the Hytrol is allowing pressure to go through it. Usually the pressure at the Hytrol inlet will be higher than on the isolation valve discharge, so if the pressure goes up to the inlet pressure, you can be sure the Hytrol is leaking. Install another gauge downstream of isolating valve. If the pressure between the valves only goes up to the pressure on the isolation valve discharge, the Hytrol Valve is holding tight, and it was just the isolation valve leaking.

Maintenance

Preventative Maintenance

Cla-Val Co. Model 100-01 Hytrol Valves require no lubrication or packing and a minimum of maintenance. However, a periodic inspection schedule should be established to determine how the operating conditions of the system are affecting the valve. The effect of these actions must be determined by inspection.

Disassembly

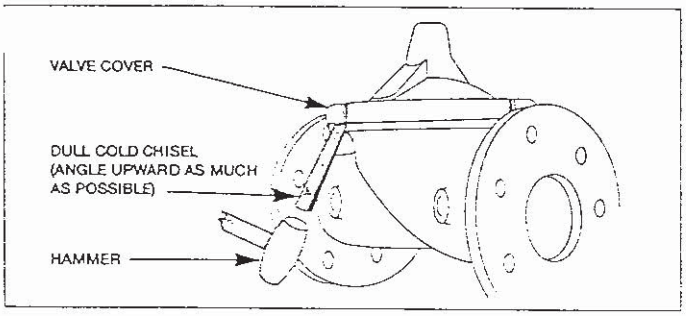
Inspection or maintenance can be accomplished without removing the valve from the line.

WARNING: Maintenance personnel can be injured and equipment damaged if disassembly is attempted with pressure in the system. **SEE CAUTION.**

1. Close upstream and downstream isolation valves **and independent operating pressure when used** to shut off all pressure to the valve.

2. Loosen tube fittings to remove pressure from valve body and cover chamber. After pressure has been released from the valve, use care to remove the controls and tubing. Note and sketch position of tubing and controls for reassembly. The schematic in front of the Technical Manual can be used as a guide when reassembling pilot system.

3. Remove cover nuts and remove cover. If the valve has been in service for any length of time, chances are the cover will have to be loosened by driving upward along the edge of the cover with a **dull** cold chisel.



On 6" and smaller valves, block and tackle or a power hoist can be used to lift valve cover by inserting proper size eye bolt in place of the center cover plug. On 8" and larger valves, there are 4 holes (5/8" — 11 size) where jacking screws may be inserted for lifting purposes. **Pull cover straight up** to keep from damaging the integral seat bearing and stem.

COVER CENTER PLUG SIZE

Valve Size	Thread Size (NPT)
1 1/4"—1 1/2"	1/4"
2"—3"	1/2"
4"—6"	3/4"
8"—10"	1"
12"	1 1/4"
14"	1 1/2"
16"	2"

4. Remove the diaphragm and disc assembly from the valve body. With smaller valves this can be accomplished by hand by **pulling straight up on the stem so as not to damage the seat bearing.** On large valves, an eye bolt of proper size can be installed in the stem and the diaphragm assembly can be then lifted with a block and tackle or power hoist. Take care not to damage the stem or bearing.

VALVE STEM THREAD SIZE

Valve Size	Thread Size (UNF Internal)
1 1/4"—2 1/2"	10—32
3"—4"	1/4—28
6"—14"	3/8—24
16"	1/2—20

5. The next item to remove is the stem nut. Examine the stem threads above the nut for signs of mineral deposits or corrosion. If the threads are not clean, use a wire brush to remove as much of the residue as possible. Attach a good fitting wrench to the nut and give it a sharp "rap" rather than a steady pull. Usually several blows are sufficient to loosen the nut for further removal. On smaller valves, the entire diaphragm assembly can be held by the stem in a vise **equipped with soft brass jaws** before removing the stem nut.

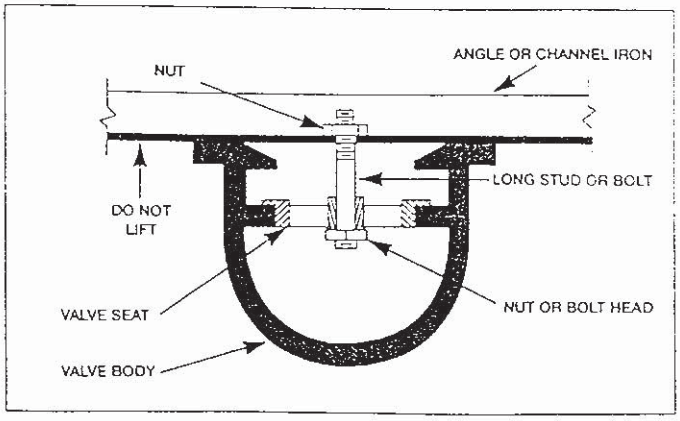
The use of a pipe wrench or a vise without soft brass jaws scars the fine finish on the stem. No amount of careful dressing can restore the stem to its original condition. Damage to the finish of the stem can cause the stem to bind in the bearings and the valve will not open or close.

6. After the stem nut has been removed, the diaphragm assembly breaks down into its component parts. Removal of the disc from the disc retainer can be a problem if the valve has been in service for a long time. Using two screwdrivers inserted along the outside edge of the disc usually will accomplish its removal. Care should be taken to preserve the spacer washers in water, particularly if no new ones are available for reassembly.

7. The only part left in the valve body is the seat which ordinarily does not require removal. Careful cleaning and polishing of inside and outside surfaces with 400 wet/dry sandpaper will usually restore the seat's sharp edge. If, however, it is badly worn and replacement is necessary, it can be easily removed.

Seats in valve sizes 1¼" through 6" can be removed with accessory X109 Seat Removing Tool available from the factory. On 8" and larger valves the seat is held in place by flat head machine screws. Use a tight-fitting, long shank screwdriver to prevent damage to seat screws. If upon removal of the screws the seat cannot be lifted out, it will be necessary to use a piece of angle or channel iron with a hole drilled in the center. Place it across the body so a long stud can be inserted through the center hole in the seat and the hole in the angle iron. By tightening the nut an upward force is exerted on the seat.

NOTE: Do not lift up on the end of the angle iron as this may force the integral bearing out of alignment, causing the stem to bind.



Lime Deposits

One of the easiest ways to remove lime deposits from the valve stem or other parts is to dip it in a 5-percent muriatic acid solution just long enough for the deposit to dissolve. This will remove most of the common types of deposits. **CAUTION: USE EXTREME CARE WHEN HANDLING ACID.** Rinse parts in water before handling. If the deposit is not removed by acid, then a fine grit (400) wet or dry sandpaper can be used with water.

Inspection of Parts

After the valve has been disassembled, each part should be examined carefully for signs of wear, corrosion, or any other abnormal condition. Usually, it is a good idea to replace the rubber parts (diaphragm and disc) unless they are free of signs of wear. These are available in a repair parts kit. Any other parts which appear doubtful should be replaced. **WHEN ORDERING PARTS, BE SURE TO GIVE COMPLETE NAMEPLATE DATA, ITEM NUMBER AND DESCRIPTION.**

NOTE: If a new disc isn't available, the existing disc can be turned over, exposing the unused surface for contact with the seat. The disc should be replaced as soon as practical.

Reassembly

1. Reassembly is the reverse of the disassembly procedure. If a new disc has been installed, it may require a different number of spacer washers to obtain the right amount of "grip" on the disc. When the diaphragm assembly has been tightened to a point where the diaphragm cannot be twisted, the disc should be compressed very slightly by the disc guide. Excessive compression should be avoided. Use just enough spacer washers to hold the disc firmly without noticeable compression.

2. MAKE SURE THE STEM NUT IS VERY TIGHT. Attach a good fitting wrench to the nut and give it a sharp "rap" rather than a steady pull. Usually several blows are sufficient to tighten the stem nut for final tightening. Failure to do so could allow the diaphragm to pull loose and tear when subjected to pressure.

3. Carefully install the diaphragm assembly by lowering the stem through the seat bearing. Take care not to damage the stem or bearing. Line up the diaphragm holes with the stud or bolt holes on the body. On larger valves with studs, it may be necessary to hold the diaphragm assembly up part way while putting the diaphragm over the studs.

4. Put spring in place and replace cover. Make sure diaphragm is lying smooth under the cover.

5. Tighten cover nuts firmly using a cross-over pattern until all nuts are tight.

6. Test Hytrol Valve before re-installing pilot valve system.

Test Procedure After Valve Assembly

There are a few simple tests which can be made in the field to make sure the Hytrol Valve has been assembled properly. Do these before installing pilot system and returning valve to service.

1. Check the diaphragm assembly for freedom of movement after all pressure is removed from the valve. **SEE CAUTION.** Insert fabricated tool into threaded hole in top of valve stem, and lift the diaphragm assembly manually. Note any roughness, sticking or grabbing. The diaphragm assembly should move smoothly throughout entire valve stroke. The tool is fabricated from rod that is threaded on one end to fit valve stem (See chart in Step 4 of "Disassembly" Section.) and has a "T" Bar handle of some kind on the other end for easy gripping.

Place marks on this diaphragm assembly lifting tool when the valve is closed and when manually positioned open. The distance between the two marks should be approximately the stem travel shown in Stem Travel Chart. (See "Freedom of Movement Check" section.) If the stroke is different than that shown, there is a good reason to believe something is mechanically restricting the stroke of the valve. The cover must be removed, the obstruction located and removed. (See "Maintenance" Section for procedure.)

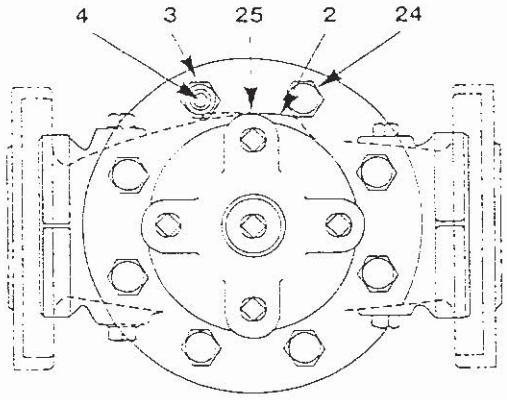
Due to the weight of the diaphragm assembly this procedure is not possible on valves 8" and larger. On these valves, the same determination can be made by carefully introducing a low pressure (less than five psi) into the valve body with the cover vented. **SEE CAUTION.** Looking in cover center hole see the diaphragm assembly lift easily without hesitation, and then settle back easily when the pressure is removed.

2. To check the valve for drip-tight closure, a line should be connected from the inlet to the cover, and pressure applied at the inlet of the valve. If properly assembled, the valve should hold tight with as low as ten PSI at the inlet. (See "Tight Sealing Check" section.)

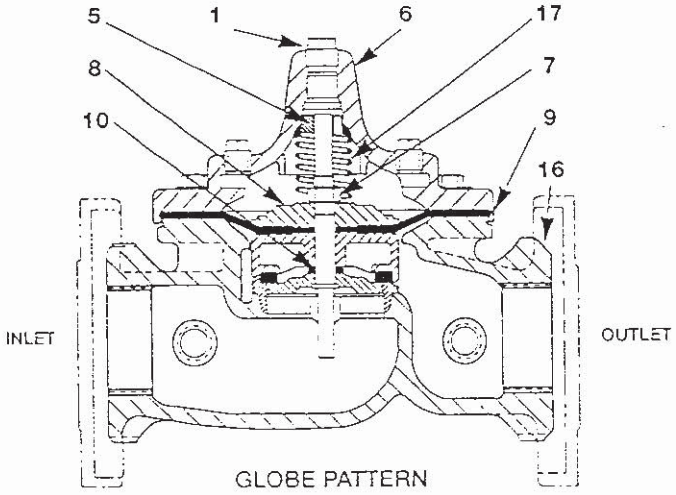
3. With the line connected from the inlet to the cover, apply full working pressure to the inlet. Check all around the cover for any leaks. Re-tighten cover nuts if necessary to stop leaks past the diaphragm.

4. Remove pressure, then re-install the pilot system and tubing exactly as it was prior to removal. **Bleed air from all high points.**

5. Follow steps under "Start-Up and Adjustment" Section in Technical Manual for returning complete valve back to service.



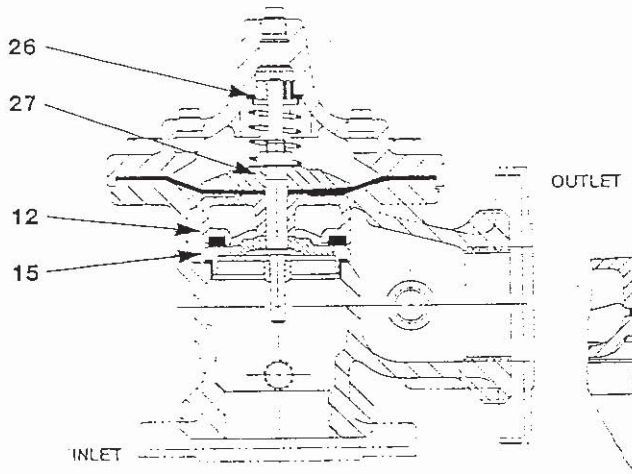
TOP VIEW



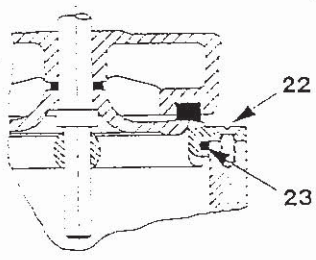
GLOBE PATTERN

PARTS LIST

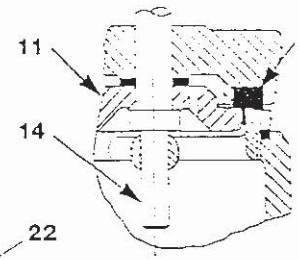
ITEM NO.	DESCRIPTION
1	Pipe Plug
2	Drive Screws (for nameplate)
3	Hex Nut (6" and larger)
4	Stud (6" and larger)
5	Cover Bearing
6	Cover
7	Stem Nut
8	Diaphragm Washer
9	Diaphragm
10	Spacer Washers
11	Disc Guide
12	Disc Retainer
13	Disc
14	Stem
15	Seat
16	Body
17	Spring
22	Flat Head Screws (8" and larger)
23	Seat O-Ring
24	Hex head Bolt (1¼" Thru 4")
25	Nameplate
26	Upper Spring Washer (Epoxy coated valves only)
27	Lower Spring Washer (Epoxy coated valves only)
28	Cover Bearing Housing (16" only)
29	Cover O-Ring (16" only)
30	Hex Bolt (16" only)
31	Pipe Cap (16" only)



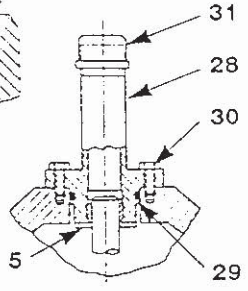
ANGLE PATTERN



8" – 16" SEAT DETAIL



1¼" – 6"
SEAT DETAIL



16" COVER DETAIL

CLA-VAL CO
P O Box 1325
Newport Beach CA 92659-0325
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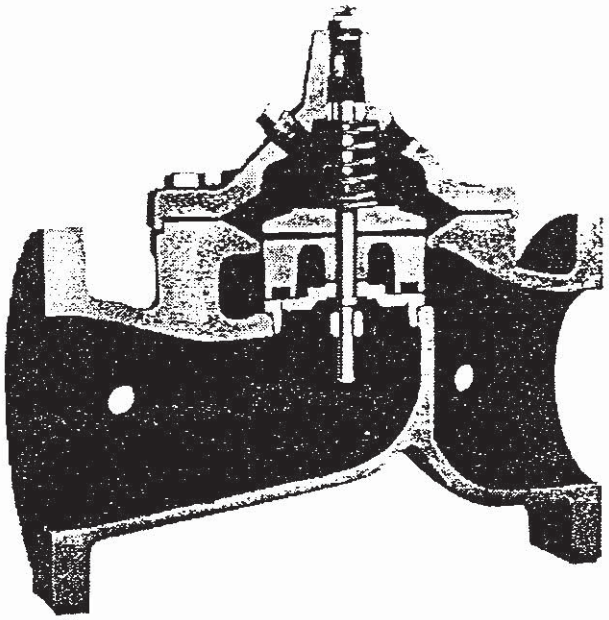
Fax: 714-548-5441

CLA-VAL CANADA LTD.
4687 Christie Drive
Beamsville, Ontario
Canada L0R 1B4
Phone: 905-563-4963
Fax: 905-563-4040

CLA-VAL™

—MODEL— **100-20**

600 Series
Hytrol Valve



- Reduced Cavitation Design
- Drip-Tight, Positive Seating Action
- Service Without Removal From Line
- Globe or Angle Pattern
- Every Valve Factory-Tested

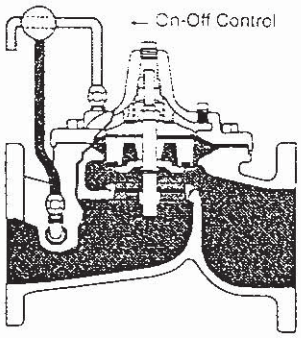
The Cla-Val Model 100-20 Hytrol Valve is a hydraulically operated, diaphragm actuated, globe or angle pattern valve. It consists of three major components: the body, diaphragm assembly and cover. The diaphragm assembly is the only moving part.

The diaphragm assembly is guided top and bottom by a precision machined stem which utilizes a non-wicking diaphragm of nylon fabric bonded with synthetic rubber. A resilient synthetic rubber disc, retained on three and one-half sides by a disc retainer, forms a drip-tight seal with the renewable seat when pressure is applied above the diaphragm.

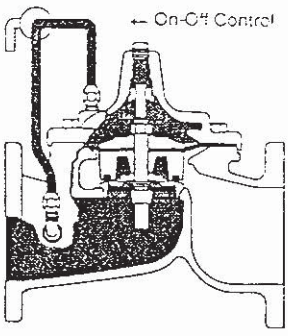
The reduced cavitation characteristics of the 100-20 Hytrol Valve is the basis for the Cla-Val 600 Series. The rugged simplicity of design and packless construction assure a long life of dependable, trouble-free operation. It's smooth flow passages and fully guided disc and diaphragm assembly assure optimum control when used in piping systems requiring remote control, pressure regulation, solenoid operation, rate of flow control or check valve operation.

Available in various materials and in a wide range of sizes. It's applications are unlimited.

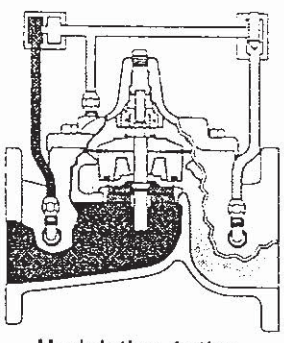
Principle of Operation



Full Open Operation
When pressure in the cover chamber is relieved to a zone of lower pressure, the line pressure at the valve inlet opens the valve, allowing full flow.



Tight Closing Operation
When pressure from the valve inlet is applied to the cover chamber, the valve closes drip-tight.

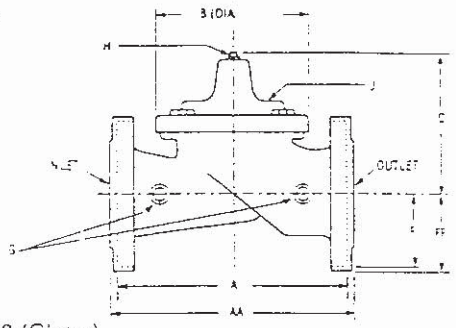


Modulating Action
The valve holds any intermediate position when operating pressure is equal above and below the diaphragm. Using a Cla-Val "Modulating" Control will allow the valve to automatically compensate for line pressure changes.

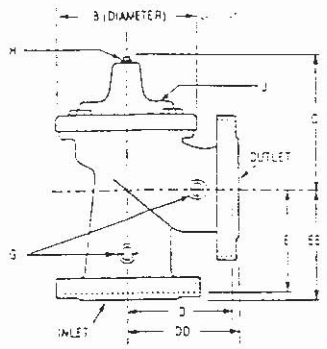
CLA-VAL™

Dimensions

Model 100 -20



100-20 (Globe)



100-20 (Angle)

VALVE SIZE (Inches)	3	4	6	8	10	12	16	20	24
A 150 ANSI	10.25	13.88	17.75	21.38	26.00	30.00	35.00	48.00	48.00
AA 300 ANSI	11.00	14.50	18.62	22.38	27.38	31.50	36.62	49.62	49.75
B DIA.	6.62	9.12	11.50	15.75	20.00	23.62	28.00	35.44	35.44
C MAX.	7.00	8.62	11.62	15.00	17.88	21.00	25.75	31.00	31.00
D 150 ANSI	—	6.94	8.68	10.69	—	—	—	—	—
DD 300 ANSI	—	7.25	9.38	11.19	—	—	—	—	—
E 150 ANSI	—	5.50	6.75	7.25	—	—	—	—	—
EE 300 ANSI	—	5.81	7.25	7.75	—	—	—	—	—
F 150 ANSI	3.75	4.50	5.50	6.75	8.00	9.50	11.75	14.56	17.00
FF 300 ANSI	4.12	5.00	6.25	7.50	8.75	10.25	12.75	16.06	19.00
G NPT Body Tapping	⅜	½	¾	¾	1	1	1	1	1
H NPT Cover Center Plug	⅛	¼	¾	¾	1	1	1¼	2	2
J NPT Cover Tapping	⅜	½	¾	¾	1	1	1	1	1
Valve Stem Internal Thread UNF	10-32	¼-28	⅜-28	½-24	⅝-24	¾-24	⅞-24	1-20	1-20
Stem Travel	0.6	0.8	1.1	1.7	2.3	2.8	3.4	4.5	4.5
Approx Ship Wt. Lbs.	45	85	195	330	625	900	1380	2551	2733

VALVE SIZE (mm)	80	100	150	200	250	300	400	508	609
A 150 ANSI	260	353	451	543	660	762	889	1219	1219
AA 300 ANSI	279	368	473	568	695	800	930	1260	1263
B DIA.	168	232	292	400	508	600	711	900	900
C MAX.	178	219	295	381	454	533	654	787	787
D 150 ANSI	—	176	226	272	—	—	—	—	—
DD 300 ANSI	—	184	238	284	—	—	—	—	—
E 150 ANSI	—	140	171	184	—	—	—	—	—
EE 300 ANSI	—	148	184	197	—	—	—	—	—
F 150 ANSI	95	114	140	172	203	241	299	370	432
FF 300 ANSI	105	127	159	191	222	260	324	408	483
G NPT Body Tapping	¾	½	¾	¾	1	1	1	1	1
H NPT Cover Center Plug	⅛	¼	¾	¾	1	1	1¼	2	2
J NPT Cover Tapping	⅜	½	¾	¾	1	1	1	1	1
Valve Stem Internal Thread UNF	10-32	¼-28	⅜-25	½-24	⅝-24	¾-24	⅞-24	1-20	1¼-20
Stem Travel	15	20	28	43	58	71	86	114	114
Approx. Ship Wt. Kgs.	21	39	89	150	283	408	626	1157	1240

Service

For continued effective operation of Cla-Val Automatic control valves, a regular maintenance program should be established based on specific applications; however, we recommend a thorough inspection of the valve at least once a year.

We recommend an isolation valve be installed on the inlet and outlet of any automatic control valve to provide for repair and maintenance. Additional working space above and around the valve for the service maintenance personnel should be considered essential.

CLA-VAL CO.
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Lausanne, Switzerland
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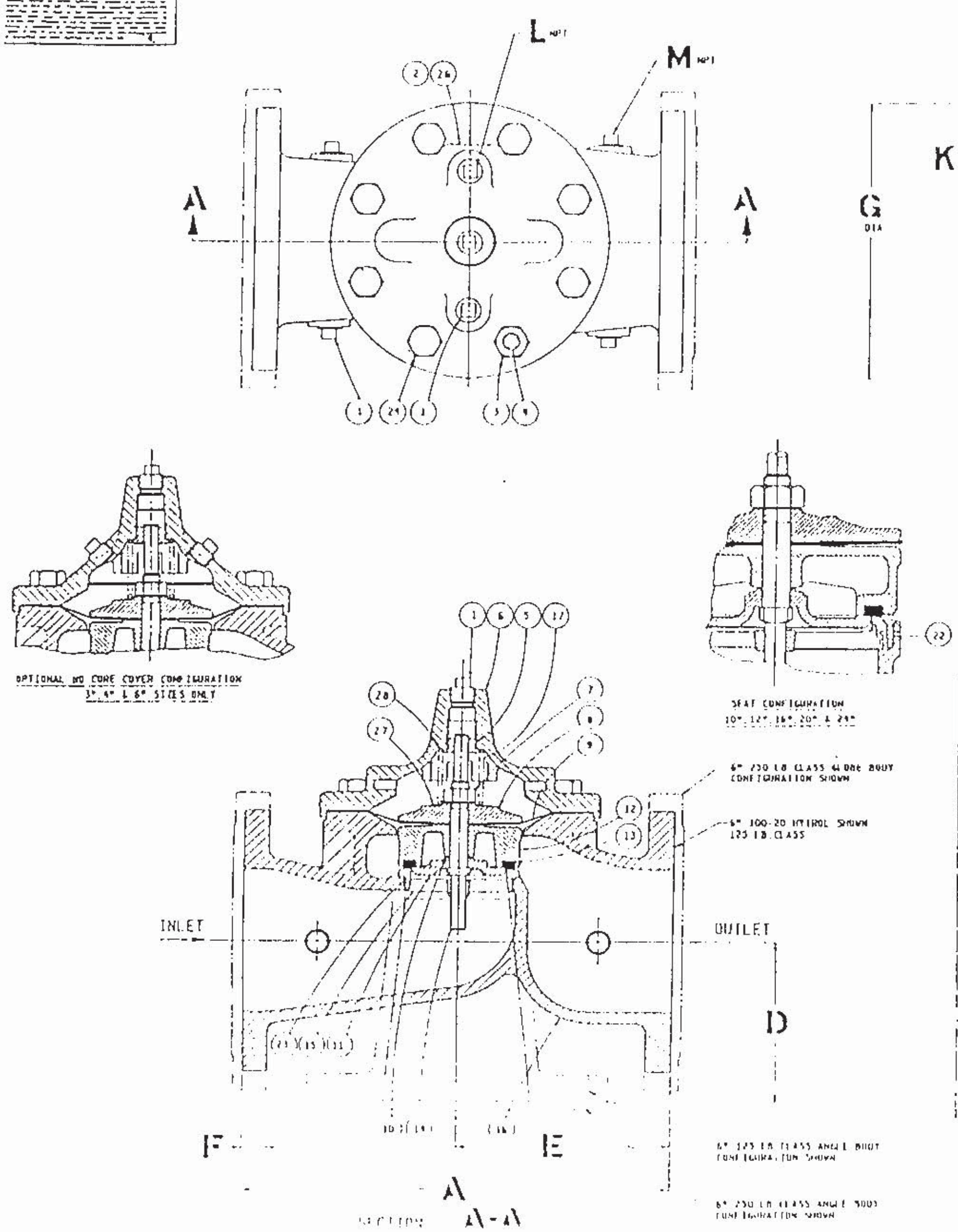
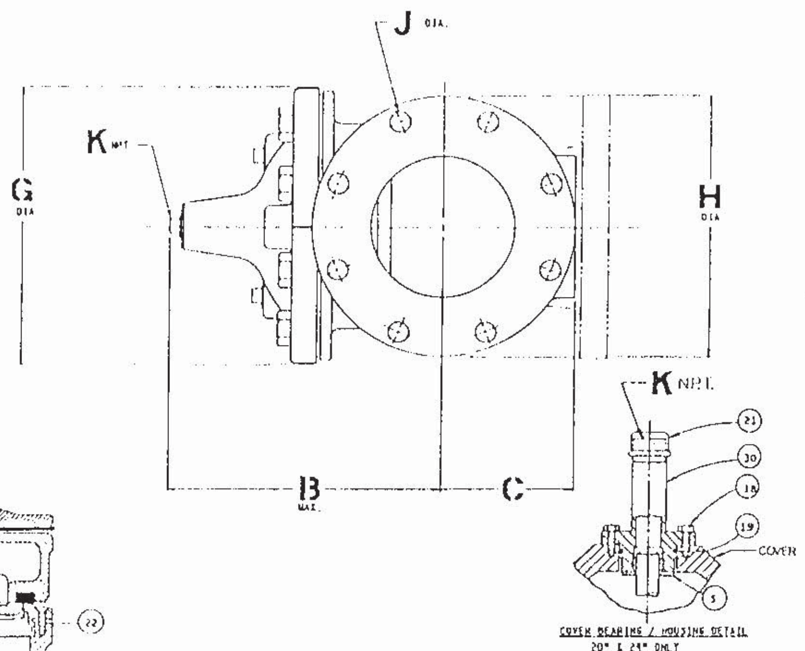
Fax: 21/646.49.59

Represented By:

CLA-VAL

E-100-20 (R6/94)





PARTS LIST

	ITEM NO	DESCRIPTION	
	1	PLUG, PIPE	
	2	SCREW, DRIVE	
	3	NUT, HEX (8", 10", 12", 16", 20", & 24"	A/R
	4	STUD, THREADED (8", 10", 12" 16", 20", & 24"	A/R
	5	BEARING, COVER	1
	6	COVER	1
	7	NUT, STEM	1
•	8	WASHER, DIAPHRAGM	1
•	9	DIAPHRAGM	1
	10	WASHER, SPACER	A/R
	11	GUIDE, DISC	1
	12	RETAINER, DISC	1
•	13	DISC	1
	14	STEM	1
	15	SEAT	1
	16	BODY	1
	17	SPRING	1
	18	BOLT HEX HD. (20" & 24" ONLY)	8
•	19	O-RING (20" & 24" ONLY)	1
	21	CAP, PIPE (20" & 24" ONLY)	1
	22	SCREW, FLAT HD. (10" THRU 24" ONLY)	A/R
	23	O-RING, SEAT	1
	24	BOLT, HEX HD (3", 4", & 6" ONLY)	A/R
	26	NAMEPLATE	1
	27	WASHER, SPRING, UPPER (100-20KC)	1
	28	WASHER, SPRING, LOWER (100-20KC)	1
	30	HOUSING, COVER BEARING (20" & 24")	1

• RECOMMENDED SPARE PARTS

DIMENSION TABLE

VALVE SIZE *	PRESSURE CLASS	A	B MAX	C	D	E	F	G DIA	H DIA	J DIA	BOLT CIRCLE DIA.	NO OF BOLT HOLES	K NPT	L NPT	M NPT
3"	125 LB	10.25	7.00	3.75			.75/.81	6.62	7.50	.750	6.000	4	1/2"	3/8"	3/8"
	250 LB.	11.00		4.12			1.12/1.19		8.25	.875	6.625	8			
4"	125 LB.	13.88	8.62	4.50	5.50	6.94	.94/1.00	9.12	9.00	.750	7.500			1/2"	1/2"
	250 LB.	14.50		5.00	5.81	7.25	1.25/1.31		10.00	.875	7.875				
6"	125 LB.	17.75	11.62	5.50	6.75	8.44	1.00/1.06	11.50	11.00		9.500		3/4"	3/4"	3/4"
	250 LB	18.62		6.25	7.25	9.38	1.44/1.50		12.50		10.625	12			
8"	125 LB	21.38	15.00	6.75	7.25	10.69	1.12/1.19	15.75	13.50		11.750	8			
	250 LB	22.38		7.50	7.75	11.19	1.62/1.69		15.00	1.000	13.000	12			
10"	125 LB	26.00	17.88	8.00			1.19/1.25	20.00	16.00		14.250		1"	1"	1"
	250 LB	27.38		8.75			1.88/1.94		17.50	1.125	15.250	16			
12"	125 LB	30.00	22.00	9.50			1.25/1.31	23.62	19.00	1.000	17.000	12			
	250 LB	31.50		10.25			2.00/2.06		20.50	1.250	17.750	16			
16"	125 LB	35.00	25.75	11.75			1.44/1.50	28.00	23.50	1.125	21.250		1-1/4"		
	250 LB	36.62		12.75			2.25/2.31		25.50	1.375	22.500	20			
20"	125 LB.	46.00	31.00	14.56			1.69/1.75	35.44	27.50	1.250	25.000	20	2"		
	250 LB.	49.62		16.06			2.50/2.56		30.50	1.375	27.000	24			
24"	125 LB	46.00	31.00	17.00			1.88/1.94	35.44	32.00	1.375	29.500	20			
	250 LB	49.75		19.00			2.75/2.81		36.00	1.688	32.000	24			

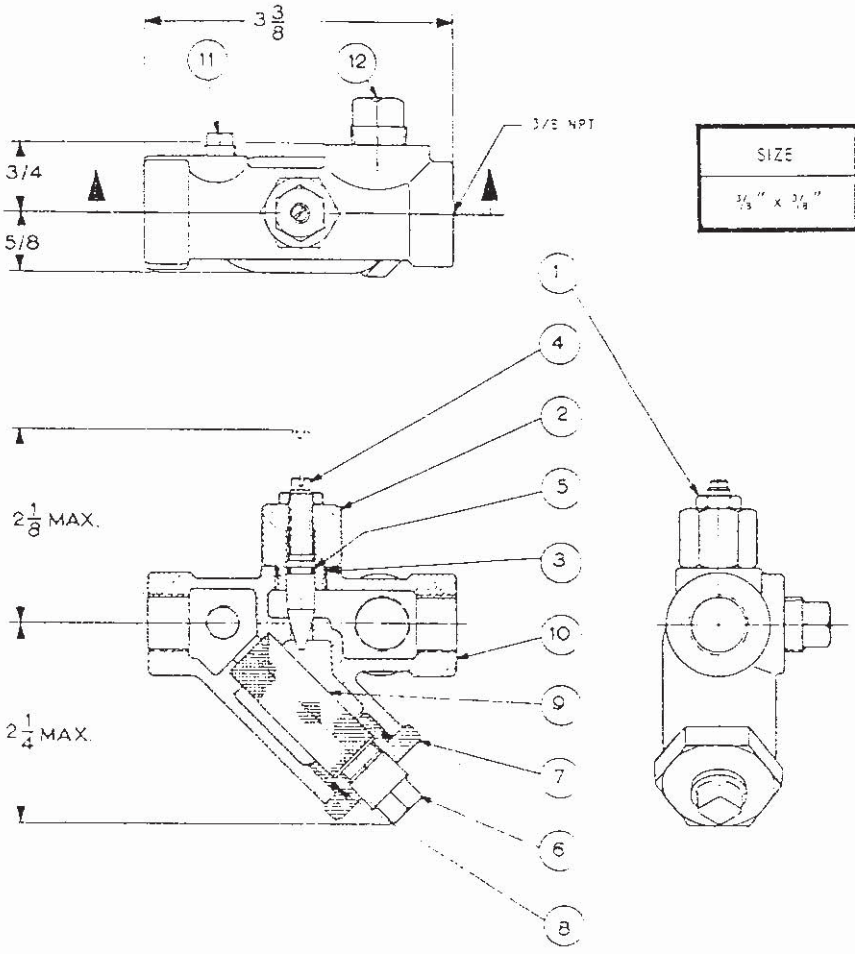
* ANGLE BODY STYLE CONFIGURATION AVAILABLE IN 4", 6" & 8" SIZES ONLY

16399

C ERROR, ECO 10114 (C) ... 8-93
B ADDED PARTS LIST TO ECO 10270 ... 2-89
A ADDED 20" & 24" VALVE COVER

3", 4", 6", 8", 10", 12", 16", 20", & 24"
100-20 HYTROL

C	CLA-VAL CO.	PARTS LIST
	STRAINER AND NEEDLE VALVE ASSEMBLY	X-42N-2



SIZE	STOCK NUMBER
3/8" x 3/8"	68372

ITEM	DESCRIPTION	MATERIAL	PART NO.
1	Jam Nut—Hex	Sil Brz	67798-01
2	Bonnet	S.S.	67910
3	"O" Ring—Bonnet	Syn Rub	00713
4	Stem	S.S.	67907
5	"O" Ring—Stem	Syn Rub	00708
6	Plug—Pipe 1/4		
7	Strainer Plug		
8	"O" Ring—Plug		
9	Screen	Monel	68373
10	Body	Rd Brs	67905
11	Plug—Pipe 1/8	Brass	67660-01
12	Plug—Pipe 3/8	Brass	67660-03

When ordering parts specify:

- All nameplate data
- Item Number
- Description

CLA-VAL CO. Newport Beach, California U.S.A.
CLA-VAL CANADA LTD. Beamsville, Ontario, Canada

C CLA-VAL CO.

INSTALLATION / OPERATION / MAINTENANCE

PRESSURE RELIEF CONTROL

Model CRL

DESCRIPTION

Model CRL Pressure Relief Control is a direct-acting, spring-loaded, diaphragm type relief valve. It may be used as a self-contained valve or as a pilot control for a Cla-Val Hytrol valve. It opens and closes within very close pressure limits.

INSTALLATION

The pressure Relief Control may be installed in any position. The control body (7) has one inlet and one outlet port with a side pipe plug (24) at each port. These plugs are used for control plumbing or gauge applications. The inlet in the power unit body (6) is the sensing line port. A flow arrow is marked on the body casting.

OPERATION

The pressure Relief Control is normally held closed by the force of the compression spring above the diaphragm; control pressure is applied under the diaphragm.

When the controlling pressure exceeds the spring setting, the disc is lifted off its seat, permitting flow through the control.

When controlling pressure drops below spring setting, the spring returns the control to its normally closed position.

ADJUSTMENT

The pressure Relief Control can be adjusted to provide a relief setting at any point within the range stamped on the data plate.

Pressure adjustment is made by turning the adjustment screw (9) to vary the spring pressure on the diaphragm. Turning the adjustment screw clockwise increases the pressure required to open the valve. Counterclockwise decreases the pressure required to open the valve.

When pressure adjustments are complete the jam nut (10) should be tightened and the protective cap (1) replaced. If there is a proble of tampering, lock wire holes have been provided in cap and cover. Wire the cap to cover and secure with lead seal.

DISASSEMBLY

The Pressure Relief Control does not need to be removed from the line for disassembly. Make sure that pressure shut down is accompanied prior to disassemoly. If the Pressure Relief Control is removed from the line for disassembly be sure to use a soft jawed vise to hold body during work.

Refer to Parts List Drawing for item numbers.

1. Remove cap (1), loosen jam nut (10) and turn adjusting screw counterclockwise until spring tension is relieved.
2. Remove the eight screws (4) holding the cover (3) and powerunit body (6). Hold the cover and powerunit together and place on a suitable work surface. See NOTE under REASSEMBLY.
3. Remove the cover (3) from powerunit body (6). The spring (12) and two spring guides (11).
4. Remove nut (13) from stem (19) and slide off the belleville washer (14), the upper diaphragm washer (15) and the diaphragm (16).
5. Pull the stem (19) with the disc retainer assembly (21) through the bottom of powerunit. The lower diaphragm washer (17) will slide off of stem top.
6. Remove jam nut (23) and disc retainer assembly (21) from stem. Use soft jawed pliers or vise to hold stem. The polished surface of stem must not be scored or scratched.
7. The seat (22) need not be removed unless it is damaged. If removal is necessary use proper size socket wrench and turn counterclockwise.
   Note: Some models have an integral seat in the body (7)

See PL-CRL on reverse side for PART ITEM Reference

INSPECTION

Inspect all parts for damage, or evidence of cross-threading. Check diaphragm and disc retainer assemoly for tears, abrasion or,other damage. Check all metal parts for damage, corrosion, or excessive wear.

REPAIR AND REPLACEMENT

Minor nicks and scratches may be polished out using fine emery or crocus cloth. Replace all "O" rings and any damaged parts.

When ordering replacement parts, be sure to specify parts list item number and all name plate data.

REASSEMBLY

In general, reassembly is the reverse of disassemoly, however, the following steps should be observed:

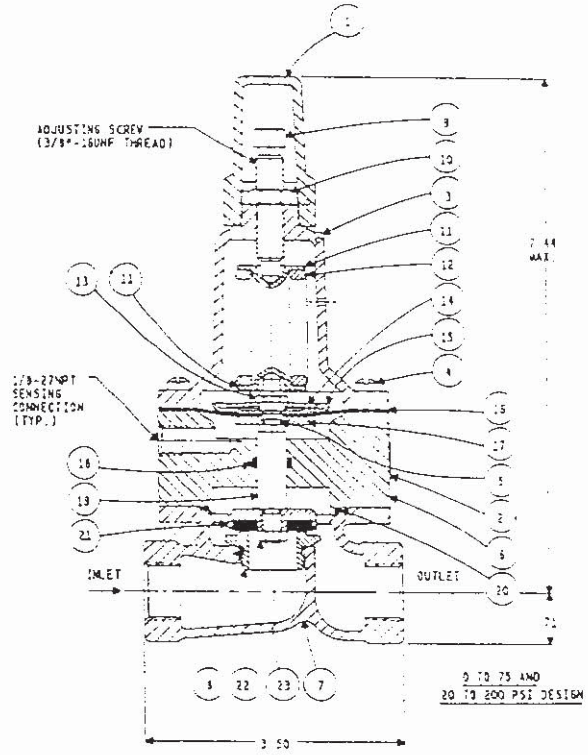
1. Lubricate the "O" ring (18) with a good grade of waterproof grease, Dow Corning 44 medium grade or equal. Use grease soaringly and install "O" ring in powerunit body (6).
2. Install stem (19) in powerunit body (6). Use a rotating motion with minimum pressure to let stem pass through "O" ring.
3. Install "O" ring (5) at top of stem (19). Place lower diaphragm washer (17) on the stem with the serrated side up. Position diaphragm (16), upper diaphragm washer (15), with serrations down, and belleville washer (14) with concave side down.
4. Position powerunit body (6) as shown on parts list drawing (top view).
5. Continue reassembly as outlined in disassemoly steps 1 through 3.
   Note: Item (4) will have a quantity of 8 for the 3-75 and 20-200psi design and a quantity of 4 for the 100-300psi design. Item (25) is used on the 100-300psi design only. Install item (25), before item 4) for preload of item (12) spring.

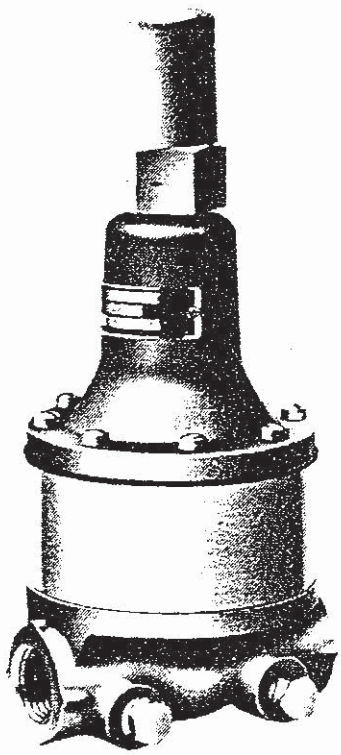
SERVICE SUGGESTIONS

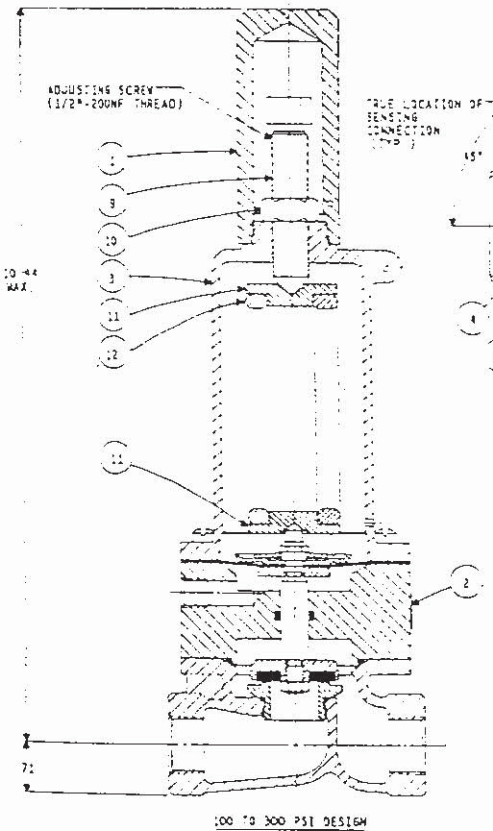
SYMPTOM	PROBABLE CAUSE	REMEDY
Fails to open	Controlling pressure too low	Back off adjusting screw until valve opens
Fails to open with spring compression removed.	Mechanical obstruction corrosion, scale build-up on stem.	Disassemble, locate, and remove obstruction, scale
Leakage from cover vent hole when controlling pressure is applied	Diaphragm damage	Disassemble, replace damaged diaphragm.
	Loose diaphragm assembly.	Tighten upper diaphragm washer
Fails to close.	No spring compression	Re-set pressure adjustment
Fails to close with spring compressed	Mechanical obstruction	Disassemble, locate and remove obstruction.

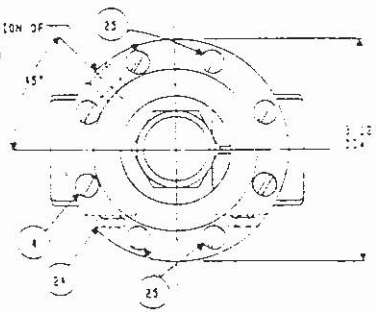
CLA-VAL CO. Newport Beach California U.S.A.
CLA-VAL CANADA LTD. Beamsville Ontario Canada

C	CLA-VAL CO.	PARTS LIST
	PRESSURE RELIEF CONTROL	1/2" & 3/4" Model CRL

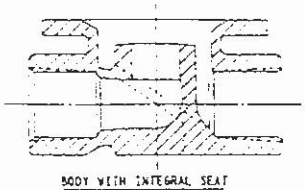








CRL RANGE PSI	APPROXIMATE INCREASE FOR EACH CLOCKWISE TURN OF ADJUSTING SCREW
0 TO 75	8.5 PSI
20-TO 200	28.0 PSI
100 TO 300	18.0 PSI



ITEM NO.	DESCRIPTION	QTY.
1	CAP	1
2	NAMEPLATE	1
3	COVER	1
4	SCREW, FIL. HD. #10-32 X .188 LG. SEE NOTE 2.	4/8
* 5	O-RING	2
6	BODY, POWERUNIT	1
7	BODY	1
* 8	O-RING, SEAT	1
9	SCREW, ADJUSTING	1
10	NUT, HEX	1
11	GUIDE, SPRING	2
12	SPRING	1
13	NUT, STEM	1
14	WASHER, BELLEVILLE	1
15	WASHER, DIAPHRAGM (UPPER)	1
* 16	DIAPHRAGM	1
17	WASHER, DIAPHRAGM (LOWER)	1
* 18	O-RING	1
* 19	STEM	1
20	O-RING	1
21	RETAINER ASSEMBLY, DISC	1
22	SEAT	1
23	NUT, HEX	1
24	PLUG, PIPE SQ. HD.	2
25	SCREW, FIL. HD. #10-32 X 2.25 LG. SEE NOTE 2.	4

* = RECOMMENDED SPARE PARTS

NOTES:
1. INSTALL ITEM NO.25 (SCREW) BEFORE ITEM NO.4 (SCREW) FOR PRELOAD OF ITEM NO.12 (SPRING).
2. ITEM NO 4 WILL HAVE A QUANTITY OF 8 FOR THE 0-75 & 20-200 PSI DESIGN AND A QUANTITY OF 4 FOR THE 100-300 PSI DESIGN. ITEM NO.25 IS USED ON THE 100-300 PSI DESIGN ONLY.

When ordering parts specify:

- All nameplate data
- Item Number
- Description
- *Recommended Spare Parts

CLA-VAL CO. Newport Beach, California U.S.A.
CLA-VAL CANADA LTD. Beamsville, Ontario, Canada

CLA-VAL

REGULATOR SPRING COLOR CODING CHART

DWG. No. 47117
Sheet 1 of 1

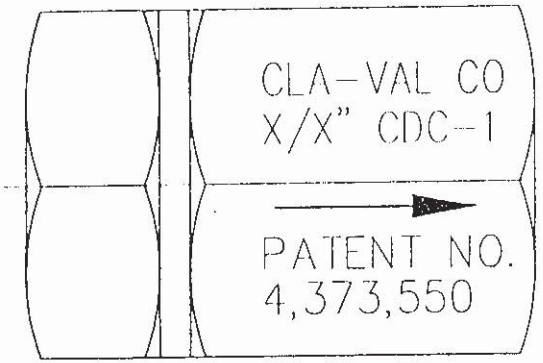
* THESE FIGURES ARE ONLY APPROXIMATE. FINAL ADJUSTMENTS SHOULD BE MADE WITH A PRESSURE GAGE.

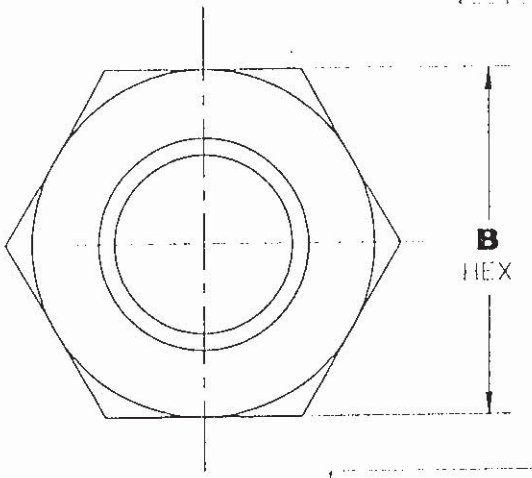
WIRE SIZE	SPRING NUMBER	COLOR	WIRE MATERIAL	CATALOG NUMBER	PSI RANGE	*PSI PER TURN
.080 DIA	C0492D	BLUE	S.S.	CDB-7 CRL-5	0-7 0-7	.75 .75
.080 DIA	82575C	*	S.S.	CRD CRD-10A	1.9-6.5 1.9-6.5	.61 .49
.116 DIA	81594E	*	S.S.	CRD CRD-10A	2.30 2.30	3.0 2.4
.120 DIA	V5654J	GREEN	CHR VAN	CRL-5 CRD	5-25 10-40	4.0 4.0
.162 DIA	32447F	NATURAL	S.S.	CDB-7 CRL-5 CRD	10-60 10-60 20-80	12.0 12.0 10.5
.162 DIA	32656B	*	INCONEL	CRL-5M	10-70	13.3
.162 DIA	V5695B	YELLOW	MUSIC WIRE	CDB-7 CRL-5 CRD	20-80 20-80 30-110	14.5 14.5 13.0
.207 DIA	C1124B	CAD PLT	MUSIC WIRE	CDB-7 CRD CRL-5	50-150 50-150 50-150	29.5 30.0 29.5
.225 DIA	V6515A	RED	MUSIC WIRE	CDB-7 CRD CRL-5	65-180 90-200 65-185	44.0 47.0 44.0
.312 DIA	31554K	CAD PLT	CHR VAN	CRL-4A	30-300	10.0
.115 X .218	71884B	RED	CHR VAN	CRL CRD CRD-10A	0-75 15-75 15-75	8.5 9.0 7.2
.118 X .225	71885J	GREEN	CHR VAN	CRL CRD CRD-10A	20-200 30-300 30-300	28.0 27.0 22.4
.225 X .295	1630201A	CAD PLT	CHR VAN	CRL	100-300	18.0
.225 X .350	44591G	CAD PLT	CHR VAN	CRD-16	30-300	14.5
.440 X .219	48211H	CAD PLT	STEEL	CRA-16 CRD-22 CRL-4A	200-450 200-450 100-450	17.0 17.0 17.0

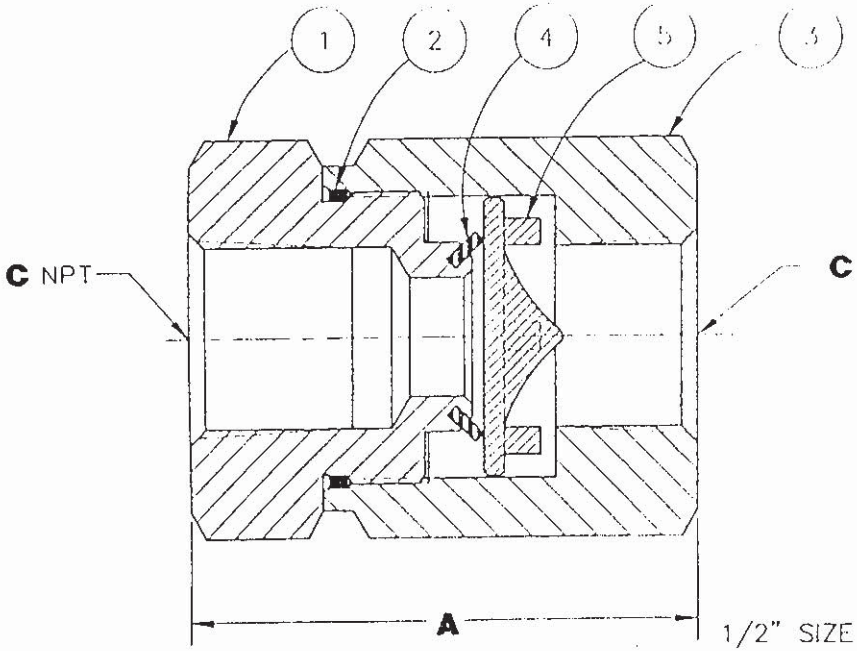
WIRE SIZE	SPRING NUMBER	COLOR	WIRE MATERIAL	CATALOG NUMBER	RANGE FEET	*FEET PER TURN
.080 DIA	C0492D	BLUE	S.S.	CRD-2	4.5-15	.82
.120 DIA	V5654J	GREEN	CHR VAN	CRD-2	10-70	7.0
.162 DIA	V5695B	YELLOW	MUSIC WIRE	CRD-2	50-170	26.0
.375 DIA	87719B 1 SPRING 2 SPRINGS 3 SPRINGS 4 SPRINGS 5 SPRINGS	EPOXY COATED	CHROME SILICON	CDS-5	5-40 30-80 70-120 110-160 150-200	1.0 2.0 3.0 4.0 5.0
.072 DIA	V5097A	*	302SS	CVC	1-17	.7

DWG NO 98345 | SH 1 | REV E

REVISION			
REV	DESCRIPTION	DATE	APPROVED
A-D	SEE REVISION FILE		
E	REVISED & REDRAWN ON CAD, WAS "D" SIZE (ECO 14229)	11 18 93	LK







1/2" SIZE SHOWN

DESCRIPTION	A	B HEX	C NPT
3/8" CHECK VALVE	2.06	1.06	.38 (3/8)-18 NPT
1/2" CHECK VALVE	2.12	1.38	.50 (1/2)-14 NPT

ITEM NO	QTY REQD	NOMENCLATURE OR DESCRIPTION
5	1	PLATE, VALVE
4	1	SEAL, VALVE RING
3	1	RETAINER, VALVE
2	1	O-RING
1	1	RETAINER, SEAL

PARTS LIST

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS 1/32 DECIMALS XXX .03 XXXX .010 ANGULAR ± 5°
SURFACE FINISH 125
BREAK CORNERS .010 MAX
--DO NOT SCALE DRAWING--

CONTRACT NO. — — — — —

APPROVALS		DATE
DRAWN	JC	11-30-84
CHECKED	LHH	12-4-84
APPROVED	CH	12-8-84
ENGR		

CLA-VAL CO. NEWPORT BEACH, CALIFORNIA

TITLE 3/8" & 1/2" CDC-1 CHECK VALVE PATENT NO. 4,373,550

SIZE B | CAGE CODE 86184 | DWG NO 98345 | REV E

SCALE 2/1 | SHEET 1 OF 1

DIST. CODE 007A

CLA-VAL

REPAIR KITS

100-01 Hytrol Diaphragm and Disc Assemblies

(Factory Assembled)

For: 100-01 Hytrol Valves with Cast Iron, Bronze Trim Materials AND 125 PRESSURE CLASS ONLY.

INCLUDES: Stem, Disc Guide, Disc, Disc Retainer, Spacer Washers, Diaphragm, Diaphragm Washer and Stem Nut.

Valve Size	Stock Number	Valve Size	Stock Number
3/8"	49097K	4"	33273E
1/2" - 3/4"	C2518D	6"	40456G
1"	C2520K	8"	45276D
1 1/4" & 1 1/2"	C2522F	10"	81752J
2"	C2524B	12"	85533J
2 1/2"	C2523D	14"	89067D
3"	C2525J	16"	89068B

100-01 Hytrol and 100-04 Hycheck Repair Kits (125 PRESSURE CLASS ONLY)

(Supplied Shrink Wrapped)

INCLUDES: Diaphragm, Disc (or Disc Assembly), and Spacer Washers.

BUNA-N (Standard material)		VITON (For -KB Valves)	
Valve Size	Stock Number	Valve	Stock Number
3/8"	9169801K	3/8"	9169806J
1/2" - 3/4"	9169802H	1/2" - 3/4"	9169807G
1"	9169803F	1"	9169808E
1 1/4" & 1 1/2"	9169804D	1 1/4" - 1 1/2"	9169809C
2"	9169805A	2"	9169810A
2 1/2"	9169811J	2 1/2"	9169817F
3"	9169812G	3"	9169818D
4"	9169813E	4"	9169819B
6"	9169815K	6"	9169820K
8"	9817901D		
10"	9817902B		
12"	9817903K		

NOTE: Larger Sizes - Order Individual Parts

WHEN ORDERING PLEASE GIVE COMPLETE NAMEPLATE DATA OF THE VALVE AND/OR CONTROL BEING REPAIRED, ITEM DESCRIPTION AND STOCK NUMBER.

MINIMUM ORDER CHARGE APPLIES

Repair Kits

100-02 Powertrol and 100-03 Powercheck Repair Kits (125 PRESSURE CLASS ONLY)

(Supplied Shrink Wrapped)

INCLUDES: Diaphragm, Disc (or Disc Assembly), and Spacer Washers.

BUNA-N Standard Material			
Valve Size	Stock Number	Valve Size	Stock Number
3/8"	9169901H	2 1/2"	9169910J
1/2" - 3/4"	9169902F	3"	9169911G
1"	9169903D	4"	9169912E
1 1/4" & 1 1/2"	9169904B	6"	9169913C
2"	9169905J	8"	99116G

NOTE: Larger sizes - Order Individual Parts

Pilot Control Valve Repair Kits

(Supplied Shrink Wrapped)

INCLUDES: Diaphragm, Disc (or Disc Assembly), O-Rings, Spare Screw or Gaskets as appropriate.

BUNA-N (Standard Material)				VITON (for -KB Controls)	
CONTROL	STOCK NO.	CONTROL	STOCK NO.	CONTROL	STOCK NO
CDB	9170006C	CRD-22	98923G	CDB-KB	9170012A
CDS4	9170014G	CRL	9170007A	CRD-KB	9170008J
CDS5	14200A	CRL5A	20666E	CRL-KB	9170013J
CFM2	12223E	CDHS2B	9170004H	CDHS2B-KB	9170010E
CFM7/7A	1263901K	CDHS2F	9170005E	CDHS2F-KB	9170011C
CRA	9170001D	CDHS18	9170003K	CDHS18-KB	9170009G
CRD	9170002B	102C	1726201F	102C-KB	1726202D

REPAIR ASSEMBLIES (In Standard Materials Only)		
CONTROL	DESCRIPTION	STOCK NO.
CF1-C1	Pilot Assembly Only	89541H
CF1-C1	Complete Float Control less Ball & Rod	89016A
CSM11-A2-2	Mechanical Parts Assy.	97544B
CSM11-A2-2	Pilot Assembly Only	18053K

WHEN ORDERING PLEASE GIVE COMPLETE NAMEPLATE DATA OF THE VALVE AND/OR CONTROL BEING REPAIRED, ITEM DESCRIPTION AND STOCK NUMBER.

MINIMUM ORDER CHARGE APPLIES

CLA-VAL

N-RK (R2/94)

Cla-Val Co.
P.O. Box 1325
Newport Beach
California 92659-0325
Phone: (714) 722-4800
Fax: (714) 548-5441

Cla-Val Canada Ltd.
4687 Christie Drive
Beamsville, Ontario
Canada, LOR 1BO
Phone: (905) 563-4963
Fax: (905) 563-4040

CLA-VAL

REPAIR KITS

600 series valves

600 Series 100-20 Hytrol Diaphragm and Disc Assemblies

(Factory Assembled)

For: 100-20 Hytrol Valves with Cast Iron, Bronze Trim Materials AND 125 PRESSURE CLASS ONLY.

INCLUDES: Stem, Disc Guide, Disc, Disc Retainer, Spacer Washers, Diaphragm, Diaphragm Washer and Stem Nut.

Valve Size	Stock Number
3"	C2524B
4"	C2525J
6"	33273E
8"	40456G
10"	45276D

Valve Size	Stock Number
12"	81752J
16"	85533J
20"	89068B
24"	89068B

600 Series 100-20 Hytrol and 100-23 Hycheck Repair Kits (125 PRESSURE CLASS ONLY)

(Supplied Shrink Wrapped)

INCLUDES: Diaphragm, Disc (or Disc Assembly), and Spacer Washers.

BUNA-N (Standard material)	
Valve Size	Stock Number
3"	9169805A
4"	9169812G
6"	9169813E
8"	9169815K
10"	9817901D
12"	9817902B
16"	9817903K

VITON (For -KB Valves)	
Valve	Stock Number
3"	9169810A
4"	9169818D
6"	9169819B
8"	9169820K

NOTE: Larger Sizes - Order Individual Parts

WHEN ORDERING PLEASE GIVE COMPLETE NAMEPLATE DATA OF THE VALVE AND/OR CONTROL BEING REPAIRED, ITEM DESCRIPTION AND STOCK NUMBER.

MINIMUM ORDER CHARGE APPLIES

600 Series 100-21 Powertrol and 100-22 Powercheck Repair Kits (125 PRESSURE CLASS ONLY)

(Supplied Shrink Wrapped)

INCLUDES: Diaphragm, Disc (or Disc Assembly), and Spacer Washers.

BUNA-N Standard Material			
Valve Size	Stock Number	Valve Size	Stock Number
3"	9169905J	8"	9169913C
4"	9169911G	10"	99116G
6"	9169912E		

NOTE: Larger sizes - Order Individual Parts

Pilot Control Valve Repair Kits

(Supplied Shrink Wrapped)

INCLUDES: Diaphragm, Disc (or Disc Assembly), O-Rings, Spare Screw or Gaskets as appropriate.

BUNA-N (Standard Material)				VITON (for -KB Controls)	
CONTROL	STOCK NO.	CONTROL	STOCK NO.	CONTROL	STOCK NO
CDB	9170006C	CRD-22	98923G	CDB-KB	9170012A
CDS4	9170014G	CRL	9170007A	CRD-KB	9170008J
CDS5	14200A	CRL5A	20666E	CRL-KB	9170013J
CFM2	12223E	CDHS2B	9170004H	CDHS2B-KB	9170010E
CFM7/7A	1263901K	CDHS2F	9170005E	CDHS2F-KB	9170011C
CRA	9170001D	CDHS18	9170003K	CDHS18-KB	9170009G
CRD	9170002B	102C	1726201F	102C-KB	1726202D

REPAIR ASSEMBLIES (In Standard Materials Only)		
CONTROL	DESCRIPTION	STOCK NO.
CF1-C1	Pilot Assembly Only	89541H
CF1-C1	Complete Float Control less Ball & Rod	89016A
CSM11-A2-2	Mechanical Parts Assy.	97544B
CSM11-A2-2	Pilot Assembly Only	18053K

WHEN ORDERING PLEASE GIVE COMPLETE NAMEPLATE DATA OF THE VALVE AND/OR CONTROL BEING REPAIRED, ITEM DESCRIPTION AND STOCK NUMBER.

MINIMUM ORDER CHARGE APPLIES

CLA-VAL

Cla-Val Co.
P.O. Box 1325
Newport Beach
California 92659-0325
Phone: (714) 722-4800
Fax: (714-548-5441

Cla-Val Canada Ltd.
4687 Christie Drive
Beamsville, Ontario
Canada, LOR 1B4
Phone: (905) 563-4963
Fax: (905) 563-4040

CLA-VAL CO.

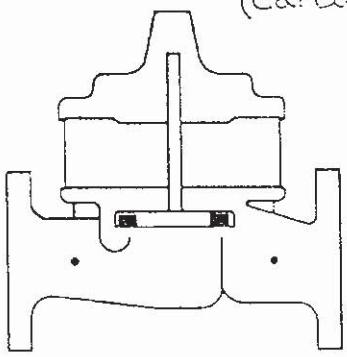
AUTOMATIC CONTROL VALVES

90-01/690-01

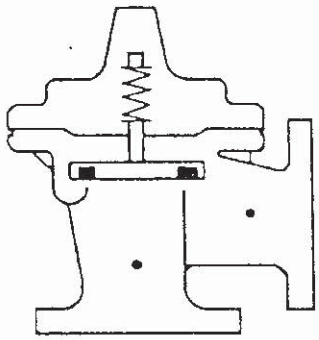
Place this manual with personnel responsible for maintenance of this valve.

Pressure Reducing (Carbon Filters)

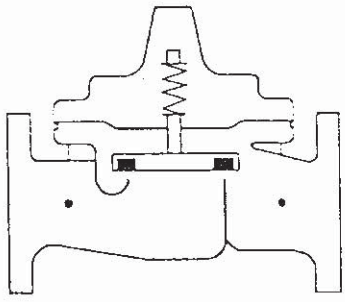
CV 4



INSTALLATION



OPERATION



MAINTENANCE

CLA-VAL CO. • P.O. BOX 1325 • Newport Beach, CA 92659-0325 • (714) 722-4800
CLA-VAL CANADA LTD. • 4687 Christie Drive • Beamsville, Ontario, Canada LOR 1B4 • (905) 563-4963

CVCL 1 (2) 3 4 DIST. CO ...002 SHEET 1 OF 3

CLA-VAL CO.

NEWPORT BEACH, CALIFORNIA

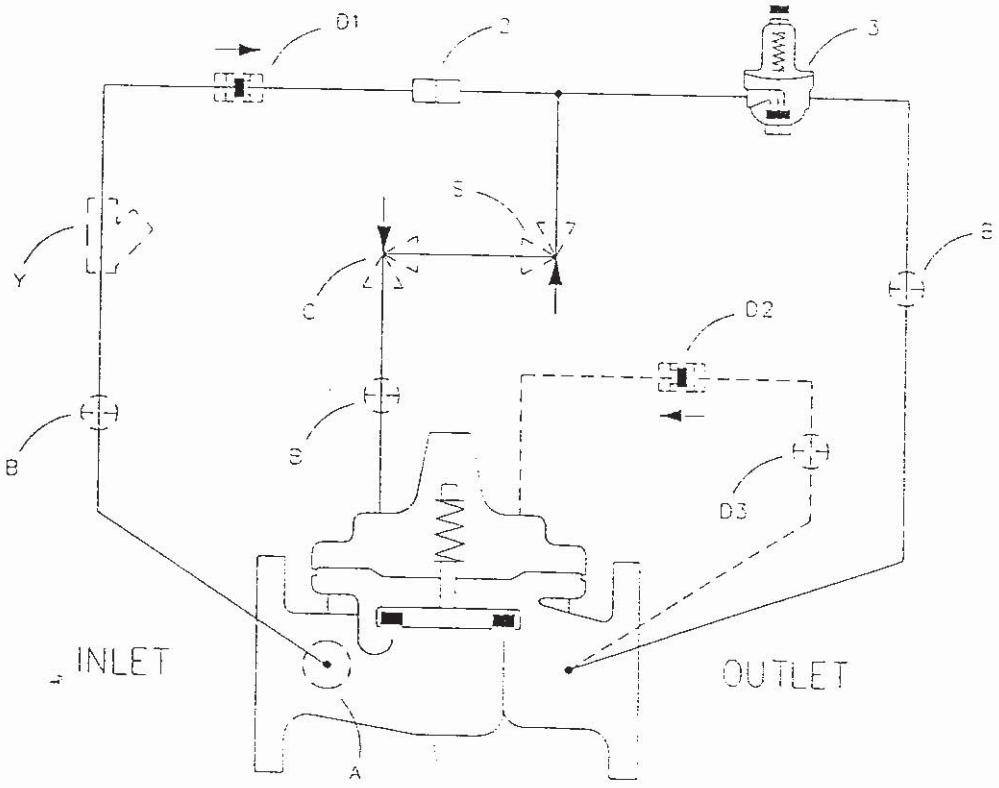
CATALOG NO.	DRAWING NO.	REV.
90-01/690-01	76551	J

TYPE OF VALVE AND MAIN FEATURES

PRESSURE REDUCING VALVE EQUIPPED WITH CRD PRESSURE REDUCING CONTROL

DESIGN		
DRAW	DP	11-30-78
CHK'D	CH	11-30-78
APV'D	WAL	11-30-78

—— — —— NOT FURNISHED BY CLA-VAL CO — — — — — OPTIONAL FEATURES



ITEM NO	BASIC COMPONENTS	QTY
1	100-01 HYTROL (90-01) MAIN VALVE 100-20 HYTROL (690-01) MAIN VALVE	1
2	X58C RESTRICTION FITTING	1
3	CRD PRESSURE REDUCING CONTROL	1

	OPTIONAL FEATURE SUFFIX	ADDED TO CATALOG NUMBER
A	X46A FLOW CLEAN STRAINER	1
B	CK2 COCK (ISOLATION VALVE)	3
C	CV FLOW CONTROL (CLOSING)	1
D	CHECK VALVES WITH COCK	1
S	CV FLOW CONTROL (OPENING)	1
Y	X43 "Y" STRAINER	1

CAD REVISION RECORD - DO NOT REVISE MANUALLY

LTR	DESCRIPTION	BY	DATE
A-G	SEE REVISION FILE		
H	ADDED D OPTIONAL FEATURE & REVISED ON CAD (ECO 12041)	TLC	7-1-91
J	CAT NO. WAS 90-01; ADDED 100-20 (690-01) TO ITEM 1 (ECO 14478)	EK	1-1-94

CLA-VAL CO. NEWPORT BEACH, CALIFORNIA

CATALOG NO	DRAWING NO.	REV.
90-01/690-01	76551	J

TYPE OF VALVE AND MAIN FEATURES

PRESSURE REDUCING VALVE EQUIPPED WITH CRD PRESSURE REDUCING CONTROL

DESIGN		
DRAWN	DP	11-30-78
CHKD	CH	11-30-78
APVD	WAL	11-30-78

OPERATING DATA

I. PRESSURE REDUCING FEATURE:

PRESSURE REDUCING CONTROL (3) IS A NORMALLY OPEN CONTROL THAT SENSES MAIN VALVE OUTLET PRESSURE CHANGES. AN INCREASE IN OUTLET PRESSURE TENDS TO CLOSE CONTROL (3) AND A DECREASE IN OUTLET PRESSURE TENDS TO OPEN CONTROL (3). THIS CAUSES MAIN VALVE COVER PRESSURE TO VARY AND THE MAIN VALVE MODULATES (OPENS AND CLOSES) MAINTAINING A RELATIVELY CONSTANT OUTLET PRESSURE. PRESSURE REDUCING CONTROL (3) ADJUSTMENT: TURN THE ADJUSTING SCREW CLOCKWISE TO INCREASE THE SETTING.

II. OPTIONAL FEATURE OPERATING DATA:

SUFFIX A (FLOW CLEAN STRAINER)
A SELF-CLEANING STRAINER IS INSTALLED IN THE MAIN VALVE INLET BODY BOSS WHICH PROTECTS THE PILOT SYSTEM FROM FOREIGN PARTICLES.

SUFFIX B (ISOLATION VALVES)
CK2 COCKS (B) ARE USED TO ISOLATE THE PILOT SYSTEM FROM MAIN LINE PRESSURE. THESE VALVES MUST BE OPEN DURING NORMAL OPERATION.

SUFFIX C (CLOSING SPEED CONTROL)
FLOW CONTROL (C) CONTROLS THE CLOSING SPEED OF THE MAIN VALVE. TURN THE ADJUSTING STEM CLOCKWISE TO MAKE THE MAIN VALVE CLOSE SLOWER.

SUFFIX D (CHECK VALVES WITH COCK):
WHEN OUTLET PRESSURE IS HIGHER THAN INLET PRESSURE, CHECK VALVE (D2) OPENS AND (D1) CLOSES. THIS DIRECTS THE HIGHER OUTLET PRESSURE INTO THE MAIN VALVE COVER AND THE MAIN VALVE CLOSES.

SUFFIX S (OPENING SPEED CONTROL)
FLOW CONTROL (S) CONTROLS THE OPENING SPEED OF THE MAIN VALVE. TURN THE ADJUSTING STEM CLOCKWISE TO MAKE THE MAIN VALVE OPEN SLOWER.

SUFFIX Y (Y-STRAINER)
A Y-PATTERN STRAINER IS INSTALLED IN THE PILOT SUPPLY LINE TO PROTECT THE PILOT SYSTEM FROM FOREIGN PARTICLES. THE STRAINER SCREEN MUST BE CLEANED PERIODICALLY.

CAD REVISION RECORD - DO NOT REVISE MANUALLY

LTR	DESCRIPTION	BY	DATE
	SEE SHEET 1		

CLA-VAL CO. NEWPORT BEACH, CALIFORNIA

CATALOG NO.	DRAWING NO.	REV
90-01/690-01	76551	J

TYPE OF VALVE AND MAIN FEATURES

PRESSURE REDUCING VALVE EQUIPPED WITH CRD PRESSURE REDUCING CONTROL

DESIGN		
DRAWN	DP	11-30-78
CHK'D	CH	11-30-78
APV'D	WAL	11-30-78

OPERATING DATA - CONTINUED

III. CHECK LIST FOR PROPER OPERATION:

( ) SYSTEM VALVES OPEN UPSTREAM AND DOWNSTREAM.
( ) AIR REMOVED FROM THE MAIN VALVE COVER AND PILOT SYSTEM AT ALL HIGH POINTS.
( ) CK2 COCKS (B) OPEN (OPTIONAL FEATURE).
( ) PERIODIC CLEANING OF STRAINER (Y) IS RECOMMENDED (OPTIONAL FEATURE).
( ) CV FLOW (C) AND (S) OPEN AT LEAST 1/4 TURN (OPTIONAL FEATURE).

CAD REVISION RECORD - DO NOT REVISE MANUALLY

LTR	DESCRIPTION	BY	DATE
	SEE SHEET 1		

C	CLA VAL CO.	INST ATION / OPERATION / MAINTENANCE
	PRESSURE REDUCING VALVE	MODEL 90-01 SERIES

INTRODUCTION

This manual titled the 90-01 Pressure Reducing Valve contains information for installation, operation and maintenance of the valve and control system. The Clayton 90-01 is an automatic valve designed to reduce the higher inlet pressure to a steady lower downstream pressure regardless of changing flow rate and/or varying inlet pressure. It is a hydraulically operated, pilot-controlled, diaphragm type globe or angle valve. This valve is a pilot operated regulator capable of holding downstream pressure to a predetermined delivery pressure. When downstream pressure exceeds the pressure setting of the control pilot the main valve and pilot valve close drip tight. The control system is very sensitive to slight pressure changes and immediately controls the main valve to maintain the desired downstream pressure. Pressure setting adjustment is made with a single adjusting screw. The adjusting screw is protected by a screw type housing which can be sealed to discourage tampering.

INSTALLATION

1. Allow sufficient room around the valve assembly to make adjustments and for disassembly.
2. It is recommended that gate or line block valves be installed on both ends of the 90-01 valve assembly to facilitate isolating the valve for preventive maintenance.

   NOTE: BEFORE THE VALVE IS INSTALLED, PIPE LINES SHOULD BE FLUSHED OF ALL CHIPS, SCALE, AND FOREIGN MATTER.
3. Place the valve assembly in the line with flow through the valve in the direction indicated on the inlet plate or by flow arrows. Check all fittings and hardware for proper makeup and that no apparent damage is evident. Be sure main valve cover nuts/bolts are tight. Pressure in some applications can be very high so be thorough in checking and inspecting for proper installation and makeup.
4. Clayton Valves operate with maximum efficiency when mounted in horizontal piping with the cover UP; however, other positions are acceptable. Due to size and weight of cover and internal components of six inch valves and larger, installation with the cover up is advisable. This makes periodic inspection of internal parts readily accessible.

OPERATION AND START-UP

1. Prior to pressurizing the valve assembly make sure the necessary gauges to measure pressure in the system are installed as required by the system engineer. A Clayton X101 Valve Position Indicator may be installed in the center cover port to provide a visual indication of the valve during startup adjustment.

   CAUTION: During start-up and test procedures a large volume of water may be discharged downstream. Check that the downstream venting is adequate to prevent damage to personnel and equipment. All adjustments in pressure should be made slowly. If the main valve closes too fast it may cause surging in upstream piping.
2. If shutoff cocks (isolation valves) are installed, open cocks (see schematic).
3. Clayton CV Flow Controls provide adjustable regulation of flow in and out of the main valve chamber which minimizes pulsations that sometimes occur at very low flow rates. If CV Controls are installed as shown on the schematic, remove the caps, loosen the jam nuts and turn the adjustment screws counterclockwise as far as they can go.
4. Open the upstream gate or block valve just slightly to allow the valve assembly and pilot system to fill with liquid.
5. Carefully loosen tube fittings at highest points and bleed air from system. Carefully loosen the plug at top of main valve cover. If an indicator is installed, carefully loosen the pipe plug at top of indicator. Bleed air from cover and tighten plug. Tighten tube fittings.
6. Open the upstream gate or block valve fully.
7. Slowly open the downstream gate or block valve. Flow should occur and pressure should remain constant.
8. Adjust the CRD Control to desired pressure. To change pressure setting, turn the adjusting screw clockwise to increase pressure, counterclockwise to decrease pressure. There must be liquid flowing through the valve during pressure adjustments. When the desired setting has been made, tighten jam nut and replace cover.
9. To check the operation of the valve, open and close the downstream gate valve. The downstream pressure should remain constant.
10. If opening and closing speed controls (Clayton CV) are installed in the valve assembly, fine tune the opening and closing speed of the main valve while performing step 9. Turn the adjustment screw clockwise on the opening speed control to make the main valve open slower. Turn the adjustment screw clockwise on the closing speed control to make the main valve close slower. When adjustments have been completed tighten jam nuts and replace cover.

MAINTENANCE

1. Clayton Valves and Controls require no lubrication or packing and a minimum of maintenance. However, a periodic inspection schedule should be established to determine how the fluid handled is affecting the efficiency of the valve assembly.
2. Repair and adjustment procedures of the Clayton Hytrol Valve and the control components are included in separate sections of this manual.
3. Refer to the Service Suggestions Chart to identify operation symptoms.

SERVICE SUGGESTIONS

SYMPTOM	PROBABLE CAUSE	REMEDY
Main valve fails to open	No pressure at valve inlet	Check inlet pressure
	Main valve diaphragm assembly inoperative	Disassemble, clean and polish stem, replace defective parts
	Pilot Valve (CRD) not opening 1 No spring compression 2 Damaged spring 3 Spring guide not in place 4 Yoke dragging on inlet nozzle	 1 Tighten adjusting screw 2 Disassemble and replace 3 Assemble properly 4 Assemble properly
	Flow Control (CV) disc inoperative, corrosion or excessive scale buildup on stem	Disassemble, clean and polish stem. Replace worn parts
Main valve fails to close	Foreign matter between disc and seat or worn disc. Scale on stem. Diaphragm ruptured	Disassemble main valve, remove matter, clean parts and replace defective parts
	Flow Clean Strainer plugged	Remove and clean or replace
	CK2 isolation valves, closed	Open isolation valves
	Flow stabilizer (CV2) has foreign material lodged in poppet assembly and check plate	Disassemble and clean parts
Main valve fails to close	Pilot Valve (CRD) remain open 1 Spring compressed solid 2 Mechanical obstruction 3 Worn disc 4 Yoke dragging on inlet nozzle 5 Diaphragm damaged or loose diaphragm nut. Leakage from vent hole in cover	 1 Back off adjusting screw 2 Disassemble and remove obstruction. 3 Disassemble, remove and replace disc retainer assembly 4 Assemble properly 5 Disassemble, replace diaphragm and/or tighten nut
Fails to regulate	Air in main valve cover and/or tubing	Loosen top cover plug and fittings and bleed air
	Pilot Valve (CRD) yoke dragging on inlet nozzle	Assemble properly
	Pilot Valve (CRD) spring not in correct range to control	Check outlet pressure requirements and compare existing spring with Spring Chart

LITHO IN U.S.A.

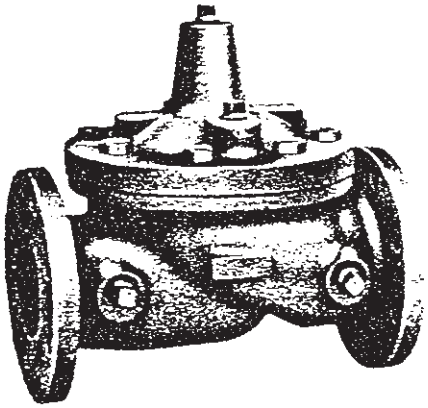
CLA-VAL CO.

MODEL 100-01
Hytrol Valve

Description

The Cla-Val Model 100-01 Hytrol Valve is a main valve for Cla-Val Automatic Control Valves. It is a hydraulically operated, diaphragm-actuated, globe or angle pattern valve.

This valve consists of three major components; body, diaphragm assembly, and cover. The diaphragm assembly is the only moving part. The diaphragm assembly uses a diaphragm of nylon fabric bonded with synthetic rubber. A synthetic rubber disc, contained on three and one half sides by a disc retainer and disc guide, forms a seal with the valve seat when pressure is applied above the diaphragm. The diaphragm assembly forms a sealed chamber in the upper portion of the valve, separating operating pressure from line pressure.



Installation

1. Before valve is installed, pipe lines should be flushed of all chips, scale and foreign matter.

2. It is recommended that either gate or block valves be installed on both ends of the 100-01 Hytrol Valve to facilitate isolating the valve for preventive maintenance and repairs.

3. Place the valve in the line with flow through the valve in the direction indicated on the inlet nameplate. (See "Flow Direction" Section)

4. Allow sufficient room around valve to make adjustments and for disassembly.

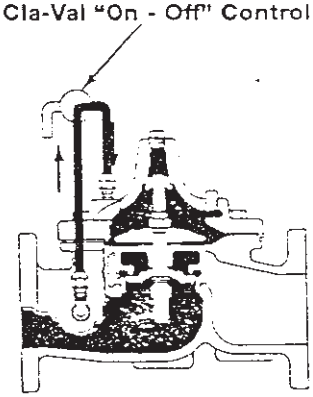
5. Cla-Val Co. 100-01 Hytrol Valves operate with maximum efficiency when mounted in horizontal piping with the cover **UP**, however, other positions are acceptable. Due to size and weight of the cover and internal components of 8 inch and larger valves, installation with the cover **UP** is advisable. This makes internal parts readily accessible for periodic inspection.

6. If a pilot control system is installed on the 100-01 Hytrol Valve, use care to prevent damage. If it is necessary to remove fittings or components, be sure they are kept clean and replaced exactly as they were.

7. After the valve is installed and the system is first pressurized, vent air from the cover chamber and tubing by loosening fittings at all high points.

Principle of Operation

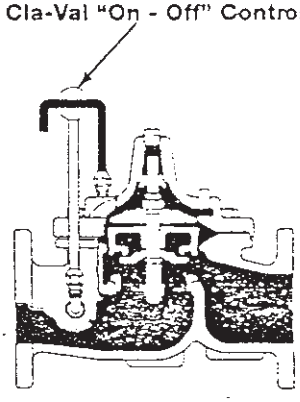
Cla-Val "On - Off" Control



Tight Closing Operation

When pressure from the valve inlet (or an equivalent independent operating pressure) is applied to the diaphragm chamber the valve closes drip-tight.

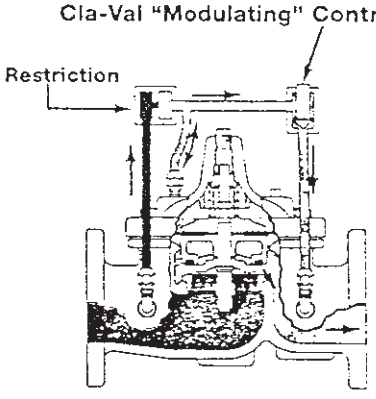
Cla-Val "On - Off" Control



Full Open Operation

When pressure in diaphragm chamber is relieved to a zone of lower pressure (usually atmosphere) the line pressure (5 psi Min.) at the valve seat opens the valve.

Cla-Val "Modulating" Control

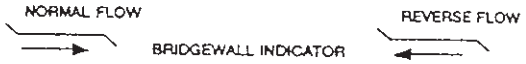


Modulating Action

Valve modulates when diaphragm pressure is held at an intermediate point between inlet and discharge pressure. With the use of a Cla-Val Co. "modulating control," which reacts to line pressure changes, the pressure above the diaphragm is varied, allowing the valve to throttle and compensate for the changes.

Flow Direction

The flow through the 100-01 Hytrol Valve can be in one of two directions. When flow is "up-and-over the seat ", it is in "normal" flow and the valve will fail in the open position. When flow is "over-the seat-and down", it is in "reverse" flow and the valve will fail in the closed position. **The valve must be installed according to nameplate data.**



Recommended Tools

1. Three pressure gauges with ranges suitable to the installation to be put at Hytrol inlet, outlet and cover connections.
2. Cla-Val Model X101 Valve Position Indicator. This provides visual indication of valve position without disassembly of valve.
3. Other items are: suitable hand tools such as screwdrivers, wrenches, etc., soft jawed (brass or aluminum) vise, 400 grit wet or dry sandpaper, and water for cleaning.

Troubleshooting

The following troubleshooting information deals strictly with the Model 100-01 "Hytrol Valve". This assumes that all other components of the pilot control system have been checked out and are in proper working condition. (See appropriate sections in Technical Manual for complete valve) All troubleshooting is possible without removing the valve from the line or removing the cover. It is highly recommended to permanently install a Model X101 Valve Position Indicator and three gauges in unused Hytrol inlet, outlet and cover connections.

SYMPTOM	PROBABLE CAUSE	REMEDY
Fails to Close	Closed cocks in control system, or in main line.	Open Cocks.
	Lack of cover chamber pressure.	Check upstreasm pressure, pilot system, strainer, tubing, cocks, or needle valves for obstruction.
	Diaphragm damaged. (See Diaphragm Check.)	Replace diaphragm.
	Diaphragm assembly inoperative. Corrosion or excessive scale build up on valve stem. (See Freedom of Movement Check)	Clean and polish stem. Inspect and replace any damaged or badly eroded part.
	Mechanical obstruction. Object lodged in valve. (See Freedom of Movement Check)	Remove obstruction.
	Worn disc. (See Tight Sealing Check)	Replace disc.
	Badly scored seat. (See Tight Sealing Check)	Replace seat.
Fails to Open	Closed upstream and/or downstream isolation valves in main line.	Open valves.
	Insufficient line pressure.	Check upstream pressure. (Minimum 5 psi flowing line pressure differential.)
	Diaphragm assembly inoperative. Corrosion or excessive buildup on valve stem. (See Freedom of Movement Check)	Clean and polish stem. Inspect and replace any damaged or badly eroded part.
	Diaphragm damaged. (For valves in "reverse flow" only)	Replace diaphragm.

After checking out probable causes and remedies in shaded portion of above chart, the following three checks can be used to diagnose the nature of the problem before maintenance is started. They must be done in the order shown.

Three Checks

The 100-01 Hytrol Valve has only one moving part (the diaphragm and disc assembly). So, there are only three major types of problems to be considered:

First: Valve is stuck - that is, the diaphragm assembly is not free to move through a full stroke either from open to close or vice versa.

Second: Valve is free to move and can't close because of a worn out diaphragm.

Third: Valve leaks even though it is free to move, and the diaphragm isn't leaking.

CAUTION: Care should be taken when doing these troubleshooting checks on the 100-01 Hytrol Valve. These checks do require the valve to open fully. This will either allow a high flow rate through the valve, or the downstream pressure will quickly increase to the inlet pressure. In some cases, this can be very harmful. Where this is the case, and there are no block valves in the system to protect the downstream piping, it should be realized that **the valve cannot be serviced under pressure.** Steps should be taken to remedy this situation before proceeding any further.

Diaphragm Check (#1)

1. Shut off pressure to the Hytrol Valve by slowly closing upstream and downstream isolation valves. **SEE CAUTION.**

2. Disconnect or close all control lines to the valve cover and leave only one fitting in highest point of cover open to atmosphere.

3. With the cover vented to atmosphere, slowly open upstream isolation valve to allow some pressure into the Hytrol Valve body. Observe the open cover tapping for signs of continuous flow. Volume in Cover Chamber Capacity Chart will be displaced as valve moves to open position. Allow sufficient time for diaphragm assembly to shift positions. If there is no continuous flow, you can be quite certain the diaphragm is sound and the diaphragm assembly is tight. If the fluid appears to flow continuously this is a good reason to believe the diaphragm is either damaged or it is loose on the stem. In either case, this is sufficient cause to remove the valve cover and investigate the leakage. (See "Maintenance" Section for procedure)

COVER CHAMBER CAPACITY
(Liquid Volume displaced when valve opens)

Valve size (inches)	Displacement	
	Gallons	Liters
1 1/4	.020	.07
1 1/2	.020	.07
2	.032	.12
2 1/2	.043	.16
3	.080	.30
4	.169	.64
6	.531	2.0
8	1.26	4.8
10	2.51	9.5
12	4.00	15.1
14	6.50	24.6
16	9.57	36.2

Freedom of Movement Check (# 2)

4. Determining the Hytrol Valve's freedom of movement can be done by one of two methods.

5. For most valves it can be done after completing Diaphragm Check (Steps 1, 2, and 3). **SEE CAUTION.** At the end of step 3 the valve should be fully open.

6. If the valve has a Cla-Val Co. X101 Position Indicator, observe the indicator to see that the valve opens wide. Mark the point of maximum opening.

7. Re-connect enough of the control system to permit the application of inlet pressure to the cover. Open pilot system cock so pressure flows from the inlet into the cover.

8. While pressure is building up in the cover, the valve should close smoothly. There is a hesitation in every Hytrol Valve closure, which can be mistaken for a mechanical bind. The stem will appear to stop moving very briefly before going to the closed position. This slight pause is caused by the diaphragm flexing at a particular point in the valve's travel and is not caused by a mechanical bind.

9. When closed, a mark should be made on the X101 Valve position indicator corresponding to the "closed" position. The distance between the two marks should be approximately the stem travel shown in chart.

STEM TRAVEL
(Fully Open to Fully Closed)

Valve Size (inches)		Travel (inches)	
Inches	MM	Inches	MM
1 1/4	32	0.4	10
1 1/2	40	0.4	10
2	50	0.6	15
2 1/2	65	0.7	18
3	80	0.8	20
4	100	1.1	28
6	150	1.7	43
8	200	2.3	58
10	250	2.8	71
12	300	3.4	86
14	350	4.0	100
16	400	4.5	114

10. If the stroke is different than that shown in stem travel chart this is a good reason to believe something is mechanically restricting the stroke of the valve at one end of its travel. If the flow does not stop through the valve when in the indicated "closed" position, the obstruction probably is between the disc and the seat. If the flow does stop, then the obstruction is more likely in the cover. In either case, the cover must be removed, and the obstruction located and removed. The stem should also be checked for scale build-up. (See "Maintenance" section for procedure.)

11. For valves 6" and smaller, the Hytrol Valve's freedom of movement check can also be done after all pressure is removed from the valve. **SEE CAUTION.** After closing inlet and outlet isolation valves and bleeding pressure from the valve, check that the cover chamber and the body are temporarily vented to atmosphere. Insert fabricated tool into threaded hole in top of valve stem, and lift the diaphragm assembly manually. Note any roughness. The diaphragm assembly should move smoothly throughout entire valve stroke. The tool is fabricated from rod that is threaded on one end to fit valve stem and has a "T" bar handle of some kind on the other end for easy gripping. (See chart in Step 4 of "Disassembly" Section.)

12. Place marks on this diaphragm assembly lifting tool when the valve is closed and when manually positioned open. The distance between the two marks should be approximately the stem travel shown in Stem Travel Chart. If the stroke is different than that shown, there is a good reason to believe something is mechanically restricting the stroke of the valve. The cover must be removed, and the obstruction located and removed. The stem should also be checked for scale build-up. (See "Maintenance" Section for procedure.)

Tight Sealing Check (# 3)

13. Test for seat leakage after completing checks #1 & #2 (Steps 1 to 12). **SEE CAUTION.** Close the isolation valve downstream of the Hytrol Valve. Apply inlet pressure to the cover of the valve, wait until it closes. Install a pressure gauge between the two closed valves. Watch the pressure gauge. If the pressure begins to climb, then either the downstream isolation valve is permitting pressure to creep back, or the Hytrol is allowing pressure to go through it. Usually the pressure at the Hytrol inlet will be higher than on the isolation valve discharge, so if the pressure goes up to the inlet pressure, you can be sure the Hytrol is leaking. Install another gauge downstream of isolating valve. If the pressure between the valves only goes up to the pressure on the isolation valve discharge, the Hytrol Valve is holding tight, and it was just the isolation valve leaking.

Maintenance

Preventative Maintenance

Cla-Val Co. Model 100-01 Hytrol Valves require no lubrication or packing and a minimum of maintenance. However, a periodic inspection schedule should be established to determine how the operating conditions of the system are affecting the valve. The effect of these actions must be determined by inspection.

Disassembly

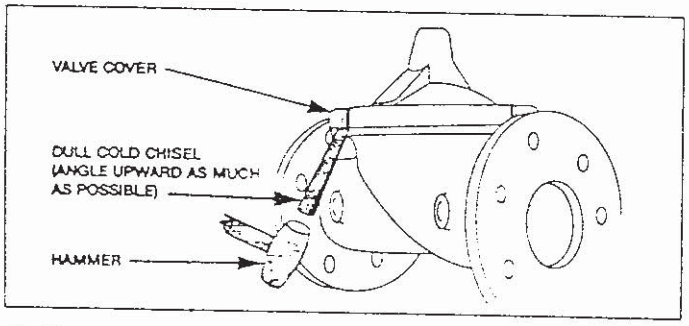
Inspection or maintenance can be accomplished without removing the valve from the line.

WARNING: Maintenance personnel can be injured and equipment damaged if disassembly is attempted with pressure in the system. **SEE CAUTION.**

1. Close upstream and downstream isolation valves **and independent operating pressure when used** to shut off all pressure to the valve.

2. Loosen tube fittings to remove pressure from valve body and cover chamber. After pressure has been released from the valve, use care to remove the controls and tubing. Note and sketch position of tubing and controls for reassembly. The schematic in front of the Technical Manual can be used as a guide when reassembling pilot system.

3. Remove cover nuts and remove cover. If the valve has been in service for any length of time, chances are the cover will have to be loosened by driving upward along the edge of the cover with a dull cold chisel.



On 6" and smaller valves, block and tackle or a power hoist can be used to lift valve cover by inserting proper size eye bolt in place of the center cover plug. On 8" and larger valves, there are 4 holes (5/8" — 11 size) where jacking screws may be inserted for lifting purposes. Pull cover **straight up** to keep from damaging the integral seat bearing and stem.

COVER CENTER PLUG SIZE	
Valve Size	Thread Size (NPT)
1 1/4"—1 1/2"	1/4"
2"—3"	1/2"
4"—6"	3/4"
8"—10"	1"
12"	1 1/4"
14"	1 1/2"
16"	2"

4. Remove the diaphragm and disc assembly from the valve body. With smaller valves this can be accomplished by hand by **pulling straight up on the stem so as not to damage the seat bearing.** On large valves, an eye bolt of proper size can be installed in the stem and the diaphragm assembly can be then lifted with a block and tackle or power hoist. Take care not to damage the stem or bearing.

VALVE STEM THREAD SIZE	
Valve Size	Thread Size (UNF Internal)
1 1/4"—2 1/2"	10—32
3"—4"	1/4—28
6"—14"	3/8—24
16"	1/2—20

5. The next item to remove is the stem nut. Examine the stem threads above the nut for signs of mineral deposits or corrosion. If the threads are not clean, use a wire brush to remove as much of the residue as possible. Attach a good fitting wrench to the nut and give it a sharp "rap" rather than a steady pull. Usually several blows are sufficient to loosen the nut for further removal. On smaller valves, the entire diaphragm assembly can be held by the stem in a vise **equipped with soft brass jaws** before removing the stem nut.

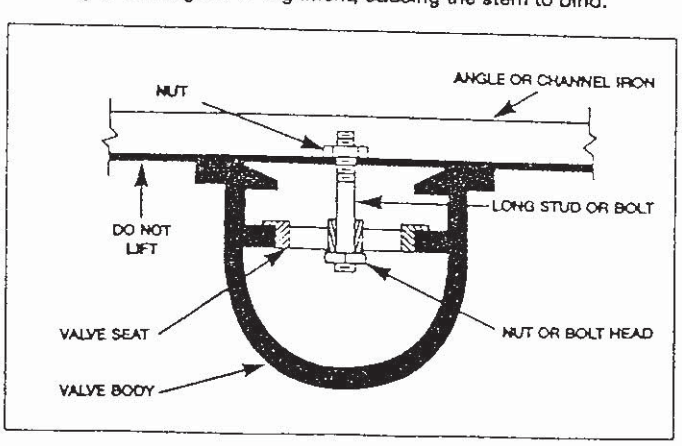
The use of a pipe wrench or a vise without soft brass jaws scars the fine finish on the stem. No amount of careful dressing can restore the stem to its original condition. Damage to the finish of the stem can cause the stem to bind in the bearings and the valve will not open or close.

6. After the stem nut has been removed, the diaphragm assembly breaks down into its component parts. Removal of the disc from the disc retainer can be a problem if the valve has been in service for a long time. Using two screwdrivers inserted along the outside edge of the disc usually will accomplish its removal. Care should be taken to preserve the spacer washers in water, particularly if no new ones are available for reassembly.

7. The only part left in the valve body is the seat which ordinarily does not require removal. Careful cleaning and polishing of inside and outside surfaces with 400 wet/dry sandpaper will usually restore the seat's sharp edge. If, however, it is badly worn and replacement is necessary, it can be easily removed.

Seats in valve sizes 1 1/4" through 6" can be removed with accessory X109 Seat Removing Tool available from the factory. On 8" and larger valves the seat is held in place by flat head machine screws. Use a tight-fitting, long shank screwdriver to prevent damage to seat screws. If upon removal of the screws the seat cannot be lifted out, it will be necessary to use a piece of angle or channel iron with a hole drilled in the center. Place it across the body so a long stud can be inserted through the center hole in the seat and the hole in the angle iron. By tightening the nut an upward force is exerted on the seat.

NOTE: Do not lift up on the end of the angle iron as this may force the integral bearing out of alignment, causing the stem to bind.



Lime Deposits

One of the easiest ways to remove lime deposits from the valve stem or other parts is to dip it in a 5-percent muriatic acid solution just long enough for the deposit to dissolve. This will remove most of the common types of deposits. **CAUTION: USE EXTREME CARE WHEN HANDLING ACID.** Rinse parts in water before handling. If the deposit is not removed by acid, then a fine grit (400) wet or dry sandpaper can be used with water.

Inspection of Parts

After the valve has been disassembled, each part should be examined carefully for signs of wear, corrosion, or any other abnormal condition. Usually, it is a good idea to replace the rubber parts (diaphragm and disc) unless they are free of signs of wear. These are available in a repair parts kit. Any other parts which appear doubtful should be replaced. **WHEN ORDERING PARTS, BE SURE TO GIVE COMPLETE NAMEPLATE DATA, ITEM NUMBER AND DESCRIPTION.**

NOTE: If a new disc isn't available, the existing disc can be turned over, exposing the unused surface for contact with the seat. The disc should be replaced as soon as practical.

Reassembly

1. Reassembly is the reverse of the disassembly procedure. If a new disc has been installed, it may require a different number of spacer washers to obtain the right amount of "grip" on the disc. When the diaphragm assembly has been tightened to a point where the diaphragm cannot be twisted, the disc should be compressed very slightly by the disc guide. Excessive compression should be avoided. Use just enough spacer washers to hold the disc firmly without noticeable compression.

2. **MAKE SURE THE STEM NUT IS VERY TIGHT.** Attach a good fitting wrench to the nut and give it a sharp "rap" rather than a steady pull. Usually several blows are sufficient to tighten the stem nut for final tightening. Failure to do so could allow the diaphragm to pull loose and tear when subjected to pressure.

3. Carefully install the diaphragm assembly by lowering the stem through the seat bearing. Take care not to damage the stem or bearing. Line up the diaphragm holes with the stud or bolt holes on the body. On larger valves with studs, it may be necessary to hold the diaphragm assembly up part way while putting the diaphragm over the studs.

4. Put spring in place and replace cover. Make sure diaphragm is lying smooth under the cover.

5. Tighten cover nuts firmly using a cross-over pattern until all nuts are tight.

6. Test Hytrol Valve before re-installing pilot valve system.

Test Procedure After Valve Assembly

There are a few simple tests which can be made in the field to make sure the Hytrol Valve has been assembled properly. Do these before installing pilot system and returning valve to service.

1. Check the diaphragm assembly for freedom of movement after all pressure is removed from the valve. **SEE CAUTION.** Insert fabricated tool into threaded hole in top of valve stem, and lift the diaphragm assembly manually. Note any roughness, sticking or grabbing. The diaphragm assembly should move smoothly throughout entire valve stroke. The tool is fabricated from rod that is threaded on one end to fit valve stem (See chart in Step 4 of "Disassembly" Section.) and has a "T" Bar handle of some kind on the other end for easy gripping.

Place marks on this diaphragm assembly lifting tool when the valve is closed and when manually positioned open. The distance between the two marks should be approximately the stem travel shown in Stem Travel Chart. (See "Freedom of Movement Check" section.) If the stroke is different than that shown, there is a good reason to believe something is mechanically restricting the stroke of the valve. The cover must be removed, the obstruction located and removed. (See "Maintenance" Section for procedure.)

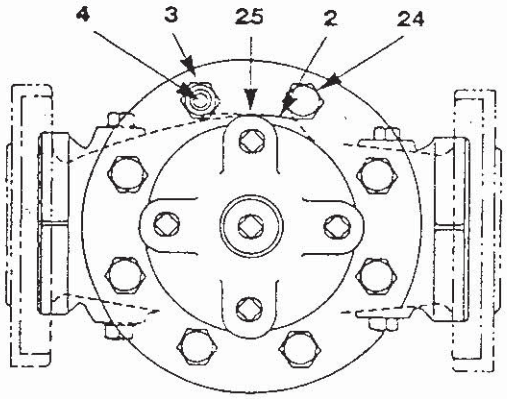
Due to the weight of the diaphragm assembly this procedure is not possible on valves 8" and larger. On these valves, the same determination can be made by carefully introducing a low pressure (less than five psi) into the valve body with the cover vented. **SEE CAUTION.** Looking in cover center hole see the diaphragm assembly lift easily without hesitation, and then settle back easily when the pressure is removed.

2. To check the valve for drip-tight closure, a line should be connected from the inlet to the cover, and pressure applied at the inlet of the valve. If properly assembled, the valve should hold tight with as low as ten PSI at the inlet. (See "Tight Sealing Check" section.)

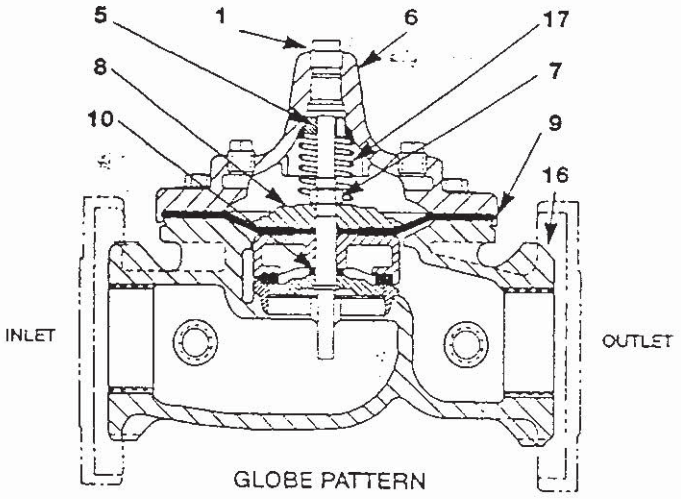
3. With the line connected from the inlet to the cover, apply full working pressure to the inlet. Check all around the cover for any leaks. Re-tighten cover nuts if necessary to stop leaks past the diaphragm.

4. Remove pressure, then re-install the pilot system and tubing exactly as it was prior to removal. **Bleed air from all high points.**

5. Follow steps under "Start-Up and Adjustment" Section in Technical Manual for returning complete valve back to service.



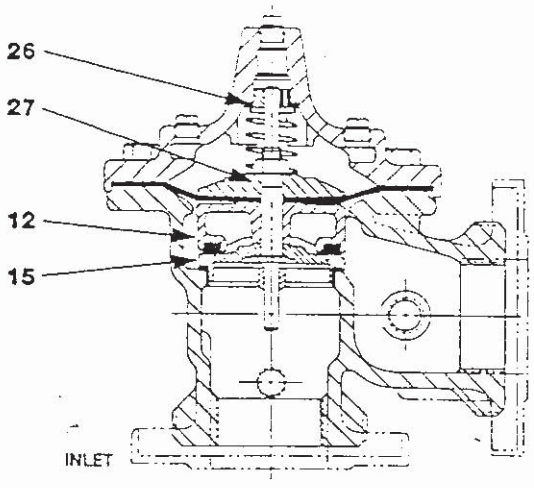
TOP VIEW



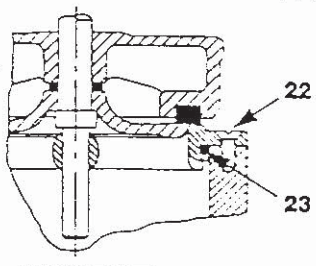
GLOBE PATTERN

PARTS LIST

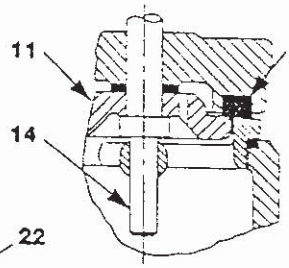
ITEM NO.	DESCRIPTION
1	Pipe Plug
2	Drive Screws (for nameplate)
3	Hex Nut (6" and larger)
4	Stud (6" and larger)
5	Cover Bearing
6	Cover
7	Stem Nut
8	Diaphragm Washer
9	Diaphragm
10	Spacer Washers
11	Disc Guide
12	Disc Retainer
13	Disc
14	Stem
15	Seat
16	Body
17	Spring
22	Flat Head Screws (8" and larger)
23	Seat O-Ring
24	Hex head Bolt (1¼" Thru 4")
25	Nameplate
26	Upper Spring Washer (Epoxy coated valves only)
27	Lower Spring Washer (Epoxy coated valves only)
28	Cover Bearing Housing (16" only)
29	Cover O-Ring (16" only)
30	Hex Bolt (16" only)
31	Pipe Cap (16" only)



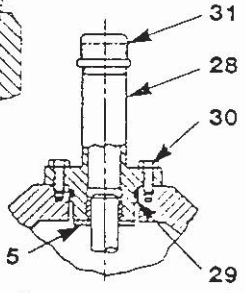
ANGLE PATTERN



8" – 16" SEAT DETAIL



1¼" – 6"
SEAT DETAIL



16" COVER DETAIL

CLA-VAL CO
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CLA-VAL CANADA LTD.
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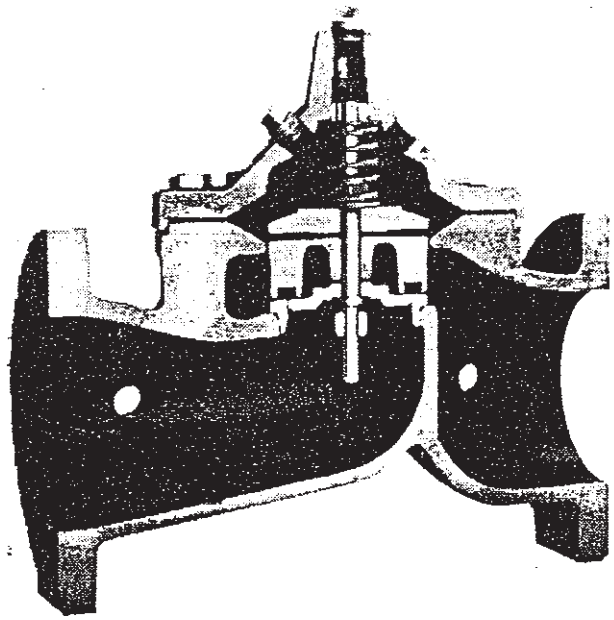
Beamsville, Ontario
Canada L0R 1B4
Phone: 905-563-4963
Fax: 905-563-4040

CLA-VAL™

—MODEL— **100-20**

600 Series
Hytrol Valve



- Reduced Cavitation Design
- Drip-Tight, Positive Seating Action
- Service Without Removal From Line
- Globe or Angle Pattern
- Every Valve Factory-Tested

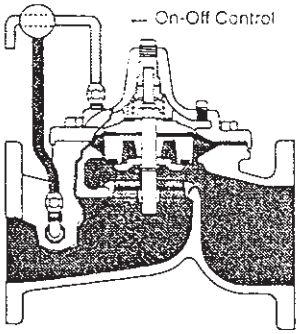
The Cla-Val Model 100-20 Hytrol Valve is a hydraulically operated, diaphragm actuated, globe or angle pattern valve. It consists of three major components: the body, diaphragm assembly and cover. The diaphragm assembly is the only moving part.

The diaphragm assembly is guided top and bottom by a precision machined stem which utilizes a non-wicking diaphragm of nylon fabric bonded with synthetic rubber. A resilient synthetic rubber disc, retained on three and one-half sides by a disc retainer, forms a drip-tight seal with the renewable seat when pressure is applied above the diaphragm.

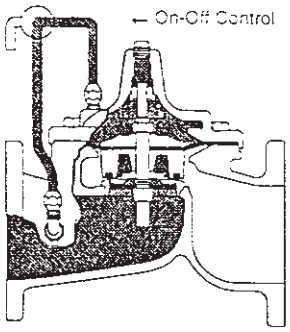
The reduced cavitation characteristics of the 100-20 Hytrol Valve is the basis for the Cla-Val 600 Series. The rugged simplicity of design and packless construction assure a long life of dependable, trouble-free operation. It's smooth flow passages and fully guided disc and diaphragm assembly assure optimum control when used in piping systems requiring remote control, pressure regulation, solenoid operation, rate of flow control or check valve operation.

Available in various materials and in a wide range of sizes. It's applications are unlimited.

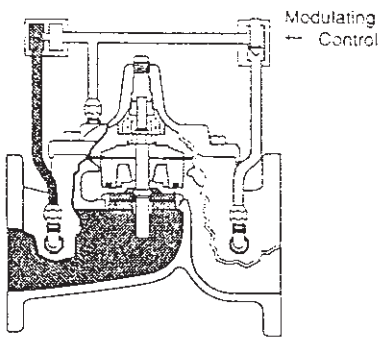
Principle of Operation



Full Open Operation
When pressure in the cover chamber is relieved to a zone of lower pressure, the line pressure at the valve inlet opens the valve, allowing full flow.



Tight Closing Operation
When pressure from the valve inlet is applied to the cover chamber, the valve closes drip-tight.



Modulating Action
The valve holds any intermediate position when operating pressure is equal above and below the diaphragm. Using a Cla-Val "Modulating" Control will allow the valve to automatically compensate for line pressure changes.

CLA-VAL™

Specifications

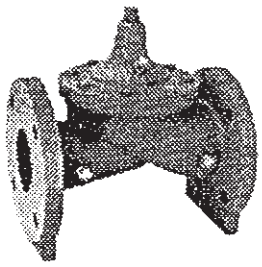
Model 100 -20

Available Sizes

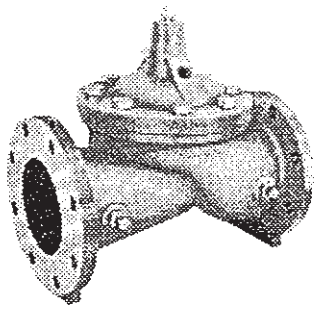
Pattern	Flanged
Globe	3",4",6",8",10",12",16",20",24"
Angle	4",6",8"

Operating Temp. Range

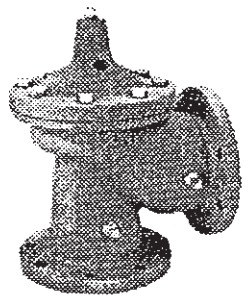
Fluids
-40° to 180° F



3" Globe, Flanged



6" Globe, Flanged



6" Angle, Flanged

Pressure Ratings (Recommended Maximum Pressure - psi)

Valve Body & Cover		Pressure Class		
		Flanged		
Grade	Material	ANSI Standards*	150 lb.	300 lb.
ASTM A-536	Ductile Iron	B16.42	250	400
ASTM A216-WCB	Cast Steel	B16.5	285	400
ASTM B62	Bronze	B16.24	225	400
Type 304	Stainless Steel	B16.5	285	400
356-T6	Aluminum	B16.1	275	—

Note: *ANSI standards are for flange dimensions only.
Flanged valves are available faced but not drilled.

Materials

Component	Material Options				
Body & Cover	Ductile Iron	Cast Steel	Bronze	Stainless Steel	Aluminum
Available Sizes	3" - 24"	3" - 24"	3" - 24"	3" - 24"	3" - 24"
Disc Retainer & Diaphragm Washer	Cast Iron	Cast Steel	Bronze	Stainless Steel	Aluminum
Trim: Disc Guide, Seat & Cover Bearing	Bronze is standard. Stainless Steel is optional.			Stainless Steel is standard.	
Disc	Buna N Rubber				
Diaphragm	Nylon Reinforced Buna N Rubber				
Stem, Nut & Spring	Stainless Steel				

Options

Epoxy Coating - suffix KC
An FDA approved fusion bonded epoxy coating for use with cast iron, ductile iron or steel valves. This coating is resistant to various water conditions, certain acids, chemicals, solvents and alkalies. Epoxy coatings are applied in an average thickness of 12 mils.

Delrin Sleeved Stem - suffix KG
The Delrin sleeved stem is designed for applications where water supplies contain dissolved minerals which can form deposits that build up on the valve stem and hamper valve operation. Scale build-up will not adhere to the Delrin sleeve stem. Delrin sleeved stems are not recommended for valves in continuous operation where differential pressures are in excess of 80 psi (2" and larger Hytrol valves).

Water Treatment Clearance - suffix KW
This additional clearance is beneficial in applications where water treatment compounds can interfere with the closing of the valve. The smaller outside diameter disc guide provides more clearance between the disc guide and the valve seat. This option is best suited for valves used in on-off (non-modulating) service.

Viton Rubber Parts - suffix KB
Optional diaphragm, disc and o-ring fabricated with Viton synthetic rubber. Viton is well suited for use with mineral acids, salt solutions, chlorinated hydrocarbons, and petroleum oils; and is primarily used in high temperature applications up to 250° F.

Heavy Spring - suffix KH
The heavy spring option is used in applications where there is low differential pressure across the valve, and the additional spring force is needed to help the valve close. This option is best suited for valves used in on-off (non-modulating) service.

Low Temperature Diaphragm - suffix KA
This single ply diaphragm uses Buna N synthetic rubber, formulated for low temperature applications to -65° F. Operating pressures in excess of 125 psi are not recommended.

For valves manufactured with special design requirements, please consult the factory.

Functional Data

Model 100 - 20

Valve Size		Inches	3	4	6	8	10	12	16	20	24
		mm	80	100	150	200	250	300	400	510	610
C_V Factor	Globe Pattern	Gal/Min	62	136	229	480	930	1458	2110	3400*	3500*
		Litres/Sec	1.52	3.28	5.30	11.8	23.0	35.8	52.0	84.0	86.0
	Angle Pattern	Gal/Min	—	135	233	545	—	—	—	—	—
		Litres/Sec	—	3.30	5.62	13.1	—	—	—	—	—
Equivalent Length of Pipe	Globe Pattern	Feet	234	210	605	591	530	543	837	1055	2473
		Meters	71.4	64.1	184	180	162	166	255	322	754
	Angle Pattern	Feet	—	210	585	464	—	—	—	—	—
		Meter	—	64.1	178	141	—	—	—	—	—
K Factor	Globe Pattern		20.6	12.7	23.1	15.7	10.4	8.5	10.2	9.7	19.1
	Angle Pattern		—	12.9	22.3	12.2	—	—	—	—	—
Liquid Displaced from Diaphragm Chamber When Valve Opens		Fl. Oz	—	—	—	—	—	—	—	—	—
		US Gal	.032	0.080	.169	.531	1.26	2.51	4.00	9.57	9.57
		ml	—	—	—	—	—	—	—	—	—
		L	.120	.300	.640	2.00	4.80	9.50	15.1	36.2	36.2

*Estimated

C_V Factor

US System: C_V = US gal/min @ 1 psi with 60°F water

Metric System: C_V = litres/sec @ 1 kPa with 15°C water

Formulas for computing C_V Factor, Flow (Q) and Pressure Drop (ΔP):

$$C_V = \frac{Q}{\sqrt{\Delta P}} \qquad Q = C_V \sqrt{\Delta P} \qquad \Delta P = \left(\frac{Q}{C_V}\right)^2$$

Where:

C_V = Number of (US gallons/minute) or (liters/second) of fresh water at one (1) (psi) or (Kilopascal) differential.

Q = Flow Rate in (US gallons/minute) or (liters/second) of fresh water.

ΔP = Pressure Drop in (psi) or (kPa).

Equivalent Length of Pipe

Equivalent lengths of pipe are based on data contained in Hydraulics Institute Pipe Friction Manual. In general, this data is for new, clean wrought iron or steel, schedule 40 pipe with no allowance made for age, differences in diameter, or any abnormal condition of the interior surface. For further details, refer to the above manual.

K Factor

The value of K's calculated from the formula: $h = \frac{KV^2}{2g}$

Where:

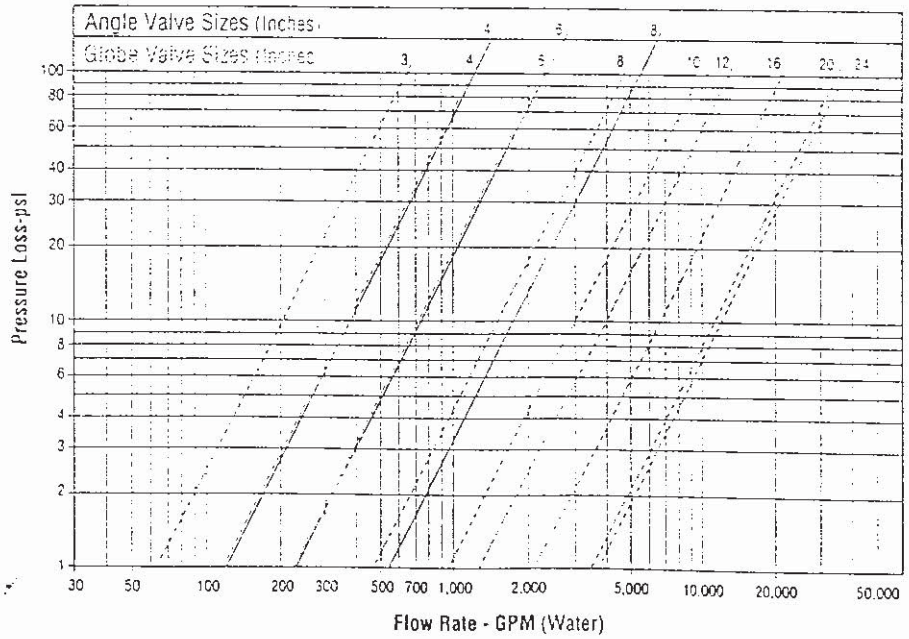
h = Fractional Resistance in (feet) or (meters) of fluid

v = Average Velocity in (feet/second) or (meters/second) in a pipe of corresponding diameter

g = 32.17 (feet/second/second) or 9.81 (meters/second/second)

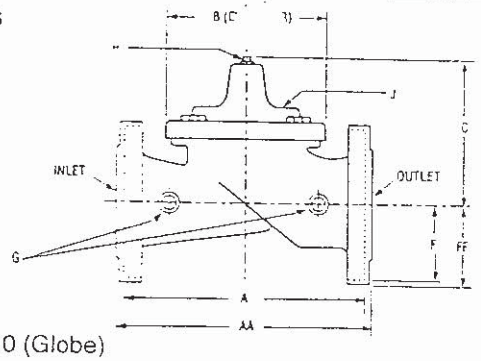
K = Resistance Coefficient for valve

Flow Chart-Normal Flow (Based on flow through a wide open valve.)

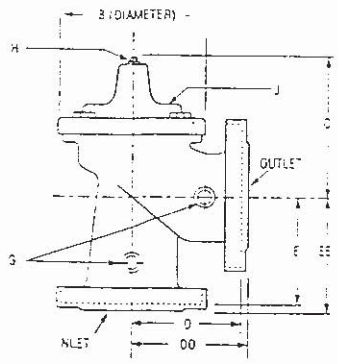


Dimensions

Model 100 -20



100-20 (Globe)



100-20 (Angle)

VALVE SIZE (inches)	3	4	6	8	10	12	16	20	24
A 150 ANSI	10.25	13.88	17.75	21.38	26.00	30.00	35.00	48.00	48.00
AA 300 ANSI	11.00	14.50	18.62	22.38	27.38	31.50	36.62	49.62	49.75
B DIA.	6.62	9.12	11.50	15.75	20.00	23.62	28.00	35.44	35.44
C MAX.	7.00	8.62	11.62	15.00	17.88	21.00	25.75	31.00	31.00
D 150 ANSI	—	6.94	8.88	10.69	—	—	—	—	—
DD 300 ANSI	—	7.25	9.38	11.19	—	—	—	—	—
E 150 ANSI	—	5.50	6.75	7.25	—	—	—	—	—
EE 300 ANSI	—	5.81	7.25	7.75	—	—	—	—	—
F 150 ANSI	3.75	4.50	5.50	6.75	8.00	9.50	11.75	14.56	17.00
FF 300 ANSI	4.12	5.00	6.25	7.50	8.75	10.25	12.75	16.06	19.00
G NPT Body Tapping	⅜	½	¾	¾	1	1	1	1	1
H NPT Cover Center Plug	½	½	¾	¾	1	1	1¼	2	2
J NPT Cover Tapping	⅜	½	¾	¾	1	1	1	1	1
Valve Stem Internal Thread UNF	10-32	¼-28	¼-28	⅜-24	⅜-24	⅜-24	⅜-24	½-20	½-20
Stem Travel	0.6	0.8	1.1	1.7	2.3	2.8	3.4	4.5	4.5
Approx Ship Wt. Lbs.	45	85	195	330	625	900	1380	2551	2733

VALVE SIZE (mm)	80	100	150	200	250	300	400	508	609
A 150 ANSI	260	353	451	543	660	762	889	1219	1219
AA 300 ANSI	279	368	473	568	695	800	930	1260	1263
B DIA.	168	232	292	400	508	600	711	900	900
C MAX.	178	219	295	381	454	533	654	787	787
D 150 ANSI	—	176	226	272	—	—	—	—	—
DD 300 ANSI	—	184	238	284	—	—	—	—	—
E 150 ANSI	—	140	171	184	—	—	—	—	—
EE 300 ANSI	—	148	184	197	—	—	—	—	—
F 150 ANSI	95	114	140	172	203	241	299	370	432
FF 300 ANSI	105	127	159	191	222	260	324	408	483
G NPT Body Tapping	⅜	½	¾	¾	1	1	1	1	1
H NPT Cover Center Plug	⅜	½	¾	¾	1	1	1¼	2	2
J NPT Cover Tapping	⅜	½	¾	¾	1	1	1	1	1
Valve Stem Internal Thread UNF	10-32	¼-28	¼-28	⅜-24	⅜-24	⅜-24	⅜-24	½-20	½-20
Stem Travel	15	20	28	43	58	71	86	114	114
Approx. Ship Wt. Kgs.	21	39	89	150	282	408	626	1157	1240

Service

For continued effective operation of Cla-Val Automatic control valves, a regular maintenance program should be established based on specific applications; however, we recommend a thorough inspection of the valve at least once a year.

We recommend an isolation valve be installed on the inlet and outlet of any automatic control valve to provide for repair and maintenance. Additional working space above and around the valve for the service maintenance personnel should be considered essential.

CLA-VAL™

E-100-20 (R6/94)

CLA-VAL CO.
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Phone: 714-722-4800 • Fax: 714-548-5441

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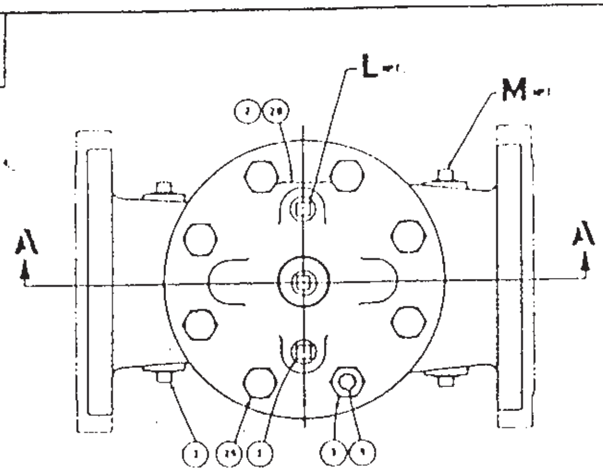
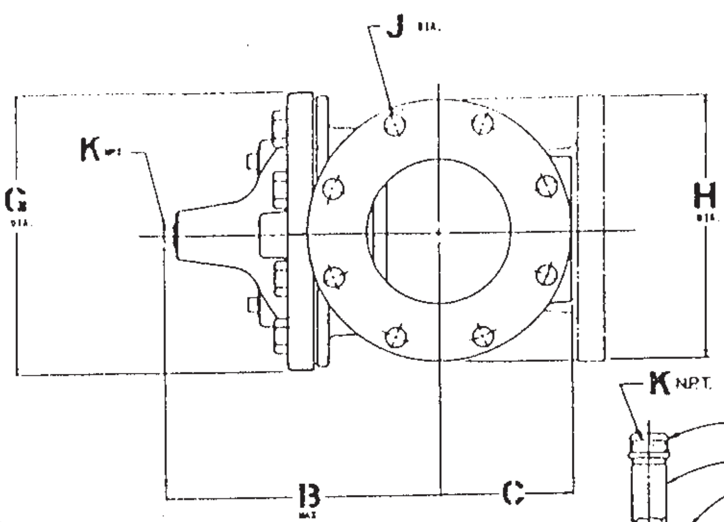
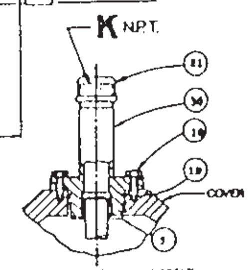
Printed in USA

Represented By:

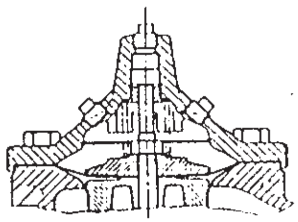
16949 C



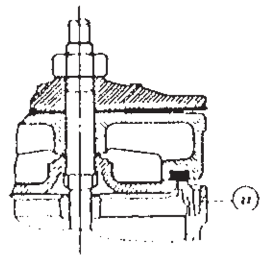




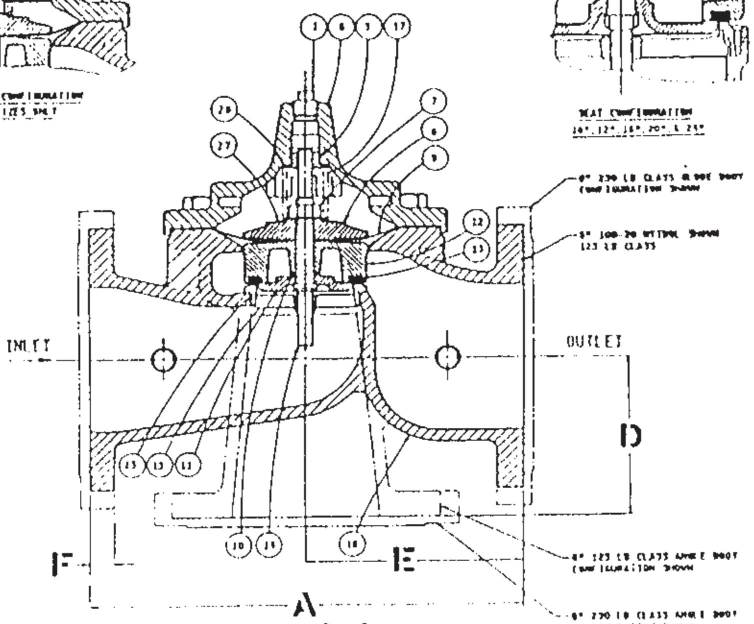
COVER BEARING / HOUSING DETAIL
20" & 24" ONLY



OPTIONAL 90 CONE COVER CONFIGURATION
3", 4" & 6" SIZES ONLY



SEAT CONFIGURATION
10", 12", 16", 20", & 24"



SECTION A-A

PARTS LIST

ITEM NO.	DESCRIPTION	QTY
1	PLUG, PIPE	
2	SCREW, DRIVE	2
3	NUT, HEX (8", 10", 12", 16", 20", & 24")	A/R
4	STUD, THREADED (8", 10", 12", 16", 20", & 24")	A/R
5	BEARING, COVER	1
6	COVER	1
7	NUT, STEM	1
* 8	WASHER, DIAPHRAGM	1
* 9	DIAPHRAGM	1
10	WASHER, SPACER	A/R
11	GUIDE, DISC	1
12	RETAINER, DISC	1
* 13	DISC	1
14	STEM	1
15	SEAT	1
16	BODY	1
17	SPRING	
18	BOLT HEX HD. (20" & 24" ONLY)	
* 19	O-RING (20" & 24" ONLY)	1
21	CAP, PIPE (20" & 24" ONLY)	1
22	SCREW, FLAT HD. (10" THRU 24" ONLY)	A/R
23	O-RING, SEAT	1
24	BOLT, HEX HD. (3", 4", & 6" ONLY)	A/R
28	NAMEPLATE	1
29	WASHER, SPRING, UPPER (100-20KC)	1
26	WASHER, SPRING, LOWER (100-20KC)	1
30	HOUSING, COVER BEARING (20" & 24")	1

* RECOMMENDED SPARE PARTS

DIMENSION TABLE

VALVE SIZE *	PRESSURE CLASS	A	B MAX	C	D	E	F	G DIA.	H DIA.	J DIA.	BOLT CIRCLE DIA.	NO. OF BOLT HOLES	K NPT	L NPT	M NPT
3"	125 LB	10.25	7.00	3.75			.75/.82	6.62	7.50	.750	6.000	4	1/2"	3/8"	3/8"
	250 LB	11.00		4.12			1.12/1.18		8.25	.875	6.625				
4"	125 LB	13.00	8.62	4.50	5.50	6.94	.94/1.00	9.12	9.00	.750	7.500	8		1/2"	1/2"
	250 LB	13.50		5.00	5.81	7.25	1.25/1.31		10.00		7.875				
6"	125 LB.	17.75	11.62	5.50	6.75	8.00	1.00/1.00	11.50	11.00	.875	9.500		3/4"	3/4"	3/4"
	250 LB.	18.62		6.25	7.25	9.50	1.44/1.50		12.50		10.625	12			
8"	125 LB.	23.50	15.00	6.75	7.12	10.12	1.12/1.18	13.75	13.50		11.750	8			
	250 LB.	22.50		7.50	7.75	11.19	1.00/1.00		15.00	1.000	13.000	12			
10"	125 LB	28.00	17.00	8.00			1.18/1.25	20.00	16.00	1.125	14.250	12	1"		
	250 LB	27.50		8.75			1.44/1.54		17.50	1.000	15.250	16			
12"	125 LB	30.00	21.00	9.50			1.25/1.31	23.62	19.00	1.000	17.000	12			
	250 LB	31.50		10.25			2.00/2.06		20.50	1.250	17.750	16			
16"	125 LB	35.00	25.75	12.75			1.44/1.50	29.00	23.50	1.125	21.250	16	1-1/4"	1"	1"
	250 LB	36.62		13.75			2.25/2.31		25.50	1.375	22.500	20			
20"	125 LB.	44.00	31.00	14.56			1.69/1.75	33.44	27.50	1.250	25.000	20	2"		
	250 LB.	49.62		16.06			2.50/2.56		30.50	1.375	27.000	24			
24"	125 LB	44.00	31.00	17.00			1.88/1.94	33.44	32.00	1.375	29.500	20			
	250 LB	49.75		19.00			2.75/2.81		36.00	1.630	32.000	24			

* ANGLE BODY STYLE CONFIGURATION AVAILABLE IN 3", 4" & 6" SIZES ONLY

3", 4", 6", 8", 10", 12", 16", 20", & 24"
100-20 HYTROL
125/250 LB. ... FLANGED
CLA-VAL CO.
16949 C

D C 007A

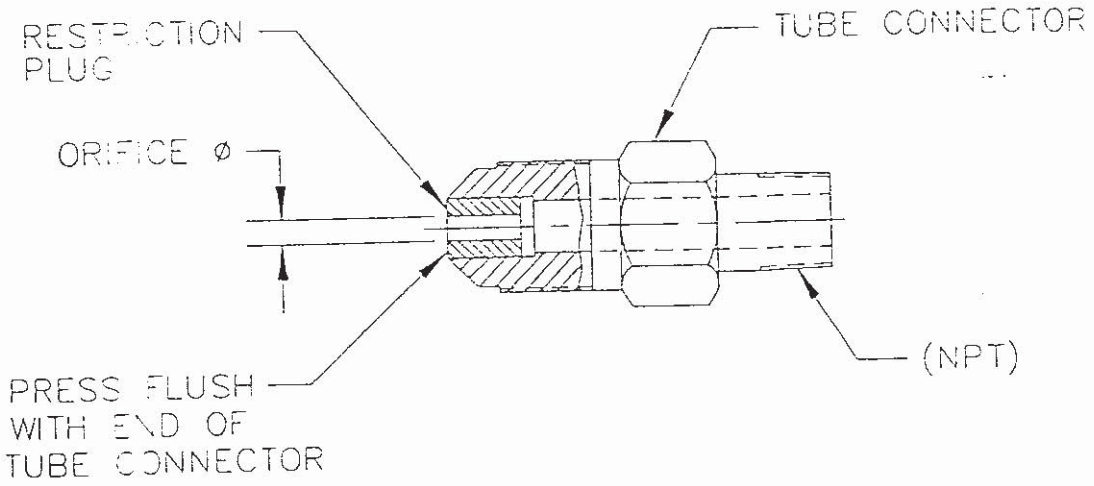
CLA-VAL CO. NEWPORT BEACH, CALIFORNIA

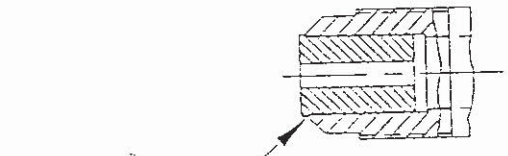
CATALOG NO.	DRAWING NO.	REV.
X58C	48834	AM

TYPE OF VALVE AND MAIN FEATURES

X58C RESTRICTION ASSEMBLIES

DESIGN		
DRAWN	JC	12-3-85
CHK'D	JC	12-4-85
APV'D	CH	12-11-85





NOTES:

1. *FOR IDENTIFICATION, THESE STOCK NO'S ARE TO BE STAINED BLUE WITH 74234-03.
2. **FOR IDENTIFICATION, THESE STOCK NO'S ARE TO BE STAINED RED WITH 74234-05.
3. SEE DWG 76740 FOR STAINLESS STEEL X58C.

CAD REVISION RECORD - DO NOT REVISE MANUALLY

LTR	DESCRIPTION	BY	DATE
A-AK	SEE REVISION FILE	EK	11-18-93
AL	REDRAWN ON CAD (ECO 14229)		
AM	REINSTATED PN 68565B & 64673H (ECO 15043)		10-18-94

CVCL 1 (2) 3 4 DIST. COL 048 SHEET 2 OF 2

CLA-VAL CO. NEWPORT BEACH, CALIFORNIA

CATALOG NO. X58C

DRAWING NO. 48834 REV AM

TYPE OF VALVE AND MAIN FEATURES

X58C RESTRICTION ASSEMBLIES

DESIGN		
DRAWN	JC	12-3-85
CHK'D	JC	12-4-85
APV'D	CH	12-11-85

X58C STOCK NO.	TUBE CONNECTOR SIZE TUBE X NPT	TUBE CONNECTOR MATERIAL	RESTRICTION PLUG ORIFICE DIA	RESTRICTION PLUG MATERIAL
	37° FLARE			
**44734C	3/8 X 3/8-18 NPT	ALUMINUM	.125 (1/8)	S. STEEL
	45° FLARE			
*37814B	1/4 X 1/8-27 NPT	BRASS	.031 (1/32)	S. STEEL
*80500C	1/4 X 1/8-27 NPT	BRASS	.062 (1/16)	S. STEEL
*67739D	3/8 X 1/8-27 NPT	BRASS	.040	S. STEEL
*64672K	3/8 X 3/8-18 NPT	BRASS	.062 (1/16)	S. STEEL
*99329-01D	3/8 X 3/8-18 NPT	BRASS	.094 (3/32)	S. STEEL
**79730J	1/2 X 1/2-14 NPT	BRASS	.125 (1/8)	S. STEEL
*85484E	1/4 X 1/8-27 NPT	BRASS	.031 (1/32)	DELRIN
*85486K	1/4 X 1/8-27 NPT	BRASS	.040	DELRIN
**48834-03A	1/4 X 1/8-27 NPT	BRASS	.125 (1/8)	DELRIN
*48834-04J	1/4 X 1/8-27 NPT	BRASS	.093	DELRIN
*88409-01G	3/8 X 1/8-27 NPT	BRASS	.031 (1/32)	DELRIN
*88409J	3/8 X 1/8-27 NPT	BRASS	.052	DELRIN
*42346H	3/8 X 1/8-27 NPT	BRASS	.062 (1/16)	DELRIN
**48834-01E	3/8 X 1/8-27 NPT	BRASS	.125 (1/8)	DELRIN
*42775H	3/8 X 1/4-18 NPT	BRASS	.062 (1/16)	DELRIN
**63604D	3/8 X 1/4-18 NPT	BRASS	.156 (5/32)	DELRIN
*10253D	3/8 X 3/8-18 NPT	BRASS	.031 (1/32)	DELRIN
*46946A	3/8 X 3/8-18 NPT	BRASS	.062 (1/16)	DELRIN
**64673H	3/8 X 3/8-18 NPT	BRASS	.125 (1/8)	DELRIN
*68565B	3/8 X 3/8-18 NPT	BRASS	.094 (3/32)	DELRIN
**43302K	3/8 X 3/8-18 NPT	BRASS	.188 (3/16)	DELRIN
**12900H	1/2 X 1/2-14 NPT	BRASS	.125 (1/8)	DELRIN
**48834-02C	1/2 X 1/2-14 NPT	BRASS	.188 (3/16)	DELRIN

CAD REVISION RECORD -- DO NOT REVISE MANUALLY

CTR	DESCRIPTION	BY	DATE
	SEE SHEET 1		

CLA-VAL CO.

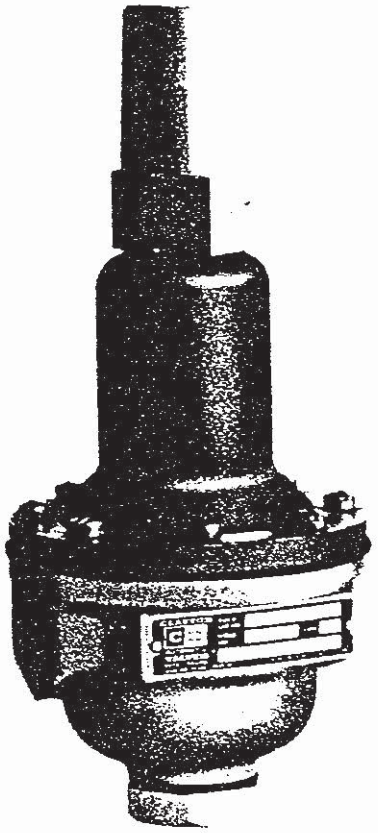
INSTALLATION / OPERATION / MAINTENANCE

PRESSURE REDUCING CONTROL

MODEL CRD

DESCRIPTION

The CRD Pressure Reducing Control automatically reduces a higher inlet pressure to a lower outlet pressure. It is a direct acting, spring loaded, diaphragm type control that operates hydraulically or pneumatically. If used as a pilot control with Cla-Val Co. Valves it will hold a constant downstream pressure.



OPERATION

The Pressure Reducing Control is normally held open by the force of the compression spring above the diaphragm; delivery pressure acts on the underside of the diaphragm. Flow through the valve responds to changes in downstream demand to maintain a pressure.

INSTALLATION

The Pressure Reducing Control may be installed in any position. There is one inlet port and two outlets, for either straight or angle installation. The second outlet port can be used for a gage connection. A flow arrow is marked on the body casting.

ADJUSTMENT PROCEDURE

The Pressure Reducing Control can be adjusted to provide a delivery pressure range as specified on the data plate.

essure adjustment is made by turning the adjustment screw to vary the spring pressure on the diaphragm. The greater the compression on the spring the higher the pressure setting.

1. Turn the adjustmest screw in (clockwise) to increase delivery pressure.
2. Turn the adjustment screw out (counter-clockwise) to decrease the delivery pressure.
3. Tighten jam nut on adjusting screw and replace protective cap.
4. When this control is used, as a pilot control on a Cla-Val Co. main valve, the adjustment can be made under flowing conditions. The flow rate is not critical, but generally should be somewhat lower than normal in order to provide an inlet pressure several psi higher than the desired setting.

MAINTENANCE

Disassembly

To disassemble follow the sequence of the item numbers assigned to parts in the sectional illustration.

Reassembly

eassembly is the reverse of disassembly. Caution must oe taken to avoid having the yoke (17) drag on the inlet nozzle of the body (18). Follow this procedure:

SERVICE SUGGESTIONS

SYMPTOM	PROBABLE CAUSE	REMEDY
Fails to open when delivery pressure lowers	No spring compression	Tighten adjusting screw
	Damaged spring	Disassemble and replace
	Spring guide (8) is not in place	Assemble properly
	Yoke dragging on inlet nozzle	Disassemble and reassemble properly (refer to reassembly No. 4)
Fails to close when delivery pressure rises	Spring compressed solid	Back off adjusting screw
	Mechanical obstruction	Disassemble and remove obstruction
	Worn disc	Disassemble remove and replace disc retainer assembly
	Yoke dragging on inlet nozzle	Disassemble and reassemble properly (refer to reassembly No. 4)
Leakage from cover vent hole	Damaged diaphragm	Disassemble and replace
	Loose diaphragm nut	Remove cover and tighten nut

CLA-VAL CO. Newport Beach, California U.S.A
CLA-VAL CANADA LTD. Beamsville, Ontario, Canada

CLA-VAL CO.

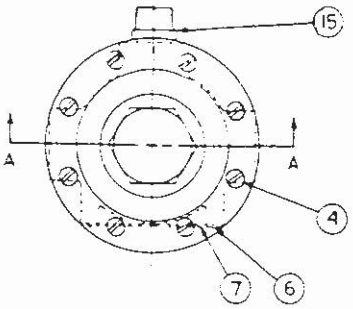
PARTS LIST

PRESSURE REDUCING CONTROL

MODEL **CRD**

SIZE	STOCK NUMBER	ADJUSTMENT RANGE PSI	ADJUSTMENT RANGE FEET OF WATER
3/8"	71943-03	15-75	35-173
3/8"	71943-04	30-300	69-692
3/8"	71943-07	2-6.5	4.5-15
3/8"	71943-08	2-30	5-69

Factory set pressure:
15-75 set @ 20 PSI
30-300 set @ 60 PSI
2-6.5 set @ 3.5 PSI
2-30 set @ 10 PSI



Place yoke (17) in body and screw the disc retainer assembly (16) until it bottoms.

Install gasket (14) [and spring (19) for 2-30 and 2-6.5 psi range] onto plug (13) and screw into body. Disc retainer must enter guide hole in plug as it is assembled. Screw the plug in by hand. Use wrench to tighten only.

Place diaphragm (12) and diaphragm washer (11) on yoke. Screw on hex nut (10).

Hold the diaphragm so that screw holes in the diaphragm and body align. Tighten diaphragm nut with a wrench. At the final tightening release the diaphragm and permit it to rotate approximately 5o to 10o. The diaphragm holes should now be properly aligned with the body holes.

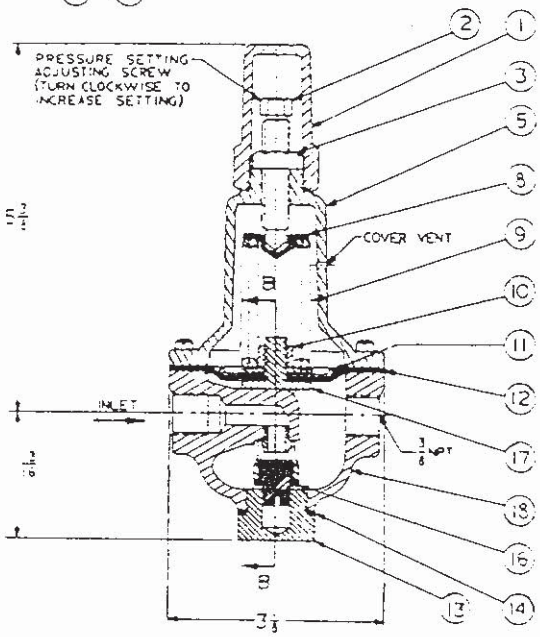
To check for proper alignment proceed as follows:

Rotate diaphragm clockwise and counter-clockwise as far as possible. Diaphragm screw holes should rotate equal distance on either side of body screw holes, ±1/8".

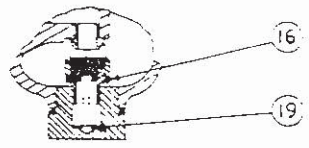
Repeat assembly until diaphragm and yoke are properly assembled. There must be no contact between yoke and body nozzle during its normal movement. To simulate this movement hold body and diaphragm holes aligned. Move yoke to open and closed positions. There must be no evidence of contact or dragging.

5. Install spring (9) with spring guide (8) on top of spring.

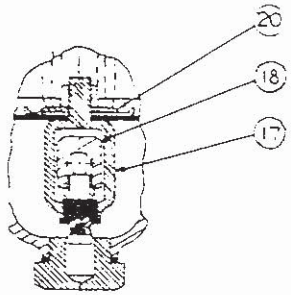
6. Install cover (5), adjusting screw (2) and nut (3), then cap (1).



SECTION A-A
OPEN POSITION
FOR HIGH PRESSURE CONTROL



BODY AND DISC RETAINER DETAIL FOR LOW PRESSURE CONTROL



SECTION B-B
CLOSED POSITION

NOTE: Bucking Spring required for Spring Ranges 2-6.5 PSI & 2-30 PSI

ITEM	DESCRIPTION	ITEM	DESCRIPTION	ITEM	DESCRIPTION
1	Cap	8	Spring Guide	16*	Disc Retainer Assy. (15-75 PSI)
2	Adjusting Screw	9*	Spring (15-75 PSI)		Disc Ret. Assy (30-300 PSI)
3	Jam Nut		Spring (30-300 PSI)		Disc Ret. Assy (2-6.5 PSI)
4	Machine Screw (Fil. Hd.) (8 Required)		Spring (2-6.5 PSI)		Disc Ret. Assy (2-30 PSI)
5	Cover		Spring (2-30 PSI)	17	Yoke
6	Nameplate Screw	10	Hex Nut	18	Body & ¼" Seat Assy
7	Nameplate (15-75 PSI)	11	Diaphragm Washer	18**	Body & ¼" Seat Assy
	Nameplate (20-300 PSI)	12*	Diaphragm	19*	Bucking Spring
	Nameplate (2-6.5 PSI)	13	Plug, Body	20	Belleville Washer
	Nameplate (2-30 PSI)	14*	Gasket		
		15	Plug, 3/8 NPT		

When ordering parts specify: • All nameplate data • Item Number • Description • *RECOMMENDED SPARE PARTS **STANDARD

CLA-VAL

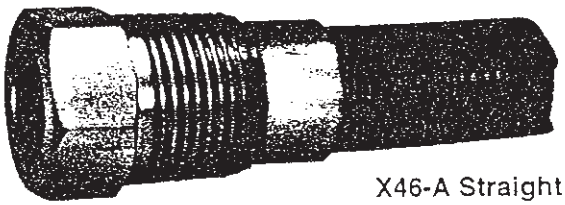
REGULATOR SPRING COLOR CODING CHART

* THESE FIGURES ARE ONLY APPROXIMATE. FINAL ADJUSTMENTS SHOULD BE MADE WITH A PRESSURE GAGE.

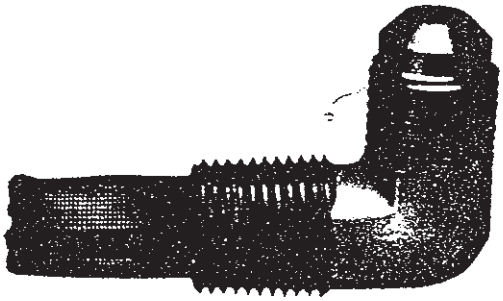
WIRE SIZE	SPRING NUMBER	COLOR	WIRE MATERIAL	CATALOG NUMBER	PSI RANGE	*PSI PER TURN
.080 DIA	C0492D	BLUE	S.S.	CDB-7 CRL-5	0-7 0-7	.75 .75
.080 DIA	82575C	*	S.S.	CRD CRD-10A	1.9-6.5 1.9-6.5	.61 .49
.116 DIA	81594E	*	S.S.	CRD CRD-10A	2.30 2.30	3.0 2.4
.120 DIA	V5654J	GREEN	CHR VAN	CRL-5 CRD	5-25 10-40	4.0 4.0
.162 DIA	32447F	NATURAL	S.S.	CDB-7 CRL-5 CRD	10-60 10-60 20-80	12.0 12.0 10.5
.162 DIA	32656B	*	INCONEL	CRL-5M	10-70	13.3
.162 DIA	V5695B	YELLOW	MUSIC WIRE	CDB-7 CRL-5 CRD	20-80 20-80 30-110	14.5 14.5 13.0
.207 DIA	C1124B	CAD PLT	MUSIC WIRE	CDB-7 CRD CRL-5	50-150 50-150 50-150	29.5 30.0 29.5
.225 DIA	V6515A	RED	MUSIC WIRE	CDB-7 CRD CRL-5	65-180 90-200 65-185	44.0 47.0 44.0
.312 DIA	31554K	CAD PLT	CHR VAN	CRL-4A	30-300	10.0
.115 X .218	71884B	RED	CHR VAN	CRL CRD CRD-10A	0-75 15-75 15-75	8.5 9.0 7.2
.118 X .225	71885J	GREEN	CHR VAN	CRL CRD CRD-10A	20-200 30-300 30-300	28.0 27.0 22.4
.225 X .295	1630201A	CAD PLT	CHR VAN	CRL	100-300	18.0
.225 X .350	44591G	CAD PLT	CHR VAN	CRD-18	30-300	14.5
.440 X .219	48211H	CAD PLT	STEEL	CRA-18 CRD-22 CRL-4A	200-450 200-450 100-450	17.0 17.0 17.0

WIRE SIZE	SPRING NUMBER	COLOR	WIRE MATERIAL	CATALOG NUMBER	RANGE FEET	*FEET PER TURN
.080 DIA	C0492D	BLUE	S.S.	CRD-2	4.5-15	.82
.120 DIA	V5654J	GREEN	CHR VAN	CRD-2	10-70	7.0
.162 DIA	V5695B	YELLOW	MUSIC WIRE	CRD-2	50-170	26.0
.375 DIA	87719B 1 SPRING 2 SPRINGS 3 SPRINGS 4 SPRINGS 5 SPRINGS	EPOXY COATED	CHROME SILICON	CDS-5	5-40 30-80 70-120 110-160 150-200	1.0 2.0 3.0 4.0 5.0
.072 DIA	V5097A	*	302SS	CVC	1-17	.7

Pilot System Strainers & Restriction Assemblies



X46-A Straight



X46-B Angle

X46A/X46B Flow Clean Strainer

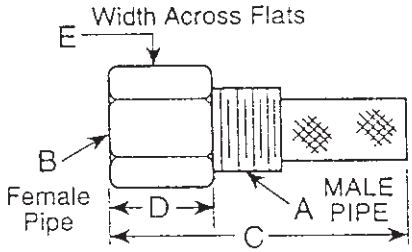
- Self Scrubbing Cleaning Action
- Straight Type or Angle Type
- Many Sizes Available

The Cla-Val Co. X46 Strainer is composed of a heavy mesh monel inner screen covered with a fine mesh monel outer screen. These two elements are securely soldered to a sturdy brass bar stock housing. The outer screen is a 40 x 40 mesh screen with .008" wire. This strainer is designed to prevent passage of foreign particles larger than .015". It is especially effective against such contaminents as algae, mud, scale, wood pulp, moss, and root fibres. Available in several different sizes as shown. There is a model for every Cla-Val Co. Valve.

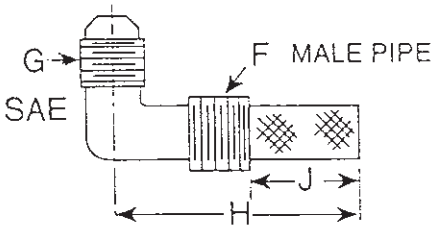
The Flow Clean strainer operates on a velocity principle utilizing the circular "air foil" section to make it self cleaning. Impingement of particles is on the "leading edge" only. The low pressure area on the downstream side of the screen prevents foreign particles from clogging the screen. There is also a scouring action, due to eddy currents, which keeps most of the screen area clean.

The strainer can be installed in any piping system where there is a moving stream to keep it clean. On Cla-Val Co. Valves the installation is made in the body tapping so the screen is projecting into the flow stream.

Dimensions (In Inches)



Straight Type A (In Inches)				
A	B	C	D	E
1/8	1/8	1-3/4	1-3/4	1/2
1/4	1/4	2-1/4	3/4	11/16
3/8	3/8	2-1/2	7/8	7/8
1/2	3/8	2-1/2	1/2	7/8
1/2	1/2	2-3/4	1	1-1/16
3/4	3/8	3-3/8	1/2	1-1/16
3/4	1/2	3-3/8	1/2	1-1/16
3/4	3/4	3-1/2	1	1-7/16
1	3/8	4-1/4	1/2	1-3/8
1	1/2	4-1/2	1/2	1-3/8
1	1	4-1/2	1-1/4	1-3/4



Angle Type B (In Inches)			
F	G	H	J
1/8	1/4	1-3/8	5/8
1/4	1/4	1-3/4	3/4
3/8	1/4	2	7/8
3/8	3/8	1-7/8	7/8
1/2	3/8	2-3/8	1

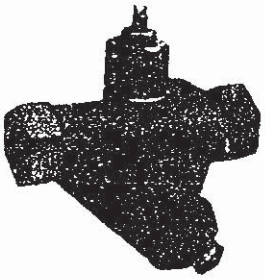
Specifications

Body — Brass (also available in stainless steel on special order)
Strainer Screen — fabricated from Monel wire.

Please Specify:

- Catalog No. X46
- Straight Type or Angle Type

X42N-2
Strainer and Needle
Valve Assembly

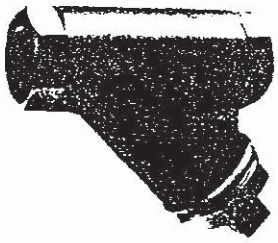


Size	Body Matl.	Screen Matl.
3/8"	Standard: Bronze	Monel
3/8"	Option: Bronze	Stainless Steel
3/8"	Option: Stainless Steel	Stainless Steel

X42N-3
Strainer and Needle
Valve Assembly

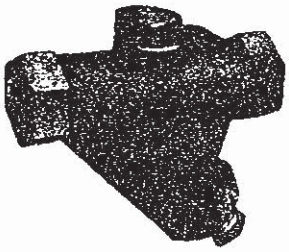
Size	Body Matl.	Screen Matl.
3/8"	Standard: Bronze	Monel
3/8"	Option: Bronze	Stainless Steel
3/8"	Option: Stainless Steel	Stainless Steel

X43
"Y" Pattern Strainer



Size	Body Matl.	Screen Matl.
'/8"	Standard: Bronze	Stainless Steel

X44A
Strainer and
Orifice Assembly

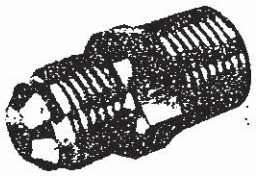


Size	Body Matl.	Screen Matl.
3/8 "	Standard: Bronze	Monel
3/8 "	Option: Bronze	Stainless Steel
3/8 "	Option: Stainless Steel	Stainless Steel

X58B
Restriction Assembly

Size	Body Matl.	Restriction Fitting Matl.
1/4 - 3/8"	Standard: Bronze	Delrin
	Option: Bronze	Delrin

X58C
Restriction Assembly



Size	Body Matl.	Restriction Fitting Matl.
1/4 - 3/8"	Standard: Bronze	Bronze
	Option: Bronze	Delrin

CLA-VAL CO.
P O Box 1325 Newport Beach CA 92659-0325
Phone: 714-722-4800 • Fax: 714-548-5441

CLA-VAL CANADA LTD.
4687 Christie Drive
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Phone: 905-563-4963
Fax: 905-563-4040

CLA-VAL SA
Chemin des Mesanges 1
CH-1032 Romanel/
Lausanne, Switzerland
Phone: 21/646.49.41
Fax: 21/646.49.59

Represented By:

REVISION FILE		
AD	See	4-04-94
AE	ADDED "-" & NOTE FOR PN -03F; REDRAWN ON CAD (ECO 14526,	JN

CLA-VAL CO NEWPORT BEACH, CALIFORNIA

CATALOG NO.

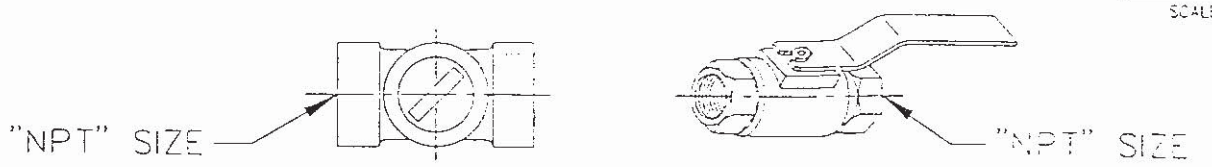
DRAWING NO. 67783 | REV. AE

TYPE OF VALVE AND MAIN FEATURES

CK2 COCK/BALL VALVE

DESIGN		
DRAWN	MGR	4-02-80
CHK'D	KD	4-03-80
APV'D	CH	4-07-80

SCALE: NONE

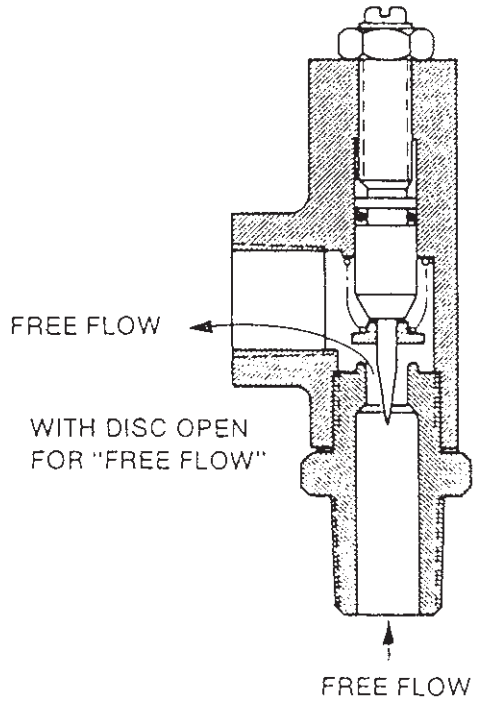


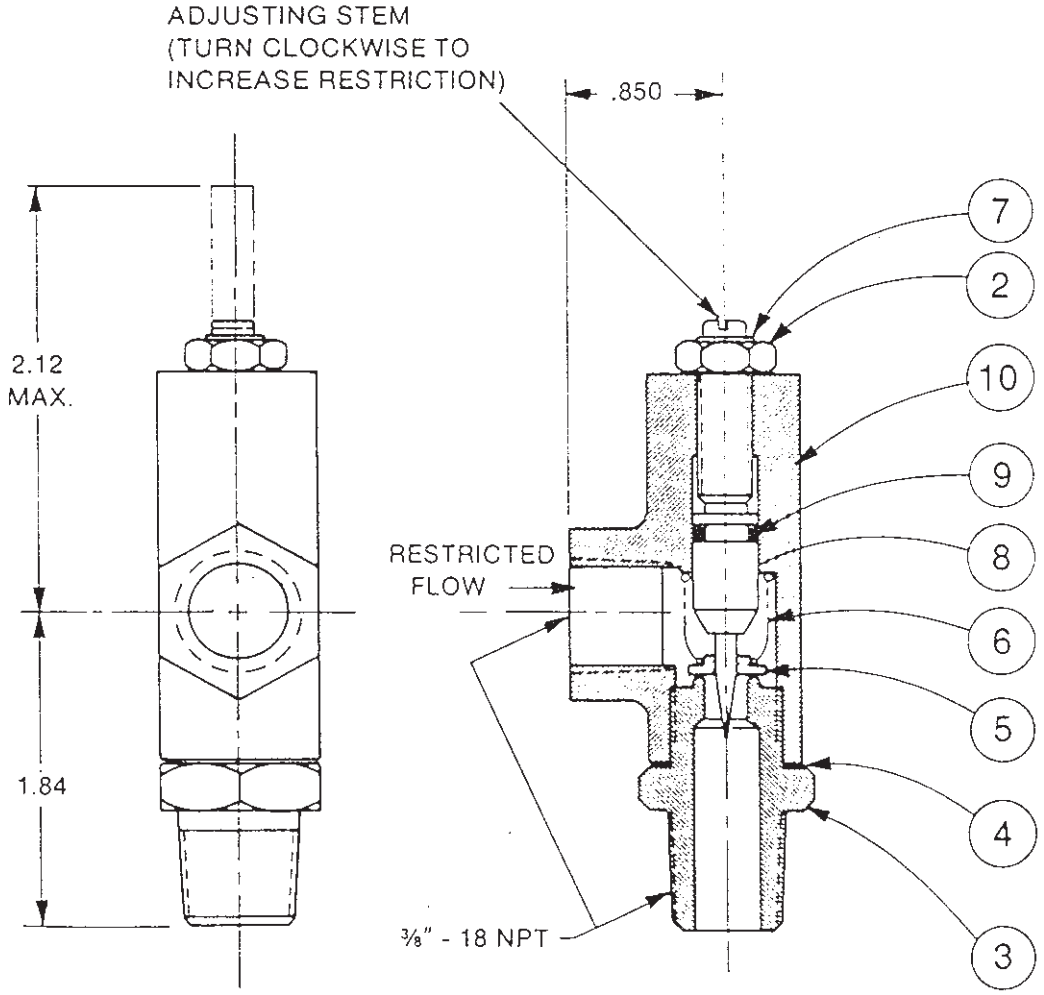
CLA-VAL PART NO. AND MATERIAL

BRONZE	STEEL	IRON	316 SS	316 SS W/HANDLE	BRONZE W/HANDLE (BACKFLOW)	SIZE "NPT"
67783-01K	-09C	-17F	SUPSD BY -26G ~~-25J~~		-41F	1/8"
-02H	-10A	-18D	-26C		-42D	1/4"
-03F*	-11J	-19B	-27E	-46E	-45G	3/8"
-04D	-12G	-20K	-28C		-43B	1/2"
-05A	-13E	-21H	-29A		-44K	3/4"
-06J	-14C	-22F	-30J			1"
-07G	-15K	-23D	-31G			1 1/4"
-08E	-16H	-24B	-32E			1 1/2"

C	CLA-VAL CO.	PARTS LIST
	FLOW CONTROL	CV 3/8"

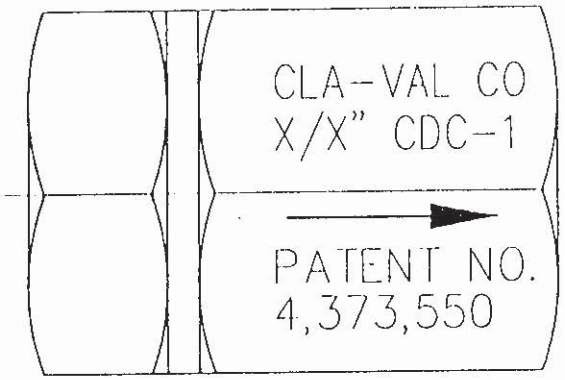
ITEM	DESCRIPTION	QUAN.
2	NUT, JAM	1
3	SEAT	1
4	GASKET	1
5	DISC	1
6	SPRING	1
7	RING, RETAINING	1
8	STEM	1
9	O-RING	1
10	HOUSING	1

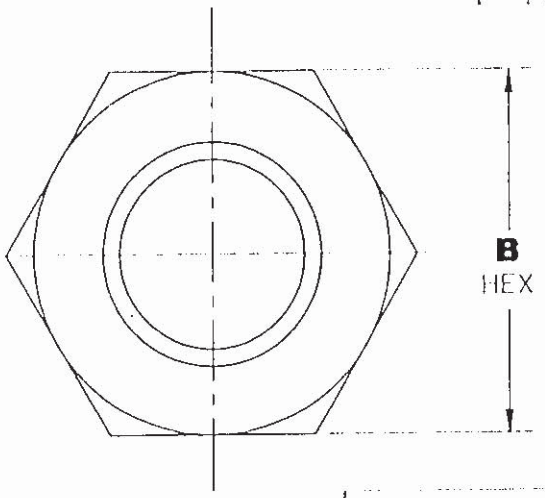


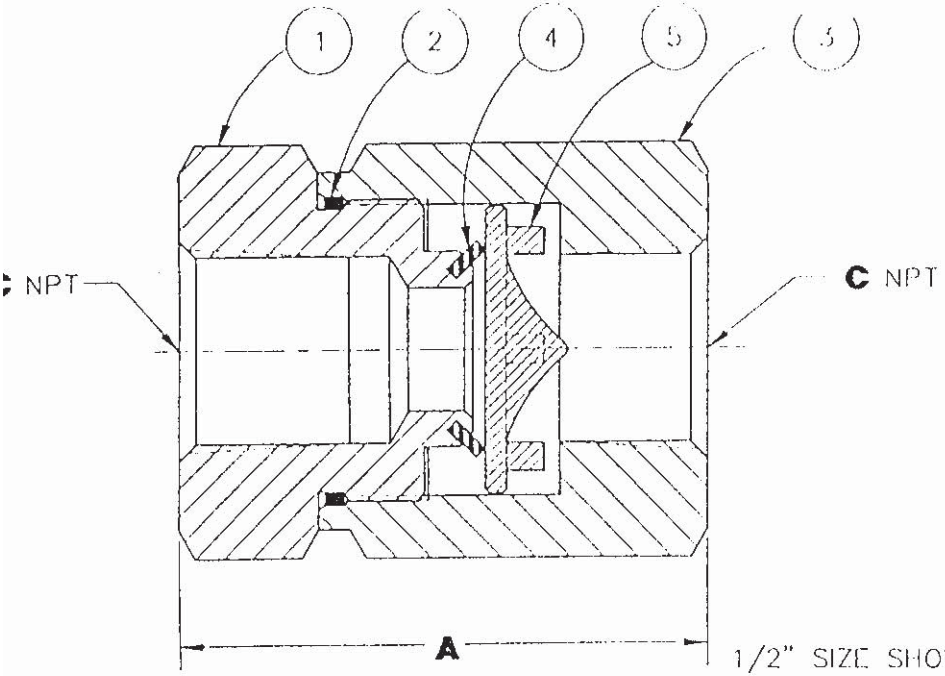


DWG NO 98345 SH 1 REV E

REVISION			
REV	DESCRIPTION	DATE	APPROVED
A-D	SEE REVISION FILE		
E	REVISED & REDRAWN ON CAD. WAS "D" SIZE (ECO 14229)	11-18 93	EK







1/2" SIZE SHOWN

DESCRIPTION	A	B HEX	C NPT
3/8" CHECK VALVE	2.06	1.06	.38 (3/8)-18 NPT
1/2" CHECK VALVE	2.12	1.38	.50 (1/2)-14 NPT

PARTS LIST

ITEM NO	QTY REQD	NOMENCLATURE OR DESCRIPTION
5	1	PLATE, VALVE
4	1	SEAL, VALVE RING
3	1	RETAINER, VALVE
2	1	O-RING
1	1	RETAINER, SEAL

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE FRACTIONS ±1/32 DECIMALS .XX ±.03 .XXX ±.010 ANGULAR ± 5° SURFACE FINISH 125 BREAK CORNERS .010 MAX --DO NOT SCALE DRAWING--

CONTRACT NO. ---

APPROVALS		DATE
DRAWN	JC	11-30-84
CHECKED	LFH	12-4-84
APPROVED	CH	12-6-84
ENGR		

CLA-VAL CO. NEWPORT BEACH, CALIFORNIA

TITLE 3/8" & 1/2" CDC-1 CHECK VALVE PATENT NO. 4,373,550

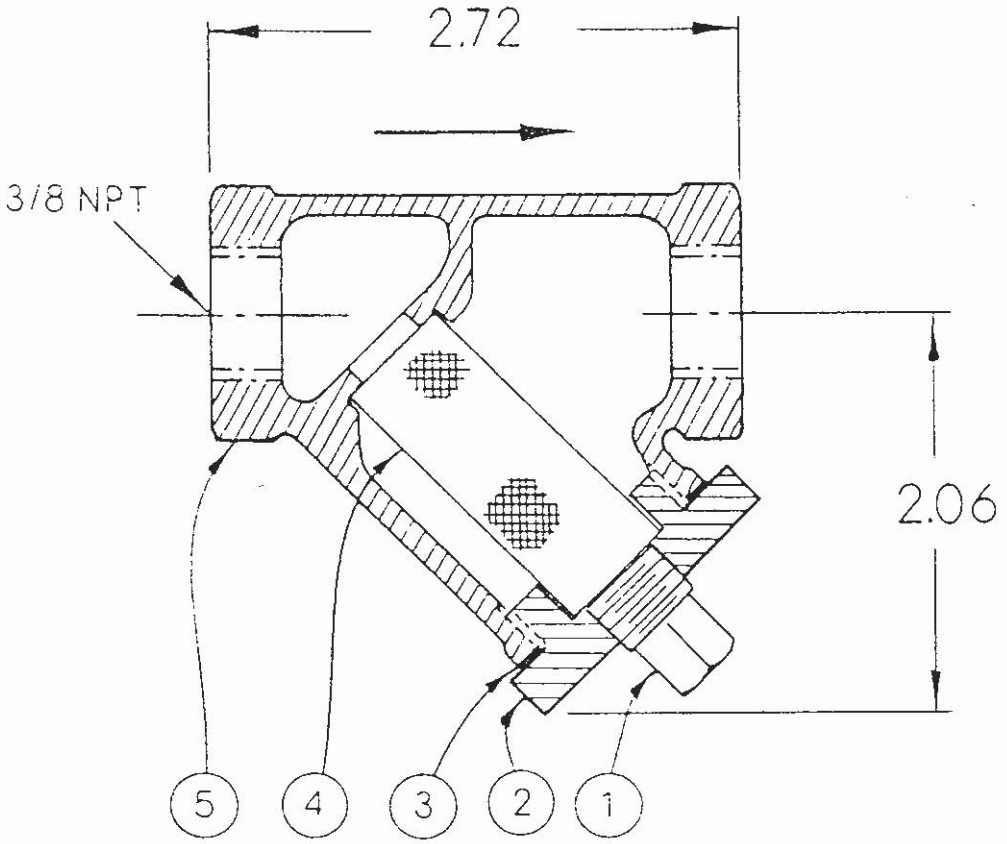
SIZE B | CAGE CODE 86184 | DWG NO. 98345 | REV. E

SCALE 2/1 | SHEET 1 OF 1

DIST. CODE 027A

C	CLA-VAL CO.	PARTS LIST
	STRAINER	Model X43

SIZE	STOCK NUMBER
3/8 X 3/8	33453



ITEM NO.	DESCRIPTION	MATERIAL
1	PIPE PLUG (3/8 NPT)	STEEL
2 †	STRAINER PLUG	BRASS
3 *	GASKET	COPPER
4 *	SCREEN	MONEL
5 †	BODY	BRASS

† AVAILABLE ONLY IN ASSEMBLY

When ordering parts specify:

- All nameplate data
- Item Number
- Description
- * Recommended Spare Parts

Cla-Val Product Identification

How to Order

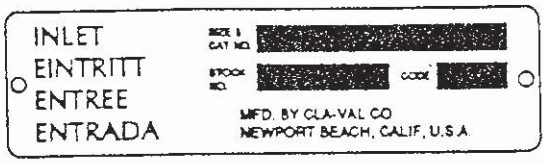
Proper Identification

For ordering of repair kits, replacement parts of for inquiries concerning valve operation it is extremely important to properly identify Cla-Val products already in service.

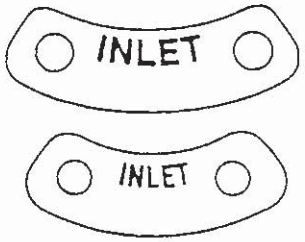
Pertinent data includes but is not limited to... valve function, size, material, pressure rating, type of pilot control used and its adjustment ranges, end details, etc.

Identification Plates

For product identification, cast in body markings are supplemented by identification plates, as illustrated on this page. The plates, depending on type and size of product, are mounted in the most practical position. It is extremely important that these identification plates are not painted over, removed, or in any other way rendered illegible.

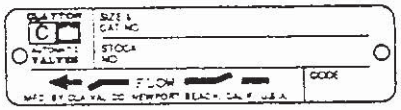


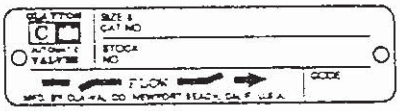
This brass plate appears on valves sized 2 1/2" and larger, and is found on the top of the inlet flange.



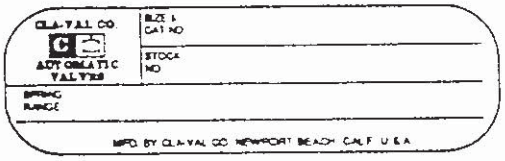
These two brass plates appear on 3/8", 1/2", and 3/4" size valves and are located on the valve cover.

This brass plate appears on altitude valves only and is found on top of the outlet flange.

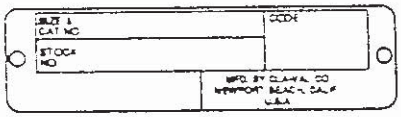




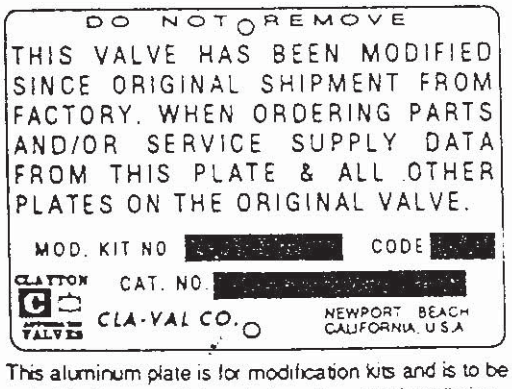
These two brass plates appear on 1" through 2" size valves and is located on only one side of the valve body.



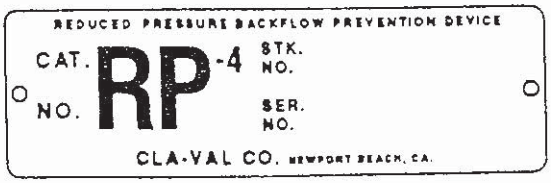
This tag is affixed to the cover of pilot control valves. The adjustment range appears in the spring range section.



This brass plate is used to identify pilot control valves. The adjustment range of the control valve is stamped into the plate.



This aluminum plate is for modification kits and is to be wired to the new pilot control section after installation.



This brass plate is on our backflow prevention assemblies and is found on the side of the number two check. The serial number of the assembly is also stamped on the top of the inlet flange of the number one check.

CLA-VAL

REPAIR KITS

100-01 Hytrol Diaphragm and Disc Assemblies

(Factory Assembled)

For: 100-01 Hytrol Valves with Cast Iron, Bronze Trim Materials AND 125 PRESSURE CLASS ONLY.

INCLUDES: Stem, Disc Guide, Disc, Disc Retainer, Spacer Washers, Diaphragm, Diaphragm Washer and Stem Nut.

Valve Size	Stock Number	Valve Size	Stock Number
3/8"	49097K	4"	33273E
1/2" - 3/4"	C2518D	6"	40456G
1"	C2520K	8"	45276D
1 1/4" & 1 1/2"	C2522F	10"	81752J
2"	C2524B	12"	85533J
2 1/2"	C2523D	14"	89067D
3"	C2525J	16"	89068B

100-01 Hytrol and 100-04 Hycheck Repair Kits (125 PRESSURE CLASS ONLY)

(Supplied Shrink Wrapped)

INCLUDES: Diaphragm, Disc (or Disc Assembly), and Spacer Washers.

BUNA-N (Standard material)		VITON (For -KB Valves)	
Valve Size	Stock Number	Valve	Stock Number
3/8"	9169801K	3/8"	9169806J
1/2" - 3/4"	9169802H	1/2" - 3/4"	9169807G
1"	9169803F	1"	9169808E
1 1/4" & 1 1/2"	9169804D	1 1/4" - 1 1/2"	9169809C
2"	9169805A	2"	9169810A
2 1/2"	9169811J	2 1/2"	9169817F
3"	9169812G	3"	9169818D
4"	9169813E	4"	9169819B
6"	9169815K	6"	9169820K
8"	9817901D		
10"	9817902B		
12"	9817903K		

NOTE: Larger Sizes - Order Individual Parts

WHEN ORDERING PLEASE GIVE COMPLETE NAMEPLATE DATA OF THE VALVE AND/OR CONTROL BEING REPAIRED, ITEM DESCRIPTION AND STOCK NUMBER.

MINIMUM ORDER CHARGE APPLIES

100-02 Powertrol and 100-03 Powercheck Repair Kits (125 PRESSURE CLASS ONLY)

(Supplied Shrink Wrapped)

INCLUDES: Diaphragm, Disc (or Disc Assembly), and Spacer Washers.

BUNA-N Standard Material

Valve Size	Stock Number	Valve Size	Stock Number
3/8"	9169901H	2 1/2"	9169910J
1/2" - 3/4"	9169902F	3"	9169911G
1"	9169903D	4"	9169912E
1 1/4" & 1 1/2"	9169904B	6"	9169913C
2"	9169905J	8"	99116G

NOTE: Larger sizes - Order Individual Parts

Pilot Control Valve Repair Kits

(Supplied Shrink Wrapped)

INCLUDES: Diaphragm, Disc (or Disc Assembly), O-Rings, Spare Screw or Gaskets as appropriate.

BUNA-N (Standard Material)

CONTROL	STOCK NO.	CONTROL	STOCK NO.
CDB	9170006C	CRD-22	98923G
CDS4	9170014G	CRL	9170007A
CDS5	14200A	CRL5A	20666E
CFM2	12223E	CDHS2B	9170004H
CFM7/7A	1263901K	CDHS2F	9170005E
CRA	9170001D	CDHS18	9170003K
CRD	9170002B	102C	1726201F

VITON (for -KB Controls)

CONTROL	STOCK NO
CDB-KB	9170012A
CRD-KB	9170008J
CRL-KB	9170013J
CDHS2B-KB	9170010E
CDHS2F-KB	9170011C
CDHS18-KB	9170009G
102C-KB	1726202D

REPAIR ASSEMBLIES (In Standard Materials Only)

CONTROL	DESCRIPTION	STOCK NO.
CF1-C1	Pilot Assembly Only	89541H
CF1-C1	Complete Float Control less Ball & Rod	89016A
CSM11-A2-2	Mechanical Parts Assy.	97544B
CSM11-A2-2	Pilot Assembly Only	18053K

WHEN ORDERING PLEASE GIVE COMPLETE NAMEPLATE DATA OF THE VALVE AND/OR CONTROL BEING REPAIRED, ITEM DESCRIPTION AND STOCK NUMBER.

MINIMUM ORDER CHARGE APPLIES

CLA-VAL

N-RK (R2/94)

Cla-Val Co.
P.O. Box 1325
Newport Beach
California 92659-0325
Phone: (714) 722-4800
Fax: (714) 548-5441

Cla-Val Canada Ltd.
4687 Christie Drive
Beamsville, Ontario
Canada, LOR 1BO
Phone: (905) 563-4963
Fax: (905) 563-4040

CLA-VAL

REPAIR KITS

600 series valves

600 Series 100-20 Hytrol Diaphragm and Disc Assemblies

(Factory Assembled)

For: 100-20 Hytrol Valves with Cast Iron, Bronze Trim Materials AND 125 PRESSURE CLASS ONLY.

INCLUDES: Stem, Disc Guide, Disc, Disc Retainer, Spacer Washers, Diaphragm, Diaphragm Washer and Stem Nut.

Valve Size	Stock Number
3"	C2524B
4"	C2525J
6"	33273E
8"	40456G
10"	45276D

Valve Size	Stock Number
12"	81752J
16"	85533J
20"	89068B
24"	89068B

600 Series 100-20 Hytrol and 100-23 Hycheck Repair Kits (125 PRESSURE CLASS ONLY)

(Supplied Shrink Wrapped)

INCLUDES: Diaphragm, Disc (or Disc Assembly), and Spacer Washers.

BUNA-N (Standard material)	
Valve Size	Stock Number
3"	9169805A
4"	9169812G
6"	9169813E
8"	9169815K
10"	9817901D
12"	9817902B
16"	9817903K

VITON (For -KB Valves)	
Valve	Stock Number
3"	9169810A
4"	9169818D
6"	9169819B
8"	9169820K

NOTE: Larger Sizes - Order Individual Parts

WHEN ORDERING PLEASE GIVE COMPLETE NAMEPLATE DATA OF THE VALVE AND/OR CONTROL BEING REPAIRED, ITEM DESCRIPTION AND STOCK NUMBER.

MINIMUM ORDER CHARGE APPLIES

600 Series 100-21 Powertrol and 100-22 Powercheck Repair Kits (125 PRESSURE CLASS ONLY)

(Supplied Shrink Wrapped)

CLUDES: Diaphragm, Disc (or Disc Assembly), and Spacer Washers.

BUNA-N Standard Material			
Valve Size	Stock Number	Valve Size	Stock Number
3"	9169905J	8"	9169913C
4"	9169911G	10"	99116G
6"	9169912E		

NOTE: Larger sizes - Order Individual Parts

Pilot Control Valve Repair Kits

(Supplied Shrink Wrapped)

INCLUDES: Diaphragm, Disc (or Disc Assembly), O-Rings, Spare Screw or Gaskets as appropriate.

BUNA-N (Standard Material)				VITON (for -KB Controls)	
CONTROL	STOCK NO.	CONTROL	STOCK NO.	CONTROL	STOCK NO
CDB	9170006C	CRD-22	98923G	CDB-KB	9170012A
CDS4	9170014G	CRL	9170007A	CRD-KB	9170008J
CDS5	14200A	CRL5A	20666E	CRL-KB	9170013J
CFM2	12223E	CDHS2B	9170004H	CDHS2B-KB	9170010E
CFM7/7A	1263901K	CDHS2F	9170005E	CDHS2F-KB	9170011C
CRA	9170001D	CDHS18	9170003K	CDHS18-KB	9170009G
CRD	9170002B	102C	1726201F	102C-KB	1726202D

REPAIR ASSEMBLIES (In Standard Materials Only)		
CONTROL	DESCRIPTION	STOCK NO.
CF1-C1	Pilot Assembly Only	89541H
CF1-C1	Complete Float Control less Ball & Rod	89016A
CSM11-A2-2	Mechanical Parts Assy.	97544B
CSM11-A2-2	Pilot Assembly Only	18053K

WHEN ORDERING PLEASE GIVE COMPLETE NAMEPLATE DATA OF THE VALVE AND/OR CONTROL BEING REPAIRED, ITEM DESCRIPTION AND STOCK NUMBER.

MINIMUM ORDER CHARGE APPLIES

CLA-VAL

Cla-Val Co.
P.O. Box 1325
Newport Beach
California 92659-0325
Phone: (714) 722-4800
Fax: (714-548-5441

Cla-Val Canada Ltd.
4687 Christie Drive
Beamsville, Ontario
Canada, LOR 1B4
Phone: (905) 563-4963
Fax: (905) 563-4040

Category	Item	Model	Manufacturer	Vendor Contact
System Components	Deep Manhole Pump	OSP50	Hydromatic Pumps	Emmons Pump & Control Inc. Trenton Emmons 453 North Pear Street Albany, NY 12204 (518)-694-0404
	Shallow Manhole Pump	-	-	
	Recharge Floor Sump Pump	SP100H	Hydromatic Pumps	
	Filter Feed Pumps	-	-	
	Redux Metering Pump	A161-61 / D131-25HV	Liquid Metronics	Northeast Pump & Instrument 190 Summer Street Lunenburg, MA 01462 (800)-378-1500
	Sternpac Metering Pump	EWB11Y1-VE	Walchem Corporation - Iwaki America	Ryan Herco Flow Solutions Albany Service Center 5 Fairchild Square, Suite #2 Clifton Park, NY 12065 Ph: (800)-848-1141 F: (518)-458-2384 newyorksales@rhfs.com
	Pneumatic Solids Transfer Pump (P-5A)	Sandpiper Model EB1 SM	Sandpiper Pump - Warren Rupp, Inc.	Rolfe Industries, Inc. 2 Parkford Drive Clifton Park, NY 12065 (518)-383-2244
	Solids Collection Tank Pneumatic Transfer Pump (P-5B)	P-200 Pneumatic	Wilden Pump & Engineering, LLC	Emerick Associates 1107 Louden Rd. Cohoes, NY 12047 Ph: (518)-785-6692 F: (518)-785-6944
	Flocculation Tank Rapid Mixer	700-1000GD	Grovhac Inc.	Grovhac Inc. 4310 N. 126th St. Brookfield, WI 53005 Ph:1-800-369-2475 F: 1-800-369-2476
	Bag Filter Housings	-	Filter Specialists, Inc. (FSI)	Filter Specialists, Inc. (FSI) Stan Perritt PALL Filter Specialists, Inc. Tel: (973)-772-2075 Email: sperritt@fsifilters.com

Category	Item	Model	Manufacturer	Vendor Contact
System Components (continued)	Various pipe, valves, gauges, etc.	-	-	Mark Bryan Jr. F.W. Webb Company 1 McCrea Hill Rd Ballston Spa, NY 12020 Tel: (518)-490-7500 F: (518)-490-7555
	Aeration System Blowers	California Series F, Model 3HV	Sutorbilt	Siewert Equipment 244 First Street Troy, NY 12180 Tel: (518)-272-3431 F: (518)-272-4406
	-Additional equipment for Aeration System	Filters, relief valves, etc.	-	Gary Copanas, Kinequip, Inc. 7340 Thompson Road North N. Syracuse, NY 13212 Tel: (315)-458-4115 F: (315)-458-3887
	Air Compressor	-	Saylor-Beall	Rich Gardiner Air Compressor Engineering 7 Solar Drive Clifton Park, NY 12065 Tel: (518)-371-4401 F: (518)-371-0742
	Specialty gauges	-	-	Gary Copanas, Kinequip, Inc. 7340 Thompson Road North N. Syracuse, NY 13212 Tel: (315)-458-4115 F: (315)-458-3887

Category	Item	Model	Manufacturer	Vendor Contact
Consumables	Anti-scaling reagent - Redux	Redux 390	Redux Technology	Brad Horn, PE, President Redux Technology 280 Callegari Drive West Haven, CT 06516 203-933-9071
	Flocculant reagent - Sternpac	Stern Pac 50	-	Slack Chemical Company, Inc. Don Bolduc 21 Grande Blvd. Saratoga Springs, NY, 12866 (800)-479-0430
	Carbon	-	Evoqua	AnnieLu DeWitt Evoqua Water Technologies 10 Technology Drive Elizabeth, NJ Tel: (603)-767-1118 F: (908)-353-8288
	Bag Filters	-	-	Grainger Industrial Supply 35 Corporate Circle Albany, NY 12203 Tel: (518)-869-1414 F: (518)-869-1418
Misc.	Florescent light fixtures	-	-	Wolberg Electric Supply Co. 60 West Avenue Saratoga Springs, NY 12866 Tel: (518) 886-0446 Fax: (518) 886-0445
	Building Heaters	-	-	Grainger Industrial Supply 35 Corporate Circle Albany, NY 12203 Tel: (518)-869-1414 F: (518)-869-1418

Category	Item	Model	Manufacturer	Vendor Contact
Controls & Electrical	Programmable Logic Controller	ProControl Series 2Plus Type A	EOS Research, Ltd.	Ron Gehl, P.E. EOS Research, Ltd. 159 Walnut Street Rochester, NH 03867 Tel: (603)-332-2099 F: (603)-332-2727
	Flow Meters	-	-	Bob Conklin Ayer Sales, Inc. 1521 Rt 9W Selkirk, NY 12158 Tel: (518)-767-3590 F: (518)-767-3567
	Contactors/Breakers/Panels	-	-	Automation Direct www.automationdirect.com Tel: (800)-633-0405 F:(770)-889-7876 sales@automationdirect.com
	Sensors	-	-	Gary Copanas Kinequip, Inc. 7340 Thompson Road North N. Syracuse, NY 13212 Tel: (315)-458-4115 F: (315)-458-3887

Appendix G

Evacuation and Spill Plan

EVACUATION AND SPILL PLAN

1.0 Introduction

This Evacuation and Spill Plan has been developed for personnel to follow during the operation and maintenance of the Interim Leachate Collection and Treatment System (ILCTS) at the Kingsbury Landfill Site, in the Village of Hudson Falls, Washington County, New York. The work consists of operation of the ILCTS, routine maintenance activities, cap inspections, and periodic sampling of the monitoring well network.

2.0 Known Contaminants of Concern

Period sampling of the leachate influent and monitoring well network indicate that the primary contaminants of concern are polychlorinated biphenyls (PCBs) and volatile organic compounds (VOCs).

3.0 Planned Field Activities

The planned field activities include the following:

- Operation of the ILCTS;
- Routine maintenance activities associated with the operation of the ILCTS;
- Periodic inspections and maintenance of the landfill cap; and
- Periodic sampling of the monitoring well network;

4.0 Responsibilities and Designation Of Emergency Coordinator

The emergency coordinator (EC) or his alternate is responsible for implementing this evacuation and spill plan during an emergency. The EC will also act as the site health and safety officer (HSO) to maintain continuity in the lines of authority during an emergency. All site employees must be familiar with the procedures in this plan and are responsible for implementing the plan should the EC or the alternate be unavailable.

A list of off-site emergency personnel is provided at the back of this plan. The EC/HSO will either notify off-site personnel or designate someone to do so. The first responders consist of police, fire, ambulance, and possibly the New York State Department of Environmental Conservation (NYSDEC). They will be alerted as to the type of emergencies that may arise and the types of hazards at the site.

5.0 Communications

Communications will be by voice where possible. As a backup, visual signals will be used. Hand signals will be as follows:

- Hand gripping throat: Can't breathe.
- Grip partner's wrist or place hands around waist: Leave work area immediately.
- Hand on top of head: Need assistance.
- Thumbs up: OK. I'm all right.
- Thumbs down: No. Negative.

Alternatively, hand-held radios may be used, if they are available and are intrinsically safe. In an emergency, and if necessary, a compressed air horn will be used to notify all workers that an emergency situation exists. The signals shall be as follows:

- One long blast: Evacuate the area by nearest exit.
- Two short blasts: Evacuate by normal exit procedures.

The EC/HSO will notify emergency personnel or designate an alternate to do so. A portable telephone will be used for this purpose. The portable telephone will be located in the clean zone. Emergency telephone numbers are included at the back of this plan.

6.0 Evacuation

In the event that the air horn is sounded, employees will evacuate the area. Emergency evacuation routes will be designated at the site. Evacuation routes must be clear of obstructions. Evacuation routes will be through the fence gate and toward the Feeder Canal Road.

7.0 Safe Distance and Refuge

The following minimum safe distances have been established. Depending upon the nature of the incident, the EC may increase these distances. Arrangements will be made with the local police department to evacuate nearby neighbors. Any decisions on the need for and distances of evacuation will be made in conjunction with the fire and police department and the NYSDEC:

- Minor Spills: Not established
- Major Spills: Evacuate non-essential personnel to clean zone or 1,000 feet, whichever is greater
- Minor Fire: Evacuate non-essential personnel to clean zone
- Fire involving a container: Evacuate all personnel 1/2 mile in all directions
- Explosion: Evacuate all personnel 1/2 mile in all directions

8.0 Emergency Response Procedures

In the event of any releases of materials the evacuation plan shall be immediately activated. The equipment to respond to an emergency will be on site and activated already. There are additional measures to be taken in the event of an emergency. Emergency equipment that will be present is described in the sections that follow. In addition to this Evacuation and Spill Plan, all responses to releases are subject to controls designated in the site HASP.

9.0 Minor Spills during Drum Handling and Removal

For purposes of the Spill Plan, minor spills would be those that consist of 5 gallons or less. Minor spills will be remediated by removing spill debris with any underlying or surrounding contaminated soil. The spilled material will be handled as hazardous waste. If leaking, the container will be placed in an overpack drum. Additional emergency measures would not be implemented, unless needed. The O&M contractor will have empty drums, speedi-dri, miscellaneous hand tools, fire extinguishers, absorbent pads, and booms to deal with minor spills that occur on site.

10.0 Minor Spills in the Drum Staging or Storage Areas

Minor spills onto soil will be cleaned up as discussed above. Minor spills that occur in other areas will need to be collected using absorbent material such as absorbent pads and/or speedi-dri.

11.0 Major Spills

For purposes of this Spill Plan, a major spill is defined as those that involve greater than 5 gallons of material. In the event of a major spill, communication and notification procedures will be implemented. The response will depend on the nature of the release. Attempts will be made to control the release by diking and draining the area. An absorbent pad, Oil Dry, or soil will be used to absorb the release. The removed material will be placed into appropriate drums and sealed to prevent hazards. Employees should note that absorbents solidify the liquid, but do not remove the fire or exposure hazards. Solvents will volatilize from the absorbent and can ignite. Therefore, a fire extinguisher will be brought to the area of the release by the emergency response team until the material is secured inside a drum. In the event that the release is of sufficient magnitude and cannot be controlled by diking, damming, absorbing, or other method, the local fire department, the NYSDEC, and National Response Center shall be notified.

The local responders would be notified through 911. If the incident requires Haz Mat response, 911 should be called and the appropriate emergency response personnel will be contacted.

12.0 Fire

A fire extinguisher will be used on minor fires where a container is not involved. If the fire cannot be extinguished immediately or a container is involved, the area must be evacuated immediately and the fire department notified from a safe location. Extinguishing methods include CO2 or dry chemical. A water spray can also be used (not a direct hose stream). Foam, water spray, or fog can be used on larger spills.

13.0 Explosion

In the event of an explosion, the area shall immediately be evacuated and the fire department notified. The cause of the explosion should be assessed and corrected prior to reentry.

14.0 Medical

Medical emergencies are addressed in the HASP. Appropriate first aid will be administered, and if necessary, the injured individual will be sent to the designated medical facility. An ambulance will be summoned, if needed. The cause of the accident will be determined and corrected, prior to continuing operations. A first aid kit will be maintained in the ILCTS plant building at all times.

When possible, injured personnel will be decontaminated or partially decontaminated in accordance with the HASP. Based upon the anticipated toxicity of the contaminants, personnel decontamination procedures may be eliminated in a life-threatening situation. Emergency medical personnel will be notified as to the lack of decontamination. Emergency medical personnel will wash with soap and potable water after handling the victim. Appropriate documentation should be completed in accordance with the HASP.

15.0 Training

All employees working on site will attend an initial 40-hour health and safety training course, annual 8-hour refresher training, and 8-hour training for managers for conducting work at hazardous waste sites. These courses satisfy the initial and follow-up training requirements of 29 CFR 1910.120 (OSHA regulation of hazardous waste site activities).

Prior to initiating site work, site personnel will be required to attend a training session given by the EC/HSO. This session will include, but is not limited to, the following topics:

- Site history
- Specific hazards
- Hazard recognition

- Standard operation procedures
- Decontamination (personnel and equipment)
- Emergency procedures

16.0 Severe Weather Conditions

When a severe storm-related threat is detected, all site personnel will immediately be notified. Each Severe Weather Alert will require last-minute preventative measures to minimize potential damage to facilities and equipment.

17.0 Emergency Telephone Numbers

Emergency telephone numbers and directions to the nearest medical facility are listed in Section 2.5.1 of the Site Management Plan.

Appendix H

Environmental Easement

316-85

642 22

-1-

Sep 19 12 32 PM '90

RECORDED & FILED
MAR 12 11 28 AM '91
FILE 642
PAGE 22

205
205

MAP AND DESCRIPTION OF REAL PROPERTY OF
FROM AND EXPRESS
WASHINGTON COUNTY N.Y.
ROSE MARIE GREGORY
CLERK

Situate in

Part of Unnumbered Lot and Part of Lot 14
Kingsbury Patent
Village of Hudson Falls, Towns of Kingsbury and Fort Edward
County of Washington, State of New York

Designated as
Kingsbury Toxic Waste Disposal Site

Reputed Owners: Town of Kingsbury
Mario Sassone
Howard Burch and Robert Liebig
James D. Sherman

Pursuant to Section 3-0305 of the Environmental Conservation Law and the Eminent Domain Procedure Law, I, Thomas C. Jorling, Commissioner of Environmental Conservation, have caused to be made and certified an accurate map and description of the following property over which I deem it necessary to acquire a permanent easement by appropriation, for the functions and purposes of the Department, to wit for remediation of an inactive hazardous waste site and not for inclusion in the forest preserve.

Parcel 1

A permanent easement to be exercised in, on, over, under, and upon the herinafter described property, for the right to (1) exclusively use and occupy the premises herinafter described; (2) secure the described property by fencing; (3) conduct soil, water, air, flora and fauna tests and analyses; (4) remove soil, water, air, flora and fauna samples; (5) construct, reconstruct, and operate thereon a work area; (6) grade; (7) clear and grub of trees, brush, debris, and structures; (8) remove therefrom any or all material excavated, cut, razed or torn down from the area described herein or deposit any material thereon; (9) place and keep machines and tools and equipment; (10) construct, reconstruct, operate, maintain and repair any and all structures, facilities, or other works necessitated by the implementation of the Kingsbury Toxic Waste Disposal Site Remedial Plan, a copy of which is on file in the Albany Office of the Department of Environmental Conservation; with the rights at all times of ingress, egress and regress by the State of New York, its employees, agents, contractors, and/or representatives for the purposes connected with the assessment of environmental problems caused by the disposal of toxic wastes and the development and implementation of remedial plans; said permanent easement being over land within the bounds of that parcel of land bounded and described as follows:

ALL THAT CERTAIN TRACT OR PARCEL OF LAND situate in part of Lot 14 and part of the Unnumbered Lot, Kingsbury Patent, Village of Hudson Falls and Towns of Kingsbury and Fort Edward, County of Washington, State of New York, more particularly bounded and described as follows:

COMMENCING at a point on the Champlain Canal Blue line between lands of Mario Sassone, reputed owner on the northeast and lands of the People of the State of New York on the southwest, said point described as Blue line point number 25 on a map entitled "Map of a portion of Champlain Canal lands belonging to the State made pursuant to Chapter 199, Laws of 1910, and amendatory Laws" prepared by SNY Department of Public Works and dated February 1928; running thence along said Blue line N 44° 19'00" W, a distance of 49.40 feet, to the northwest corner of Parcel 1 and Point of Beginning; running thence from said Point of Beginning and through the lands of Mario Sassone, reputed owner, the following 2 courses:

1) N 47° 10'43" E, passing through an iron pipe at 29.19 feet, a total distance of 246.24 feet to a point marked by an iron pipe; thence,

2) N 73° 57'19" E, a distance of 238.87 feet to a point in the boundary between lands of Mario Sassone, reputed owner on the southwest and lands of the Town of Kingsbury, reputed owner on the northeast; thence through the lands of the Town of Kingsbury, reputed owner, the following 2 courses:

1) N 73° 57'19" E, a distance of 154.21 feet to a point marked by an iron pipe; thence,

2) S 85° 41'14" E, passing through an iron pipe at 10.97 feet, a total distance of 187.47 feet to a point in the boundary between lands of James D. Sherman, reputed owner on the east and lands of the Town of Kingsbury on the west; thence, through the lands of James D. Sherman, reputed owner, the following 3 courses:

1) S 85° 41'14" E, a distance of 69.92 feet to a point marked by an iron pipe; thence,

2) S 77° 16'08" E, a distance of 190.84 feet to a point marked by an iron pipe; thence,

3) S 70° 59'14" E, a distance of 140.85 feet to a point in the boundary between lands of James D. Sherman, reputed owner on the west and lands of Howard Burch and Robert Liebig, reputed owners on the east; thence, through the lands of Howard Burch and Robert Liebig, reputed owners, the following 5 courses:

1) S 70° 59'14" E, a distance of 116.29 feet to a point marked by an iron pipe; thence,

2) S 57° 17'35" E, a distance of 405.31 feet to a point marked by an iron pipe; thence,

3) S 20° 56'30" W, a distance of 208.23 feet to a point marked by an iron pipe; thence,

4) S 24° 56'41" W, a distance of 409.77 feet to a point marked by an iron pipe; thence,

5) S 22° 04'00" W, passing through an iron pipe at 428.89 feet, a total distance of 441.50 feet to a point on the Blue line of the State of New York Champlain Canal lands; thence, along the Blue line between lands of the People of the State of New York on the southwest and lands of Howard Burch and Robert Liebig, reputed owners on the northeast, the following 2 courses:

1) N 67° 11'00" W, a distance of 198.94 feet to a point on the Blue line; thence,

2) N 67° 37'00" W, a distance of 48.92 feet to a point in the boundary between lands of the Town of Kingsbury, reputed owner on the northwest and lands of Howard Burch and Robert Liebig, reputed owners on the southeast; thence, continuing along said canal Blue line between lands of the People of the State of New York on the south and west and lands of the Town of Kingsbury on the north and east, the following 12 courses:

1) N 67° 37'00" W, a distance of 14.82 feet to a point; thence,

2) N 57° 16' 00" W, a distance of 126.75 feet to a point, thence,

3) N 47° 37'00" W, a distance of 126.13 feet to a point; thence,

4) N 39° 44'00" W, a distance of 95.94 feet to a point; thence,

5) N 17° 51'00" W, a distance of 128.13 feet to a point; thence,

6) N 21° 57'00" W, a distance of 162.90 feet to a point; thence,

7) N 28° 36'00" W, a distance of 58.07 feet to a point; thence,

8) N 56° 58'00" E, a distance of 322.73 feet to a point; thence,

9) N 41° 38'00" W, a distance of 320.76 feet to a point; thence,

10) S 44° 20'00" W, a distance of 300.30 feet to a point; thence,

11) N 54° 42'00" W, a distance of 57.68 feet to a point; thence,

12) N 72° 01'00" W, a distance of 20.13 feet to a point in the boundary line between the lands of Mario Sassone, reputed owner on the northwest and lands of the Town of Kingsbury, reputed owner on the southeast; thence, continuing along the aforesaid Blue line between the lands of Mario Sassone, reputed owner on

the northeast and lands of the People of the State of New York on the southwest the following 3 courses:

1) N 72° 01'00" W, a distance of 19.43 feet to a point; thence,

2) N 64° 26'00" W, a distance of 298.46 feet to a point; thence,

3) N 44° 19'00" W, a distance of 49.40 feet to the point and place of beginning, containing 23.903 acres of land be the same more or less.

Parcel 2

A permanent easement to be exercised in, over, under, and upon the hereinafter described property for ingress, egress and regress, including the right to construct, reconstruct, improve and maintain a roadway in, over and upon the following described parcel of land for use by the State of New York, its employees, agents, contractors, and/or representatives, in common with all others having rights in and to the hereinafter described parcel; said permanent easement being over land within the bounds of that parcel bounded and described as follows:

ALL THAT CERTAIN TRACT OR PARCEL OF LAND situate in the unnumbered lot, Kingsbury Patent, Village of Hudson Falls, County of Washington and State of New York, more particularly bounded and described as follows:

COMMENCING at the northwest corner of Parcel 1 described above, running thence N 44° 19'00" W along the Champlain Canal Blue line a distance of 271.13 feet to the Point of Beginning of Parcel 2; running thence from said Point of Beginning along the said Blue line between lands of the People of the State of New York on the southwest and lands of Mario Sassone, reputed owner on the northeast the following 2 courses:

1) N 44° 19'00" W, a distance of 65.05 feet to a point; thence,

2) N 07° 29'00" E, a distance of 11.62 feet to a point in the southerly boundary of Old Burgoyne Avenue; thence, along the southerly boundary of Old Burgoyne Avenue N 52° 30'08" E, a distance of 39.64 feet to a point; thence, through the lands of Mario Sassone, reputed owner, S 08° 38'24" E, a distance of 83.14 feet to the point and place of beginning, containing 0.040 acres of land be the same more or less.

Parcel 3

A permanent easement to be exercised in, on, over, under and upon the hereinafter described property to enter upon and exclusively use said property for the purpose of installing and maintaining a groundwater monitoring well,

and access thereto, including the collection and removal of groundwater samples, and in connection therewith to construct, operate, repair and maintain any and all structures including fencing, that are deemed necessary by the Commissioner; said easement to be for use by the State of New York, its employees, agents, contractors, and/or representatives, and to affect the following described parcel of land.

ALL THAT CERTAIN TRACT OR PARCEL of land situate in Lot 14, Kingsbury Patent, Town of Kingsbury, County of Washington and State of New York, more particularly bounded and described as follows:

COMMENCING at the northwest corner of Parcel 1 described above, running thence N 47° 10'43" E, a distance of 246.24 feet to a point marked by an iron pipe; thence, N 73° 57'19" E, a distance of 393.08 feet to a point marked by an iron pipe, being the Point of Beginning; running thence through the lands of the Town of Kingsbury N 28° 38'03" E, a distance of 76.27 feet to a point in the boundary between lands of the Town of Kingsbury (reputed owner) on the southwest and lands of James D. Sherman (reputed owner) on the northeast; thence through the lands of James D. Sherman (reputed owner) the following 3 courses:

1) N 28° 38'03" E, a distance of 77.07 feet to a point marked by an iron pipe; thence,

2) S 61° 21'57" E, a distance of 10.00 feet to a point marked by an iron pipe; thence,

3) S 28° 38'03" W, a distance of 76.73 feet to a point in the boundary between lands of James D. Sherman (reputed owner) on the northeast and lands of the Town of Kingsbury (reputed owner) on the southwest; thence through the lands of the Town of Kingsbury the following 2 courses:

1) S 28° 38'03" W, a distance of 72.09 feet to a point marked by an iron pipe; thence,

2) N 85° 41'14" W, a distance of 10.97 feet to the Point of Beginning, containing .035 of an acre of land, be the same more or less.

All bearings are with reference to True North as shown on State of New York map showing Champlain Canal Lands dated February 1928.

All as shown on a map entitled "Map of easements to be acquired pursuant to Section 3-0305 of the Environmental Conservation Law and the Eminent Domain Procedure Law, Project HW Washington 1502 Kingsbury Toxic Waste Disposal Site, James D. Sherman - Reputed Owner (Project No. 1502.4) (Parcel No. 1.4 and 3.2);

Mario Sassone - Reputed Owner (Project No. 1502.2) (Parcel Nos. 1.2 and 2); Town of Kingsbury - Reputed Owner (Project No. 1502.1) (Parcel Nos. 1.1 and 3.1); Howard Burch and Robert Liebig - Reputed Owners (Project No. 1502.3) (Parcel No. 1.3); situate in Unnumbered Lot and Lot 14, Kingsbury Patent, Village of Hudson Falls, Town of Kingsbury and Town of Fort Edward, County of Washington, State of New York", dated November 16, 1989, and revised May 8, 1990, by Adelbert R. Young, Land Surveyor, License No. 49156, and filed in the Albany Office of the New York State Department of Environmental Conservation as Map No. 10814.

That pursuant to Section 3-0305 of the Environmental Conservation Law, and the Eminent Domain Procedure Law, this map and description of the easements to be acquired by the People of the State of New York are hereby approved and officially filed in the office of the Department of Environmental Conservation at Albany, New York on July 26, 1990

Thomas C. Jorling
Commissioner
Environmental Conservation
Department

BY: Langdon Marsh
Langdon Marsh, Executive Deputy
Commissioner

Dated Aug 24, 1990

I have compared the foregoing copy of map and description of easements to be acquired by the People of the State of New York designated as "Map and Description of Real Property situate in Part of Unnumbered Lot and Part of Lot 14, Kingsbury Patent, Village of Hudson Falls, Towns of Kingsbury and Fort Edward, County of Washington, State of New York; designated as Kingsbury Toxic Waste Disposal Site", with the original thereof as filed in the office of the Department of Environmental Conservation at Albany, New York, and I hereby certify the same to be a true and correct copy thereof.

Dated Sept. 4, 1990

James M. West
Superintendent
Bureau of Real Property

Appendix I

Discharge Permit

EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning: Commencement of discharge from treatment system

And lasting until: 5 years from commencement of discharge from treatment system

the discharges from the treatment facility to water index number H-321, Class C, RECEIVING WATER shall be limited and monitored by the operator as specified below:

Outfall Number and Parameter	Discharge Limitations		Units	Minimum Monitoring Requirements	
	Daily Avg.	Daily Max		Measurement Frequency	Sample Type
Outfall 001 - Treated Groundwater Remediation Discharge:					
Flow	Monitor	Monitor	GPD	Continuous	Meter
pH (range)	6.5 to 8.5		SU	Monthly	Grab
BOD, 5-day		20	mg/l	Monthly	Grab
Solids, Total Suspended		20	mg/l	Monthly	Grab
Settleable Solids		0.3	ml/l	Monthly	Grab
Oil & Grease		15	mg/l	Monthly	Grab
Aroclor 1016 (see Footnote)		0.30	µg/l	Monthly	Grab
Aroclor 1021 (see Footnote)		0.30	µg/l	Monthly	Grab
Aroclor 1232 (see Footnote)		0.30	µg/l	Monthly	Grab
Benzene		5	µg/l	Monthly	Grab
Chlorobenzene		10	µg/l	Monthly	Grab
Trichloroethylene		10	µg/l	Monthly	Grab
Toluene		5	µg/l	Monthly	Grab
Barium - Total		0.8	mg/l	Monthly	Grab
Iron - Total		4.0	mg/l	Monthly	Grab
Manganese - Total		2.0	mg/l	Monthly	Grab
Chromium - Total		0.008	mg/l	Monthly	Grab
Copper - Total		0.08	mg/l	Monthly	Grab

Footnote on Page 3
Additional Conditions on Page 4

SCHEDULE OF COMPLIANCE

a) Kingsbury Landfill Remediation Project shall comply with the following schedule:

Outfall Number(s)	Compliance Action	Due Date
001	Kingsbury Landfill Remediation Project shall commence a study of EPA method 1668A. Kingsbury Landfill Remediation Project shall collect one grab sample quarterly for 1 year (4 samples in all) and analyze each sample for 209 PCB Congeners (using EPA method 1668A) and PCB Aroclors (using EPA method 608).	15 weeks from commencement of discharge and every 13 weeks thereafter
001	Kingsbury Landfill Remediation Project shall submit the results of the 1 year study described above. The results may not be used to assess compliance with effluent limitations. The results shall be reported in electronic format, with the following tabulated rows: PCB Aroclor, individual PCB Congener, total PCB Congeners (considering non-detect results to be equal to zero), detection limit for each Congener and Aroclor, and the daily flow for the day on which the sample was collected; and columns for each date that samples were collected. All Aroclor and Congener sampling results shall be reported in parts per trillion. Kingsbury Landfill Remediation Project shall also report the laboratory(s) performing the analyses.	62 weeks from commencement of discharge

b) Kingsbury Landfill Remediation Project shall submit a written notice of compliance or non-compliance with each of the above schedule dates no later than 14 days following each elapsed date, unless conditions require more immediate notice under terms of the General Conditions (Part ll), Section 5. Each notice of <u>non-compliance</u> shall include the following information:

1. A short description of the non-compliance;
2. A description of any actions taken or proposed by Kingsbury Landfill Remediation Project to comply with the elapsed schedule requirements without further delay and to limit environmental impact associated with the non-compliance;
3. A description or any factors which tend to explain or mitigate the non-compliance; and
4. An estimate of the date Kingsbury Landfill Remediation Project will comply with the elapsed schedule requirement and an assessment of the probability that Kingsbury Landfill Remediation Project will meet the next scheduled requirement on time.

c) Kingsbury Landfill Remediation Project shall submit copies of any document required by the above schedule of compliance to the NYSDEC Bureau of Water Permits, 4th Floor South, 625 Broadway, Albany, N.Y. 12233-3505, unless otherwise specified in this permit or in writing by the Department.

Footnote:

The following are requirements which pertain to the monitoring of PCBs:

a. The Kingsbury Landfill Remediation Project must monitor this discharge for PCBs using USEPA laboratory method 608. The laboratory must make all reasonable attempts to achieve an MDL of 0.065 µg/l or less per Aroclor. Monitoring requirements may be modified in the future if the Department approves a method different from 608.

b. Non-detect at the MDL is the discharge goal. The Kingsbury Landfill Remediation Project shall report all values above the Minimum Detection Level (MDL) (0.065 µg/l per Aroclor). If the level of any Aroclor is above the MDL, the Kingsbury Landfill Remediation Project must evaluate the treatment system and identify the cause of the detectable level of PCBs in the discharge. Following three consecutive months that include analytical results above the MDL (0.065 µg/l), the Kingsbury Landfill Remediation Project shall prepare an approvable report identifying the measures undertaken to eliminate the detections and proposed additional steps to be taken to eliminate the recurrence of such detections. This report shall be submitted to the Department within 28 days following receipt of sampling results from the third monitoring period.

c. If the Department determines that effluent monitoring results above the MDL (0.065 µg/l) can be prevented by implementation of additional measures as proposed by the Kingsbury Landfill Remediation Project, the Kingsbury Landfill Remediation Project shall implement such additional measures.

d. The treatment technology for this discharge constitutes the maximum feasible treatment technology for treatment of PCBs. As treatment technology improvements become available, the Kingsbury Landfill Remediation Project shall, at its own initiative or the Department's request, review the available technology and submit for Department approval, plans to improve the treatment technology and/or Best Management Practices employed to remove maximum feasible amount of PCBs from the wastewater discharge.

e. This limit is a phased Total Maximum Daily Loading limit, prepared in accordance with 6 NYCRR 702.16(b).

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Additional Conditions:

(1) Discharge is not authorized until such time as an engineering submission showing the method of treatment is approved by the Department. The discharge rate may not exceed the effective or design treatment system capacity. All monitoring data, engineering submissions and modification requests must be submitted to:

Chief - Operation, Maintenance and Monitoring Section
Bureau of Hazardous Site Control
Division of Environmental Remediation
NYSDEC
625 Broadway Road
Albany, N.Y. 12233-7014

With a copy sent to:

William Wasilarski, P E.
Regional Water Engineer
NYSDEC
232 Hudson Street
P.O. Box 220
Warrensburg, NY 12885

(2) Only site generated wastewater is authorized for treatment and discharge.

(3) Authorization to discharge is valid only for the period noted above but may be renewed if appropriate. A request for renewal must be received 6 months prior to the expiration date to allow for a review of monitoring data and reassessment of monitoring requirements.

(4) Both concentration (mg/l or µg/l) and mass loadings (lbs/day) must be reported to the Department for all parameters except flow and pH.

(5) Any use of corrosion/scale inhibitors or biocidal-type compounds used in the treatment process must be approved by the Department prior to use.

(6) This discharge and administration of this discharge must comply with the attached General Conditions.

Appendix J

Responsibilities of Owner and Remedial Party

Appendix K

Well Borings and Construction Logs

AECOM

AECOM, Inc.
40 British American Boulevard
Latham, New York 12110
Phone: (518) 951-2200
Fax: (518) 951-2300

BOREHOLE LOG

BORING ID #: KLF-01
START DATE: 3/25/13 END DATE: 3/25/13

PROJECT NAME: Kingsbury Landfill
SITE LOCATION: Kingsbury, NY
DRILLING CO.: GeoLogic
BOREHOLE DIAMETER: 4.25"
TOTAL DEPTH REACHED: 51'
EASTING:

PROJECT NO.: 60277036.6.02
BORING LOCATION:
DRILLER: Dwed John
DEPTH TO BEDROCK: -
INSPECTOR: Matthew Dean
NORTHING:

PROJECT MANAGER: Paul Kareth
DRILLING METHOD: HALLOW STEM AUGER
TOTAL DEPTH DRILLED: 51'
WEATHER CONDITIONS: Overcast 35°
ELEVATION AND DATUM:

FIELD SAMPLE INFORMATION								HAMMER	SAMPLER	ST. WATER LEVELS	DATE 1:	DEPTH 1:	TIME 1:	
							WEIGHT(S)				DATE 2:	DEPTH 2:	TIME 2:	
							FALL			CASING	TUBE	CORE		RIG TYPE:
							TYPE							
							ID/OD							
DEPTH (feet bgs)	Blow Counts	RECOVERY	PID (ppm)	ODOR OBSERVED	LAB ANALYSIS	VISIBLE PRODUCT	GEOLOGIC DESCRIPTION						LITHOLOGY/ SOIL TYPE	WATER LEVEL 3/26/13 27.90'
0.0	1 2 2 3	1.2	0.0 0.0 0.0	n	n	n	0-.2 Organic Blk Sandy Course to med .2-1.2 Blck to brown med to course fine sand w/ cky lense @ 1.0ft						moist/ loose	2.6 hit water
52.0	2 3 2 3	1.7	0.0 0.0 0.0				Course, med, fine grained sand w/ some Organics						wet/ v/loose	
1.0	12 14 11 12	1.5	0.0 0.0 0.0				Gray med to fine sand w/ v.little organics						wet/ loose	
1 50	2 3 3	1.5	0.0 0.0 0.0				Gray clay 1.Hle to no silt ~~some~~ varves						moist/ med	
2 50	2 2 4 5	1.5	0.0 0.0 0.0				Same						moist/ med	
25.0	1 10 9 20	2	0.0 0.0 0.0				Same w/ course sand lense @25.5 last 2" ~~med~~ course gravel Black clayey silt						dry/ stiff	
27	20 15 19	1.5	0.0 0.0 0.0				Black fine sandy silt w/ course gravel intermitent						dry/stiff	
29	1 43 31 47	2	0.0 0.0 0.0				29-30.5 Blackish gray silty cky w/ some fine gravel, 30.5 2" layer of shale (fractured) 30.7-31 Black clayey silt w/ fine gravel						wet/med moist/hard	
31	12 50 40 54	1.5	0.0 0.0 0.0				31-32 Same 32-32.5 Gray fine to med grained sand some silt						moist/hard moist/dense	
33	38 39 26 31	1.5	0.0 0.0 0.0				33-34 Same 34-34.5 Gray coarse, med, fine sand some med gravel						moist/dense moist/loose	

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AECOM

AECOM, Inc.
40 British American Boulevard
Latham, New York 12110
Phone: (518) 951-2200
Fax: (518) 951-2300

BOREHOLE LOG

BORING ID #: KLF-01
START DATE: 3/25/13 END DATE: 3/25/13

PROJECT NAME: Kingsbury Landfill
SITE LOCATION: Kingsbury, NY
DRILLING CO.: GeoLogic
BOREHOLE DIAMETER:
TOTAL DEPTH REACHED:
EASTING:

PROJECT NO.: 60277036.6.02
BORING LOCATION:
DRILLER:
DEPTH TO BEDROCK:
INSPECTOR: Matthew Dean
NORTHING:

PROJECT MANAGER: Paul Kareth
DRILLING METHOD: HALLOW STEM AUGER
TOTAL DEPTH DRILLED:
WEATHER CONDITIONS:
ELEVATION AND DATUM:

FIELD SAMPLE INFORMATION								HAMMER	SAMPLER	ST. WATER LEVELS	DATE 1:	DEPTH 1:	TIME 1:	
							WEIGHT(S)				DATE 2:	DEPTH 2:	TIME 2:	
							FALL			CASING	TUBE	CORE		RIG TYPE:
							TYPE							
							ID/OD							
DEPTH (feet bgs)	Blow Counts	RECOVERY	PID (ppm)	ODOR OBSERVED	LAB ANALYSIS	VISIBLE PRODUCT	GEOLOGIC DESCRIPTION					LITHOLOGY/ SOIL TYPE		WATER LEVEL
35.0	11 8 16 28	2	0.0 0.0 0.0	N	N	N	C,M,F Sand w/ little silt & some Fine gravel Intermittent clay lenses					wet/loose		
37.0	15 38 39 5/4	2	0.0 0.0 0.0				C,M,F Sand w/ little silt last 2" med gravel					moist/dense		
39.0	14 34 50/3	1.5	0.0 0.0 0.0				C,M,F Sand little silt					moist/dense		
41.0	14 26 33 50/4	2	0.0 0.0 0.0				41-42 Gray silty clay w/ some sand 42-43 Gray silty sand w/ occasional gravel					wet/dense		
43.0	22 38 41 60	2	0.0 0.0 0.0				Same w/ occeasional clay lense					wet/dense		
45.0	10 23 44 53	1.5	0.0 0.0 0.0				C,M,F sand & C,M gravel					wet/dense		
47.0	31 44 50 /1	2	0.0 0.0 0.0				Same					wet/dense		
49.0	23 34 50/4	1.5	0.0 0.0 0.0				~~F sand & silt~~ Black Fine sand w/ little silt no gravel					wet/dense		
51.0							0-15' C,M,F Sand some organics & little silt 15'-28' Clay w/ little to no silt sand lense @ 25.5'							
18.0							28'-32 Intermitent clayey silt / silty clay 32-42 C M F sand w/ some gravel 42-42 Silty Clay some sand 42-49 C,M,F Sand some silt							
20.0							49-51 Fine sand little silt no gravel WL: 27.90'							

AECOM

AECOM, Inc.
40 British American Boulevard
Latham, New York 12110
Phone: (518) 951-2200
Fax: (518) 951-2300

BOREHOLE LOG

BORING ID #: KLF-02
START DATE: 3/28/13 END DATE: 3/29/13

PROJECT NAME: Kingsbury Landfill
SITE LOCATION: Kingsbury, NY
DRILLING CO.: GeoLogic
BOREHOLE DIAMETER:
TOTAL DEPTH REACHED:
EASTING:

PROJECT NO.: 60277036.6.02
BORING LOCATION:
DRILLER: Dave + John
DEPTH TO BEDROCK:
INSPECTOR: Matthew Dean
NORTHING:

PROJECT MANAGER: Paul Kareth
DRILLING METHOD: HALLOW STEM AUGER
TOTAL DEPTH DRILLED:
WEATHER CONDITIONS:
ELEVATION AND DATUM:

FIELD SAMPLE INFORMATION								HAMMER	SAMPLER	ST. WATER LEVELS	DATE 1:	DEPTH 1:	TIME 1:	
							WEIGHT(S)				DATE 2:	DEPTH 2:	TIME 2:	
							FALL			CASING	TUBE	CORE		RIG TYPE:
							TYPE							
							ID/OD							
DEPTH (feet bgs)	Blow Counts	RECOVERY	PID (ppm)	ODOR OBSERVED	LAB ANALYSIS	VISIBLE PRODUCT	GEOLOGIC DESCRIPTION					LITHOLOGY/ SOIL TYPE		WATER LEVEL
0.0	2 3 6 12	1.5	0.0 0.0 0.0	N	N	N	0-.2 Organics .2-1.3 Brown M to F sand w/ some gravel 1.3-1.5 Gray F sand some silt + F gravel					dry/loose		
5.0 10	11 10 4 6	1.8	0.0 0.0 0.0				5.6 Gray F sand some silt 6+2" layer of silty clay 6.2-6.5 Gray F sand some silt					moist/loose wet/loose		← WL 5.1'
10.0 12	2 2 2 3	1.0	0.0 0.0 0.0				Same					wet/loose		
15.0 17	2 3 3 4	2	0.0 0.0 0.0				15-15.5 Brown sandy clay w/ some silt 15.5-17 Gray silty clay w/ some sand varves present in clay					wet/soft moist/soft		
20.0 22	2 2 2 3	2	0.0 0.0 0.0				Gray silty clay. varves every 2" w/ silt lenses					moist/soft		
25.0 27	4 4 5 6	0	0.0 0.0 0.0				Same					moist/stiff		
12.0 29	5 8 7 7	1.7	0.0 0.0 0.0				Same					moist/stiff		
14.0	2 3 4 5	2	0.0 0.0 0.0				Same less silt					wet/medium		
30.0	4 5 6 6	2	0.0 0.0 0.0				Same fractured shale piece @ bottom					wet/medium		
33.0 35	18 44 43 42	1.6	0.0 0.0 0.0				Gray to black sandy silt w/ C, M, F gravel subrounded pebbles					moist/hard		

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BOREHOLE LOG

BORING ID #: KLF-02

START DATE: 3/28/13 END DATE:

PROJECT NAME: Kingsbury Landfill
SITE LOCATION: Kingsbury, NY
DRILLING CO.: GeoLogic
BOREHOLE DIAMETER:
TOTAL DEPTH REACHED:
EASTING:

PROJECT NO.: 60277036.6.02
BORING LOCATION:
DRILLER: Dave & John
DEPTH TO BEDROCK:
INSPECTOR: Matthew Dean
NORTHING:

PROJECT MANAGER: Paul Kareth
DRILLING METHOD: HALLOW STEM AUGER
TOTAL DEPTH DRILLED:
WEATHER CONDITIONS:
ELEVATION AND DATUM:

WEIGHT(S)	HAMMER	SAMPLER	ST. WATER LEVELS	DATE 1:	DEPTH 1:	TIME 1:
FALL			CASING	TUBE	CORE	RIG TYPE:
TYPE						
ID/OD						

DEPTH (feet bgs)	Blow Counts	RECOVERY	PID (ppm)	ODOR OBSERVED	LAB ANALYSIS	VISIBLE PRODUCT	GEOLOGIC DESCRIPTION	LITHOLOGY/ SOIL TYPE	WATER LEVEL 3/29/13 26.8
35.0	10 18 32 24	.4	0.0 0.0 0.0	N	N	N	Same	wet/ hard	
37.0	11 7 21 19	1.0	0.0 0.0 0.0				Same	wet/hard to stiff	
39.0	23 29 29 36	1.8	0.0 0.0 0.0				39-39.3 Same 39.3-40 Gray sandy silt w/ little F gravel 40-40.8 Gray silty sand w/ intermittent silt layers	wet/ hard wet/ dense	
44.0	21 45 50 49	2.0	0.0 0.0 0.0				Gray silty sand w/ gravel @ 41.5' Hard silt lense @ 42.5'	wet/dense	
45.0	32 34 50 49	1.5	0.0 0.0 0.0				Same	wet/dense	
46.0	18 29 34 32	1.5	0.0 0.0 0.0				~~45-46.0~~ 45-46.2 Same 46.2-46.5 C,M,F Sand some CMF Gravel (till)	wet/dense	
47.0	29 32 33 34	2	0.0 0.0 0.0				Gray C,M,F sand w/ C,M,F Gravel sorted well graded till	wet/dense	
49.0	26 30 35 37	1.8	0.0 0.0 0.0				Same	wet/dense	
51.0	27 30 50/4	2	0.0 0.0 0.0				Same coursening w/ depth	wet/dense	
53.0	19 26 57 53	2	0.0 0.0 0.0				53-54.4 Black silt little clay 54.4 Gray f sandy silt	moist/Hard wet/dense	
55.0									

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BOREHOLE LOG

BORING ID #: KLF-02
START DATE: 3/28/13 END DATE: 3/29/13

PROJECT NAME: Kingsbury Landfill
SITE LOCATION: Kingsbury, NY
DRILLING CO.: GeoLogic
BOREHOLE DIAMETER:
TOTAL DEPTH REACHED: 59'
EASTING:

PROJECT NO.: 60277036.6.02
BORING LOCATION:
DRILLER: Dave & John
DEPTH TO BEDROCK:
INSPECTOR: Matthew Dean
NORTHING:

PROJECT MANAGER: Paul Kareth
DRILLING METHOD: HALLOW STEM AUGER
TOTAL DEPTH DRILLED: 59'
WEATHER CONDITIONS:
ELEVATION AND DATUM:

FIELD SAMPLE INFORMATION								HAMMER	SAMPLER	ST. WATER LEVELS	DATE 1:	DEPTH 1:	TIME 1:
							WEIGHT(S)				DATE 2:	DEPTH 2:	TIME 2:
							FALL			CASING	TUBE	CORE	RIG TYPE:
							TYPE						
							ID/OD						
DEPTH (feet bgs)	Blow Counts	RECOVERY	PID (ppm)	ODOR OBSERVED	LAB ANALYSIS	VISIBLE PRODUCT	GEOLOGIC DESCRIPTION					LITHOLOGY/ SOIL TYPE	WATER LEVEL
5.0	21 30 29 30	2	0.0 0.0 6.6	N	N	N	~~Silty~~ Gray ~~Silty~~ Sandy silt w/ intermitent layers of clayey silt lenses					wet/v.s	stiff
5.0	23 32 45 47	2	0.0 0.0 0.0				Intermitent ~~Silty~~ Sandy silt & clayey silt					moist/v	stiff
5.0													
~~6.0~~							0-.2 Organics .2-1.3 M,F Sand some gravel 1.3-12 F Sand some silt, little gravel						
8.0							12-17 ~~Silty Clay~~ Sandy clay 17-33 Silty Clay 33-46.2 Intermitent silty sand & sandy silt						
10.0							46.2-53 G,M,F Sand & G,M,F Gravel (Till) 53-59 Intermitent sandy silt & silty clay						
12.0							TD = 59' well @ 55'-50'						
14.0							screen						
16.0													
18.0													
20.0													

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BOREHOLE LOG

BORING ID #: KLF-03
START DATE: 4/1/13 END DATE: 4/2/13

PROJECT NAME:	Kingsbury Landfill	PROJECT NO.:	60277036.6.02	PROJECT MANAGER:	Paul Kareth
SITE LOCATION:	Kingsbury, NY	BORING LOCATION:			
DRILLING CO.:	GeoLogic	DRILLER:	Dave / John	DRILLING METHOD:	HALLOW STEM AUGER
BOREHOLE DIAMETER:	4.25	DEPTH TO BEDROCK:		TOTAL DEPTH DRILLED:	
TOTAL DEPTH REACHED:		INSPECTOR:	Matthew Dean	WEATHER CONDITIONS:	
EASTING:		NORTHING:		ELEVATION AND DATUM:	

FIELD SAMPLE INFORMATION

	HAMMER	SAMPLER	ST. WATER LEVELS	DATE 1:	DEPTH 1:	TIME 1:
WEIGHT(S)				DATE 2:	DEPTH 2:	TIME 2:
			CASING	TUBE	CORE	RIG TYPE:
FALL						
TYPE						
ID/OD						

DEPTH (feet bgs)	Blow Counts	RECOVERY	PID (ppm)	ODOR OBSERVED	LAB ANALYSIS	VISIBLE PRODUCT	GEOLOGIC DESCRIPTION	LITHOLOGY/ SOIL TYPE	WATER LEVEL
0.0 – 2.0	3 4 4 6	1.3	0.0 0.0	N	N	N	0-.2 Organics .2-1.3 Br. med to F sand	moist/loose	
5.0 – 7.0	14 20 24 25	2	0.0 0.0 0.0				5-5.5 Same 5.5-6 Gray M,F sand 6-7 Brown F sand little silt	moist/med dense	
10.0 – 12.0	4 3 4 5	1.5	0.0 0.0				Br. F sand	wet/loose	8.7 WL
15.0 – 17	3 3 3 4	2	0.0 0.0 0.0				15-16 Same 16-17 Gray silty clay w/ little sand	wet/med stiff	
20.0 – 22	2 2 2 3	1.8	0.0 0.0 0.0 0.0				Same	wet/soft	
25.0	2 3 5 3	2	0.0 0.0 0.0				Same	wet/soft	
27.0	4 4 4 3	2	0.0 0.0 0.0				Same increasing sand	wet/soft	
29.0	7 7 11 14	2	0.0 0.0 0.0				Alternating silty clay w/ some sand to sandy silt w/ some clay	wet/medium	
31.0	4 3 5 5	2	0.0 0.0 0.0				Same	wet/medium	
33 – 35	3 3 4 7	2	0.0 0.0 0.0				Gray clay little silt	wet/stiff	

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BOREHOLE LOG

BORING ID #: KLF-03
START DATE: 4/1/13 END DATE: 4/2/13

PROJECT NAME: Kingsbury Landfill
SITE LOCATION: Kingsbury, NY
DRILLING CO.: GeoLogic
BOREHOLE DIAMETER:
TOTAL DEPTH REACHED:
EASTING:

PROJECT NO.: 60277036.6.02
BORING LOCATION:
DRILLER: Dave + John
DEPTH TO BEDROCK:
INSPECTOR: Matthew Dean
NORTHING:

PROJECT MANAGER: Paul Kareth
DRILLING METHOD: HALLOW STEM AUGER
TOTAL DEPTH DRILLED:
WEATHER CONDITIONS:
ELEVATION AND DATUM:

	HAMMER	SAMPLER	ST. WATER LEVELS	DATE 1:	DEPTH 1:	TIME 1:
WEIGHT(S)				DATE 2:	DEPTH 2:	TIME 2:
FALL			CASING	TUBE	CORE	RIG TYPE:
TYPE						
ID/OD						

DEPTH (feet bgs)	Blow Counts	RECOVERY	PID (ppm)	ODOR OBSERVED	LAB ANALYSIS	VISIBLE PRODUCT	GEOLOGIC DESCRIPTION	LITHOLOGY/ SOIL TYPE	WATER LEVEL
36.0	4 5 6 7	2	0.0 0.0 0.0	↓	N ↓	N ↓	Gray clay w/ silt partings every 2"	wet/stiff	
37.0	5 6 5 6	2	0.0 0.0 0.0	↓	↓	↓	Same	wet/stiff	
39.0	3 3 4 6	2	0.0 0.0 0.0	↓	↓	↓	39-40.8 Same Last 2" sandy silt w/ M, F gravel	wet/soft	
41.0	11 33 36 60	1.5	0.0 0.0 0.0	↓	↓	↓	41-41.5 Same 41.5 Silty sand w/ lenses of gray silty clay	moist/	stiff to hard
43.0	7 15 22 30	2	0.0 0.0 0.0	↓	↓	↓	43.0-43.5 Same 43.5-44.5 Gray silty sand w/ little clay 44.5-45 Gray F sand + F gravel	wet/	stiff
45.0	19 20 27 35	1.5	0.0 0.0 0.0	↓	↓	↓	Gray F sand little silt	wet/dense	
47.0	23 43 50/4	1.3	0.0 0.0 0.0	↓	↓	↓	Same coursening downward	wet/dense	
49.0	20 28 28 34	1.8	0.0 0.0 0.0	↓	↓	↓	Same	wet/dense	
51.0	25 33 60 50/5	1.5	0.0 0.0 0.0 0.0	↓	↓	↓	Same	wet/	dense
53.0	25 36 39 50/4	2	0.0 0.0 0.0	↓	↓	53 ↓	53-54 Black silt w/ F, M gravel 54-55 Gray clayey silt little F sand	moist/	hard
55.0									
200									

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BOREHOLE LOG

BORING ID #: KLF-03
START DATE: 4/1/13 END DATE: 4/2/13

PROJECT NAME: Kingsbury Landfill
SITE LOCATION: Kingsbury, NY
DRILLING CO.: GeoLogic
BOREHOLE DIAMETER:
TOTAL DEPTH REACHED:
EASTING:

PROJECT NO.: 60277036.6.02
BORING LOCATION:
DRILLER: Dave & John
DEPTH TO BEDROCK:
INSPECTOR: Matthew Dean
NORTHING:

PROJECT MANAGER: Paul Kareth
DRILLING METHOD: HALLOW STEM AUGER
TOTAL DEPTH DRILLED:
WEATHER CONDITIONS: Sunny ~30°
ELEVATION AND DATUM:

FIELD SAMPLE INFORMATION								HAMMER	SAMPLER	ST. WATER LEVELS	DATE 1:	DEPTH 1:	TIME 1:
							WEIGHT(S)				DATE 2:	DEPTH 2:	TIME 2:
DEPTH (feet bgs)	Blow Counts	RECOVERY	PID (ppm)	ODOR OBSERVED	LAB ANALYSIS	VISIBLE PRODUCT	FALL			CASING	TUBE	CORE	RIG TYPE:
							TYPE						
							ID/OD						
							GEOLOGIC DESCRIPTION					LITHOLOGY/ SOIL TYPE	WATER LEVEL
0.0	39 24 30 24	1.3	0.0 0.0 0.0	N	N	N	Black silt M,F gravel					moist/wet	
57.0							TD = 57'						
4.0													
6.0							0-.2 organics .2-16 M,F Sand 16-33 Alternating silty clay & sandy silt						
8.0							33-40 Clay w/ 2" silt partings 40-44.5 Sandy silt w/ some gravel						
10.0							44.5-53 F sand little silt coarsening downward 53-57 Silt w/ clay partings & M, F gravel						
12.0													
14.0													
16.0													
18.0													
20.0													

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BOREHOLE LOG

BORING ID #: KLF-04
START DATE: 4/2/13 END DATE: 4/3/13

PROJECT NAME: Kingsbury Landfill
SITE LOCATION: Kingsbury, NY
DRILLING CO.: GeoLogic
BOREHOLE DIAMETER:
TOTAL DEPTH REACHED:
EASTING:

PROJECT NO.: 60277036.6.02
BORING LOCATION:
DRILLER: Dave + John
DEPTH TO BEDROCK:
INSPECTOR: Matthew Dean
NORTHING:

PROJECT MANAGER: Paul Kareth
DRILLING METHOD: HALLOW STEM AUGER
TOTAL DEPTH DRILLED:
WEATHER CONDITIONS:
ELEVATION AND DATUM:

FIELD SAMPLE INFORMATION

	HAMMER	SAMPLER	ST. WATER LEVELS	DATE 1:	DEPTH 1:	TIME 1:
WEIGHT(S)				DATE 2:	DEPTH 2:	TIME 2:
FALL			CASING	TUBE	CORE	RIG TYPE:
TYPE						
ID/OD						

DEPTH (feet bgs)	Blow Counts	RECOVERY	PID (ppm)	ODOR OBSERVED	LAB ANALYSIS	VISIBLE PRODUCT	GEOLOGIC DESCRIPTION	LITHOLOGY/ SOIL TYPE	WATER LEVEL
0.0 / 2	3 3 3 4	1.0	0.0 0.0 0.0	N	N	N	0-.2 Organics .2-1.0 Br. M, F sand	dry/v. loose	
5.0 / 7	19 27 32 32	1.5	0.0 0.0 0.0				Br. M, F sand	moist/dense	
10.0 / 12	5 4 4 5	1.5	0.0 0.0 0.0				Same	wet/loose	WL: 10.4
15.0 / 17	2 2 3 4	1.8	0.0 0.0 0.0				15-15.8 Same 15.8-16.8 Gray clay little silt	sat/loose wet/soft	
20.0 / 22	4 4 4 5	1.8	0.0 0.0 0.0				20-20.8 Gray clay some silt 20.8-21.8 Br/Gr F sand trace silt	wet/loose	
25.0	6 7 8 12	2	0.0 0.0 0.0				25.0-25.2 Same 25.2-26.2 Gray clay little silt 26.2-27 Br. silty sand trace clay	wet/soft	
27.0	5 8 10 10	2	0.0 0.0				27-28.5 Br silty sand 28.5-29 Gray silty sand	wet/loose	
29.0	3 3 4 4	2	0.0 0.0 0.0				Same	sat/loose	
31.0	4 3 5 8	2	0.0 0.0 0.0				31-32 Same 32-33 Gray silty clay varves	wet/medium	
33.0 / 35.0	6 6 8 8	2	0.0 0.0				Same	wet/medium	

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BOREHOLE LOG

BORING ID #: KLF-04

START DATE: 4/2/13 END DATE: 4/3/13

PROJECT NAME: Kingsbury Landfill
SITE LOCATION: Kingsbury, NY
DRILLING CO.: GeoLogic
BOREHOLE DIAMETER:
TOTAL DEPTH REACHED:
EASTING:

PROJECT NO.: 60277036.6.02
BORING LOCATION:
DRILLER:
DEPTH TO BEDROCK:
INSPECTOR: Matthew Dean
NORTHING:

PROJECT MANAGER: Paul Kareth
DRILLING METHOD: HALLOW STEM AUGER
TOTAL DEPTH DRILLED:
WEATHER CONDITIONS:
ELEVATION AND DATUM:

FIELD SAMPLE INFORMATION								HAMMER	SAMPLER	ST. WATER LEVELS	DATE 1:	DEPTH 1:	TIME 1:
							WEIGHT(S)			DATE 2:		DEPTH 2:	TIME 2:
							FALL			CASING	TUBE	CORE	RIG TYPE:
							TYPE						
							ID/OD						
DEPTH (feet bgs)	Blow Counts	RECOVERY	PID (ppm)	ODOR OBSERVED	LAB ANALYSIS	VISIBLE PRODUCT	GEOLOGIC DESCRIPTION					LITHOLOGY/ SOIL TYPE	WATER LEVEL
35	3 4 5 7	2	0.0 0.0 0.0	N	N	N	Same					wet/medium	
37	7 8 8 7	2	0.0 0.0 0.0	↓	↓	↓	Same					wet/medium	
39	3 4 5	2	0.0 0.0 0.0	↓	↓	↓	Same					wet/medium	
41	4 5 7 7	2	0.0 0.0 0.0	↓	↓	↓	Same					wet/soft	
43	2 4 5 7	2	0.0 0.0 0.0	↓	↓	↓	Same					wet/soft	
46	3 4 4 5	2	0.0 0.0 0.0	↓	↓	↓	45-46.5 Same 46.5-47 Black silt w/ little gravel + F sand					wet/soft	
47	5 58 29 35	1	0.0 0.0 0.0	↓	↓	↓	Black silt w/ little F sand some gravel Rock chips at bottom					wet/Hard	
49	12 12 18 19	2	0.0 0.0 0.0	↓	↓	↓	Black silt w/ little clay + little M, F gravel					moist/stiff	
51	21 19 15 19	2	0.0	↓	↓	↓	Same					moist/Hard	
53 55													

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BOREHOLE LOG

BORING ID #: KLF-04
START DATE: 4/2/13 END DATE: 4/3/13

PROJECT NAME: Kingsbury Landfill
SITE LOCATION: Kingsbury, NY
DRILLING CO.: GeoLogic
BOREHOLE DIAMETER:
TOTAL DEPTH REACHED:
EASTING:

PROJECT NO.: 60277036.6.02
BORING LOCATION:
DRILLER:
DEPTH TO BEDROCK:
INSPECTOR: Matthew Dean
NORTHING:

PROJECT MANAGER: Paul Kareth
DRILLING METHOD: HALLOW STEM AUGER
TOTAL DEPTH DRILLED:
WEATHER CONDITIONS:
ELEVATION AND DATUM:

FIELD SAMPLE INFORMATION								HAMMER	SAMPLER	ST. WATER LEVELS	DATE 1:	DEPTH 1:	TIME 1:
							WEIGHT(S)				DATE 2:	DEPTH 2:	TIME 2:
							FALL			CASING	TUBE	CORE	RIG TYPE:
							TYPE						
							ID/OD						
DEPTH (feet bgs)	Blow Counts	RECOVERY	PID (ppm)	ODOR OBSERVED	LAB ANALYSIS	VISIBLE PRODUCT	GEOLOGIC DESCRIPTION					LITHOLOGY/ SOIL TYPE	WATER LEVEL
0.0							0-.2 Organics .2-15.8 M,F Sand						
2.0							15.8-32 Silty sand 32-46.5 Silty clay						
4.0							46.5-53 Silt little clay trace gravel						
6.0													
8.0													
10.0													
12.0													
14.0													
16.0													
18.0													
20.0													

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BOREHOLE LOG

BORING ID #: KLF-05
START DATE: 4/3/13 END DATE: 4/4/13

PROJECT NAME: Kingsbury Landfill
SITE LOCATION: Kingsbury, NY
DRILLING CO.: GeoLogic
BOREHOLE DIAMETER:
TOTAL DEPTH REACHED:
EASTING:

PROJECT NO.: 60277036.6.02
BORING LOCATION:
DRILLER: Dave + John
DEPTH TO BEDROCK:
INSPECTOR: Matthew Dean
NORTHING:

PROJECT MANAGER: Paul Kareth
DRILLING METHOD: HALLOW STEM AUGER
TOTAL DEPTH DRILLED:
WEATHER CONDITIONS:
ELEVATION AND DATUM:

FIELD SAMPLE INFORMATION								HAMMER	SAMPLER	ST. WATER LEVELS	DATE 1:	DEPTH 1:	TIME 1:
							WEIGHT(S)				DATE 2:	DEPTH 2:	TIME 2:
							FALL			CASING	TUBE	CORE	RIG TYPE:
							TYPE						
							ID/OD						

DEPTH (feet bgs)	Blow Counts	RECOVERY	PID (ppm)	ODOR OBSERVED	LAB ANALYSIS	VISIBLE PRODUCT	GEOLOGIC DESCRIPTION	LITHOLOGY/ SOIL TYPE	WATER LEVEL
0.0	2 2 5 8	1.8	0.0 0.0	N	N	N	0 - .2 Organics .2 - 1.8 Br. M,F sand	moist/loose	4/4/13 10.8 @ 25'
5.0 7	11 14 16 14	2	0.0 0.0	N	N	N	Same	moist/med dense	
10.0 12	3 3 3 3	1.6	0.0 0.0				Same	wet/loose	BL 12.2
15.0 17	2 2 2 2	1.6	0.0 0.0				Same Coursening	Sat/loose	
20.0 22	1 1 1 3	1	0.0				Same	sat/v. loose	
25.0 27	2 3 4 3	1.5	0.0				Same	sat/loose	
12.0	5 7 7 10	1.0	0.0				Same	sat/loose	
29.0	5 6 7 10	1.2	0.0				Same	sat/loose	
34.0	5 5 8 11	1.6	0.0				Same	sat/loose	
38.0 35.0	3 5 9 12	1.8	0.0				Same	sat/loose	

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BOREHOLE LOG

BORING ID #: KLF-05
START DATE: 4/3/13 END DATE: 4/4/13

PROJECT NAME: Kingsbury Landfill
SITE LOCATION: Kingsbury, NY
DRILLING CO.: GeoLogic
BOREHOLE DIAMETER:
TOTAL DEPTH REACHED:
EASTING:

PROJECT NO.: 60277036.6.02
BORING LOCATION:
DRILLER:
DEPTH TO BEDROCK:
INSPECTOR: Matthew Dean
NORTHING:

PROJECT MANAGER: Paul Kareth
DRILLING METHOD: HALLOW STEM AUGER
TOTAL DEPTH DRILLED:
WEATHER CONDITIONS:
ELEVATION AND DATUM:

FIELD SAMPLE INFORMATION								HAMMER	SAMPLER	ST. WATER LEVELS	DATE 1:	DEPTH 1:	TIME 1:
							WEIGHT(S)				DATE 2:	DEPTH 2:	TIME 2:
							FALL			CASING	TUBE	CORE	RIG TYPE:
							TYPE						
							ID/OD						
DEPTH (feet bgs)	Blow Counts	RECOVERY	PID (ppm)	ODOR OBSERVED	LAB ANALYSIS	VISIBLE PRODUCT	GEOLOGIC DESCRIPTION					LITHOLOGY/ SOIL TYPE	WATER LEVEL
360	3 2 3 4	1.8	0.0	N	N	N	Same					sat/loose	
370	8 9 9 12	0	-	-	-	-	No recovery (flowing sand)					-	
390	5 5 8 10	1.5	0.0	N	N	N	Br. M,F Sand					sat/loose	
410	8 10 10 12	1.0	0.0				Same					sat/loose	
433	4 5 9 10	0	-	-	-	-	2 attempts no recovery sand washes out Trying new technique for spoons						
460	3 6 5 9	1	0.0				Same					Sat/loose	
470	5 9 10 12	1	0.0				Br C/M/F Sand					sat/med dense	
490	4 8 16 19	0					no recovery (flowing sand) sent 2nd spoon to collect sample 1.8' recovery Same material					sat/med dense	
510	3 8 11 17	0					no recovery						
530 / 550	5 9 12 16	1.5	0.0				Same					sat/med dense	

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BOREHOLE LOG

BORING ID #: KLF-05

START DATE: 4/3/13 END DATE: 4/4/13

PROJECT NAME: Kingsbury Landfill
SITE LOCATION: Kingsbury, NY
DRILLING CO.: GeoLogic
BOREHOLE DIAMETER:
TOTAL DEPTH REACHED:
EASTING:

PROJECT NO.: 60277036.6.02
BORING LOCATION:
DRILLER:
DEPTH TO BEDROCK:
INSPECTOR: Matthew Dean
NORTHING:

PROJECT MANAGER: Paul Kareth
DRILLING METHOD: HALLOW STEM AUGER
TOTAL DEPTH DRILLED:
WEATHER CONDITIONS:
ELEVATION AND DATUM:

	HAMMER	SAMPLER	ST. WATER LEVELS	DATE 1:	DEPTH 1:	TIME 1:
WEIGHT(S)				DATE 2:	DEPTH 2:	TIME 2:
FALL			CASING	TUBE	CORE	RIG TYPE:
TYPE						
ID/OD						

DEPTH (feet bgs)	Blow Counts	RECOVERY	PID (ppm)	ODOR OBSERVED	LAB ANALYSIS	VISIBLE PRODUCT	GEOLOGIC DESCRIPTION	LITHOLOGY/ SOIL TYPE	WATER LEVEL
									10.6
56.0	7 6 10 14	0					no recovery		
52.0	6 11 16 17						no recovery		
54.0	12 25 25 17						no recovery		
60.0	5 8 8 13	2	0.0	N	N	N	Gray clay little silt varves highly plastic moist	medium	
62.0	6 9 11 12	2	0.0				Same silt parting every 2"	moist	medium
65.0									
12.0							0-.2 organics .2-61 Well-sorted M,F sand coarsening to depth		
14.0							61-65 Clay w/ little silt @ 2" partings		
16.0									
18.0									
20.0									

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BOREHOLE LOG

BORING ID #: KLF-06
START DATE: 4/4/13 END DATE: 4/5/13

PROJECT NAME: Kingsbury Landfill
SITE LOCATION: Kingsbury, NY
DRILLING CO.: GeoLogic
BOREHOLE DIAMETER:
TOTAL DEPTH REACHED:
EASTING:

PROJECT NO.: 60277036.6.02
BORING LOCATION:
DRILLER:
DEPTH TO BEDROCK:
INSPECTOR: Matthew Dean
NORTHING:

PROJECT MANAGER: Paul Kareth
DRILLING METHOD: HALLOW STEM AUGER
TOTAL DEPTH DRILLED:
WEATHER CONDITIONS:
ELEVATION AND DATUM:

FIELD SAMPLE INFORMATION

	HAMMER	SAMPLER	ST. WATER LEVELS	DATE 1:	DEPTH 1:	TIME 1:
WEIGHT(S)				DATE 2:	DEPTH 2:	TIME 2:
FALL			CASING	TUBE	CORE	RIG TYPE:
TYPE						
ID/OD						

DEPTH (feet bgs)	Blow Counts	RECOVERY	PID (ppm)	ODOR OBSERVED	LAB ANALYSIS	VISIBLE PRODUCT	GEOLOGIC DESCRIPTION	LITHOLOGY/ SOIL TYPE	WATER LEVEL
									10.5
3.5	7 11 12 14	1.5	0.0	N	N	N	Same	sat/loose	
3	10 10 14 16	2	0.0				Same	sat/loose	
39	3 5 10 15	1.8	0.0				Same	sat/med dense	
41	9 15 19 30	2	0.0				Same	sat/dense	
43	5 9 9 12	2	0.0				Br. F sand trace silt	sat/loose	
45	6 11 15	1	0.0				Same	sat/loose	
47	7 12 17 22	2	0.0				47-48.2 Same 48.2-49 Gray F sand little silt * Oxidation zone @ interface	sat/med dense	
49	5 5 6 10	1	0.0				Same Gray F sand little to some silt	sat/loose	
51	5 5 7 7	1	0.0				Same	sat/loose	
53	5 5 5 7	2	0.0				Gray clay w/ little silt @ partings every 1"	moist/stiff	
55	10 8 9 9	1	0.0				Same	moist/stiff	

TD = 57'

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BOREHOLE LOG

BORING ID #: KLF-06
START DATE: 4/4/13 END DATE: 4/5/13

PROJECT NAME: Kingsbury Landfill
SITE LOCATION: Kingsbury, NY
DRILLING CO.: GeoLogic
BOREHOLE DIAMETER:
TOTAL DEPTH REACHED:
EASTING:

PROJECT NO.: 60277036.6.02
BORING LOCATION:
DRILLER: Dave & John
DEPTH TO BEDROCK:
INSPECTOR: Matthew Dean
NORTHING:

PROJECT MANAGER: Paul Kareth
DRILLING METHOD: HALLOW STEM AUGER
TOTAL DEPTH DRILLED:
WEATHER CONDITIONS:
ELEVATION AND DATUM:

	HAMMER	SAMPLER	ST. WATER LEVELS	DATE 1:	DEPTH 1:	TIME 1:
WEIGHT(S)				DATE 2:	DEPTH 2:	TIME 2:
FALL			CASING	TUBE	CORE	RIG TYPE:
TYPE						
ID/OD						

DEPTH (feet bgs)	Blow Counts	RECOVERY	PID (ppm)	ODOR OBSERVED	LAB ANALYSIS	VISIBLE PRODUCT	GEOLOGIC DESCRIPTION	LITHOLOGY/ SOIL TYPE	WATER LEVEL
0.0 – 2	2 1 4 9	1.8	0.0	N	N	N	0–.2 Organics .2–1.8 Br F sand w/ little silt	moist/loose	
5.0 – 7	15 14 17 13	1.6	0.0				Br. F sand w/ black horizontal layers ~~of~~ mixed throughout	moist/med dense	
10.0 – 12	1 2 3 3	1.6	0.0				Br. F sand	sat/loose	
15.0 – 17	1 3 4 4	2	0.0				Same	sat/loose	
20.0 – 22	3 2 4 5	1	0.0				Same	sat/loose	
25.0	2 2 5 7	1.4	0.0				Same	sat/loose	
27.0	4 6 7 10	.8	0.0				Same	sat/loose	
29.0	2 3 4 8	.8	0.0				Same	sat/loose	
34.0	4 6 8 9	1.2	0.0				Same	sat/loose	
33.3	3 3 7 10	1.5	0.0				Same	sat/loose	
38.0									

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BOREHOLE LOG

BORING ID #: KLF-07

START DATE: 3/26/13 END DATE: 3/27/13

PROJECT NAME: Kingsbury Landfill	PROJECT NO.: 60277036.6.02	PROJECT MANAGER: Paul Kareth			
SITE LOCATION: Kingsbury, NY	BORING LOCATION:				
DRILLING CO.: GeoLogic	DRILLER: Dave & John	DRILLING METHOD: HALLOW STEM AUGER			
BOREHOLE DIAMETER:	DEPTH TO BEDROCK:	TOTAL DEPTH DRILLED:			
TOTAL DEPTH REACHED:	INSPECTOR: Matthew Dean	WEATHER CONDITIONS:			
EASTING:	NORTHING:	ELEVATION AND DATUM:			

FIELD SAMPLE INFORMATION								HAMMER	SAMPLER	ST. WATER LEVELS	DATE 1:	DEPTH 1:	TIME 1:
							WEIGHT(S)				DATE 2:	DEPTH 2:	TIME 2:
							FALL			CASING	TUBE	CORE	RIG TYPE:
							TYPE						
							ID/OD						
DEPTH (feet bgs)	Blow Counts	RECOVERY	PID (ppm)	ODOR OBSERVED	LAB ANALYSIS	VISIBLE PRODUCT	GEOLOGIC DESCRIPTION					LITHOLOGY/ SOIL TYPE	WATER LEVEL 3/27/13 6.00'
0.0 / 2	2 3 4 6	15	0.0 0.0 0.0	N	N	N	0-.2 Organics .2-1.5' Brown med to fine sand little fine gravel					dry/v loose	
5.0 / 7	14 14 17 16	2	0.0 0.0 0.0				Same (fill compact)					dry/med dense	8' water
10.0 / 12	3 5 5 7	2	0.0 0.0 0.0				Brown med to fine sand w/ organic silty sand laminations intermitent					wet/loose	
15.0 / 17	2 3 4 4	2	0.0 0.0 0.0				Same w/ no organics					sat/loose	
20.0 / 22	5 5 4 4	1.6	0.0 0.0 0.0				Same					sat/loose	
25.0 / 27	6 5 7 12	2	0.0 0.0 0.0				Same					sat/loose	
30.0 / 32	17 14 15 21	1.7	0.0 0.0 0.0				Same					sat/loose	
35.0 / 37	16 29 32 22	2	0.0 0.0 0.0				Same					sat/loose	
40.0 / 41	1 2 5 10	1.5	0.0 0.0 0.0				Same					sat/loose	
38.0 / 40.0	8 14 18 20	1.8	0.0 0.0 0.0				Same					sat/loose to med dense	

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BOREHOLE LOG

BORING ID #: KLF-07
START DATE: 3/04/13 END DATE: 3/27/13

PROJECT NAME:	Kingsbury Landfill	PROJECT NO.:	60277036.6.02	PROJECT MANAGER:	Paul Kareth
SITE LOCATION:	Kingsbury, NY	BORING LOCATION:			
DRILLING CO.:	GeoLogic	DRILLER:		DRILLING METHOD:	HALLOW STEM AUGER
BOREHOLE DIAMETER:		DEPTH TO BEDROCK:		TOTAL DEPTH DRILLED:	
TOTAL DEPTH REACHED:		INSPECTOR:	Matthew Dean	WEATHER CONDITIONS:	
EASTING:		NORTHING:		ELEVATION AND DATUM:	

WEIGHT(S)	HAMMER	SAMPLER	ST. WATER LEVELS	DATE 1:	DEPTH 1:	TIME 1:
FALL			CASING	TUBE	CORE	RIG TYPE:
TYPE						
ID/OD						

DEPTH (feet bgs)	Blow Counts	RECOVERY	PID (ppm)	ODOR OBSERVED	LAB ANALYSIS	VISIBLE PRODUCT	GEOLOGIC DESCRIPTION	LITHOLOGY/ SOIL TYPE	WATER LEVEL
35.0	10 14 14 20	1.5	0.0 0.0 0.0	N ↓	N ↓	N ↓	Same w/ some fine gravel towards bottom	wet/med dense	
37.0	8 9 10 14	2	0.0 0.0 0.0	↓	↓	↓	Same w/ some silt last 4" (lense of silty sand)	wet/med dense	
39.0	3 4 6 12	2	0.0 0.0 0.0	↓	↓	↓	Same w/ no silt	wet/loose	
41.0	6 7 10 16	1.5	0.0 0.0 0.0	↓	↓	↓	41-42 Same 42-42.5 Brown silty sand	wet/loose	
43.0	6 5 6 10	1.5	0.0 0.0 0.0	↓	↓	↓	Brown to gray silty sand w/ occasional hard clay lenses & occasional oxidation laminations	wet/loose	
45.0	3 5 7 10	1.5	0.0 0.0 0.0	↓	↓	↓	Gray fine sand w/ little silt	wet/loose	
47.0	7 11 15 20	2	0.0 0.0 0.0	↓	↓	↓	Gray fine sand w/ some silt	wet/med dense	
49.0	6 7 12 15	1.5	0.0 0.0 0.0	↓	↓	↓	49-49.5 Same 49.5 2" Gray silty clay 49.7 Gray sandy silt	wet/med dense wet/stiff	
51.0							0-15 M to F sand w/ some organics 15-42 M to F sand w/ F sand increasing downwards		
18.0							42-45 Silty sand 45-49.5 F sand w/ some silt Clay lense @ 49.5		
20.0							49.7-51 Sandy silt		

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BOREHOLE LOG

BORING ID #: KLF - 08

START DATE: 4/8/13 END DATE: 4/8/13

PROJECT NAME: Kingsbury Landfill
SITE LOCATION: Hudson Falls, NY
DRILLING CO.: GeoLogic
BOREHOLE DIAMETER: 4.25"
TOTAL DEPTH REACHED:
LATITUDE:

PROJECT NO.: 60277036.6.02
BORING LOCATION:
DRILLER: Dave and John
DEPTH TO BEDROCK:
INSPECTOR: Matthew J. Dean
LONGITUDE:

PROJECT MANAGER: Paul Kareth
DRILLING METHOD: Hallow Stem Auger
TOTAL DEPTH DRILLED:
WEATHER CONDITIONS: Overcast – 45°
ELEVATION AND DATUM:

FIELD SAMPLE INFORMATION								HAMMER	SAMPLER	ST. WATER LEVELS	DATE 1:	DEPTH 1:	TIME 1:	
							WEIGHT(S)				DATE 2:	DEPTH 2:	TIME 2:	
							FALL			CASING	TUBE	CORE		RIG TYPE:
							TYPE							
							ID/OD							
DEPTH (feet bgs)	Blow Count	RECOVERY	PID (ppm)	ODOR OBSERVED	LAB ANALYSIS	VISIBLE PRODUCT	GEOLOGIC DESCRIPTION					LITHOLOGY/ SOIL TYPE	WATER LEVEL	
0.0 2	2 3 5 9	16	0.0	N	N	N	0 - .6 Dk Br organic A. .6 - 1.6 Br F Sand w/ trace rk frgmt					moist/loose		
5 7	5 5 6 6	16	0.0				5 - 5.5 Br F Sand 5.5 - 6.6 Grayish Br. F sand					moist/loose wet/loose	wet @ 5.5' WL 7.7'	
10 12	1 3 3 3	18	0.0				Br. F sand w/ some silt					wet/loose		
15 17	2 1 2 2	18	0.0				Br. F sand w/ little silt					sat/loose		
20 22	1 2 5 5	2	0.0				Same					sat/loose		
25 27	3 6 9	18	0.0				Same					sat/loose		
27 29	7 9 12 11	2	0.0				Same 2" Clay lense @ 27.9'					Sat/loose		
29 31	3 5 4 7	2	0.0				Intermittent ~~silty~~ clayey silt + silty sand					wet/medium		
31 33	4 8 12 14	20	0.0				Br. F sand some silt					sat/medium dense		
33 35	5 8 10 10	2	0.0				Same					Sat/med dense		
35														

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BOREHOLE LOG

BORING ID #: KLF - 08

START DATE: 4/8/13 END DATE: 4/8/13

PROJECT NAME: Kingsbury Landfill
SITE LOCATION: Hudson Falls, NY
DRILLING CO.: GeoLogic
BOREHOLE DIAMETER: 4.25"
TOTAL DEPTH REACHED: 55'
LATITUDE:

PROJECT NO.: 60277036.6.02
BORING LOCATION:
DRILLER: Dave and John
DEPTH TO BEDROCK:
INSPECTOR: Matthew J. Dean
LONGITUDE:

PROJECT MANAGER: Paul Kareth
DRILLING METHOD: Hallow Stem Auger
TOTAL DEPTH DRILLED: 55'
WEATHER CONDITIONS: Sunny 50°
ELEVATION AND DATUM:

	HAMMER	SAMPLER	ST. WATER LEVELS	DATE 1:	DEPTH 1:	TIME 1:
WEIGHT(S)				DATE 2:	DEPTH 2:	TIME 2:
FALL			CASING	TUBE	CORE	RIG TYPE:
TYPE						
ID/OD						

FIELD SAMPLE INFORMATION

DEPTH (feet bgs)	Blow Count	RECOVERY	PID (ppm)	ODOR OBSERVED	LAB ANALYSIS	VISIBLE PRODUCT	GEOLOGIC DESCRIPTION	LITHOLOGY/ SOIL TYPE	WATER LEVEL
36	4 6 8 11	2	0.0	N	N	N	Br. F sand little silt	sat/med dense	
37	6 8 10	2	0.0				Same last 2" gray clay little silt	sat/med dense	
39	3 5 5 5	2	0.0				Intermittent silty clay & silty sand	wet/med dense	
41	4 5 6 6	2	0.0				Same	wet/med	
43	5 8 8 16	2	0.0				Same	wet/med	
45	3 3 4 2	2	0.0				Same	wet/med	
47	5 7 11 15	2	0.0				Same last 1' gray clay w/ 2" silt partings	wet/med	
49	4 5 5 7	2	0.0				Gray clay w/ some silt @ 2" partings	moist/med	
51	4 6 5 10	2	0.0				Same	moist/med	
53	5 6 6 8	2	0.0				Same	moist/med	
55									

0-29' F sand
29'-49' Intermittent clayey silt & silty sand
49'-55' Clay some silt

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BOREHOLE LOG

BORING ID #: KLF - 09

START DATE: 4/8/13 END DATE:

PROJECT NAME: Kingsbury Landfill
SITE LOCATION: Hudson Falls, NY
DRILLING CO.: GeoLogic
BOREHOLE DIAMETER: 4.25"
TOTAL DEPTH REACHED:
LATITUDE:

PROJECT NO.: 60277036.6.02
BORING LOCATION:
DRILLER: Dave and John
DEPTH TO BEDROCK:
INSPECTOR: Matthew J. Dean
LONGITUDE:

PROJECT MANAGER: Paul Kareth
DRILLING METHOD: Hallow Stem Auger
TOTAL DEPTH DRILLED:
WEATHER CONDITIONS:
ELEVATION AND DATUM:

WEIGHT(S)	HAMMER	SAMPLER	ST. WATER LEVELS	DATE 1:	DEPTH 1:	TIME 1:
FALL			CASING	TUBE	CORE	RIG TYPE:
TYPE						
ID/OD						

DEPTH (feet bgs)	Blow Count	RECOVERY	PID (ppm)	ODOR OBSERVED	LAB ANALYSIS	VISIBLE PRODUCT	GEOLOGIC DESCRIPTION	LITHOLOGY/ SOIL TYPE	WATER LEVEL
0.0 – 2	WOR WOH 1 1	1.5	0.0	N	N	N	Br. F sand trace silt	moist/loose	
5.0 – 7	3 3 3 5	2	0.0				Same	wet/loose	wet @ 5.2' wl = 5.1
10.0 – 12	1 2 2 2	1.6	0.0				Same	sat/loose	
15.0 – 17	WOR WOH 2 3	2	0.0				Same	sat/loose	
20.0 – 22	3 5 5 5	2	0.0				Same	sat/loose	
25.0 – 27	2 2 3 5	1.7	0.0				Same oxidation lense @ 25.7'	sat/loose	
30.0 – 32	4 5 8 10	2	0.0				Same	sat/loose	
29 – 31	3 3 4 6	1.4	0.0				Intermitent gray silt layers + Br F sand layers	sat/loose	
36.0 – 38	4 5 8 10	2	0.0				Same	sat/loose	
35.0 – 37	3 2 2 2	2	0.0				33 – 33.5 Same 33.5 – 35 Gray silty clay	wet/soft	
40.0									

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BOREHOLE LOG

BORING ID #: KLF - 09

START DATE: 4/8/13 END DATE:

PROJECT NAME: Kingsbury Landfill
SITE LOCATION: Hudson Falls, NY
DRILLING CO.: GeoLogic
BOREHOLE DIAMETER: 4.25"
TOTAL DEPTH REACHED:
LATITUDE:

PROJECT NO.: 60277036.6.02
BORING LOCATION:
DRILLER: Dave and John
DEPTH TO BEDROCK:
INSPECTOR: Matthew J. Dean
LONGITUDE:

PROJECT MANAGER: Paul Kareth
DRILLING METHOD: Hallow Stem Auger
TOTAL DEPTH DRILLED:
WEATHER CONDITIONS:
ELEVATION AND DATUM:

FIELD SAMPLE INFORMATION								HAMMER	SAMPLER	ST. WATER LEVELS	DATE 1:	DEPTH 1:	TIME 1:
							WEIGHT(S)				DATE 2:	DEPTH 2:	TIME 2:
							FALL			CASING	TUBE	CORE	RIG TYPE:
							TYPE						
							ID/OD						

DEPTH (feet bgs)	Blow Count	RECOVERY	PID (ppm)	ODOR OBSERVED	LAB ANALYSIS	VISIBLE PRODUCT	GEOLOGIC DESCRIPTION	LITHOLOGY/ SOIL TYPE	WATER LEVEL
36	3 3 6 5	2	0.0	N	N	N	~~35-36~~ Gray ~~clay~~ silty clay starting @ 36.5' 2" silt partings	wet/med	
37	5 3 3 5	16	0.0				Same	wet/med	
39	3 8 14 20	1.3	0.0				39-40 Same 40-40.3 Gray sandy silt	wet/med	
49	5 6 6 5	2	0.0				Intermittent gray silty clay & gray sandy silt	wet/med	
48	3 5 8	1.8	0.0				Gray clayey silt w/ little F sand	moist/med	
47	2 3 10 6	16	0.0				Gray silty clay w/ 1" silt partings trace F sand	moist/med ~~stiff~~	
47	3 3 5	2	0.0				Same	moist/med stiff	
46	3 5 5	1.8	0.0				Same	moist/med stiff	
57							0-29' F sand trace silt 29'-33.5 Intermittent clayey silt & sandy silt layers		
51							33.5-40 Silty clay 40-43 Intermittent silty clay & sandy silt 43-51 Silty clay w/ 2" silt partings		
50									

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BOREHOLE LOG

BORING ID #: KLF - 10

START DATE: 4/9/13 END DATE: 4/10/13

PROJECT NAME: Kingsbury Landfill
SITE LOCATION: Hudson Falls, NY
DRILLING CO.: GeoLogic
BOREHOLE DIAMETER: 4.25"
TOTAL DEPTH REACHED:
LATITUDE:

PROJECT NO.: 60277036.6.02
BORING LOCATION:
DRILLER: Dave and John
DEPTH TO BEDROCK:
INSPECTOR: Matthew J. Dean
LONGITUDE:

PROJECT MANAGER: Paul Kareth
DRILLING METHOD: Hallow Stem Auger
TOTAL DEPTH DRILLED:
WEATHER CONDITIONS: Sunny ~ 60's
ELEVATION AND DATUM:

FIELD SAMPLE INFORMATION								HAMMER	SAMPLER	ST. WATER LEVELS	DATE 1:	DEPTH 1:	TIME 1:
							WEIGHT(S)				DATE 2:	DEPTH 2:	TIME 2:
							FALL			CASING	TUBE	CORE	RIG TYPE:
							TYPE						
							ID/OD						
DEPTH (feet bgs)	Blow Count	RECOVERY	PID (ppm)	ODOR OBSERVED	LAB ANALYSIS	VISIBLE PRODUCT	GEOLOGIC DESCRIPTION					LITHOLOGY/ SOIL TYPE	WATER LEVEL 4/10/13 10.8
0.0	1 3 5 6	1.5	0.0	N	N	N	Br. M,F sand trace silt					moist/loose	
2													
5.0	2 3 3 5	2	0.0				5-5.5 Same 5.5-6.5 Br. silty clay (cap material) 6.5-7.0 Br. M,F sand					moist/loose	
7													
10.0	3 3 4 6	1.6	0.0				Br. M,F sand					sat/loose	WL = 11.8
12													
15.0	5 5 6 7	2	0.0				Same					sat/loose	
17													
20.0	2 2 2 2	2	0.0				20-20.8 Br. M,F sand 20.8-22 Grayish green M,F sand trace silt slightly leachate smell					sat/loose	
22													
24.0	1 1 1 2	.6	0.0				Grayish green M,F sand trace silt slight leachate smell					sat/v. loose	
27.0	2 2 2 3	.7	0.0				Same					sat/loose	
29.0	3 6 7 8	0	-				No recovery						
31.0	5 6 9 12	1	0.0				Grayish green M,F sand trace silt slight leachate smell					sat/loose	
33.0	1 3 5 7	1.7	0.0				Same					sat/loose	
36.0													

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BOREHOLE LOG

BORING ID #: **KLF - 10**

START DATE: 4/4/13 END DATE: 4/10/13

PROJECT NAME: Kingsbury Landfill
SITE LOCATION: Hudson Falls, NY
DRILLING CO.: GeoLogic
BOREHOLE DIAMETER: 4.25"
TOTAL DEPTH REACHED:
LATITUDE:

PROJECT NO.: 60277036.6.02
BORING LOCATION:
DRILLER: Dave and John
DEPTH TO BEDROCK:
INSPECTOR: Matthew J. Dean
LONGITUDE:

PROJECT MANAGER: Paul Kareth
DRILLING METHOD: Hallow Stem Auger
TOTAL DEPTH DRILLED:
WEATHER CONDITIONS:
ELEVATION AND DATUM:

WEIGHT(S)	HAMMER	SAMPLER	ST. WATER LEVELS	DATE 1:	DEPTH 1:	TIME 1:
FALL			CASING	TUBE	CORE	RIG TYPE:
TYPE						
ID/OD						

DEPTH (feet bgs)	Blow Count	RECOVERY	PID (ppm)	ODOR OBSERVED	LAB ANALYSIS	VISIBLE PRODUCT	GEOLOGIC DESCRIPTION	LITHOLOGY/ SOIL TYPE	WATER LEVEL
30 / 30	3 5 5 8	0	0.0	N	N	N	No recovery		
32 / 32.0	6 8 8 10	1.5	0.0				Grayish green M,F sand little silt	sat/loose	
34 / 34	3 3 3 4	2	0.0				Same Intermittent hard silt lenses m Clayey silt lense	sat/loose	
46 / 46	4 5 5 9	2	0.0				Gray to green, m,F sand some silt trace clay	sat/loose	
43 / 43	2 2 7 8	1.5	0.0				Same	sat/loose	
46 / 46	1 1 2 5	1.0	0.0				45-45.5 Same 45.5-46 Hard gray sandy silt	sat/loose	
42 / 42	4 4 4 9	1.2	0.0				Gray clayey silt some f sand	sat/medium	
44 / 44	3 3 5 10	2	0.0				Intermittent Gray silty sand & clayey silt	sat/medium	
56 / 56	4 5 5 7	2	0.0				Same	sat/medium	
58 / 58	4 6 6 10	2	0.0				Gray silty sand w/ little clay	sat/medium	
60 / 60									

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40 British American Boulevard
Latham, New York 12110
Phone: (518) 951-2200
Fax: (518) 951-2300

BOREHOLE LOG

BORING ID #: KLF - 10

START DATE: 4/8/13 END DATE: 4/10/13

PROJECT NAME: Kingsbury Landfill
SITE LOCATION: Hudson Falls, NY
DRILLING CO.: GeoLogic
BOREHOLE DIAMETER: 4.25"
TOTAL DEPTH REACHED:
LATITUDE:

PROJECT NO.: 60277036.6.02
BORING LOCATION:
DRILLER: Dave and John
DEPTH TO BEDROCK:
INSPECTOR: Matthew J. Dean
LONGITUDE:

PROJECT MANAGER: Paul Kareth
DRILLING METHOD: Hallow Stem Auger
TOTAL DEPTH DRILLED:
WEATHER CONDITIONS:
ELEVATION AND DATUM:

FIELD SAMPLE INFORMATION								HAMMER	SAMPLER	ST. WATER LEVELS	DATE 1:	DEPTH 1:	TIME 1:
							WEIGHT(S)				DATE 2:	DEPTH 2:	TIME 2:
DEPTH (feet bgs)	Blow Count	RECOVERY	PID (ppm)	ODOR OBSERVED	LAB ANALYSIS	VISIBLE PRODUC	FALL			CASING	TUBE	CORE	RIG TYPE:
							TYPE						
							ID/OD						
							GEOLOGIC DESCRIPTION					LITHOLOGY/ SOIL TYPE	WATER LEVEL
0	3 4 5 5	1.6	0.0	N	N	N	Gray sandy silt no clay					sat/loose	
5	4 4 3 8	2	0.0				5-5.8 Same 5.8-8.9 Gray silty varved clay					wet/loose wet/medium	
10	4 3 3 3	2	0.0				Same					moist/soft	
15	4 6 6 10	1.5	0.0				Same 2" silt partings last 6"					moist/soft	
20													
10.0							TD = 63' Well @ 59'						
12.0													
14.0													
16.0													
18.0													
20.0													

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BOREHOLE LOG

BORING ID #: KLF-11
START DATE: 3/27/13 END DATE: 3/28/13

PROJECT NAME: Kingsbury Landfill
SITE LOCATION: Kingsbury, NY
DRILLING CO.: GeoLogic
BOREHOLE DIAMETER:
TOTAL DEPTH REACHED: 51'
EASTING:

PROJECT NO.: 60277036.6.02
BORING LOCATION:
DRILLER: Dave + John
DEPTH TO BEDROCK:
INSPECTOR: Matthew Dean
NORTHING:

PROJECT MANAGER: Paul Kareth
DRILLING METHOD: HALLOW STEM AUGER
TOTAL DEPTH DRILLED: 51'
WEATHER CONDITIONS:
ELEVATION AND DATUM:

	HAMMER	SAMPLER	ST. WATER LEVELS	DATE 1:	DEPTH 1:	TIME 1:
WEIGHT(S)				DATE 2:	DEPTH 2:	TIME 2:
FALL			CASING	TUBE	CORE	RIG TYPE:
TYPE						
ID/OD						

DEPTH (feet bgs)	Blow Counts	RECOVERY	PID (ppm)	ODOR OBSERVED	LAB ANALYSIS	VISIBLE PRODUCT	GEOLOGIC DESCRIPTION	LITHOLOGY/ SOIL TYPE	WATER LEVEL 26.70 3/29/13
0.0	3	1.5	0.0	N	N	N	0-.2 Organic	dry/v. loose	
	5		0.0				.2-.4 Gray gravel (road bed)		
2	12		0.0				.4-1.5 Brown m, F Sand		
5.0	8	1.7	0.0				Same	dry/v. loose	
	9		0.0						
7	7		0.0						
10.0	3	1.8	0.0				Same	dry/v. loose	
	4		0.0						
12	5		0.0						
15.0	1	1.5	0.0				Same	saturated/loose	wl = 13.70
	1		0.0						
17	1		0.0						
20.0	2	1.6	0.0				Same	sat/loose	
	3		0.0						
22	5		0.0						
25.0	6	2	0.0	Y	N	N	25-26.5 Same	sat/med dense	
	8		0.0				26.5-27 Same about color change br to gr. Slight sewer smell		
27	10		0.0						
30.0	9	2	0.0	N			Same	wet/med dense	
	5		0.0				Last 2" Gray clay little silt		
32	2		0.0						
35.0	1	2	0.0				Gray clay little silt varves	moist/medium	
	2		0.0						
37	2		0.0						
38.0	3	2	0.0				Same	moist/medium	
	3		0.0						
40	3		0.0						
43.0	2	1.7	0.0				Same	moist/medium	
	2		0.0						
45.0	4		0.0						

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BOREHOLE LOG

BORING ID #: KLF-11
START DATE: 3/27/13 END DATE: 3/28/13

PROJECT NAME: Kingsbury Landfill
SITE LOCATION: Kingsbury, NY
DRILLING CO.: GeoLogic
BOREHOLE DIAMETER:
TOTAL DEPTH REACHED:
EASTING:

PROJECT NO.: 60277036.6.02
BORING LOCATION:
DRILLER:
DEPTH TO BEDROCK:
INSPECTOR: Matthew Dean
NORTHING:

PROJECT MANAGER: Paul Kareth
DRILLING METHOD: HALLOW STEM AUGER
TOTAL DEPTH DRILLED:
WEATHER CONDITIONS:
ELEVATION AND DATUM:

FIELD SAMPLE INFORMATION								HAMMER	SAMPLER	ST. WATER LEVELS	DATE 1:	DEPTH 1:	TIME 1:
							WEIGHT(S)			DATE 2:	DEPTH 2:	TIME 2:	
							FALL			CASING	TUBE	CORE	RIG TYPE:
							TYPE						
							ID/OD						

DEPTH (feet bgs)	Blow Counts	RECOVERY	PID (ppm)	ODOR OBSERVED	LAB ANALYSIS	VISIBLE PRODUCT	GEOLOGIC DESCRIPTION	LITHOLOGY/ SOIL TYPE	WATER LEVEL
30.0	4 4 5 5	15	0.0 0.0 0.0	N	N	N	Gray silty clay, w/ parting more silt @ parts	moist/med stiff	
32.0	2 2 2 3	2	0.0 0.0 0.0				Same	moist/med stiff	
34.0	4 4 4 5	2	0.0 0.0 0.0				Same	moist/med stiff	
36.0	3 3 3 2	2	0.0 0.0 0.0				Same	moist/med stiff	
38.0	WOH 1 2 3	2	0.0 0.0 0.0				Same	moist/med stiff	
40.0	2 3 3 4	2	0.0 0.0 0.0				Same	moist/med stiff	
42.0	4 3 3 4	2	0.0 0.0 0.0				Same	moist/med stiff	
44.0	2 2 3 4	2	0.0 0.0 0.0				Same	wet/med stiff	
50.0							0-.2 Organic .2-.4 Road bed gravel .4-26.5 M,F sand color change		
18.0							26.5-28.9 M,F sand odor 28.9-51 Clay w/ parting. Silt layers every 2", Varves.		
20.0									

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BOREHOLE LOG

BORING ID #: KLF - 12

START DATE: 4/10/13 END DATE: 4/11/13

PROJECT NAME: Kingsbury Landfill
SITE LOCATION: Hudson Falls, NY
DRILLING CO.: GeoLogic
BOREHOLE DIAMETER: 4.25"
TOTAL DEPTH REACHED:
LATITUDE:

PROJECT NO.: 60277036.6.02
BORING LOCATION:
DRILLER: Dave and John
DEPTH TO BEDROCK:
INSPECTOR: Matthew J. Dean
LONGITUDE:

PROJECT MANAGER: Paul Kareth
DRILLING METHOD: Hallow Stem Auger
TOTAL DEPTH DRILLED:
WEATHER CONDITIONS: Overcast 50°
ELEVATION AND DATUM:

FIELD SAMPLE INFORMATION								HAMMER	SAMPLER	ST. WATER LEVELS	DATE 1:	DEPTH 1:	TIME 1:
							WEIGHT(S)				DATE 2:	DEPTH 2:	TIME 2:
							FALL			CASING	TUBE	CORE	RIG TYPE:
							TYPE						
							ID/OD						
DEPTH (feet bgs)	Blow Count	RECOVERY	PID (ppm)	ODOR OBSERVED	LAB ANALYSIS	VISIBLE PRODUCT	GEOLOGIC DESCRIPTION					LITHOLOGY/ SOIL TYPE	WATER LEVEL 4/11/13 17.8
0.0	6 7 8 9	1.7	0.0	N	N	N	0-.5 Road bed Grave + course sand .5-1.7 Br. F sand					moist/loose	
5.0 7	10 20 22 27	1.8	0.0				Same					moist/dense	
10.0 12	6 6 5 5	2	0.0				10-10.5 Same 10.5-12 Grayish green F,M sand little silt slight sewer smell * KLF-12 041013					wet/loose	WL = 14.00
15.0 17	4 4 3 3	1.5	0.0	N			Grayish green F sand little silt Last 2" Black silty sand (organic)					sat/loose	
20.0 22	1 2 2 2	2	0.0				20-20.5 Black organic silty sand 20.5-21 Gray silty sand 21-22 Br. silty sand					sat/loose	
25.0	2 2 2 3	1.4	0.0				Gray silty sand some silt last 2" Gray silty clay trace sand					sat/loose	
27.0	2 3 1 3	1	0.0				Gray silty clay little to trace sand					wet/soft	
30.0	1 2 2 3	2	0.0				Gray clay w/ 1" silt partings Varving					moist/medium	
31.0	2 4 4 3	2	0.0				Same					wet/medium	
33.0	1 1 2 3	2	0.0				Same					wet/medium to soft	
35.0													

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BOREHOLE LOG

BORING ID #: KLF-12
START DATE: 4/10/13 END DATE: 4/11/13

PROJECT NAME: Kingsbury Landfill
SITE LOCATION: Hudson Falls, NY
DRILLING CO.: GeoLogic
BOREHOLE DIAMETER: 4.25"
TOTAL DEPTH REACHED:
LATITUDE:

PROJECT NO.: 60277036.6.02
BORING LOCATION:
DRILLER: Dave and John
DEPTH TO BEDROCK:
INSPECTOR: Matthew J. Dean
LONGITUDE:

PROJECT MANAGER: Paul Kareth
DRILLING METHOD: Hallow Stem Auger
TOTAL DEPTH DRILLED:
WEATHER CONDITIONS: Overcast 40°
ELEVATION AND DATUM:

WEIGHT(S)	HAMMER	SAMPLER	ST. WATER LEVELS	DATE 1:	DEPTH 1:	TIME 1:
FALL			CASING	TUBE	CORE	RIG TYPE:
TYPE						
ID/OD						

DEPTH (feet bgs)	Blow Count	RECOVERY	PID (ppm)	ODOR OBSERVED	LAB ANALYSIS	VISIBLE PRODUC	GEOLOGIC DESCRIPTION	LITHOLOGY/ SOIL TYPE	WATER LEVEL
30.0	2 WOR 2	2	0.0	N	N	N	Same	wet/medium	
32.0	3 WOR 2	2	0.0				Same	wet/soft	
34.0	WOR WOH 2	2	0.0				Same	wet/soft	
36.0	1 2 3	2	0.0				Same	wet/soft	
38.0	2 WOR 5	2	0.0				Same	wet/soft	
40.0	1 1 2	2	0.0				Same	wet/soft	
42.0	4 3 4	2	0.0				Same	wet/soft	
44.0	WOR 1 3	2	0.0				Same	wet/soft	
46.0	3 3 3	2	0.0				Same	wet/soft	
48.0	WOR 1 3	2	0.0				Same	wet/soft	
50.0									

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BOREHOLE LOG

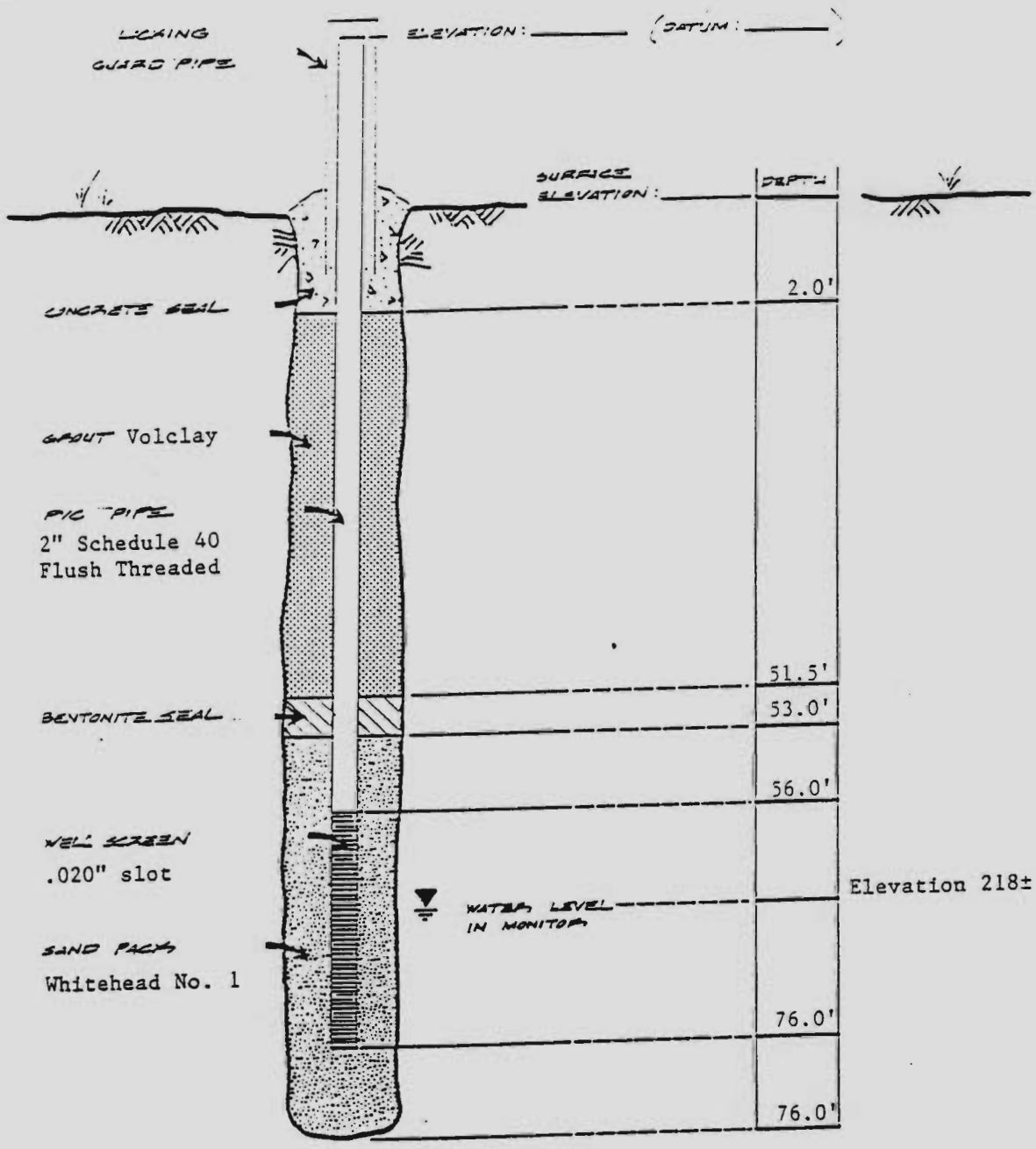
BORING ID #: KLF - 12

START DATE: 4/10/13 END DATE: 4/11/13

PROJECT NAME:	Kingsbury Landfill	PROJECT NO.:	60277036.6.02	PROJECT MANAGER:	Paul Kareth
SITE LOCATION:	Hudson Falls, NY	BORING LOCATION:			
DRILLING CO.:	GeoLogic	DRILLER:	Dave and John	DRILLING METHOD:	Hallow Stem Auger
BOREHOLE DIAMETER:	4.25"	DEPTH TO BEDROCK:		TOTAL DEPTH DRILLED:	
TOTAL DEPTH REACHED:		INSPECTOR:	Matthew J. Dean	WEATHER CONDITIONS:	
LATITUDE:		LONGITUDE:		ELEVATION AND DATUM:	

	HAMMER	SAMPLER	ST. WATER LEVELS	DATE 1:	DEPTH 1:	TIME 1:
WEIGHT(S)				DATE 2:	DEPTH 2:	TIME 2:
FALL			CASING	TUBE	CORE	RIG TYPE:
TYPE						
ID/OD						

DEPTH (feet bgs)	Blow Count	RECOVERY	PID (ppm)	ODOR OBSERVED	LAB ANALYSIS	VISIBLE PRODUCT	GEOLOGIC DESCRIPTION	LITHOLOGY/ SOIL TYPE	WATER LEVEL 4/11/13 17.8
50	3 3 3 3	2	00	N	N	N	Same	wet/soft	
52	3 3 3 3	2	0.0	N	N	N	Same	wet/soft	
54 60									
6.0							0-10.5 Br. F,M Sand 10.5-12 grayish green slight oder M,F sand sampled KLF-12, 041013		
8.0							12-26.8 Grayish silty sand 26.8-59 Clay w/ silt partings		
10.0							TD=59'		
12.0									
14.0									
16.0									
18.0									
20.0									



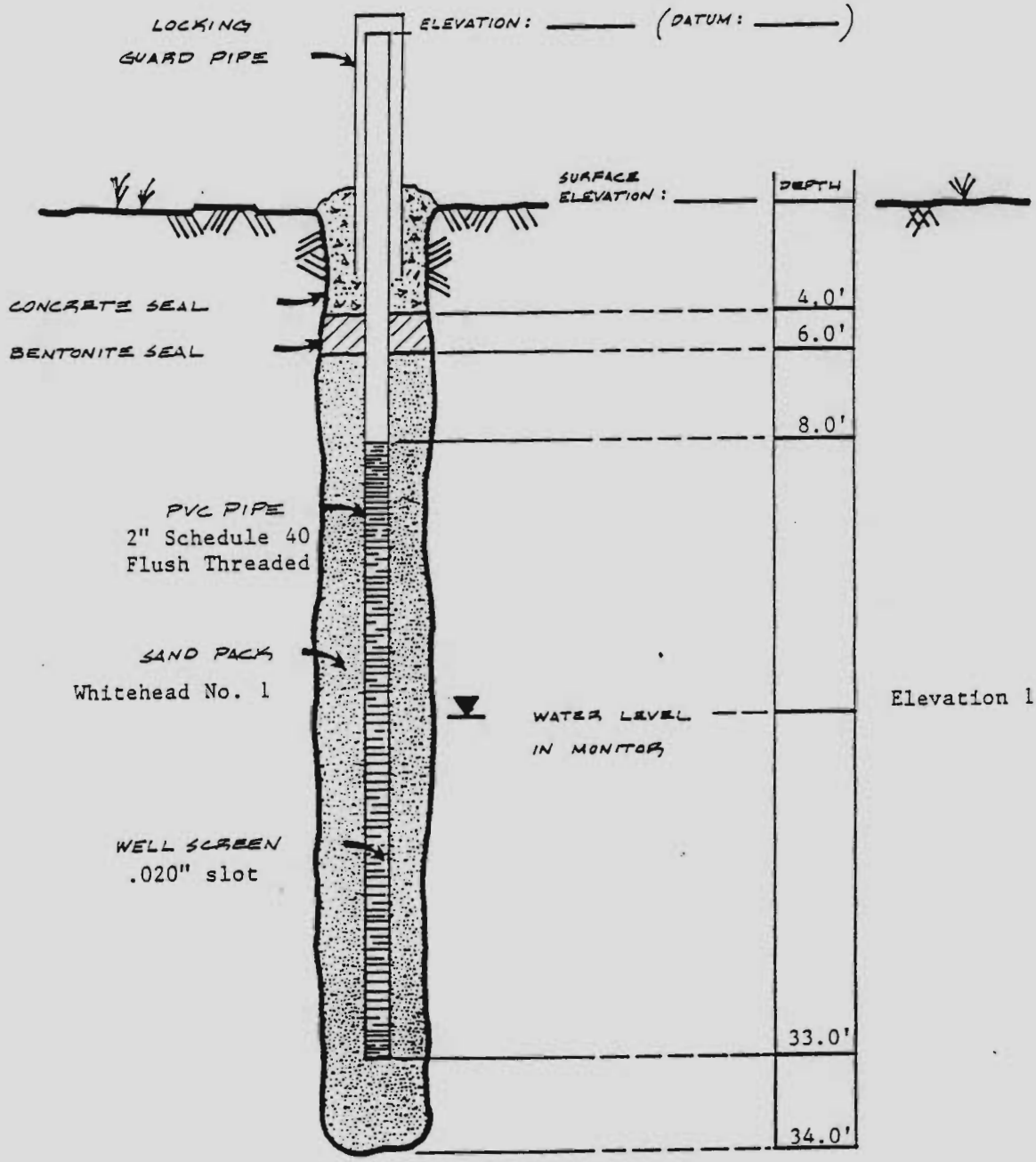
EMPIRE SOILS INVESTIGATIONS INC

MONITORING WELL DETAILS

KINGSBURY LANDFILL

WELL No. GMW-1

DR BY	JH	SCALE:	N.T.S.	PROJ. NO.	AD-86-90
CK'D BY	RWD	DATE:	6-15-88	DRWG NO	



WELL No.

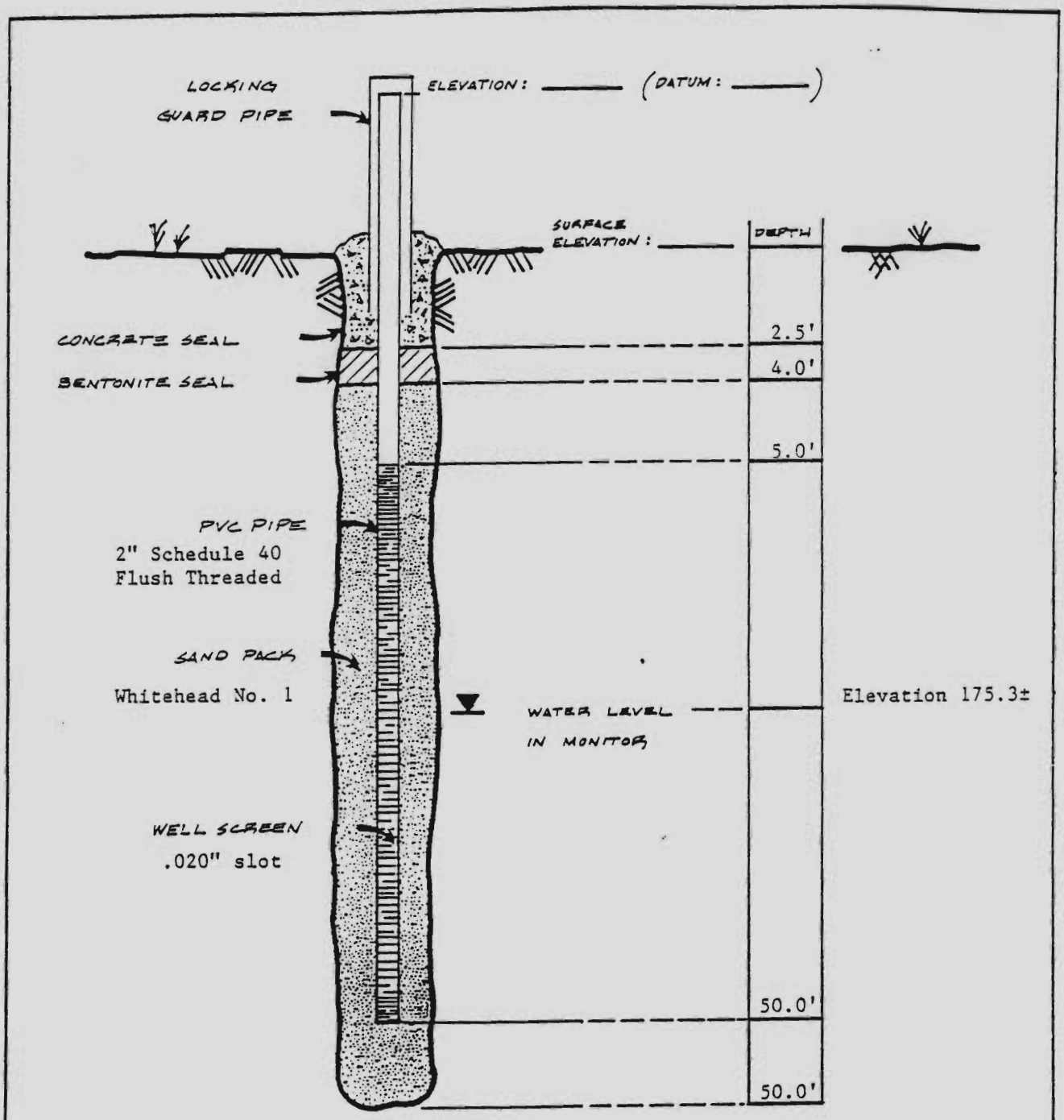
GMW-2

EMPIRE SOILS INVESTIGATIONS INC.

MONITORING WELL DETAILS

KINGSBURY LANDFILL

DR BY	JH	SCALE	N.T.S.	PROJ NO	AD-86-90
CK'D BY	RWD	DATE	6-15-88	DRWG NO	



WELL No

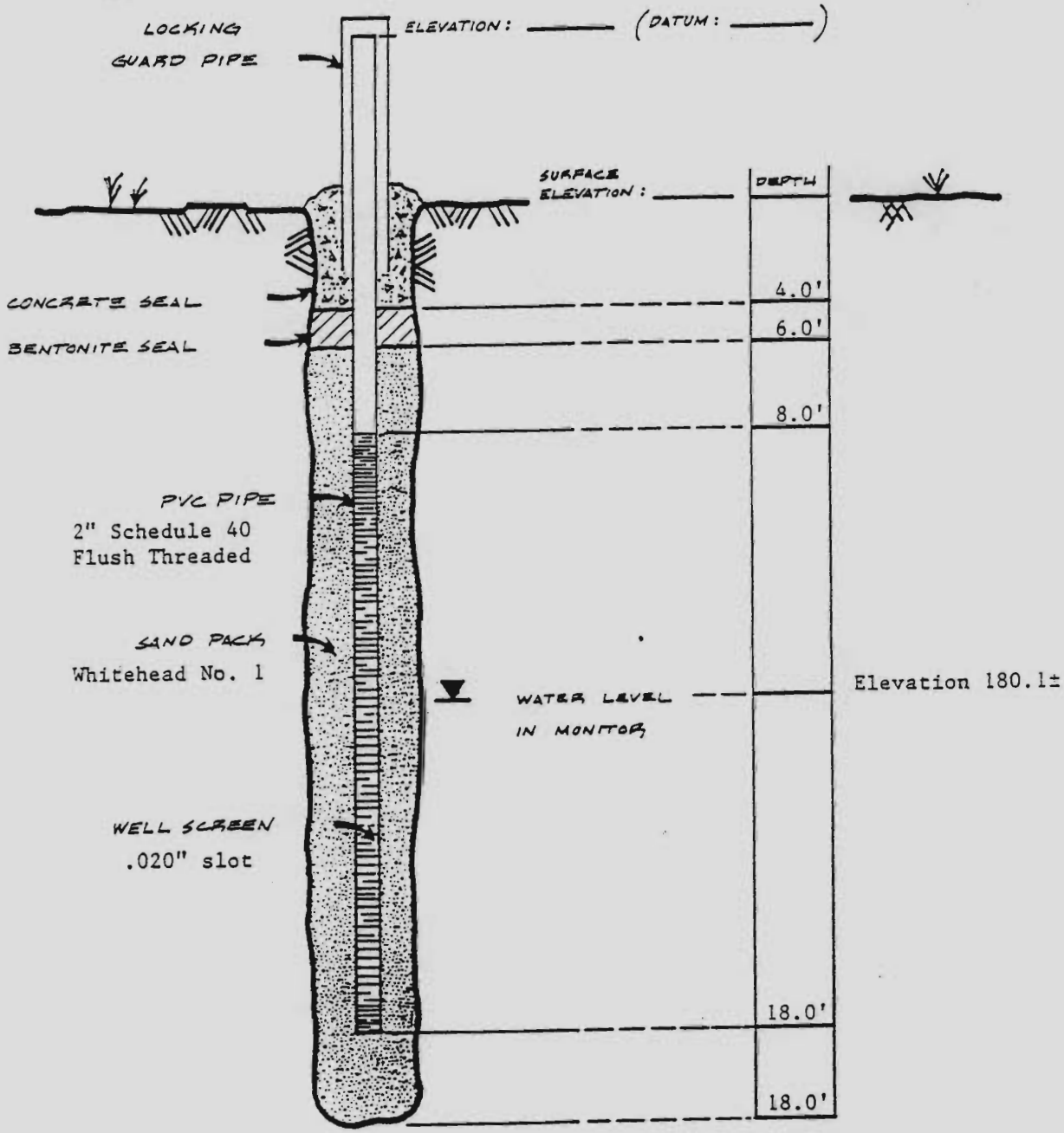
GMW-3

EMPIRE SOILS INVESTIGATIONS INC

MONITORING WELL DETAILS

KINGSBURY LANDFILL

DR BY	JH	SCALE	N.T.S.	PROJ NO	AD-86-90
CK'D BY	RWD	DATE	6-15-88	DRWG NO	



WELL No

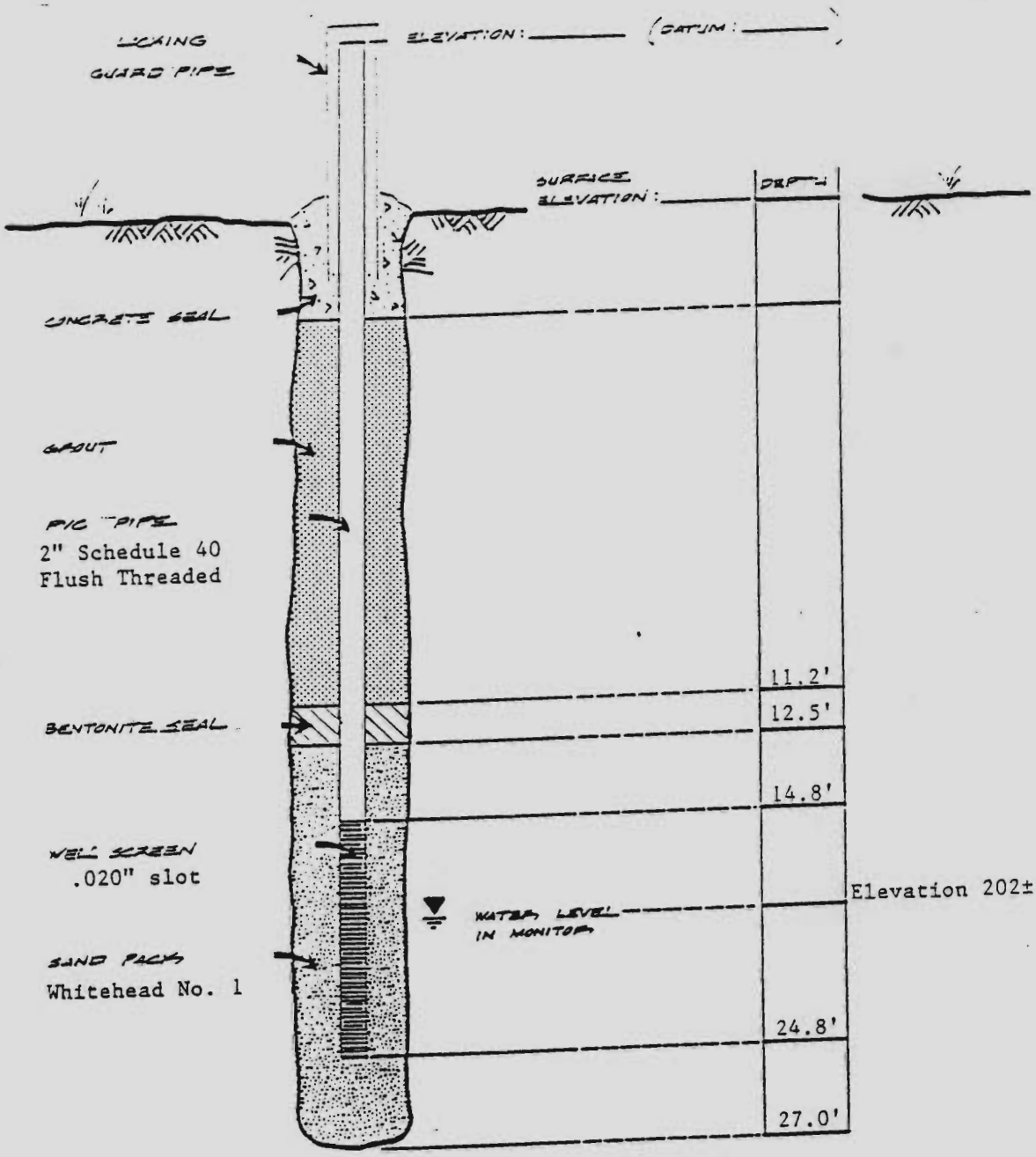
GMW-4

EMPIRE

MONITORING WELL DETAILS

KINGSBURY LANDFILL

DR BY JH	SCALE N.T.S.	PROJ NO. AD-86-90
CK'D BY RWD	DATE 6-15-88	DRWG NO



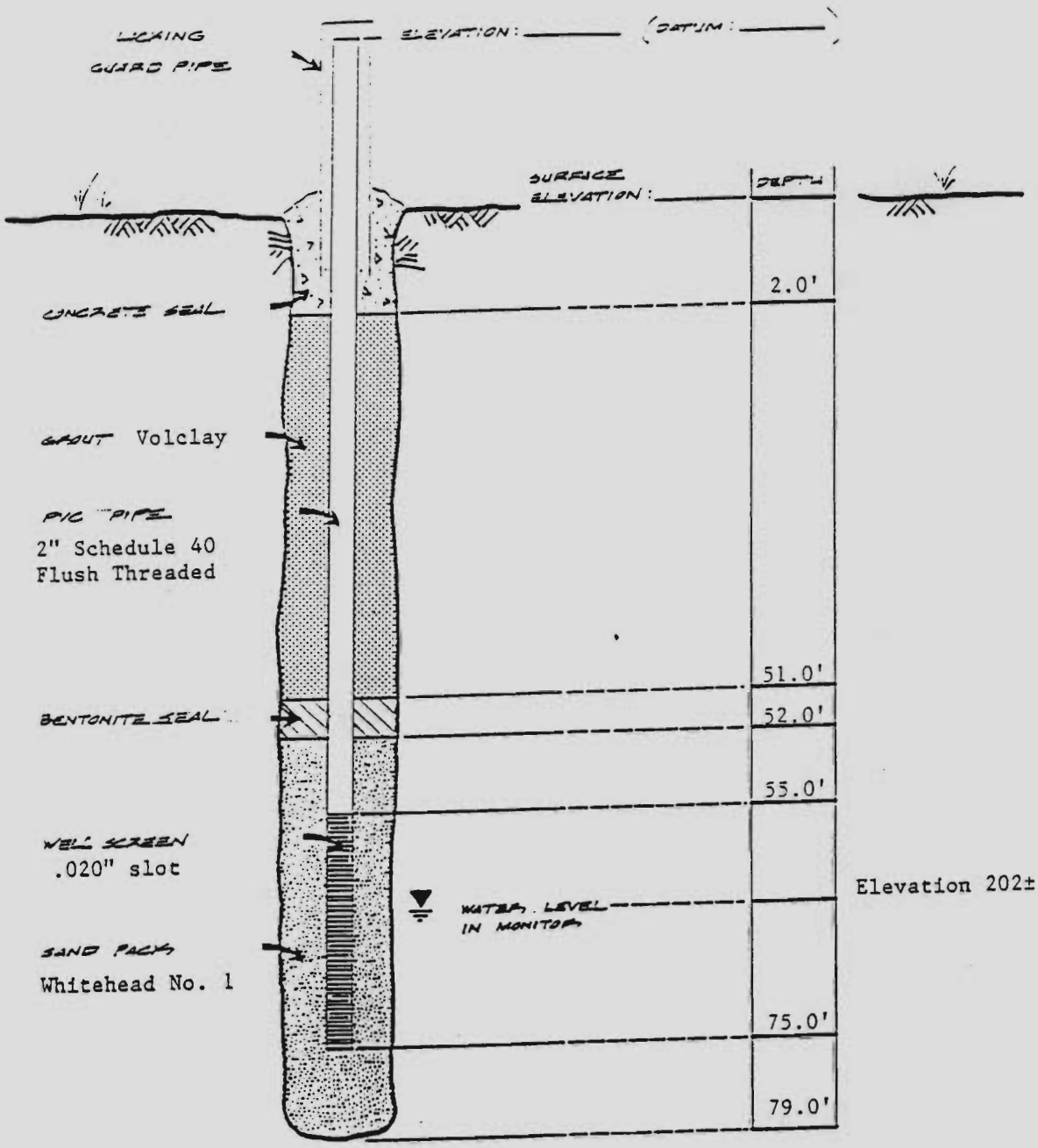
WELL No. GMW-5

EMPIRE SOILS INVESTIGATIONS INC

MONITORING WELL DETAILS

KINGSBURY LANDFILL

DR BY	JH	SCALE:	N.T.S.	PROJ. NO	AD-86-90
		DATE:	6-16-88	DRWG NO	



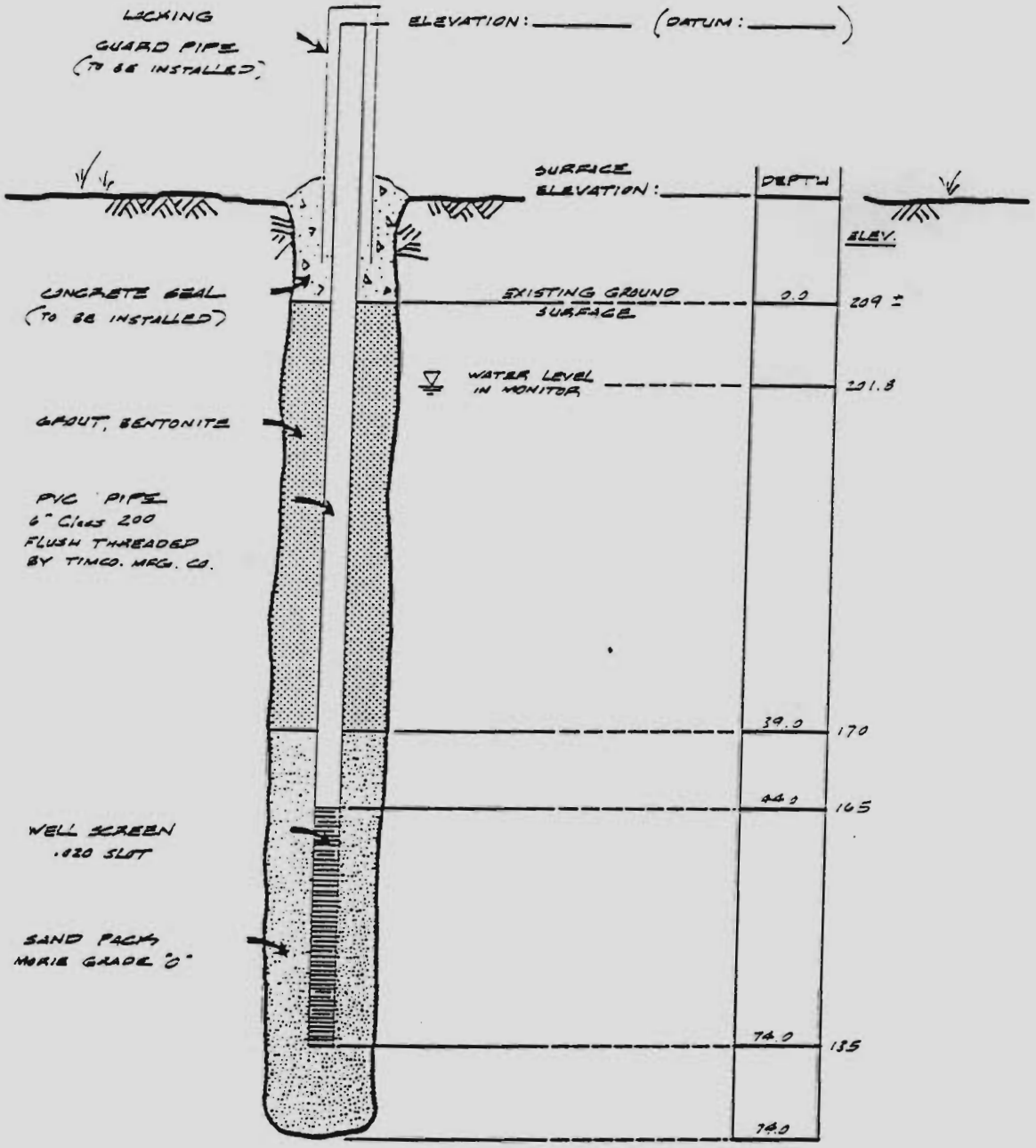
WELL No. GMW-6

EMPIRE SOILS INVESTIGATIONS INC.

MONITORING WELL DETAILS

KINGSBURY LANDFILL

DR BY	JH	SCALE:	N.T.S.	PROJ. NO.	AD-86-90
CKD BY	RWD	DATE:	6-15-88	DRWG NO	



EMPIRE
SOILS INVESTIGATIONS INC

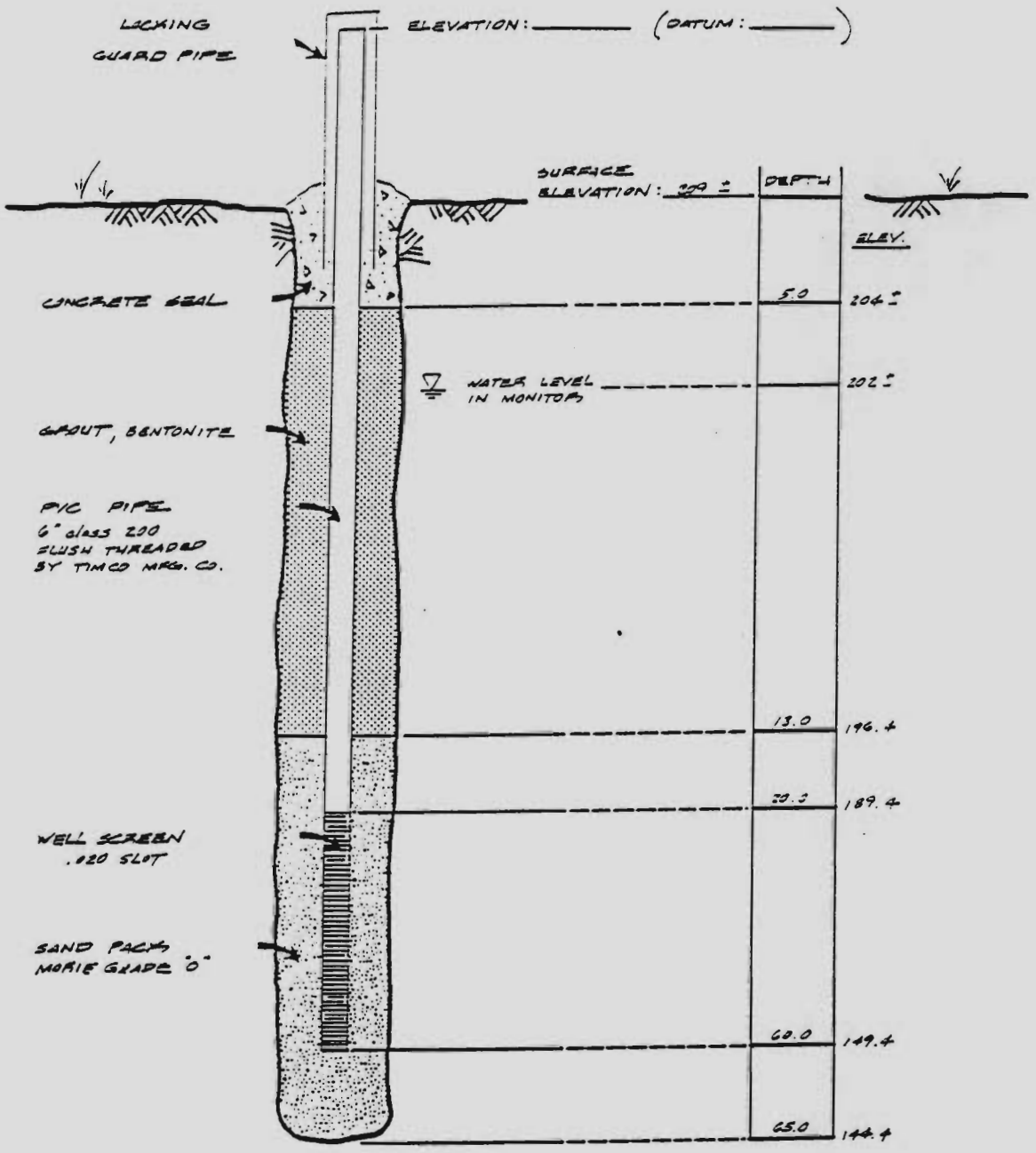
RELIEF WELL DETAILS

KINGSBURY LANDFILL

DR BY JW	SCALE N.T.S.	PROJ NO 10-86-90
CKD BY AWD	DATE 6-21-88	DRWG NO

WELL No.

RW-1



EMPIRE SOILS INVESTIGATIONS INC

RELIEF WELL DETAILS
KINGSBURY LANDFILL

WELL No.

RW-2

DR BY	JLI	SCALE	N.T.S.	PROJ NO.	40-86-90
CKD BY	RWD	DATE	6-21-88	DRWG NO.	

Appendix L

List of Contacts

List of Contacts

Medical, Fire, and Police	911
DigSafely New York	800-962-7962 or 811
Poison Control Center	800-2221222
Pollution Toxic Chemical Oil Spills	800-424-8802
NYSDEC Spills Hotline	800-457-7362
Payson Long, NYSDEC Project Manager	518-402-9813
Washington County Department of Health	518-793-3893

Note: Contact numbers are subject to change and should be updated as necessary

Non-Emergency Telephone Numbers

Fire Department, 3715 Burgoyne Ave, Hudson Falls	518-747-4990
Hudson Falls Police	518-747-4011
Document Repository	

Note: Contact numbers are subject to change and should be updated as necessary